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# Digital Art Requirements for Submission

## Contents

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|   |          |
|---|----------|
| <b>1. Overview</b>  | <b>3</b> |
| What Is Digital Art?  | 3        |
| Types of Digital Art: Scans and Computer-Based Drawings       | 3        |
| <b>2. Image Resolution for Continuous-Tone Scans</b>          | <b>4</b> |
| Continuous-Tone or Bi-tonal?                                  | 4        |
| Determining Resolution Settings for Continuous-Tone Scans     | 4        |
| <b>3. Halftones: A Necessary Step in the Printing Process</b> | <b>5</b> |
| What is a Halftone?   | 5        |
| Scanning Books and Magazines                                  | 5        |
| <b>4. Image Resolution for Bi-tonal Scans</b>                 | <b>6</b> |
| Continuous-Tone or Bi-tonal?                                  | 6        |
| Determining Resolution Settings for Bi-tonal Scans            | 6        |
| <b>5. Charts, Graphs, and Maps</b>                            | <b>7</b> |
| Preparing Charts and Graphs                                   | 7        |
| Preparing Maps  | 7        |
| How to Submit Final Art to Publishers                         | 7        |
| <b>Preparing Charts and Graphs: Exhibit A</b>                 | <b>8</b> |
| Proportion Sizing in Figure Layouts                           | 8        |
| <b>Preparing Charts and Graphs: Exhibit B</b>                 | <b>9</b> |
| Anticipating the Effects of Reducing Image Size               | 9        |

## 1. Overview

There are several factors to consider when attempting to reproduce illustrations in printed books. Quality of original illustrations is foremost, but we also consider scanning resolution, the paper books will be printed on, and printing presses. Failure to consider any one of these factors can lead to problems when books are on press and to disappointment with finished books. To avoid this, we prefer to handle scanning your photographs and illustrations. If this is not possible, have a professional graphic arts service bureau scan your art to specifications below. Prints from digital files, submitted as art to be scanned, are not acceptable. Scans that do not meet these guidelines may be rejected. The guidelines set forth in this document pertain strictly to black and white digital art.

### What Is Digital Art?

Digital art is any image that has been captured through scanning or digital photography, or that has been created using a software program.

### Types of Digital Art: Scans and Computer-Based Drawings

#### Scans

Scans (or bitmap files) are images composed of pixels—the smallest building blocks of bitmapped art. The figures on the right show two basic types of scans. Figure 1.1 is a continuous-tone scan, and figure 1.2 is a bi-tonal scan.

**CONTINUOUS-TONE SCANS (8-BIT)** In continuous-tone scans, each pixel is one of 256 shades of gray, ranging from pure white to solid black. Because each pixel can vary in tonality, transitions from light to dark are smooth and realistic—as long as the **RESOLUTION** is high enough. Photographs and drawings with fine transitions between light and dark, such as figure 1.1, are ideal candidates for continuous-tone or 8-bit scanning.

**BI-TONAL SCANS (1-BIT)** In bi-tonal scans, each pixel can be only one of two values: 100% black or 100% white. Images that lack gray values, such as figure 1.2, are good candidates for bi-tonal scanning.

#### Computer-Based Drawings

Charts, timelines, graphs, and other quantitative information-based images are often created (as opposed to being scanned) using a vector-based drawing application. Vector-based drawing applications build images by using mathematical formulas to describe points, lines, and shapes. Unlike scans, which depend on proper resolution for realistic rendering, vector graphics are resolution independent and can be enlarged to any size without loss of quality. See figure 1.3.

**RESOLUTION** The number of pixels per unit of measure to form an image. In the United States, image resolution is calculated per inch, hence the abbreviation ppi.

#### TIP ON TERMINOLOGY

**Continuous-tone** images are often referred to as “photographs.” In Adobe Photoshop, the term **Grayscale** is used (Menu: Image > Mode).

