3 Layout Design

ALL TOGETHER NOW

So let's say that you have just finished making the best map ever using the techniques in Chapter 6, "Features," and now you are ready to stick on some extras like a scale bar and north arrow, quickly send it off to the printer, then sit back and let your map audience admire your work.

WAIT! STOP!

After all that hard work making your map why would you want to risk printing it without, say, a title or legend? And what if there are other things you ought to include there but didn't? Do you expect your audience to automatically know what this map is all about? Of course the map itself is the most important part of your printed product and it is always a good idea to spend a lot of time on *that* aspect of your effort. But neglecting the *margin elements* (all non-map elements) and their arrangement within and around the main map (or maps) can make your hard work appear confusing, unreadable, or just plain ugly. The layout deserves attention so that it can act as a showcase for the main map and also provide all the elements necessary to give the audience the appropriate context with which to understand it.

So what will you need to do to create a professional-looking layout? Following these points will help you get there:

- Look through a list of all the possible things that could go on the layout — you can find one in this chapter in the Layout Checklist section.
- Decide which of those things will go on the layout and get input from others.
- Research and gain inspiration from other maps and artwork and then choose a style.
- Decide which of the layout items will be emphasized and which will be understated by creating an emphasis map.
- Decide on an initial configuration for those items.
- Build the layout.
- Obtain feedback and repeat this process as needed.

Accordingly, the layout checklist and the Element Details and Examples in the next section guide you through the process for the first two steps. The last five bullets above consist of arranging the chosen elements into a stylistically cohesive layout by utilizing the arrangement principles found in the sections following Element Details and Examples.

In order to give an overview of how a seasoned professional would create a layout, let's continue with the example of the all-too-hasty GISer who made a great map only to ultimately undermine that effort by not considering the layout. Once it is printed, perhaps it looks so terrible that the GISer decides to get out this book and follow the methods found here. So, to begin, she adds a title to the map after considering that her audience will need a quick introduction to the map that can be read in five seconds or less. She chooses a title that succinctly explains the subject of the map without using jargon. She then realizes that the scale bar and north arrow are fine but that some text to document the data sources, author, and date ought to be included. Finally, after looking through the layout checklist, she is reminded of the need for an inset map that shows the study area's location in a broader context for those who aren't already familiar with it.

Now that she has taken a first look at which items to include, she asks a colleague for some input. The colleague thinks a portion of the map is too densely detailed for the map viewer to understand and recommends an inset map that shows a zoom-in to that area. With that, the GISer begins the second phase of the layout method, the arrangement. She creates an emphasis map with a preliminary arrangement of the major items, decides that the map should be the first thing the audience sees, with the title coming in at second, inset maps third, and the rest of the items last. After taking some time to arrange the elements in the GIS software, the GISer finally decides that the map is ready for printing. With some additional changes suggested by her colleagues, she revises it once again and then reprints the final product.

This GISer managed to transform her layout from a novice-looking product to a professionally designed product by following the steps and details described in this chapter. Please note that she did not need to use all of the ideas presented in the following sections, and neither do you. Some of these ideas you may use so much that they become second nature, and others you will use only when a particular layout needs them. You'll also note that the time that it took for her to complete her initial layout was a small fraction of the time that she spent creating her second layout. In fact, the creation of a professional layout can be extremely time-consuming, even for the most accomplished layout artists. Do not consider it unusual if your unique 8.5-inch by 11-inch masterpiece takes 40 hours to design, build, and print. A poster-sized layout could take anywhere from 40 to 200 hours depending on your level of fastidiousness, familiarity with your chosen software, number of people who provide input, and perceived audience size. (Notice I say "perceived audience size," instead of just "audience size." The audience may indeed become much larger than originally anticipated, especially if the map is designed well. Some of the layout element descriptions, such as date and network path, will provide more detail on how you can set up the layout to provide adequate value to an unintended audience.)

As you read through the following sections, keep in mind that the main focus is on large-format layouts ranging in size from 8.5-inch by 11-inch to full posters. This is because layouts smaller than 8.5 inches by 11 inches tend to contain minimal to nonexistent margin elements as they are primarily used on Web sites, in slide shows, and in reports.

LAYOUT CHECKLIST

- Primary Elements
  - Title
  - Subtitle
  - Legend
  - Maps
  - North arrow
  - Date
  - Authorship
  - Scale bars
  - Page border
- Secondary Elements
  - Neat lines
  - Graticules
  - Network path
  - Disclaimer
  - Data sources
  - Data citations
  - Logos
  - Graphs
  - Photographs
  - Graphics
  - Map number, if series
  - Tables
  - Copyright
  - Projection
  - Inset maps
  - Descriptive text

ELEMENT DETAILS AND EXAMPLES

Each line of the layout checklist contains what is referred to in this book as a "layout element" or simply "element." These elements include all the common ways of presenting information on a map and its surrounding layout. Any element that is not on the map itself is referred to in this book as a "margin element," in reference to the fact that the element is located on the periphery of the layout and not directly over the map. The map itself is also an element of the layout. Since the first step in designing a layout is to decide which elements will make the cut and appear on the final map, I suggest going over this checklist to ensure that no element is overlooked. Any element that can lend additional informative support for the map ought to at least be considered during this step.

The questions you should ask yourself about each element can include (but are not limited to) the following:

Q. Would the element provide information that is crucial for correctly understanding this map?

The answer to this question is not necessarily a no-brainer. Many times, we won't even realize that a certain graph would help explain the map better, or that a subtitle is needed, or that a photograph of each location will draw interest. First, of course, you will make the first cut. Carefully consider each element, try to put yourself in the audience's place, and also try to consider any "unintended" audiences such as future employees, non-departmental colleagues, and so on. Asking for outside input is the next task. This is an important step that often makes the difference between a substandard map product and a well-made one. A colleague or boss can look it over and even your family can offer good advice. Soliciting a critique can be as easy as asking, "If I were to make a map of X, what elements on this list do you think would enhance your understanding of the subject?" To go a step beyond this and garner even more detailed advice, create a draft map before asking for input. Do not be afraid of critical feedback. Without it you cannot improve nearly as quickly. Your map is made for other people to look at, so why not involve the audience in the planning process? Present them with the layout checklist and have them check any element that it is not currently present but desirable.

Q. Would the element provide visual relief or create a cluttered feeling?

If you have checked every element on the checklist, then there are probably too many. An 8.5-inch by 11-inch layout will start to look cluttered by the time a fifth or sixth element is placed upon it. A poster-sized layout could possibly support the inclusion of all the layout elements if enough time is spent on their arrangement. (Time is generally what separates a good map from a poor map, not experience.) Elements like logos and text are often present on maps, but this does not mean you have to use them yourself. If they generate clutter and have no functional value, then you can safely and assuredly get rid of them.

Q. Is it necessary?

You may think everyone knows where north is because your entire work group is more than familiar with the area in question. If your map's audience is your work group, then you are more than justified in omitting the north arrow. However, if there is an inkling of possibility that someone from "the outside" will view the map, perhaps it wouldn't hurt to allow an unobtrusive, simple, north arrow as standard practice. I caution, though, that you have to decide when standard practice verges on the ridiculous. For example, a disclaimer on every map that your department creates is a nice idea *most of the time*. But when you are passing out directions to the ice cream store where you are holding a staff meeting and are required to include a disclaimer that takes up half the map, it could get silly.

Once the decisions about which elements to use and why have been made, the next step is to decide where they will go with consideration toward functional and visual appeal. Many of the non-map layout elements can be placed either on the map itself or in the margins, depending on your design schema, map characteristics, and other considerations. While those are by far the most important aspects to layout design (the what and the where), you can go further in your pursuit of layout excellence by carefully considering the design of each of those elements. You'll need to think of each in terms of color, font, word choice, and overall style. The details for each element that follow will therefore not only help further your decision as to what to put on the layout but also help inform their placement and their style.

Title

Though a title is short, give it lengthy thought.

The title's purpose is to succinctly pronounce the intent of the map. In many cases it also identifies the geographic location of the map as well as the authoring agency, although this is not usually in good form (see below).

Best Practices

Take a look at Figure 3.1 and decide which title you think is better.

It is not usually necessary and often unintentionally arrogant to include the authoring agency or company in first position of the title. A better approach is to include the information in the subtitle if it is deemed sufficiently important or, more advisable, to include it in the authorship element (see the Authorship section). You should think twice about putting the name of the geographic location for your map in the title. The geographic location ought to be immediately readable from the primary map element and, if needed, in its overview map element. This renders the geographic location-in-title practice redundant and, well, boring. The exception is when the map does not display an analysis of any sort, thus making the geographic location one of the main focuses of the map such as in a road map titled "Larimer County Roads."

The title is either the primary or secondary layout element (if secondary, it is only second to the map element). It is written in large enough type to grab attention and be readable from a generous distance. It is short enough to read quickly, it is interesting, pertinent, and accurate. It ought to summarize in ten words or less the primary finding of the analysis, if there is one. Avoid any obvious and redundant terms such as "map of … " or "analysis of … " Also avoid using jargon such as "framework," or "model," as these result in useless mind-clutter for the reader. All words in a

Schmoe County Land Consortium's Analysis of Purple Toad Habitat in Northwest Hooktown

OR

Purple Toad Habitat Greater Than Previously Thought

FIGURE 3.1 The first title is long and laborious and is suitable for dry analytical presentations. The second title gets straight to the point and is suitable for all audiences.

FIGURE 3.2 Though titles could be placed anywhere on the layout page, these placements offer visibility while still allowing the map element to remain central to the overall layout.

title should be spelled out, so avoid acronyms at all cost. Attention-grabbing tactics such as questions ("How Much Purple Toad Habitat Do We Have?"), sensational assertions ("Purple Toads Living Large!"), and actions ("Improving Purple Toad Habitat") can serve the map well at conferences, in office hallways, cubicles, and many other locations.

Placement

A title is located at the top or bottom of a layout and is either center or flush left, though occasionally you will see it flush right. If placed inside an architect's margin element box (see the Margins section), it is generally shown at the top of the box, centered, or in the case of a vertical right-hand box, flush left. The diagrams in Figure 3.2 show some title placement options. The title is depicted in these diagrams as a gray bar.

Style

Using all capitals is acceptable in a title; however, consider a small-cap style for a slightly more readable look, especially if using a bold font in conjunction with the uppercase style. A drop-cap for the first letter may also be used. Some argue that all capitals is never okay because people cannot easily decipher the letter codes as they read when the letters are all the same height. As the argument goes, lowercase letters are read easily because of the different heights of various letters, resulting in specific shapes for each word. These shapes allow a reader to scan a word rather than look at it letter by letter. This makes words that are in all capitals, and therefore all the same shape, harder to read, resulting in more time taken to read the same words. However, a title on a layout usually needs a lot of emphasis in order to attain its proper placement as number one or two in the hierarchy of layout elements. Often, the all-capital

FIGURE 3.3 There are many different ways to bring a title to life. Shown here are several options ranging from simple to complex. The last title uses expanded character spacing which requires a serif font for better readability (see Chapter 4, "Fonts"). The other titles are in a sans serif Arial font.

style is the only way to achieve the amount of emphasis needed. Additionally, a title containing ten words or less ought to be short enough not to cause any undue reading strain on your audience, regardless of the uppercase style.

