## 11.3 TYPOGRAPHY

**Type**, or text, refers to the words that appear on maps. **Typography** is the art or process of specifying, arranging, and designing type. Several of the map elements described in the previous section are partly composed of type—the legend, for example—and others, such as the data source, are composed entirely of type. Type can be considered a special sort of symbol, or even a map element in its own right. Type that is well designed and smartly applied can make a map easier to understand and more attractive. The rules and guidelines for the use of type in cartography are derived from general rules of typography, but have been modified over time to reflect the specific purposes of mapmaking. Fortunately, these rules and guidelines are relatively well defined.

### 11.3.1 Characteristics of Type

Type is commonly organized according to characteristics such as type family, type style, and type size. **Type family** refers to a group of type designs that reflect common design characteristics and share a common base name—Palatino, for example (Figure 11.18A). Within a type family, type is differentiated by **type style**: Roman (normal), bold, and italic are common type styles* (Figure 11.18B). Additional type styles include condensed, expanded, light, and extra bold. Type of a particular family and style is referred to as a **typeface**, such as Palatino Roman or Helvetica Bold (Figure 11.18C). A particular typeface is further differentiated by **type size** (Figure 11.18D). Type size (height) is measured in points (one point equals 1/72"). Although type sizes are described in points, the actual height of a given character cannot be inferred from its point size; the point size refers to the height of the metal block on which type was created prior to the development of digital type. A **font** is a set of all alphanumeric and special characters of a particular type family, type style, and type size, such as Palatino Italic, 12 point (Romano 1997). Many typographical terms are

* When applying type styles, it is best to use a member of a type family that has been specifically designed with that style (e.g., Bookman Bold). Many software applications allow roman type to be crudely modified into italic or bold, resulting in type that is unsuitable for high-quality printing.

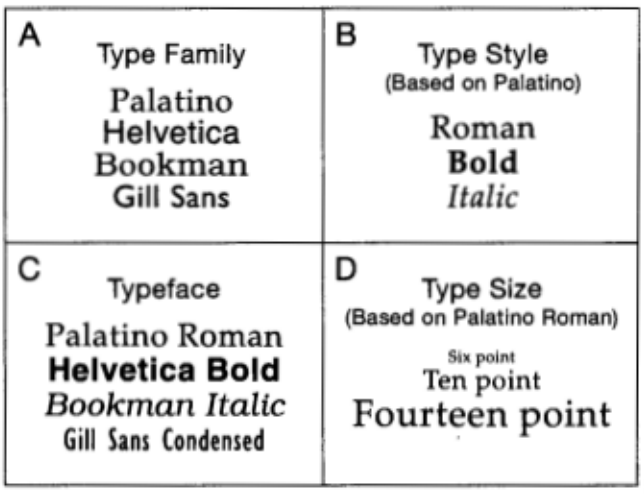


**FIGURE 11.18** (A) Type family. (B) Type style. (C) Typeface (a particular type family and type style). (D) Type size.

misunderstood and misused. For example, the term *font* is commonly (and inappropriately) used to refer to a type family or typeface.

Uppercase and lowercase letters are used in cartography, but lowercase letters have proven to be easier to read. This is because lowercase letters are less blocky, and they provide more detail that helps differentiate one letter from another. The majority of type on a map should be set in title case, as illustrated in Figure 11.19A. **Title case** is composed of lowercase letters with the first letter of each word set in uppercase. Conjunctions and other "linking words" (in, on, or, of, per, by, for, with, the, and, over, etc.) are set in lowercase. Title case is appropriate for use in titles, subtitles, legend headings, legend definitions, labels for point and line features, and so on. **Sentence case** is composed of lowercase letters with the first letter of each sentence set in uppercase, and is appropriate when formal sentences are used, such as in textual explanations or descriptions appearing on a map. Words set in all uppercase are sometimes used as short titles and as labels for areal features, as described later.