**Bi-tonal** images are often referred to as “line art” or “monochrome” images. In Adobe Photoshop, the term **Bitmap** is used (Menu: Image > Mode).

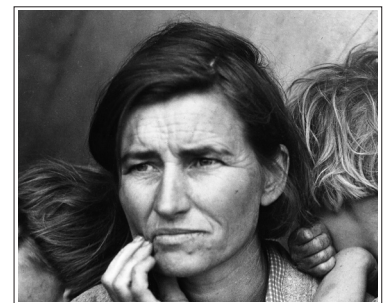


Fig. 1.1

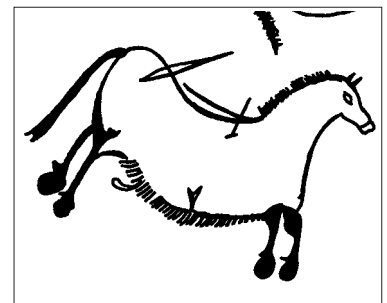


Fig. 1.2

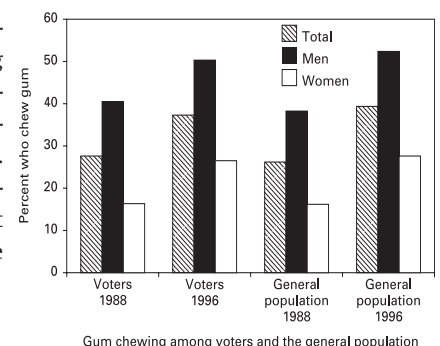


Fig. 1.3

Figure 1.1: *Migrant Mother* by Dorothea Lange. Courtesy of the U.S. Farm Security Administration Collection, Library of Congress. Figure 1.2: Drawing by R. Dale Guthrie.

## 2. Image Resolution for Continuous-Tone Scans

Resolution is a major factor in determining the quality of all scans. Resolution is the number of pixels per unit of measure (inches, in the United States, hence the abbreviation ppi) used to form an image. In general, photographic scans intended for print usage should be at least 300ppi at the final size for reproduction. Resolution should be determined at the scanning stage based on the qualities of the originating image: (1) whether it is continuous-tone or bi-tonal and (2) the size of the original. For further guidance, see the table below.

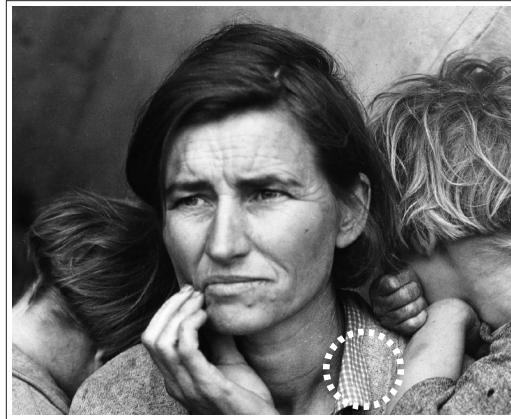


Fig. 2.1 - 300ppi

**FIGURE 2.1**

Example of a properly scanned, grayscale photograph at 300ppi. This resolution setting is suitable for high-quality offset print production.



Fig. 2.2 - 72ppi (Note the pixelized edges and loss of details.)

**FIGURE 2.2**

Example of a photograph scanned at 72ppi, resulting in an image that appears blurry or out of focus. **PIXELATION** is another phenomenon associated with a low-resolution scan. Low-resolution settings are not suitable for print.

**FIGURE 2.3**

Example of a low-resolution scan to which resolution has been artificially added.



Fig. 2.3 - Scanned at 72ppi; with resolution artificially increased to 300ppi. (Compare the circled areas in the figures. Note that there is little improvement in detail in fig. 2.3 after resolution has been added.)

**PIXELATION** A phenomenon in bitmap images that results from insufficient resolution or over-enlargement. Individual pixels become visible, especially on the edges of objects, creating a stair-stepped or jagged look.