You can use other techniques instead of or in addition to the all-capitals and small-capitals styles to provide title emphasis. These are drop shadows to lend additional visual weight; special leading characters such as a pipes (|), leading dots (…), or colons (:); drop-caps and extra-large first letters; and underlining. In terms of color choice, dark grays are being used much more now and are a great alternative to black, which tends to be more obtrusive and harsh. Therefore, a bold dark gray can make a modern statement as long as the title retains its proper level of emphasis. If it still doesn't seem bold enough, then switch to black. Also, avoid using bold red, as it tends to contribute to a dizzying Willy Wonka effect. Some style options are shown in Figure 3.3.

Subtitle

The subtitle is comprised of any spillover text that is slightly less important than the title but still somewhat necessary to fully understand the map. This is a better place to put the geographic location of the map and the sponsoring or authoring information than in the title. But again, if possible, leave that type of information for metadata text blocks in less conspicuous locations of the layout rather than the subtitle. Ideally, the subtitle provides further detail that the viewer needs to know prior to being able to understand the map element(s).

If your title does not state a key finding or impressive fact, then this information could also be placed in a subtitle. For example, the title, "Channel Conditions Database Developed for In-Stream Data" could have a subtitle such as, "Data from multiple sources and protocols integrated seamlessly into a single comprehensive spatial database." In this case the *what* is described in the title and the *why* is described in the subtitle. Another example would be a title/subtitle pair such as, "Species Distribution Change over Time" subtitled with, "Five Species Tracked — Four Show Significant Change." You notice that unnecessary words are discarded for the sake of conciseness and that the subtitle here is relating the key finding of the study. A non-analysis-type map might use a subtitle to relate an important qualifier

for the map such as this title/subtitle pair: "Animal Shelter and Rescue Organizations" subtitled with, "Non-Homecare Facilities Only."

Best Practices

The subtitle is displayed in the same font as the title but carries slightly less emphasis than the title. This is accomplished by not using a bold font on the subtitle, employing a smaller font size than the main title, and perhaps italicizing or indenting the text to further deemphasize and separate it from the main title.

Placement

The subtitle is placed directly below or to the right of the title.

Legend

The legend is a standard element on most layouts. It provides the color and symbol key look-up details for the map element. It is comprised of an item (icon, point, line, polygon) and its label (description of the item). If the layout is being created for a narrow audience such as your work group and the map includes commonly understood feature types with standard symbology such as county boundaries, water bodies, elevation, and so on, then these may be granted an exception from inclusion in a legend. Wider audience maps may also exclude certain given feature types drawn with standard symbology such as blue water bodies or green land expanses; however, these are left to the discretion of the map author. Only exclude map layers from a legend — or the legend itself from the layout — purposefully. Don't just forget some. Err on the side of the more legend items the better, since a map is not worth much if its features cannot be understood. What is obvious to the map author can easily be unknown to the map viewer.

In some situations the entire legend could conceivably be omitted. For example, map layouts on slides aren't always necessary due to the fact that the presenter will be talking about the slides and can point out the necessary features. Legends are also often unreadable on slides presented to a large audience. Be cautioned, though, that many slides are reproduced online or in other media, and these will need legends, especially when they are not accompanied by the presenter's notes. Another situation in which you could omit a legend is when you are creating report maps that comprise a series of similar features. In this case, one legend at the beginning of the series can apply to all the maps and thus allow more space for the map elements on the subsequent pages. Simple, small report maps may also have so few features that they only need to be explained in the text of the report or in the map captions.

Best Practices

Items are placed to the left of their corresponding label. Complicated legends with many items necessitate the usage of grouping levels. The two forms of grouping levels most commonly seen are the categorical group (e.g., all land use colors placed separately from all stream-level colors) and the shape-type group (e.g., all polygon features placed separately from all line features). Use headings to describe each group in categorically separated legends, if your organization schema is not immediately

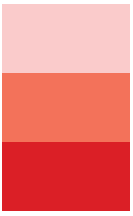

FIGURE 3.4

FIGURE 3.5

obvious. When categorical separations are not needed, shape-type groupings are often displayed in the following order: points, lines, polygons. Other times they are displayed in the order of relevance to the overall map purpose.

Default legends produced in the GIS are a great way to begin production of the legend but ought to be further manipulated prior to map publication. First of all, make sure there isn't too much space between the items and their labels. Also, if the legend is describing a gradient of values (choropleth color scheme), then those items will look more professional if they are touching each other rather than separated by white space. Don't forget that color gradients can be depicted vertically (see Figure 3.4) or horizontally (see Figure 3.5).

A label can still be associated with each item although in many cases we can do without the intermediates and label only the maximum and minimum values. An often overlooked feature of the default legend is the default legend font. The font needs to be changed to match the other fonts on the map so that a cohesive style is maintained.

As with gradient-type items, the groups of items do not need to be arranged vertically if it would fit better on the page to distribute them horizontally. The legend in Figure 3.6 illustrates a horizontally oriented legend.

A legend title such as "legend," "symbols," "key," or "map key" can be associated with the legend. If a title is used, ensure that it does not obscure the main points, which are the items and labels. For that matter, it may be better to eliminate the legend title altogether as it is usually obvious what the items and their labels are. A floating legend (explained later) within the map element may be one situation when the title is more necessary in order to provide clear separation between the two elements, especially if there are other floating text boxes on the map.

FIGURE 3.6 A horizontally oriented legend is shown here.

Placement

Legends need to be within or nearby the map element with which they are associated. Legends can be placed outside of the map element, in the margin, in either of the following two cases: if there is only one map element on the layout or if all map elements on the layout share a common legend. If there are multiple map elements with different features on each, it is not always clear which legend goes with which map unless the legend is superimposed on its map element. When placed inside the map element it ought not to obscure the underlying data and is often therefore placed in areas that are not important to the map's purpose such as on the ocean for a terrestrially focused map or on the land for a marine-centered map. In such instances a background box is often needed to provide uniform background color on which to set the text.

Style

When the legend is placed outside of the map element it can be encased with a shaded box or outlined box. However, it may look better if the outline and shading are done away with so that the legend can be incorporated with the other margin elements. This creates fewer seams on the layout. If a separation is still desired, a compromise is to use a shortened line above and below the legend (see Figure 3.7).

Under certain circumstances you might use the same background color for your legend background that you use in the map element to ensure that the colors will look the same in the legend as they do on the map. For example, let's say you have a map with some buoy locations shown in yellow on top of blue water. For the map's legend, though, you've chosen a light-yellow, almost tan, background color. If you try to superimpose the buoy color onto this light-yellow legend background, you'll see that the buoy color doesn't look nearly as vibrant as it does on the blue water background. It may even look like a different color entirely (see Figure 3.8). If you find this sort of thing happening on one of your maps, the best thing to do is to change the background color of the legend to something that more closely matches the main background color of the map. This particular effect is called a "chromatic contrast." The same thing can happen with grayscale colors — called "achromatic contrast" or "lightness contrast."

As far as the legend labels go, try changing the style of the text around a bit to add some interest and variety. For example, if you are using a graduated symbol to

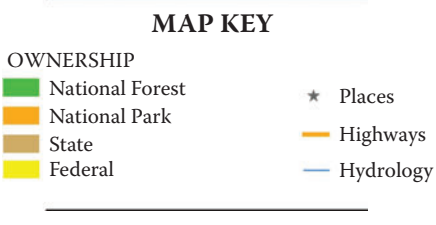

FIGURE 3.7 Rather than creating a full box around the map key, a short line above and below the legend items could suffice, keeping things neat but uncluttered.

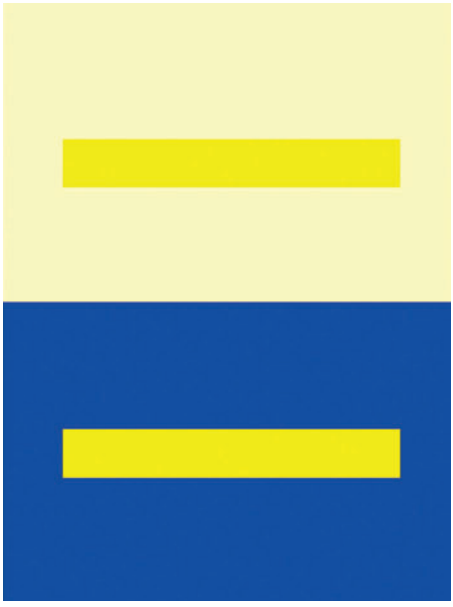

FIGURE 3.8 This is an example of chromatic contrast. The two inside boxes are actually the same yellow color, but it looks different depending on the background. This becomes important when you trying to match legend colors to map colors.

represent numerical ranges, you could go with a common format such as "0–10%" or you could try a slight change such as "0 to 10%."

Maps

The map element is a large graphic that shows off data in coordinate space. There are two questions that you need to answer as soon as you start thinking about a layout. The first is how many maps do you need on one layout? And related to that is the second question: should you overlap multiple layers onto one large map element or separate the layers onto multiple smaller map elements?

Multiple maps are generally used when displaying the same data over separate time periods (in such cases a common scale and legend are important) or when displaying differing geographic extents that all have related data. Additionally, multiple maps may be required when ancillary data that contribute to the overall map purpose need to be displayed but are not central to the main purpose. Multiple maps on one layout can be highly informative as they offer on-the-fly analysis by the viewer of the map, thus making the map interactive and more likely to endure in the viewer's memory. Whether your layout will contain one map or many, the map element(s) will be your primary means of conveying information to the viewer and therefore will likely be the layout element that takes, by far, most of your time to create and polish. Indeed, Chapter 6 is devoted solely to the techniques used in developing and refining

the map element. It can be designed in conjunction with the rest of the layout or it can be designed prior to the layout design process.

Best Practices

Because Chapter 6, "Features," describes in detail the best practices and other design considerations needed to create a map element, this section focuses solely on general design considerations for map frames and geographic extent. Essentially, the map or maps can be framed with a border (either simple or fancy) or it can be left to "float" in the layout space without a border. A studied look at many of the most impressive, elegant, and recently designed maps will reveal that for the most part their designers have included no map frame. In contrast, many of the GIS maps made prior to the last few years were made with these frames. It is also an observation that early GIS careerists will retain the default frame in their map layouts, perhaps due to a lack of interest in the subject considering how difficult it can be simply to get the map on the page in the first place or a perceived need to separate the map from the other layout elements. Usually, however, there is such a stark contrast between the map and the surrounding layout that there is no need to provide the visual separation that a border provides. For example, a map that is completely covered in various colors put onto a layout with a white background already has a built-in visual separator in the white space between the map and the other elements.