**Serifs** are short extensions at the ends of major letter strokes, as illustrated in Figure 11.19B. Type families with serifs are termed serifed; type families without are termed sans serif (without serifs). Serifed type is preferred in the context of written documents because the serifs provide a horizontal guideline that helps to tie subsequent letters together, reducing eye fatigue. In cartographic applications, where type is used primarily as short labels and descriptions, both serifed and sans serif type is used; one has not proved to be more effective than the other. In certain situations, a serifed type family can be used for one category of features (e.g., cultural) and a sans serif type family can be used for another category of features (e.g., natural).

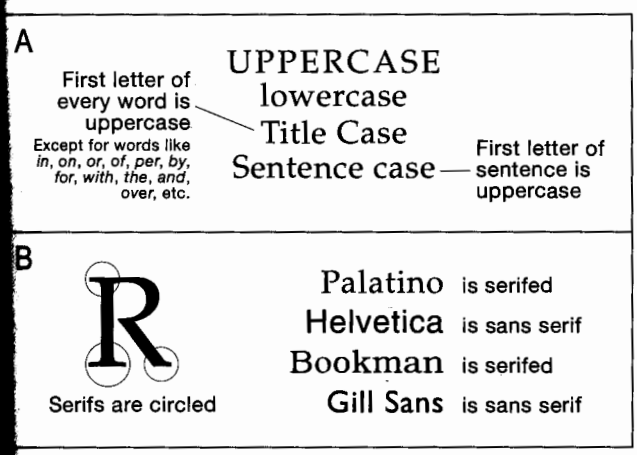


**FIGURE 11.19** (A) Uppercase, lowercase, title case, and sentence case. The majority of type on a map should be set in title case. (B) Serifs are extensions at the ends of letter strokes.

Not surprisingly, **letter spacing** refers to the space between each letter in a word, and **word spacing** refers to the space between words. Minimal letter and word spacing (Figure 11.20A) results in compact type that is often easier to place on complex maps (words occupy less space from beginning to end). Slightly increased letter and word spacing results in type that appears less "cramped" and is easier to read. You should employ slightly increased spacing if possible. The blocky nature of all-uppercase type normally requires greater letter and word spacing than lowercase type to prevent it from looking cramped. Exaggerated letter and word spacing is often employed in conjunction with all-uppercase type when labeling areal features, as described later. Letter and word spacing should be kept consistent within individual blocks of text, and among labels that are otherwise similar. For example, each line of type in a three-line data source should have the same letter and word spacing, as should every label that identifies a restaurant on a particular map.

**Kerning** refers to the variation of space between two adjacent letters, as illustrated in Figure 11.20B. Different combinations of adjacent letters require different amounts of kerning if spaces between letters are to be visually consistent. For example, the letter pair WA requires the removal of space between letters to look consistent with the space between MN. Digital type includes preset "kerning pairs" that automatically set the space between various letter pairs. Kerning can also be performed

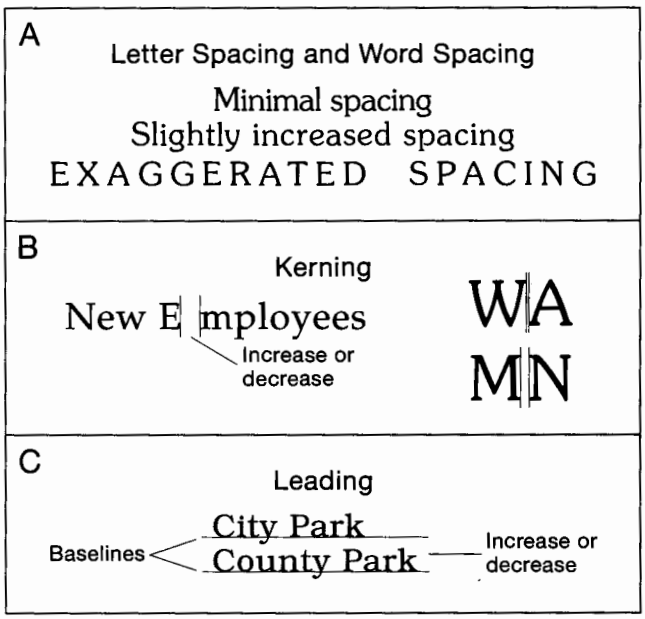


**FIGURE 11.20** (A) Letter spacing and word spacing can be altered for different situations. (B) Kerning adjusts the space between two individual, adjacent letters. (C) Leading is the space between lines of type, from baseline to baseline.