Often when we are faced with presenting the results of an analysis we wonder if the analysis extent should be the same as the visible map extent or if we ought to include the surrounding geography in order to provide context, even though it may detract from the central focus. For example, let's say you've analyzed which households will be impacted by a proposed tax increase within a town's boundaries. Do you display just the town, given its irregular border, or do you show the houses that lay outside the town boundaries as well, out to such an extent that the map becomes a square or rectangle shape? A few techniques are used to solve this problem. You can decide to either clip out all the outlying areas, leaving the map to "float" within the rectangular or square area that the page requires or you can decide to include the other areas. Another technique is to include the analysis extent plus the outer boundaries but generalize the data in the outer extent. Another is to provide the context while still maintaining the focus on the analysis extent by changing the outer extent to a faded or semitransparent look. This last technique gives the analysis extent a popped-out effect.

Placement

In most cases the map element or elements will consume the majority of the layout space. When there is a hierarchy of maps on the same layout there should be no doubt as to which is the main map. It is either set apart in size or position or, most effectively, both. When just one map is desired it is placed in a central but slightly off-center location on the layout. (If you have multiple time series maps, they are usually all of the same size and shape, and when put together they function similarly to a single large map in terms of layout placement.) Does this mean that you have to conform to this convention? Not necessarily, but make sure you have good reason not to. For example, there are layouts that contain a centered map with, say, logos

or pictures surrounding it on all sides such as a city tourist map that is distributed for free but contains advertisements around the map on all sides. Because the advertising is very important on that type of layout it can be acceptable, but on most analytical and informational layouts, surrounding the map with an equal amount of margin information on all sides results in an undesirable amount of clutter and lends itself to confusion as to what the main focus of the layout is.

North Arrow

The north arrow, whether it is fancy or unadorned, has the sole purpose of illustrating the orientation of the map to the viewer. Yes, it is true that most GIS maps are already oriented with north at the top of the layout. However, there are certainly instances where this is not the case and therefore it is standard practice to include the north arrow. Its inclusion is almost always warranted. Nautical charts and other orienteering maps should show both true north and magnetic north. In fact, these types of maps usually illustrate the directions on a compass rose, rather than a north arrow, which shows at least four, and sometimes more, cardinal directions.

Best Practices

Keep the north arrow small, simple, and unobtrusive for most modern layouts. Historical visualizations or other unique situations may warrant a fancier, bolder look.

Placement

North arrows are best left in a less conspicuous area of the layout. Sometimes you might use one to conveniently balance out some other element. Grouping the north arrow with other ancillary map information such as the scale bar and legend is another common practice. In a very small layout meant for a slide or in an in-line report graphic, the north arrow can be placed directly on the map element, in a corner, perhaps with a white box behind it if it is unreadable against the background (or alternatively change the color as in white on black or black on white). This is also a technique used sometimes in 8.5-inch by 11-inch layouts and more rarely on larger layouts. The larger layouts tend to show the north arrow outside of the map element and grouped with the scale bar and other supporting information.

Style

For some reason we GISers (and, indeed, cartographers as a whole) have not developed one standard north arrow that everyone uses. Instead, there exist hundreds of the things out there to choose from, in all manner of styles. And even with that, GISers still sometimes get the idea that each company or department ought to develop its own. It is almost like a logo in these cases. And to this I say, well, why not? It is fairly easy to design one yourself and it will help further our cause to put a unique stamp on our map.

As mentioned earlier, the trend in mapping design has been going toward simplistic north arrows for some time. The context and style of your overall layout will help determine whether you should stick with this trend or branch out to a fancier style

(perhaps you are displaying historical data, an archeological dig, or some other type of map that may lend itself to a less modern-era north arrow).

Date

The date referred to here is the date on which the layout was printed. (Dates of your data sources are addressed in the Data Citations section). It is important to include the date on most layouts that are intended to be stand-alone prints. Layouts destined for reports do not necessarily need a date because the report ought to already contain date information, although it is still recommended to include one should there be any chance that the map will be copied separately from the report. Layouts destined for slide shows also do not need a date for the same reason, although one could be included if the slide show will be posted in a digital realm or if your map slide will be separated from the title slide (or wherever the date is).

Stand-alone layouts, such as 8.5-inch by 11-inch sheets and larger, should include date information as a form of embedded version control (e.g., "Oh, I see now, that was the old map I printed out last week. Here's the one from this week."). The date also gives the audience an idea of the map's vintage for maps that endure. Whether the layout designer considers the map an enduring one is usually inconsequential. Maps often contain items of value that are referred to long after the mapmaker originally thought possible. For example, the map you created only for this week's board meeting might take on a life of its own by getting passed around (digitally or on paper) after the meeting, and before you know it you have created a lasting legacy map that people have photocopied and put in their files. Let's hope you thought to put a date on it so that those who will pull it out of their files and "dust" it off will instantly understand whether it is of a useful vintage or not. In summary, inclusion of the date on a map or layout is often a preemptory practice used to mitigate unforeseen events.

Best Practices

The date can be preceded by text such as "printed on:" to dispel any confusion over whether the date refers to the data or the day of printing.

Placement

The date is considered metadata and therefore should be placed with the other margin elements in an inconspicuous location.

Authorship

"Authorship" refers to the person and agency who designed the map, created the analysis, and put together the layout. It can include more than one author if these tasks were completed by several people, but it always includes at least one name, not just the agency. Authorship information is not to be confused with logos, which don't necessarily state who created the map. For example, does that logo near the title signify that that was the company that contributed the underlying data, performed the analysis, designed the layout, or sponsored the work? Who knows? Authorship

is a plain-text way of getting that information across to the viewer of the map. The agency that commissioned the map or is in some other way involved in the map's reason for being can be signified more prominently than the authorship information, as long as the author's name is included *somewhere* on the layout. Indeed, many times the sponsoring agency's name winds up in the title of the layout, although I do not consider this a best practice (see the Title section).

Best Practices

According to Edward Tufte, in his book *Beautiful Evidence*, the author's name is important to include for many reasons such as signifying that someone is taking responsibility for what is contained in the printed work, providing the contact name for follow-up questions, and signaling reputation (or lack of). Furthermore, he states, "Authorship credit is too often absent from corporate and government reports; we should remember that *people* do things, not agencies, bureaus, departments, divisions. People may do better work when they receive public acknowledgment and take public responsibility for their work. The good [Charles Joseph] Minard put his name on nearly all his work and personally signed with pen and ink … some of [his] … figurative maps."[1]

Placement

Conference posters can include the authorship information directly after the title and subtitle or in the descriptive text portion of the poster, or in a corner by itself. If placed under the title(s), we will often see the author(s) names followed by numbers in superscript that are referenced elsewhere on the poster for the author's affiliation and contact information. On smaller maps and even some poster-sized (non-conference) maps, my preference is to put the authorship information in a corner, in dark gray, italicized text. In this way it is clearly metadata: it is there if the viewer needs it but does not intrude on the layout.

Style

The authorship information ought to include as much information as possible including organization, address, phone numbers, E-mail addresses, and Web addresses. This information can be organized with comma or pipe separators (|) to ensure a neater look than hard returns between each item. Incidentally, a practice that is sometimes used in architectural renderings is to have certain supervisors sign off on the completed design. This could be a useful addition to a GIS map being used in a work-group situation. For example, if the map needs to be examined by several supervisors you might type out their names next to several blank lines to serve as signature lines.

Scale Bars

A scale bar is a graphic that shows the map viewer how to translate between map units and real-world units. While historic maps often had verbal scales such as, "200 feet to the inch," or "1 inch = 200 feet," the modern convention is to use a graphic scale

due to the fact that when a map is scanned, shrunk, and put on a slide, or some other similar enlargement or reduction process, the scale will remain accurate.

Best Practices

Modern scale bars are simple and unadorned. In many cases the viewer needs to see only two divisions (one at the beginning and one at the end) and a number indicating the distance between those divisions in real-world units. This is due to the fact that the typical GIS map is not used to measure distances. The scale bar, therefore, serves only to illustrate the general scale of the geographic extent. Subdivisions aren't needed. The point is, if you are creating a simple map, stick with a simple scale bar. For example, let's say you are making a 3-inch by 3-inch graphic for a newspaper story that shows general school district boundaries, you do not need to create a huge scale bar showing four major and four minor divisions. A single line with labeled end-points will suffice. Even with simple scale bars, however, there is utility in providing multi-unit scales together on the same map so that the viewer need not perform mental unit conversions should a different unit be desired. Of course, maps that are used for the primary purpose of pinpointing an exact location or distance such as hiking maps or road maps do require a more detailed scale bar that shows subdivisions and their associated measurements.

Style

Scale bars are almost always black, or in some instances, dark gray, in color. The font used should conform to the other fonts used on the layout. Several layout styles are possible depending on the space allowed within your layout. The more compact form of the scale bar is used more often on modern maps, whereas the more linear form is a relic from previous decades (see Figure 3.9).

Either format is acceptable, though one should tend toward the compact form since it is more balanced and modern. As mentioned earlier, multiple-unit scale bars are sometimes required or beneficial. In this case, we can simply show two separate scale bars with the different units but place them close enough to one another maintain an orderly looking layout (see Figure 3.10).

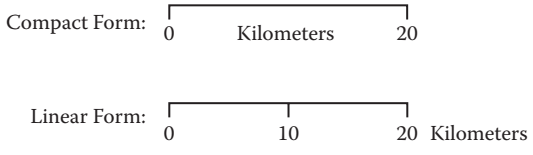

FIGURE 3.9 Two formats for scale bars are shown here. The compact form is more modern, the linear form is classic.

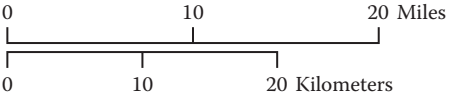

FIGURE 3.10 When two scales are required, place them close together like this.

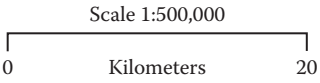

FIGURE 3.11 A scale bar coupled with a representative fraction.

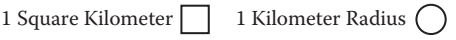

FIGURE 3.12 Other scale types can also be depicted on the layout including square area and buffer distance.

You might also want to note the map scale as a representative fraction (e.g., 1:24,000) in the same visual space as the scale bar as in Figure 3.11.

An uncommon way of depicting scale, but still worthy of your note should your data be especially suited for it, is to show the scale in area form. Many population density maps, for example, are shown in square mile or square kilometer units and would be ideal for this kind of scale graphic. Additionally, a map with buffers around points at certain distances could also use a scale graphic. See Figure 3.12 for examples. If these types of scales are used, they ought to be shown in conjunction with a conventional scale bar as well.

Page Border

A page border is used to group all the layout elements together by means of a single graphic line surrounding all of the elements. When the layout consists of a single map element with all other elements floating on top of the map, the page border is sometimes, but not always, redundant with the map border. When the layout contains elements outside of the map element(s), a page border is usually used to contain those items.

Placement

The page border is placed around all the layout elements, including a narrow white-space buffer that acts as a frame. The frame does not have to be white; it can be any color that unifies the layout. The frame ought to be the same width or proportional to the other separating spaces on the layout.

Style

Double lines, single lines, varying thicknesses, shadow boxes, rounded corners, and so on are all used and acceptable. The simplest and best is the single-line page border so as not to detract from the surrounding elements. Just make sure that poster-sized maps at C size or larger are at least 3-point thickness, up to 5-point thickness for E-size sheets.

Neat Lines

A neat line is simply a graphic line placed on the layout. These lines can be used singly, in tandem, or in groups and can consist of simple lines or boxes. A large

FIGURE 3.13 The architectural margin boxes shown here organize the margin elements into the same three sections but separate them differently. The top one achieves the same goal of visual separation but with much less visual clutter than the bottom one.

neat line around the entire layout is referred to as a "page border" and is discussed, fittingly, in the Page Border section preceding this one. The purpose of a neat line is to explicitly separate elements to provide an organized look. Sometimes the same visual relief and separation can be achieved without neat lines by simply utilizing the empty space between elements for this purpose. However, through experimentation with your elements as you place them on the page, you may feel that they need more separation than the empty space provides. For example, a poster-sized layout with three major sections in the architectural margin element box (which is itself a form of a neat line) may benefit from the use of a short vertical bar between each section. The reason a short vertical bar would be used instead of, say, a box around each section is to reduce visual clutter but still provide the required separation (see Figure 3.13).

Placement

One neat line placement illustration is in the Legend section of this chapter (see Figure 3.7), which shows a neat line placed above and below a legend in order to separate it from other elements on the layout. Experimenting with different places to put neat lines on your own layout as well as getting ideas from existing layouts will instantly increase the quality of your finished product. In fact, even though neat lines are on the lowest end of the information spectrum for map elements, they are on the high end of the scale of the design spectrum for layouts. It is these little touches that can make a map look like a professional with years of experience created it. Although be warned that it can also take years (slight exaggeration) to place, re-place, and tweak these so that they look just right.

Style

Neat lines are almost always black or dark gray. The thickness of each line needs to be commensurate with the importance of the information it is enclosing or separating as well as the total layout size. Neat lines are drawn as boxes or simple lines. If using lines, and they are intended to meet up with other lines, ensure that they join together neatly by using a snapping feature and by zooming in to the largest extent to double-check the results. Sometimes what looks like a snapped line winds up printing out as an offshoot like the top example in Figure 3.14 instead of properly snapped like the bottom example in Figure 3.14. Conversely, ensure that any neat line that is not purposefully intended to meet up with another line is far enough away from all other lines so that it does not look as if it was supposed to be connected.

FIGURE 3.14 Make sure any lines that you use to organize layout elements snap together appropriately, as in the bottom part of this example.

Another symptom of neat lines not ending up quite so "neat" as intended is when they show up as jagged lines on the printed page. The cause of the zigzag is due to the software's habit of starting and ending a line at exactly the start and end-points that were clicked when the user created the line so that if those points are not on the same axis a jagged line is created. Use guidelines and rulers when possible along with snapping functionality to avoid this often undetected issue.

Christopher Walter, the GIS manager at the Cascade Land Conservancy, came up with a unique twist on the typical neat line. Instead of using a line to separate blocks of text in his map's margin box, he used words. The words were written in a horizontal fashion, reading from bottom to top. For example, between the page border and the legend he wrote "Map Legend" and between the legend and the data sources he wrote "Data Sources." In this way he titled the separate parts of the margin and separated them all at the same time.

Graticules

Graticules are latitude and longitude lines that run along the surface of the map element and enable the viewer to visualize how the flat map surface relates to the real-world 3D surface in the map's projection. Although this is an arguable convention, graticules are almost never present on GIS map elements that are not for navigational purposes. Even so, you may consider including them on your non-navigational maps as an additional location- and scale-related metadata element.

Best Practices

Layouts showcasing analytical-results maps do not need to include graticules and, indeed, if they are included, they may provide too much clutter for the map audience to decipher the analytical results easily.

Style

Navigational maps will require easy-to-read, prominent labels at the top and bottom of the graticule lines. If you want to include graticules on a non-navigational map,

FIGURE 3.15 A common convention is to place the graticules underneath landmasses when designing very small-scale maps.

you will likely want to make them unobtrusive on the map surface by using gray or dashed lines, fewer divisions, and small labels (that are visible if the viewer looks but do not intrude on the other important aspects of the map). An additional technique to minimize their interference is to run the graticules behind certain portions of the map, usually the land portions of a worldwide map (see Figure 3.15).

Network Path

The network path (e.g., \ProjectResults\AnalysisB\ConferencePoster) can be included on the layout as part of the metadata textbox or as its own entity tucked away somewhere even less conspicuous. Its purpose is to alert the viewer to the location of the layout and data files should the map need to be updated or the data used for a future project. This is one of those items that is hardly ever seen on a layout although it should be included on most internal layouts and ought to at least be considered for external layouts. When an author leaves a project, a successor may pick up the old documents and use these network paths to find the digital files. In fact, the original author may also need this memory boost to find the files at some later date. As far as layouts destined for the external audience are concerned, though you may consider this type of data irrelevant for the viewer you have in mind, do not forget that these types of presentation maps are often kept around and cited much longer than originally anticipated. In the case of an enduring presentation map, the network path can be of vital importance for anyone picking up that project in the future.

FIGURE 3.16 A text item directly underneath the page border or hidden in a corner like this signifies to your audience that the text is for internal reference.

Best Practices

Depending on the complexity and number of projects in your GIS work group, you may want to consider making the inclusion of network paths a standard practice for your work group.

Style

A technique sometimes used for nonessential but informative data such as the network path (and sometimes authorship, date, and so on) is to put the information in a corner of a map either just above or just below the page border. Thus, it would look something like Figure 3.16.

Disclaimer

The GIS map disclaimer is used by most public agencies and many private companies to protect themselves from lawsuits arising from the map being used for unintended purposes and to inform the reader as to the potential limitations of the map product. For example, disclaimers often contain text such as: "The agency provides this data *as is*, it is the user's responsibility to determine proper uses for the data; the agency is not responsible for any adverse outcomes associated with such use; and the features are not at a survey scale and are not complete." If you are tasked with creating a disclaimer, then it is wise to look at the myriad examples that exist on the Web under the search term "map disclaimer" as well as to get input from your legal counsel. Those who work in agencies where the disclaimer is already written need only figure out how to best place it on the map and style it appropriately.

Best Practices

Whether to use the word "Disclaimer," or some other title, at the beginning of the disclaimer text block should be considered. Does it really need to be there? Could a term like, "Note" or nothing at all work instead? On the flip side you may want to add a term like "Standard Disclaimer" or "Disclaimer of Liability" in order to alert the viewer that this is not a special block of text that is only used on this one layout. In any case, you may be constrained by what your legal department requires.

Style

The common practice of printing the disclaimer in small but legible text on the layout with the other metadata elements is pretty much the only way to go. Unfortunately, the disclaimer can be quite long, resulting in a huge text box relative to the other elements, and it is left to the layout designer to figure out how to print such a large block of text in an unobtrusive fashion. Using a gray font color or less than single spacing

between lines may help. Also, pushing it to the edge of a layout as opposed to placing it between two other margin elements may help minimize it.

Data Sources

Originating agencies for the data used in the map or maps are reported in the data sources section of the layout. It provides the agency and company names for each dataset used in the map or maps, the name or a short description of the data, and the date of the data. This is a classic metadata element.

Best Practices

The data sources element is very common and indeed is extremely useful for both the intended audience as well as for the future reference of the layout originator or project successor. Care needs to be taken that no abbreviations are used. For example, the layout designer may place something like this on the layout: "Data are from USGS EROS and NAIP 2006," which is scarcely better than not putting anything on there at all. While those may be common acronyms in the designer's office, the external map audience will certainly not understand them, the designer may forget what was meant a year from the printing, and the designer's successor on the project may not be acquainted with them. Furthermore, it is a common assumption that people who work in your close work group understand what the acronyms mean as well, and it would probably surprise most of us to learn that those we work closely with still have not deciphered these things. A better way of stating the above example is shown in Figure 3.17.

Style

The style guidelines for the data sources element are similar to all the other metadata text elements: keep it unobtrusive and minimal. However, the data sources may have an edge over the disclaimer and network path metadata elements as far as level of importance is concerned. Items to consider including about each dataset are

- Data dates
- Agency names
- Web site
- A short description of how the data were used
- Potential limitations

High altitude aerial photo courtesy of the U.S.
Geological Survey's Earth Resources
Observation and Science data center

Elevation courtesy of the National Agriculture
Imagery Program; 2006 imagery

FIGURE 3.17 An example of correct data source text: all acronyms except "U.S." are spelled out and no other abbreviations are used. This ensures that your map viewer (or even you several months down the line) can understand it.

Data Citations

Data that are contained on the map may require citations by the source agencies and authors of the data. Many times this is stated in a "Creative Commons" licensing agreement that goes something like, "You may use the data for any purpose as long as the source of the data is cited as follows:" Therefore, your publication of the map, whether for in-house use or external use, needs to contain the citation in the manner specified. Sometimes, the exact string of text to be used is specified in the licensing agreement. Because this string of text may not be in a format that matches the surrounding text or appealing to the layout designer, the designer may have reason to be somewhat redundant in this case by citing the data source in the data sources element as well as citing it in a data citations element. An alternative is to ask the source author if your alternate wording is acceptable and to get the permission in writing. Because the data citation is the originating author's way of receiving due credit for work that is being made freely available, it is important from an ethical as well as a legal standpoint to include it.

Best Practices

If data with a citation clause is one of the major elements of your map or analysis, then you might consider making the data citation less of a fine-print metadata element and instead move it up in the element hierarchy of your layout. In other words, you will want to duly acknowledge the source of any data, without which you would not have been able to complete your work.