manually, after letter and word spacing has been specified, to adjust the space between particular letter pairs that still appear to be too close together or too far apart. Kerning is measured according to a unit called an *em*, which is equal to the point size of the type being used.

**Leading** (pronounced like *heading*), or line spacing, refers to the vertical space between lines of type, according to their *baselines*, and is altered to place lines of type closer together or further apart (Figure 11.20C). Leading should be great enough to allow multiple lines of type to be read easily, but not so great as to result in wasted space between lines. (An exception to this guideline is presented in section 11.3.6.)

### 11.3.2 General Typographic Guidelines

The following is a list of general guidelines for the use of type in cartography.

1. Avoid the use of decorative type families, and use bold and italic styles sparingly. Script, cursive, and otherwise fancy and ornate styles are unnecessarily difficult to read. They should be avoided in favor of more practical type families, such as those used as examples in this chapter. The overuse of bold styles can overshadow other map elements, and is normally not required if appropriate type sizes are chosen. If possible, italic type should be reserved for two applications: to label hydrographic (water) features, and to identify publications in the data source. Italics are appropriate for hydrographic features because their slanted form resembles the flow of water. (It is also conventional to use the color cyan for hydrographic labels and features.) The use of italics for publications is standard bibliographic practice. The wide variety of features on general reference maps might require that you use bold and italic styles outside of these guidelines.
2. Avoid using more than two type families on a given map. Simpler maps can, and should, be limited to one type family. Variations in style and size within a family normally offer sufficient variety for all but the most complex maps. For the sake of consistency, map elements such as the title, subtitle, legend heading, legend definitions, data source, and scale should all employ the same typeface. If two type families are required (e.g., to label a wide variety of map features), choose families that are distinctly different—one serifed and one sans serif, for example. As mentioned earlier, a serifed family can be used for one category of features (e.g., cultural) and a sans serif family can be used for another category of features (e.g., natural).
3. Choose a realistic lower limit for type size; all type needs to be readable by the intended audience. Factors for consideration include the age and visual acuity of the map user, map reproduction method, anticipated lighting conditions, and the map user's physical proximity to the map. Mark Monmonier (1993) recommended a lower size limit of 7 points for lowercase type, but this value is conservative. Type as small as 3.2 points (usually uppercase, sans serif) is commonly used on congested street maps where space is at a premium (Jonathan Lawton, California State Automobile Association, personal communication, 2002). Readability is ultimately tied to the typeface used, crispness of reproduction, and other factors. The only way to ensure the readability of small type is to provide a sample to members of the intended audience.
4. Generally speaking, type size should correspond with the size or importance of map features. For example, type representing the names of large cities should be noticeably larger than type used to represent small cities. Type size is also partially dictated by the relative importance of map elements, as described in sections 11.2 and 11.4. Because map users are not sensitive to slight differences in type size, avoid differences of less than two points if possible (Shortridge 1979).
5. Critically evaluate and apply type specifications such as type family, type style, type size, letter spacing, word spacing, kerning, and leading. Do not passively accept the default settings provided by software applications. Instead, consider the purpose of each block of type in the context of the map, and apply type specifications accordingly.
6. All type should be spell-checked. Special attention should be focused on the most current spelling of place names, which change over time and are often controversial. Also, be aware that certain older place names are considered to be offensive or derogatory by today's standards.

### 11.3.3 Specific Guidelines: All Features

The following is a list of specific guidelines for the placement of type associated with point, linear, and areal features.