Logos

> The ability to throw the kitchen sink at one's output tempts many of us to clutter our maps. At the same time, we need not be constrained from employing capabilities not available to traditional cartographers.
>
> **— Walker Willingham, GIS Analyst, Earth Walker GIS**

A logo is a graphical way of signifying a company name or brand and is used to enable rapid identification of what it is representing. Logos proclaiming authoring or sponsoring agencies are often displayed prominently on presentation maps. I am honestly not sure why logos are so ubiquitous on GIS layouts. Whatever the reason they are used, you can be sure that the logos will clash with the colors and style of the map product and that they will either float unconvincingly in the margins or worse, in some prominent place on the map. Occasionally we can get away with it if we balance the logo out with some other feature or tuck one black-and-white rectangular-shaped logo at the bottom or corner of the layout. The much preferred alternative to using a logo is to simply credit the authoring agency or agencies in a textbox within the other margin elements. Often, though, the mapmaker does not have a choice and is directed by the higher-ups to have the logo placed on the product. In such a case, a gentle nudge toward the less intrusive method mentioned above, for the sake of design cohesiveness, is advised. Of course, people used to draw dragons on their maps, so …

Best Practices

If you are forced to include a company or agency logo on a layout where the brand is not of primary emphasis, then see if a black-and-white version of the logo can be used, as this may interfere less with the overall color scheme of the layout as well as keep the eye from being drawn toward it. Also, sometimes a version of a logo that is a rectangle, square, or circle, rather than irregular, is available. If so, use that. As I alluded to earlier, a logo can sometimes be used to balance out another element of the layout. For example, a circular logo can be placed opposite a circular north arrow for balance or a square logo can be placed directly under a square descriptive textbox.

Placement

The best place to put a logo, if it must be on the layout, is in the least obtrusive part of the layout, wherever that may be. Often this means the lower right-hand corner. Putting logos on either side of the title, or just at the beginning of a title, adds to a cluttered feeling and leaves the eyes dancing around wondering where the most important piece of information is (hint: it should be the title or the map not the logo.) Okay, so as with any rule of thumb, there are some exceptions. One is if the map is being made for commercial use and the logo represents a brand as opposed to a company or agency. There may be a case for making this type of logo the primary element of the layout with the map element retaining only secondary emphasis. A skateboarding company, for example, that prints free maps for customers of great places to skate in town, might make its brand logo the most prominent part of the map since its purpose is primarily for marketing. However, for the analysts among us, we ought to keep the focus on the title and the map and forget the logo (see Figure 3.18).

Graphs

A graph shows the values of your data in diagram or chart form. Graphs can be any of several types such as scatterplot, bar graph, pie chart, histogram, or bar chart. Many times an analysis map or even an informational map can benefit from the use of graphs to help highlight trends in the data. For example, a layout with a gradient map showing dark colors for areas with high crime and light colors for areas with low crime might also contain a scatterplot with matching color schema showing crime rates on the x-axis and proximity to police stations on the y-axis.

Graphs can also provide ancillary data that, although not shown on the map, help to further the viewer's understanding of the material. For example, a layout with a map of population density by region might also contain several bar graphs illustrating the age distribution in each region.

Best Practices

Graphs ought to match the data shown in the map in terms of color and hue, if they display the same data. As far as the type of graph goes, choose the type that depicts the trend or trends as simply as possible, and if you need to, insert a text box, arrow, or other highlighting mechanism that explicitly shows the viewer why that graph is important. Another method to achieve this is to provide a caption or headline for the

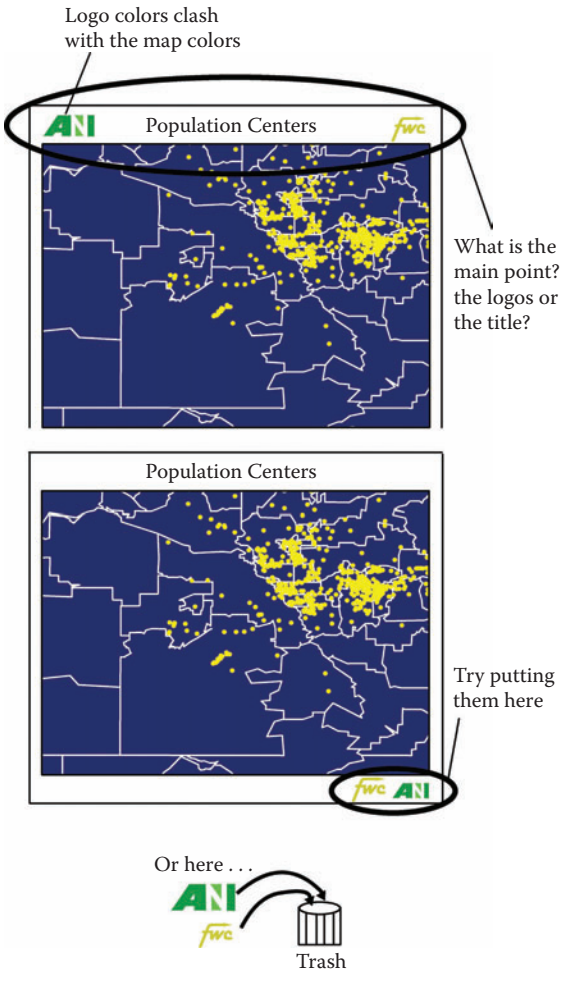

FIGURE 3.18 The map above is cluttered with logos. Deemphasize logos by relegating them to a corner or see if you can trash them completely.

graph. Pie charts, in particular, are often too showy due to distracting color choices and wind up hiding the ultimate trend rather than highlighting it. Indeed, this type of graph is often misleading if the pie slices number more than four because it becomes too difficult to determine what the individual values are without the aid of labels. A series of pie charts can be particularly egregious as they often don't contain the same categories or have them in different parts of each pie, making them difficult to compare.[2]

Placement

Many possibilities exist for graph placement on a layout. A graph can float on top of the map element or it can be placed outside of the map element along with the margin elements. Much of this will be determined by how much white space (empty space) is

contained on your layout, where the white space is, and how intimately tied the graph is to the map. If the graph has the same color scheme as the map element, you may consider placing it next to the legend or close to the map so the viewer can glance from the graph to the map or legend easily and thereby make comparisons on the fly. When the graph relates specifically to a single feature on the map, then it ought to have a leader line connecting it to that feature or some other appropriate means of letting the viewer know to which feature it is related. If you have a set of small, simple graphs that show additional details about discreet areas on the map (such as polygons), they can be positioned on top of the polygons, perhaps with connecting lines if needed.

Photographs

Digital photographs are used to enable the map viewer to "see" portions of the map in its real-world likeness. In some cases the photographs are tied to a very specific location via coordinates and placed near where the corresponding location is on the map element.

Potential photograph types for GIS layouts include the following:

- Pictures of the data collection process for presentation layouts such as a picture of a crew on a boat.
- Pictures that exemplify the data such as pictures of representative habitat types for each habitat depicted on the map.
- Pictures that enhance the map's usefulness such as pictures of store fronts featured in a map of all the downtown coffee shops so the map viewer can easily find them when on the street.
- Pictures of conditions such as drainpipe pictures for each drainpipe in a quarter-mile area.

Best Practices

The photograph should not be the focus of your layout. The best defense for including photographs on your layout at all is if they greatly enhance the viewer's understanding of the subject matter. For example, if you are mapping the distribution of squirrels across the United States, you may find adequate reason to include a photograph (or sketch, for that matter) of a representative squirrel for each of the ranges in order to help the viewer understand the difference in squirrel size across the mapped area. The photograph should be professionally composed and contain only relevant information in the foreground, if possible. The viewer should be able to look at the photo and immediately recognize the subject of the picture, rather than, say, wondering if the squirrel or the trees or the sky is the focus.

Placement

The photograph can be nestled anywhere it seems appropriate. An inappropriate location would be anywhere that it distracts from the title or map element. For example, if two photographs flank a title (i.e., photograph, TITLE, photograph) it causes confusion as to which element the audience ought to read first — the title or the photos?

Style

If the photo is tied to a particular location on the map, then this needs to be identified in some way either by leader line(s) or with a matching label on the map and photo. Always include a caption with the photograph unless it is tied to the map with a leader line. For example, an overview picture could be captioned, "A view of Boulder County, Colorado, from the air." In most cases, strive to write the caption in a professionally worded, complete sentence format and remember to describe the photograph's relevance to the map subject. Do not, for example, caption a photograph of a boat crew with something that sounds like it comes from your high school yearbook such as, "Sammy and the crew hitting the waves."

Graphics

Graphics can include sketches, drawings, cartoons, illustrations, clip art, and other similar illustrative items. Whether displayed on a layout to provide information or whether they serve a purely decorative function, they are usually used sparingly or not at all on modern GIS layouts. Historic maps are distinguished by their sketches of dragons, gods, sea serpents, scrolls, dueling captains, and other superfluous graphics. In some special instances these could be employed on modern cartographic outputs as well, especially if the map's purpose is more for entertainment than for research or reference.

Research or reference maps of particular genres may also provide supplementary graphics in certain circumstances. For example, maps of archeological sites, burial grounds, and landscape designs are some modern map varieties for which these kinds of graphics could enhance, rather than detract from, the overall map goal. In fact, if you can recognize that your subject matter is sufficiently unique, you can use graphics to create a commensurately unique-looking map product. Putting that level of thinking into a map product rather than simply making a map that looks exactly like all the other GIS layouts you've seen puts you into the professional range of cartographic skills that you want to have. If, however, your work genre is of the standard GIS analysis or informative nature then the professional will generally steer very clear from any ornamentation, as our modern mode dictates.

Best Practices

Do not use ornamental graphics unless your subject matter warrants it or you want to confront the modern fashion of information-only outputs.

Placement

Graphics can basically be placed anywhere and everywhere on the map layout from a light background image to hundreds of sketches placed around the edges to one illustration in the margin.

Style

Graphics can have any style and level of importance the designer deems appropriate. There is much leeway here and a lot of opportunities to make your map unique.

Map Number

A map number refers to the page number of a map that is contained within a series. Map numbers are usually accompanied by a number signifying the total number of maps in the series. If your layout is part of a series, then it will be imperative that you include this information.

Placement

The map number element can be seen as similar in importance to the scale, author, and data source elements. It is usually placed in the margin along with those elements but could also conceivably be placed higher up in the element hierarchy if you wish to put it in large type in the upper-right or lower-left corner of the page. Adhering to the convention of placing it in one of those locations allows a researcher to flip through the series until the correct map number is located. Series-type maps usually also include a locator map. The map number and locator map are well suited for placement next to one another.

Style

Some examples of the way the map numbers are written include:

- 1 of 10 *or* 1 of 10
- First in a series of ten
- Map number 1 of 10
- Series #1:10
- Map 1 of 10

Tables

A table is a series of data arranged in rows and columns, often with column headings. Because a GIS is composed of both the visualization of the features in their geographic space and the attributes of those features, the map output of the GIS can lose value when it shows only the visualization of the features and perhaps one attribute (such as the road lines and the road names) but not the other applicable attributes (such as road length, width, or condition). When the other attributes are lengthy or numerous, a layout designer may wish to include a table corresponding to the mapped features as part of the layout. This enables the viewer to connect the features with their attributes without needing complicated and sometimes impossibly numerous colors, symbols, and labels on top of the features themselves.

In some cases, we are faced with trying to decide between summarizing the attributes so that they can all fit onto the map or including the full data table on the layout. If we are showing the distribution of cancer patients and cancer patient treatment costs across all counties in a state, you may be tempted to group the percentiles into four or five categories and color the counties with a corresponding gradient color scheme. However, the map could provide much more information if it is accompanied by a table showing the actual percentages for both attributes by county in descending order. There seems to be a misperception about the amount of detail

that people can understand on a poster-sized presentation. For example, I have seen the advice, "Don't insert long tables of numerical data or text" on conference poster guidelines. I think this advice comes from underestimating the human brain's ability to discern patterns in large amounts of data. If we format the table properly we can, indeed, present long tables, and we should if they further the message that we are trying to get across. This also increases your map's credibility.

Best Practices

If you have a table showing many attributes for the same features, you could alternatively choose to create a series of maps with each one showing the features and one particular attribute. This is a judgment call based on the space available, the size of the features, and the complexity of the attributes.

Style

There are many table styles. The important guidelines are to ensure that the column and row headings are legible, that the data line up, and that the column and row lines do not detract from the data. Because the map is still likely to be of more importance, the table ought to include as few ornamental lines and borders as possible to ensure that it has less visual weight than the map. In fact, delineating every cell in a table with a border usually adds unnecessary clutter, and you may also consider doing away with any lines at all and instead using white space as the main separator, with perhaps one or two simple neat lines separating the table from the elements above and below it.

To further enhance the table, you can add visual weight to certain elements. Anomalies in the data that may be too hard to detect on the map can be highlighted in the table with a circle or bold text. These enhancements need to highlight only the pertinent data cell, not the whole table row. The conservative use of color — to differentiate assets (black) from debt (red), for example — can also add to a viewer's understanding of the data. Another trick is to change the locations of numbers based on some characteristic of the numbers. For example, a table of acres of impervious surface per watershed could show the impervious acreages at a distance from the watershed name in proportion to the watershed's size. This would be a great accompaniment to a map of watershed-level impervious surface normalized by watershed area because it would be presenting the viewer with the unnormalized numbers in the table but generalized percentages in the map (see Figure 3.19).

Fish Creek	25|150
Barberville	150|180
Granton	50|200
Lakeland	62|250
Upwater	124|320

FIGURE 3.19 Tables can be formatted to clearly portray patterns in the data. In this example, the distance between the ratios and the place names increases proportionally to the denominators. When the data are presented like this it is easier to see that Barberville's numerator does not follow the pattern. The circle highlights this anomaly.

Copyright

A map copyright states the author of the map layout and is sometimes accompanied by the date of copyright declaration. However, in the United States, all maps are automatically protected (except some government documents) and therefore explicitly stating the copyright is not an absolute necessity.[3] A newer method of licensing a creative work like a map layout that acts in addition to a copyright, whereby some rights are explicitly given to the licensee, is called Creative Commons licensing.[4]

Placement

The copyright information is usually left as an inconspicuous metadata-type element and is given the least emphasis possible while still remaining legible.

Style

Usually, the text of the copyright includes the word "copyright" and the author's name or the copyright symbol (©) and author's name. The phrase "All Rights Reserved" and the copyright date(s) are optionally included as well. If using a Creative Commons license, the abbreviation (CC) plus the appropriate icon or text would need to be stated as advised by that license and your attorney.

Copyright Traps: A "copyright trap" or a "hook" is an error placed purposefully on a map so that if the same misinformation were to turn up on a rival's map, the original map owner would supposedly have definitive proof that the rival's map was directly copied from the original owner and simply resold for the rival's profit. Without this kind of misinformation, the rival could claim that it was simply coincidence that both maps display the same data. For example, the San Francisco Municipal Railway Map reportedly contained at least two fake streets ("Geek Street," and "Moe Street") for this purpose.[4] However, whether these traps actually serve their purpose is unclear.[5] With the traps used as evidence, a few allegations of copyright infringement have surfaced in the United States and other country's courts in recent years. In one such U.S. case a U.S. federal court found, "To treat 'false' facts interspersed among actual facts and represented as actual facts as fiction would mean that no one could ever reproduce or copy actual facts without risk of reproducing a false fact and thereby violating a copyright."[6] This statement reflects the concept that factual information cannot be copyrighted. Still, these traps may at least alert the author of a copyrighted map that their work was copied.

Projection

The projection of the main map element is sometimes reported in the layout margin as part of the metadata for the layout. One purpose for providing projection information is as a means of alerting the viewer to the potential benefits and limitations of the

map product. For example, the Lambert Conformal Conic projection would inform a knowledgeable viewer that the map is great for discerning the real-world shape of mapped features but that using it for measuring the area of those features may yield erroneous results. However, if the viewer is not knowledgeable about projections, the same information could be described on the map in a more direct way by simply stating the limitations of the map (e.g., "Not for use as an area measuring tool").

Best Practices

If your map audience is comprised of geographers or cartographers and possibly GISers, the projection information will be appreciated, depending on the subject of the map. However, even if the audience is comprised of only GIS professionals, you may still want to consider laying out clearly what the projection consequences are as not all GIS professionals are up to speed on projection nuances. By including both forms of text, the projection and its limitations, you can ensure that everyone is adequately informed.

Placement

The map projection information is placed in the margin along with the other metadata elements that are similar such as the disclaimer, data sources, data citations, and copyright.

Inset Map

An inset map is a small map relative to the primary map, generally with a ratio of about one eighth to one sixteenth the size of the primary map element. The inset map has two potential functions. One is to show an area of the primary map in more detail by zooming in to a portion of the primary map and the other is to give an overview of the primary map's location by zooming out from the primary map. This latter type of inset is variously referred to as an "inset," "overview," or "locator map." An example of the zoomed-in type would be large-scale maps of particularly densely populated portions of a county in order to allow all of the mapped features to be viewed adequately. An example of the zoomed-out type would be a watershed map that shows a stream in relation to the mainstem and other tributaries, shown in conjunction with a main map showing just the stream and detailed stream survey attributes.

Best Practices

The same features and feature styles in the primary map element need to be duplicated in the inset map element. The orientation, or north position, should also be the same as in the primary map. Additionally, it is usually necessary to highlight the position of the inset's features on the primary map using a box, shaded area, or other such technique if it is of the zoomed-in variety. Lines coming out from the primary map's box and connecting with the inset map, sometimes called "rays," visually connect the inset with the corresponding inset box on the main map (see Figure 3.20).

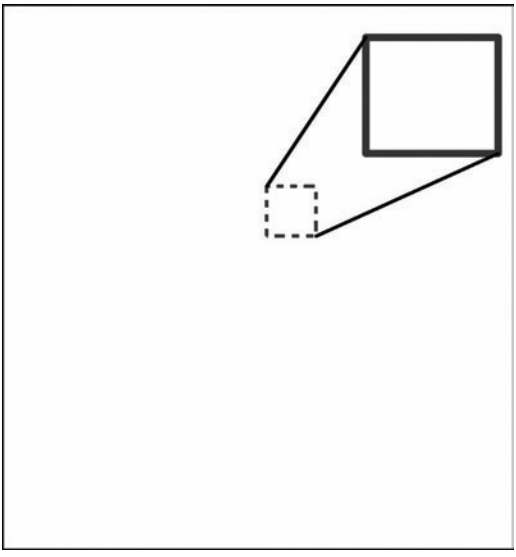

FIGURE 3.20 Inset maps that enlarge an area of the main map are tied to the main map in various ways. In this example the inset map is connected to its corresponding portion of the main map via a bounding box and rays.

Style

The inset map element should include its own scale bar, especially if it is a detail map. The overview style insets do not necessarily require a scale bar if enough spatial context is provided for the audience to orient themselves.

Descriptive Text

Descriptive text refers to any text that furthers the map's purpose that does not fit into any of the above categories. Often, the specific nature of your map will require unique descriptive elements. A confident and skilled GIS professional will recognize when and where a unique text element will enhance the viewer's understanding of the map and include it even though it is not referred to in any textbook on cartography or, indeed, on any other maps the professional has seen. For example, a handout map of ski trails might list Web sites to go to for current slope conditions.

Style

On a large poster-sized layout please remember to ensure the readability of all large blocks of text. This means that the font size must be large enough to read (14 point or 16 point at least) at a distance of 1 or 2 feet (see Chapter 4, "Fonts," for more text size guidelines). You should also double-space the lines to make it even easier to read, look less dense, and be therefore less off-putting. Headings for large blocks of text should avoid the use of common terms like "introduction" or "study area" and instead use a description that is pertinent to the material such as "Tide Levels" or "The Great Lakes." This ensures that you do not waste one ounce of space on a

word that is not specific to your subject. Consider a drop-cap for the first letter of the text block to draw the eye to that spot or perhaps a special leading graphic like a simple icon.

STYLE

Once you have scrutinized the layout checklist and read through the Element Details and Examples section in this chapter, you will have a good idea as to what you will be putting on the layout. What should the overall style of the layout be, though? While the Element Details and Examples section did describe some style guidelines for each element, this section focuses on the general style of the overall layout.

To begin with, this section advises seeking inspiration from other maps or artwork to get an idea of what overall composition and style you like and would fit the subject matter of the map. Note that I say "seeking inspiration," not "copying." Your data will lend your map a certain level of uniqueness but, as you start to add elements to the layout page, you will find yourself moving them around in order to better fit your own style and the unique considerations that your subject matter requires. While inspiration may be sought initially, the final map product ought to avoid being similar to the original inspirational work.[7] In its final form, the layout will be in harmony with the data it is comprised of, its audience's expectations, and the most current cartographic styling.

Some things to take note of when perusing other people's maps and art work are

- Overall feel: simple, complicated, scientific, humorous, medical, historical
- Colors: light or dark, patterns, color distribution around the page, background versus foreground hue, chart colors
- Element configurations
- Element separators such as neat lines, boxes, other graphics
- Font choices and styles
- Metadata text, style, and location on the layout

Choosing favorite parts of various types of maps and creating an amalgam of them in your layout is another way to go. Yet another place to find inspiration for the overall design is to consider the context and audience where the map will be displayed. The following introduction to context explores this concept further.

Context

Where will your printed map be viewed? Who will be viewing it? These two basic questions are the basis for most of the contextual considerations a mapmaker faces. Stemming from these are the secondary questions of how many people will be viewing the map, at what distance, with what surroundings, and so on. In the examples that follow, the contextual question of where a poster-sized map will be located forms the main design consideration.

Will your map be viewed as part of a poster gallery at a conference? A light-colored map with just the right "pop" in the important elements can provide soothing

FIGURE 3.21 One style approach might be to counteract the audio-visual chaos at conference poster events with a map that provides a modicum of calmness and sanity.

relief for bleary-eyed conference goers. Add a graph or two and your audience will enjoy at least pretending that they are scrutinizing the graph so that they may appear to be intellectual. If they happen to actually walk away having absorbed the simple message you were trying to convey with the map or graph, then you have served your purpose (see Figure 3.21).