1. Orient type horizontally, as illustrated in Figure 11.21A. One exception is when labeling a map that includes a graticule with curved parallels, in which case the type should be oriented with the parallels (Figure 11.21B). Another exception is when labeling diagonal or curved linear and areal features, in which case the type should reflect the orientation of the features, as illustrated in Figure 11.21C.
2. Avoid overprinting and, when unavoidable, minimize its effects. **Overprinting** is a phenomenon that occurs when a block of type is placed on top of another

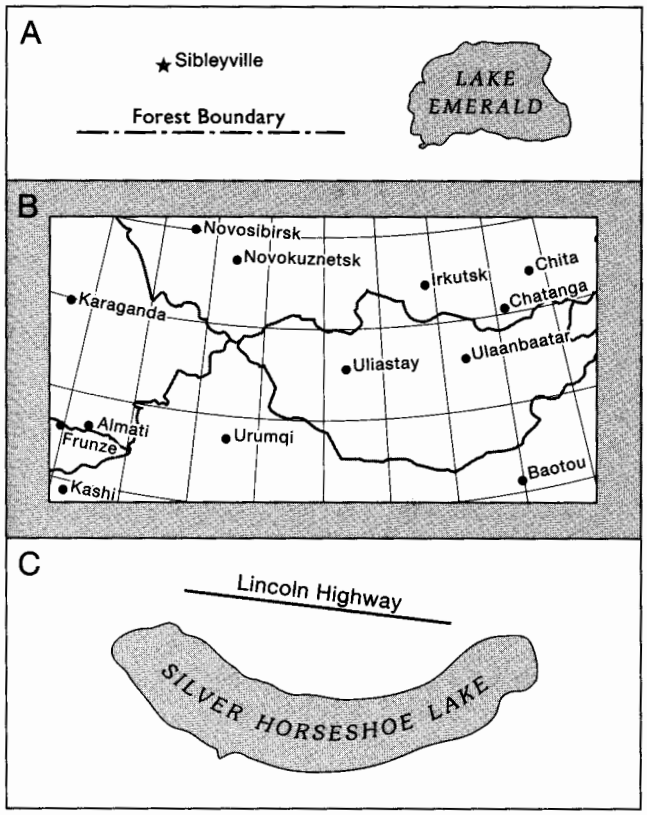


**FIGURE 11.21** (A) Type placed horizontally. (B) Type oriented with a graticule. (C) Diagonal and curved type.

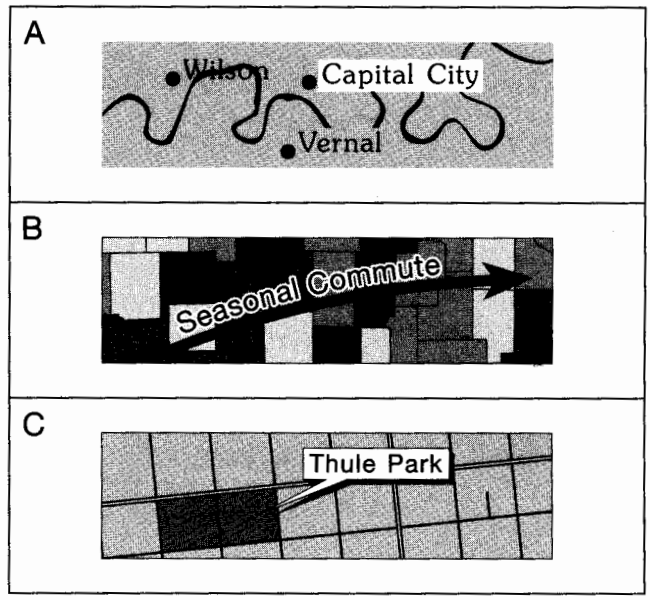


**FIGURE 11.22** (A) Masks placed underneath type. (B) A halo around type. (C) A callout combines a mask with a leader line.

graphic object (e.g., a river), obscuring the type and making it difficult to read, as illustrated by "Wilson" in Figure 11.22A. The effects of overprinting can be minimized through the use of either a mask, halo, or callout. A **mask** is a polygon (e.g., a white rectangle) that is placed underneath type, but above the underlying graphics, as illustrated by "Capital City" in Figure 11.22A. As seen in this example, masks can sometimes obscure too much of the underlying graphics, and should be used with caution. Masks can also be specified with the same color as the background area, allowing them to blend in better, as illustrated by "Vernal" in Figure 11.22A. A **halo** is an extended outline of letters in a type label (Figure 11.22B). Haloes cover less of the underlying graphics than masks, while still allowing the type to be read. **Callouts** are a combination of mask and leader line (Figure 11.22C). Callouts are effective, but should be used with caution because they are visually dominant and can overshadow other map elements.

3. Ensure that all type labels are placed so that they are clearly associated with the features they represent. In pursuit of this goal, it is often useful to place larger type labels first, followed by intermediate and then smaller labels (Imhof 1975).

### 11.3.4 Specific Guidelines: Point Features

The following is a list of specific guidelines for the placement of type associated with point features.

1. When labeling point features, select positions that avoid the overprinting of underlying graphics according to the sequence of preferred locations illustrated in Figure 11.23A. This sequence is based on the work of Pinhas Yoeli (1972), but is modified by the authors according to the idea that, if possible, the symbol should be placed on the left and defined to the right (as in a legend). Notice, also, that the least preferred locations for a label are directly to the right and left of the symbol. This results in an "unfavorable optical coincidence" (Imhof 1975, 132), in which the point symbol might be misinterpreted as a type character in the label.
2. Do not allow other map features to come between a point symbol and its label (Figure 11.23B). Emphasize the association between the label and symbol by placing the label close to the symbol, even if it means choosing a less preferred location.
3. If the sequence of preferred locations does not provide a suitable option, consider using a mask, halo, or callout. Another option is to use a simple leader line as illustrated in Figure 11.23C. Leader lines should be

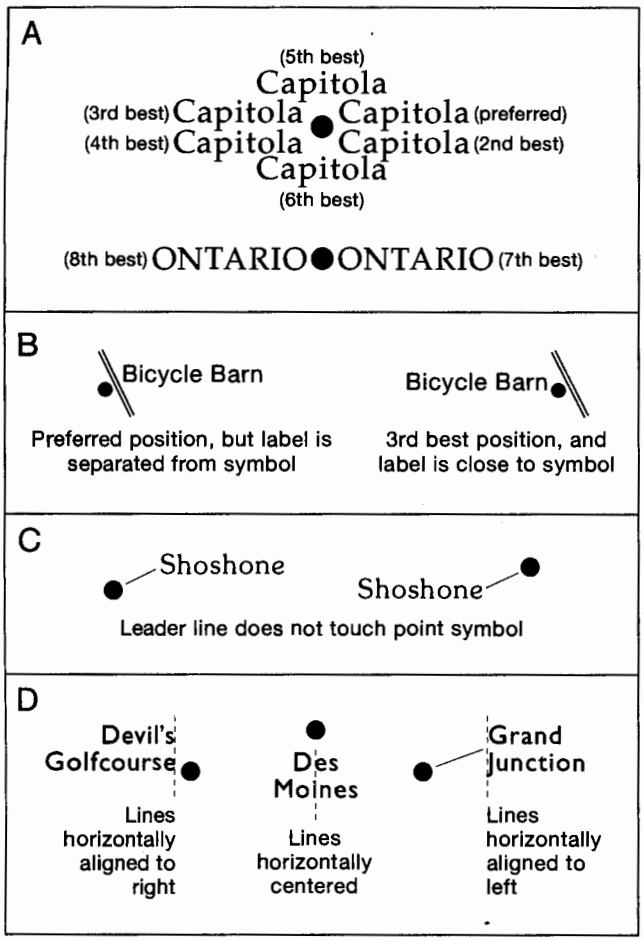


**FIGURE 11.23** (A) Sequence of preferred locations for labeling point features. (B) A road coming between a point symbol and its label. (C) Leader lines are used if necessary. (D) Multiple-line labels are horizontally aligned or centered to imply association with the symbol.

very thin (e.g., 0.25 point), not include an arrowhead, and point to the center of the point symbol without actually touching it.