Will this map be on a wall in the company hallway that happens to be painted a striking white color? Perhaps the opposite strategy could attract attention to your masterpiece. A great way to make a statement in this location is to use very dark, saturated colors to provide a pleasing contrast. Blues and grays are perfect for this, give a modern out-of-this-world feel, and are soothing all at the same time (see Figure 3.22).

How about creating a map for your work group that will be put on a gray cubicle wall within eyeshot of everyone walking by (including your boss)? Using candy-shop colors would brighten the gray cube wall and provide visual relief for those passing by (see Figure 3.23). Of course, an actual jar of candy sitting nearby could also serve your cause well.

Finally, consider your subject. Who is your audience? Tailoring the style to the audience's expectations can lead to a successfully received layout. For example, although you may not be in the medical field yourself, perhaps you are tasked with creating a poster of some health data for an upcoming medical conference. Instead of creating the layout in the same style as you have for other types of presentations, you can research the style that people in the medical field are accustomed to seeing. This might lead you to add in trend reports along the margins in the form of graphs and statistics tables. Another example is making a map for a business audience. If you aren't familiar with business style, then check out some of the leading business books and study their graphics. One of the things you would find is that the graphics are

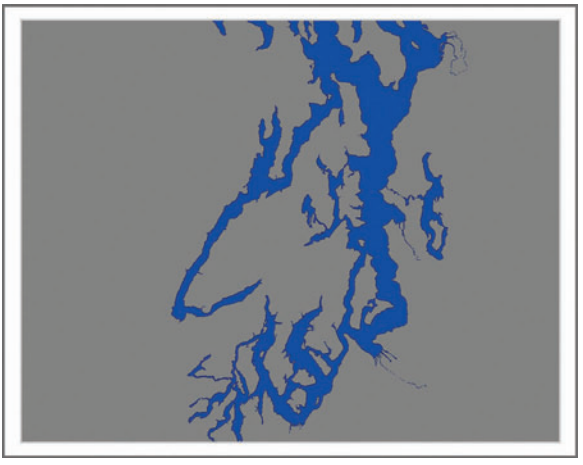

FIGURE 3.22 Dark colors provide drama for otherwise boring office walls.

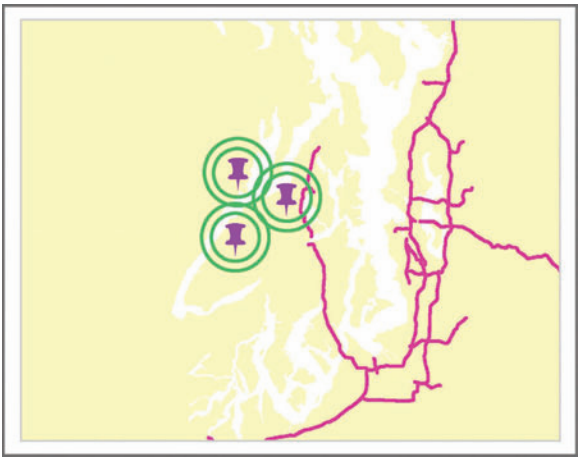

FIGURE 3.23 This map is designed with vibrant purple, green, and pink foreground features as a means of livening up a gray cubicle wall.

generally black-and-white line drawings with boxes, diagrams, and graphs. If you can get your layout to conform to a similar style you might buy yourself some credibility from the get-go.

If you have a particular style in mind that is different from what your audience is used to seeing, it is still okay to use it if you have some good reasons for it. Some good reasons might include that you want to "update" the field with a more modern-looking design, you found a better way, or you feel that your audience is tired of the old way. When introducing a drastically new design style to an audience you need to preface your presentation with an explicit acknowledgment that what they are seeing is different from the norm, why you went ahead and designed it that way, and what

the audience will gain from seeing it in the new way. This prevents your audience from simply concluding that you have no idea what you are doing.

The subject matter of your map may also influence its design. Consider archeology maps, which present some very interesting design options. Perhaps you are managing the GIS data for a site dig. When the overall site map is displayed on a large-format layout, you could take a cue from historical maps (after all, the site is historical) and place supporting information like graphics around the main map. The graphics can fade out toward the main map in order to provide visual separation as well as to further the old-world look. The graphics can consist of pen-and-ink drawings like artist's renditions of what various parts of the site may have looked like in the past and drawings of what the site looks like now.

Arrangement

Once the layout style is chosen and the context for the layout considered, the placement, design, and arrangement of the layout elements should be easier. The first step in arrangement is to think in very general terms of what you want the viewer to see first on the layout by creating an emphasis map. The next step is to consider the arrangement of the elements more specifically as well as the level of detail you will be providing in each element. The last step is to build the layout, ask for feedback, and revise, repeating these steps until a satisfactory layout is produced.

Before explaining the ins and outs of an emphasis map, we need a short introduction to types of layouts, some typical compositions, and a warning. First, the type of layout that you are creating will greatly constrain your attempts at arrangement. For example, static report maps located in-line or full-page, Web site maps, and slide maps do not typically have a layout at all. At the most, they will include a map, title, legend, and scale bar floating over the map, all potentially bound within a framing box. At the least they consist of the map itself with no supporting information, except as might be written in the accompanying text or caption or as might be referenced in a verbal presentation.

Reports with Maps: If a map designed for an 8.5-inch by 11-inch report is not large enough to fill the entire space between the left and right margin of the report, consider using two maps side by side to avoid having too much white space on either side. Another trick is to create the map so that its size is half the width of the page minus the margin area and then place it in-line so that the text wraps around it. The result is more of a newspaper or magazine style layout and is more pleasing to the eye (see Figure 3.24). For example, if the page was divided into a table of six squares, two columns, and three rows, a map would ideally fit directly into one of the six squares. On an 8.5-inch by 11-inch page with 1.25-inch margins on the left and right, this would translate to a map approximately the size of a 3-inch by 3-inch square. Because of the small size, of course, the map should show only a large-scale view of the subject, or only a few features, or both.

FIGURE 3.24 Report map placement options.

Arrangement considerations are mostly applicable to larger format layouts beginning with a letter-size sheet (8.5 inch by 11 inch) and moving up to large poster-sized sheets. Some typical poster-sized map layout compositions are

- One map comprising two thirds of a layout; extensive margin elements
- Multiple maps in a time series; bounding boxes that group items; time labeled clearly
- Multiple maps of related data layers within the same geographic boundaries
- Working map with one large-scale map comprising the entire layout; specifications and legend information are placed in blank or nonessential spaces
- Conference poster with a small map relative to the poster size used for supporting information

And finally, a warning: while many concrete examples and guidelines are presented here (and other examples and guidelines can be found in other cartography texts) that will be useful to study for creative inspiration, the map designer ultimately needs to rely on a mixture of these guidelines, intuition, and previous experience to produce a layout appropriate to the map's unique data, subject, and shape.

Emphasis Map

"Emphasis map" is a term borrowed from the world of Web design. It consists of an initial sketch-up of what your product will look like with specific attention to where the eye needs to be directed on an initial perusal of the document. In the case of a map document in which the mapmaker wants the viewer to read the title first and then look at the map, the sketch-up would show a title in large bold characters and then a map frame with lighter outline and color scheme. All other elements would be sketched in a light and cursory fashion.

Make it a standard practice to put pen to paper and create a sketch-up, taking perhaps ten minutes of your time, prior to embarking on any major map endeavor. It will force you to consider the main goals of your mapping from a design standpoint before your mind gets overwhelmed with the details. As always, do not avoid taking the time to rework the emphasis map as you reconsider where the title will be and how much emphasis the map will be given. As an aside, the time you take up front

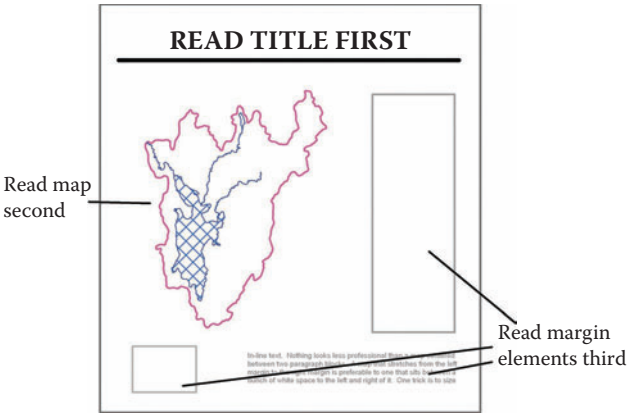

FIGURE 3.25 An example of an emphasis map. The largest and boldest elements signify where the mapmaker wants the map viewer to focus first.

to consider the layout will probably not decrease as you continue in this profession. Remember that there is a positive correlation between the quality of your layout products and the quality of your planning.

Figure 3.25 illustrates what an emphasis map might look like with the title as the primary element, map as the secondary element, and margin elements as tertiary elements in the visual hierarchy.

While it is common for a title to be created with the highest visual weight, it is conceivable that the mapmaker would want the primary map element to be the first element in the visual hierarchy, with the title being read only after a quick glance at the map. Other combinations are also possible but less common.

You can see that in the emphasis map in Figure 3.25 the designer has already taken some preliminary steps toward laying out the elements, albeit in a generalized fashion. If even this level of detail is too much to begin with, the designer could start by writing out the emphasis map in word form like this: title=first, map=second, margin=third.

When a final emphasis map is drafted, the planning stage is complete and the process of placing elements onto the layout can officially begin. As you start to place the various elements onto the page, keep in mind how the overall feel of the layout is taking shape. If the layout is starting to look too cluttered, reassess whether the offending element is necessary and, if it is, try to find a way to minimize its visual impact. Although useless clutter is obviously not desirable, do not confuse that principle with the more insidious principle of keeping the map simple or "dumbed down." This is explained in the next section.

Simplicity versus Complexity

To begin with, the two output media types where simplicity is always okay are slides and in-line report graphics. For these, aim for color continuity on all slides and report graphics for a polished look. If your map is not of either type, though,

a certain amount of complexity is needed in order to justify the larger format. As long as your main data are appropriately highlighted, complex background data can add contextual understanding for the viewer that allows the map to be a rich resource for information. This leads to the following principle: do not be afraid to present extremely complex information as long as it is pertinent to your map's purpose. If it is presented in a coherent and unified manner, a complex map may even become your best printed work.

Many times we confuse "readable" with "simple." A map does not necessarily need to be simple to be readable as long as the appropriate highlighting of important information and organization of background elements are executed. An oft-cited reason for simplifying is the dumbing down of information for busy superiors and the non-expert public. However, if you keep in mind the example of a standard U.S. Geological Survey topographic map, which contains many details on trails, roads, rivers, towns, schools, and so on in addition to innumerable contour lines, you can realize that most people with a high-school education are able to gain some understanding from them and feel a sense of knowledge gained as a result. That said, if your background data are both cluttering up the map and have no real utility, then by all means consider getting rid of them. Examples of background data that may, in some contexts, offer no additional value to the viewer while adding mindless clutter to the map are hillshade layers and small-scale aerial photos.