4. Multiple-line labels should be placed according to the sequence of preferred locations, and individual lines of type should be horizontally aligned or centered to emphasize the association between the label and point symbol (Figure 11.23D).
5. Point symbols on land that are close to coastlines should be labeled entirely on land if possible. Point symbols that touch coastlines should be labeled either entirely on land or entirely on water, depending on which option offers greater legibility (Wood 2000). Avoid overprinting the coastline with type (Figure 11.24).
6. These guidelines should be followed as closely as possible. In practice, however, it is often impossible to adhere to all guidelines simultaneously. Figure 11.24 illustrates how these guidelines might be applied on a map of restaurant locations in a coastal region.

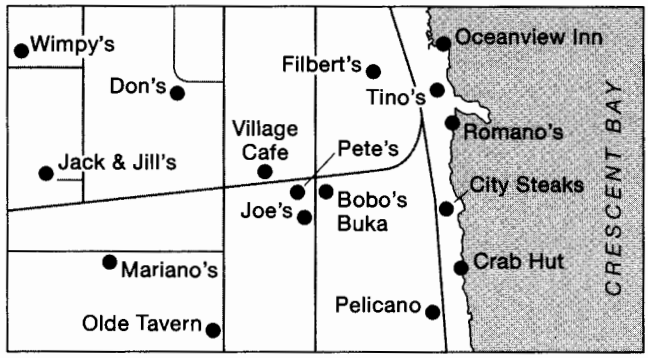


**FIGURE 11.24** Guidelines for labeling point features applied simultaneously.

7. Do not exaggerate letter or word spacing for point features. Exaggerated spacing weakens the association between a point symbol and its label, and tends to emphasize the *areal* extent of features (point features have no areal extent).

### 11.3.5 Specific Guidelines: Linear Features

The following is a list of specific guidelines for the placement of type associated with linear features.

1. When labeling linear features, place type above the features, close to, but not touching them, as illustrated in Figure 11.25A. Descenders, such as the

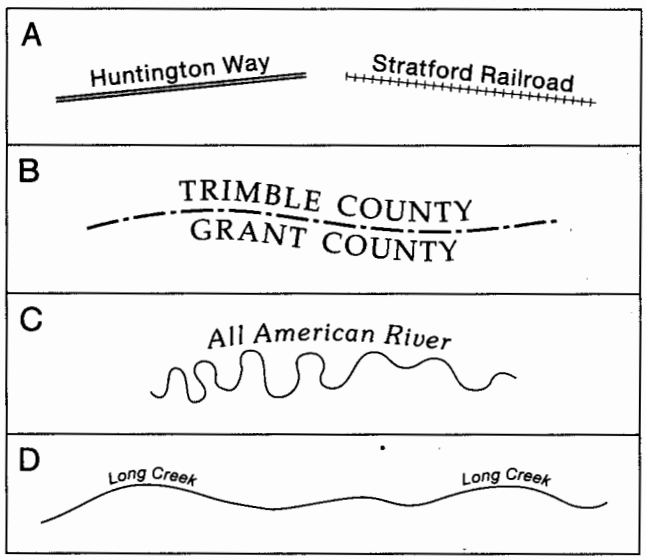


**FIGURE 11.25** (A) Type labels placed above linear features. (B) Labels on both sides of a boundary. (C) Label following the general trend of a complex curve. (D) Long feature labeled twice.

lower extensions of "g" and "y" in "Huntington Way" should just clear the line symbol. Type is placed above linear features because it appears to rest on the feature instead of hanging below it, and because the bottom edge of lowercase type is normally less ragged than the upper edge, resulting in a more harmonious relationship between label and symbol. One exception is when labeling areas on both sides of a boundary, in which case type appears above *and* below the line, centered with one another (Figure 11.25B).

2. When labeling linear features that have complex curves, follow the *general* trend of the feature (Figure 11.25C), as type that curves too much is difficult to read.
3. Very long linear features can be labeled more than once (Figure 11.25D). The use of multiple labels is preferred to the exaggeration of letter and word spacing to emphasize linear extent.
4. Labels for linear features should be placed upright, not upside down. Correctly placed labels read from left to right, whereas incorrectly placed labels read from right to left, as illustrated in Figure 11.26. By convention, type that is absolutely vertical should be readable from the right side of the page. These rules actually apply to all type that appears on a map, but are most closely associated with linear features.

### 11.3.6 Specific Guidelines: Areal Features

The following is a list of specific guidelines for the placement of type associated with areal features.

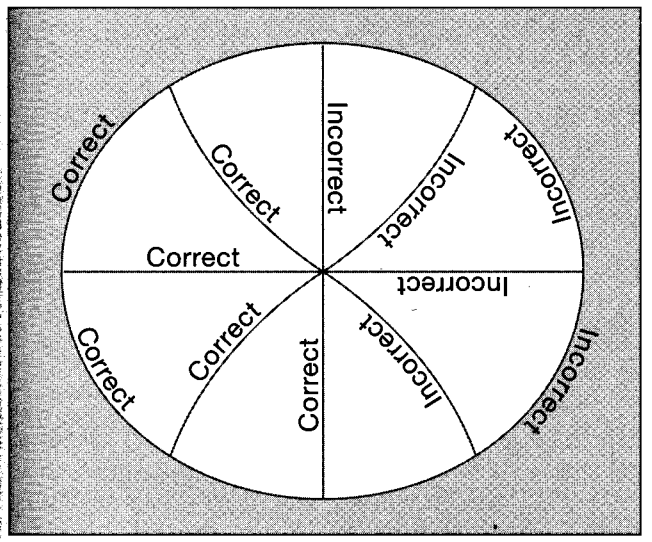


**FIGURE 11.26** Type should be placed upright, and should read from left to right. Vertical type should be readable from the right side of a page.

1. When labeling areal features that are large enough to fully contain a label, visually center the label within the feature, as illustrated in Figure 11.27A. Don't allow the label to crowd the areal symbol—allow a space of at least one and one half times the type size (1.5 ems) between the ends of the label and the boundary of the feature (Imhof 1975). As when labeling linear features, follow the *general* trend of areal features that have complex curves.
2. Consider using all-uppercase type when labeling areal features (Figure 11.27A). The blocky nature of uppercase type can help to emphasize areal extent.
3. Exaggerated letter and word spacing can be used to emphasize areal extent, and is most effective when applied to all-uppercase type (Figure 11.27B); lowercase type tends to look disjointed when exaggerated spacing is applied (Figure 11.27C). Caution should be exercised when exaggerating letter and word spacing, as individual letters can become so far apart that the map user would have trouble seeing the label as anything other than individual letters. An extreme upper limit of four times the type size (4 ems) should be observed for letter spacing. Maximum word spacing can exceed