Inset maps of the overview type, which give the viewer an overview of the general location for the main map, are an element that does require simplicity simply due to the lack of space allowed within their smaller map frames (this is a similar case to the in-line report maps mentioned earlier). When using an overview inset map it is important to remember not to simply create a large-scale replica from the same exact data and symbology used in your main map. Detailed data presented in this manner need to be generalized first. For example, if development zoning data are presented in the main map, the zones will probably be too small in the inset map for the viewer to distinguish between them and, furthermore, they are probably not even necessary. The inset map for a development map might just show a simple box or single polygon that outlines the extent of the development zones with relation to nearby regional boundaries (that themselves should be generalized).

Those exceptions aside, the main point of keeping the complexity in your map is to empower your map reader. Let's say your boss asks you to create a customized map to be handed out to employees showing how to get from the office to the company picnic site. A typical dumbed-down approach would be to show the office, the picnic spot, and only the roads in between that the driver will take to get there. What if the driver takes a wrong turn? In that case, the driver is out of luck and needs to get a detailed road map to get back on track. If you want to avoid disempowering the map reader but preserve the quick readability that comes from the original approach you could, instead, use a detailed road map as the main map and use a smaller inset showing the simplified map. Since the product would now resemble an old-fashioned road map, you could even fold it into twenty sections and hold a contest to see if anyone can refold it.

The last two principles to keep in mind as you start to add elements to the page are the design of the margin, if any, and the overall balance of the elements.

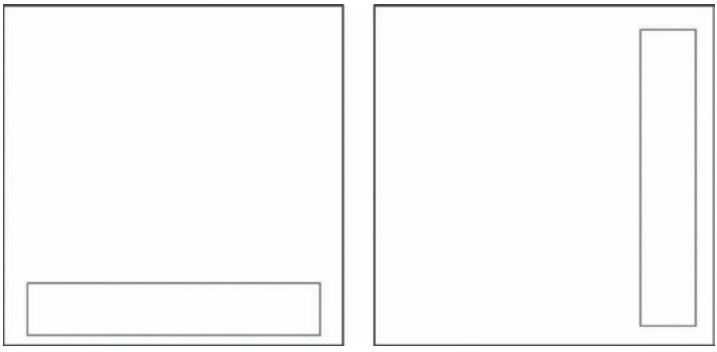

FIGURE 3.26 Margin elements are normally placed at the bottom or right-hand side of the layout.

Margins

The convention in traditional architectural drawing is to place the margin elements, especially the key metadata, at the bottom or right-hand side of the map in a white rectangular area that spans the width or height of the page (see Figure 3.26). This ensures that flipping through a flat file drawer to find a particular map will produce the desired result instead of a heap of crumpled papers on the floor.

The margin can be further split up into discreet parts that focus on particular details of the map. For example, the layout in Figure 3.27 contains an architectural box on the bottom of the page, split into three segments, with the middle segment being the largest.

You might wonder why I don't tell you to float the margin elements over the map. While I do think that this is acceptable practice for some of the margin elements, such as scale bars and north arrows, which are intimately tied to the map, it doesn't make for a very nice looking map when there are a bunch of graphic elements floating all over the place. Much more professional and polished looking are the maps where the designer has placed those elements outside of the map element in their own nice and neat margin section.

Balance

Balance is more than avoiding a lopsided layout, although this is certainly a priority. Balance entails harmony in color, line weight, and content that ensures the layout is read as a cohesive whole rather than a sum of disparate parts. Practical application of the concept includes unifying fonts, counterweighting a peninsular geographic feature with a logo or graph, and correctly utilizing empty space. (Remember your grade-school art teacher's advice to make your drawing fit the whole page? Risking a stern reprimand from said teacher, some white space can be defensible on a printed map.)

White space used as a visual separator between elements needs to be balanced throughout the layout in terms of spacing and alignment. This is best explained via the example in Figure 3.28, which is a close-up of the lower right-hand portion of the map in Figure 3.27 of the Margins section.

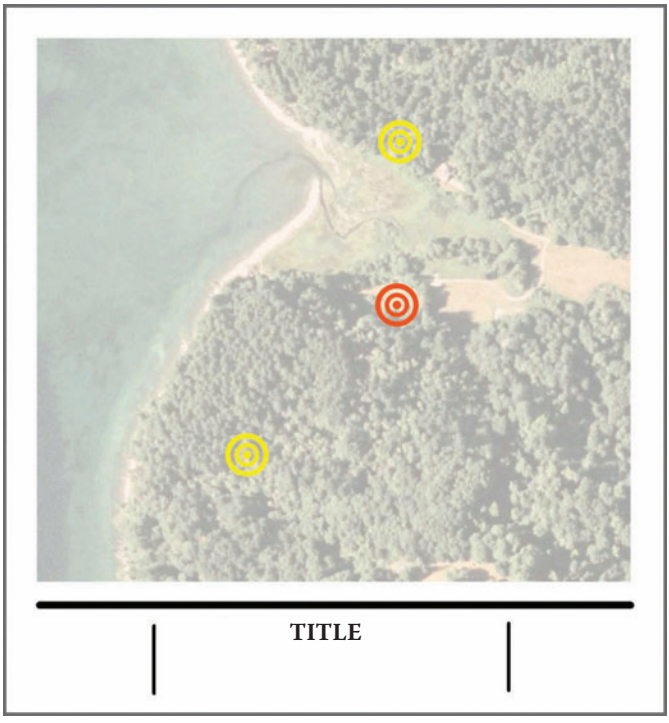

FIGURE 3.27 An architect's box at the bottom of the layout is elegantly split into three segments. The segments can be physical (straight lines or boxes) or elegantly implied (white space).

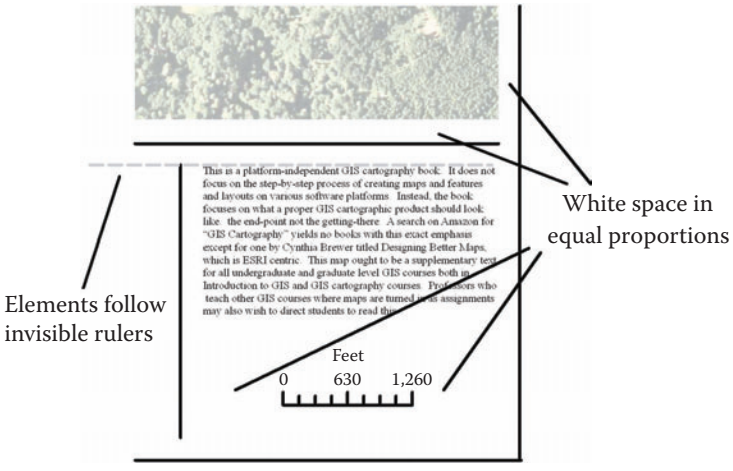

FIGURE 3.28 All white space needs to be carefully aligned so that it is in equal proportion around the layout elements. This is accomplished via on-screen rulers or guides and a lot of patience. Always check to make sure the elements are aligned properly at a 1:1 scale before printing.

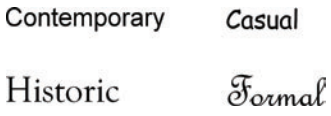

FIGURE 3.29 Different fonts evoke different styles.

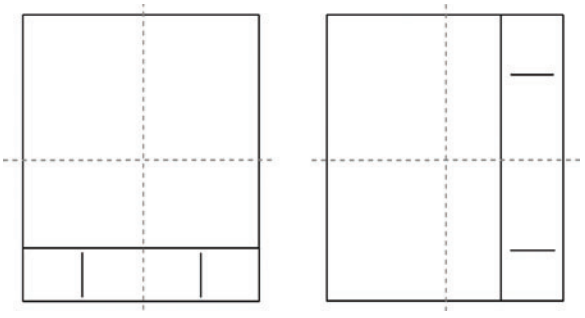

FIGURE 3.30 You can put your layout elements on the page in a symmetric fashion along the x- or y-axis.

Content balance in terms of style is also a consideration. As the style of your finished map ought to be chosen at this point, you can choose appropriate fonts, color choices, and element arrangements that will conform to that style. For example, different fonts can portray different styles such the examples in Figure 3.29. See Chapter 4, "Fonts," for more information on choosing the right fonts.

Balancing out graphics by shape and color is also advisable. For example, counterweight a large circular north arrow with a logo by placing it on the opposite side of the page. Taking this one step further, the logo could be displayed in a black-and-white color scheme to match the black-and-white north arrow, with the added benefit of deemphasizing the logo.

Modern map layouts should contain elements of both symmetry and asymmetry. The main parts of the layout may be asymmetrical along the horizontal axis, for example, while the subsections remain symmetrical around an imaginary vertical axis. Conversely, the asymmetry may be around the vertical axis while the symmetry is present around the horizontal axis (see Figure 3.30).

How will you decide what kind of symmetry is best for your map? As with all of the other aspects of the arrangement phase of the mapping method, experimentation, coupled with inspiration with an eye toward standard practices, is all that is necessary to achieve a balanced design. As the Staples button says, "That was easy."

SUGGESTIONS FOR FURTHER READING

Brewer, Cynthia A. *Designing Better Maps: A Guide for GIS Users*. Redlands, CA: ESRI Press, 2005.

Few, Stephen. *Information Dashboard Design*. Sebastopol, CA: O'Reilly Media, Inc., 2006.

Robbins, Naomi. *Creating More Effective Graphs*. Hoboken, N.J.: John Wiley & Sons, Inc., 2005.

Silberbauer, M. J. *DWAF Presentation Standards for GIS Users Adapted for the Institute for Water Quality Studies.* Pretoria, South Africa: Institute for Water Quality Studies Department of Water Affairs and Forestry, 1996. Based on the document by F. Jonck, W. Wolfer, R. Potgieter.

END NOTES

1. Edward Tufte, *Beautiful Evidence* (Cheshire, Conn.: Graphics Press LLC, 2006), p. 133.
2. More information on the use of pie charts, including when they are and are not appropriate, is in Stephen Few's online report: S. Few, "Save the Pies for Dessert," *Perceptual Edge Visual Business Intelligence Newsletter* (August 2007). Available at: http://www.perceptualedge.com/library.php (accessed July 29, 2008).
3. See Title 17 United States Code Section 101, et seq. This information is provided for informational purposes only and does not constitute legal advice.
4. C. Squatriglia, "Mapmakers' Sleight of Hand: Cartographers Put 'Bunnies' on the Map, Tricking Copycats, Sometimes Tourists," *San Francisco Chronicle*, 12 August 2001. p. A-19.
5. Mark Monmonier, *How to Lie with Maps*, 2nd ed. (Chicago: University of Chicago Press, 1996).
6. *Nester's Map & Guide Corp. v. Hagstrom Map Co.*, 796 F. Supp. 729 (E.D.N.Y. 1992).
7. Map products are protected under copyright laws in the United States.