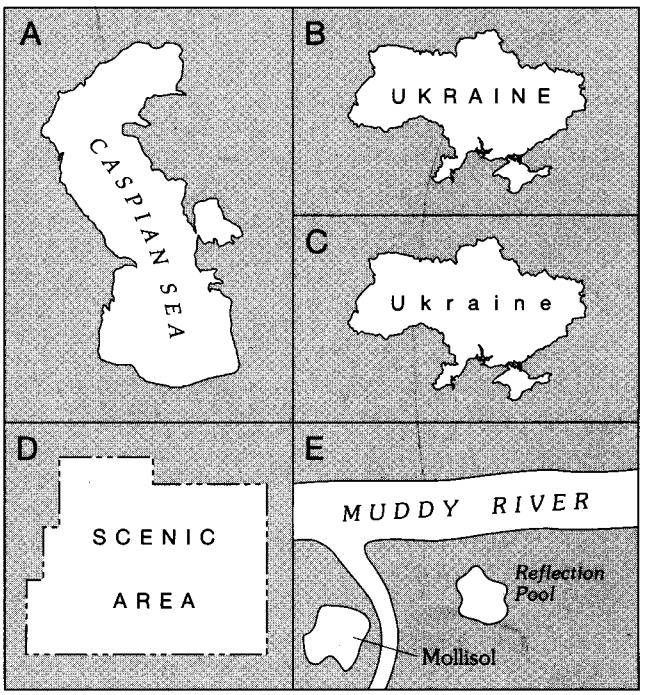


**FIGURE 11.27** (A) A type label visually centered within an areal feature. (B) Uppercase type with exaggerated letter and word spacing, emphasizing the areal extent of the feature. (C) Lowercase type is not as well suited to exaggerated spacing. (D) Exaggerated leading. (E) A river labeled as an areal feature, a small areal feature (reflection pool) labeled as a point feature, and a leader line used to help identify an areal feature.

this value, but care should be exercised to ensure that the relationship between words is clear.

4. Leading can also be exaggerated to emphasize areal extent, as illustrated in Figure 11.27D. Leading should not be so great that the relationship between lines of type is lost.
5. Features typically thought of as being linear (e.g., rivers) that are represented at such a large scale that they appear as areas should be labeled as areal features, as illustrated in Figure 11.27E.
6. Areal features that are too small to contain a label should be labeled as if they were point symbols, as illustrated by the reflection pool in Figure 11.27E.
7. If necessary, leader lines can be used with areal features. Leader lines should be very thin (e.g., 0.25 point), not include an arrowhead, and just enter the areal symbol, as illustrated by the Mollisol in Figure 11.27E.

### 11.3.7 Automated Type Placement

Throughout this section, we have assumed that the cartographer is making all decisions regarding type placement. When using general-purpose graphic design software (e.g., FreeHand or Illustrator), this is almost certainly the case. The reader must bear in mind, however, that specialized **labeling software** has been developed for automatically positioning type, often within the context of a GIS. Labeling software focuses primarily on the placement of type associated with map features (e.g., streams) as opposed to positioning textual map elements, such as the title. Development of this software has been the focus of both computer scientists and cartographers, who have created sophisticated algorithms (including heuristics, or "rules of thumb") based on established rules and guidelines of cartographic type placement. Most labeling software applications incorporate aspects of cartographic **expert systems**, which make decisions based on rules and guidelines obtained from cartographic experts (Zoraster 1991).

Labeling software is designed to approach or achieve "optimal" placement of type labels that avoids both the overprinting of underlying map elements and conflicts among type labels. Two general approaches have emerged: (1) placement of each label in its preferred position, followed by an iterative reorganization of labels to avoid or minimize conflict among labels (Freeman 1995); and (2) casual, sub-optimal placement of labels, followed by an iterative reorganization of labels until the combined placement of all labels approaches an optimal state (Edmondson et al. 1996; Pinto and Freeman 1996).

The biggest potential advantage of labeling software is its ability to save time, as manual type placement remains one of the most time-consuming aspects of map construction, particularly when labeling linear and areal features (Barrault 2001). One problem associated with labeling software is the fact that optimal solutions are often computer-intensive when a considerable amount of type must be positioned. Another problem is that the wide variety of maps, together with variations in map scale and complexity, make it difficult to achieve satisfactory results in all situations. The finished product normally requires some interactive editing to arrive at a solution that is visually acceptable. As more sophisticated algorithms are developed and the speed of computers increases, it appears inevitable that type placement will become a more fully automated process.