### Continuous-Tone or Bi-tonal?

To determine whether you should scan your original art in continuous-tone mode (8-bit) or in bi-tonal mode (1-bit), consider the following:

- ▶ If your original is a photograph or fine art drawing that contains multiple levels of gray tones, you should scan the original in *continuous-tone mode*.
- ▶ If the original is a line drawing without gray tonalities, and consists of only black and white lines and shapes, you should scan the original in *bi-tonal mode*.

### Determining Resolution Settings for Continuous-Tone Resolution Scans

| Size of Original (inches) | Resolution (ppi) |
|---------------------------|------------------|
| Smaller than 5 x 7        | 600ppi           |
| 5 x 7                     | 300ppi           |
| 8 x 10                    | 300ppi           |

Save all scans in the TIFF or EPS format.

### 3. Halftones: A Necessary Step in the Printing Process

#### What Is a Halftone?

All continuous-tone scans must become halftones in order to be printed. A halftone is an image formed by breaking up a continuous-tone image into a pattern of dots of varying sizes. In the lighter areas of the image, the dots are very small. In the darker areas, the dots enlarge to overlap each other. When printed, the dots, though clearly visible through a magnifying glass, merge to give the illusion of continuous tone to the naked eye.

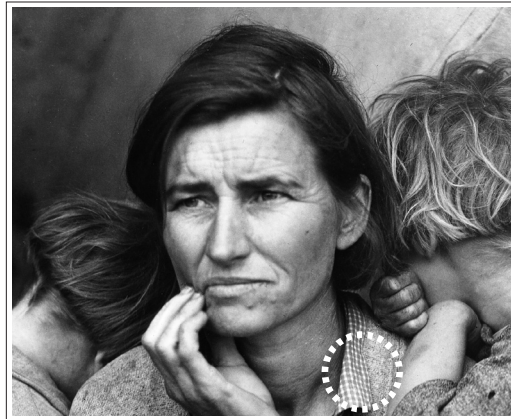


Fig. 3.1 - Printed halftone

Figure 3.1 has been scanned from an original photograph.



Fig. 3.2 - Halftone dot pattern

Figure 3.2 is a detail of figure 3.1. Note the dot pattern.

#### Scanning Books and Magazines

In general, you should avoid using previously printed images (such as halftones from books and magazines) as your original art, as they can result in unwanted pattern effects called **MOIRÉS**. Printed photographs contain a dot pattern as a result of the halftone process, so scanning printed images creates an overlapping array of patterns: (1) the pattern present in the printed piece and (2) the new pattern created from the scan. When these two patterns overlap, a moiré is formed. While **DESCREENING** techniques can be used to minimize the effect of moirés, these techniques usually result in a softening of detail in the image.

**MOIRÉ** In printing, an undesirable pattern created by the overlapping of halftone screens. Moirés occur when printed images are scanned and not properly *descreened*.

**DESCREENING** A process by which evidence of the original halftone screen pattern is removed. This can be achieved through the use of software and/or mechanical filters.

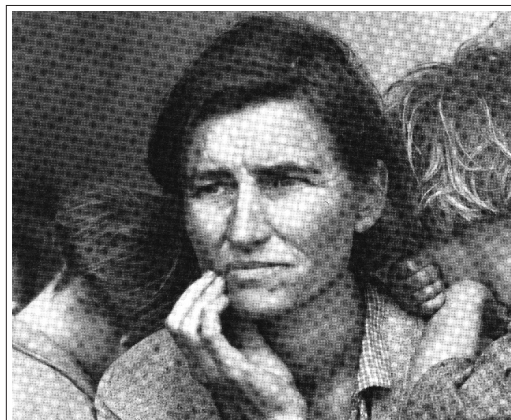


Fig. 3.3 - Moiré pattern

Figure 3.3 has a moiré pattern that is unpleasant to look at and unsuitable for print production.

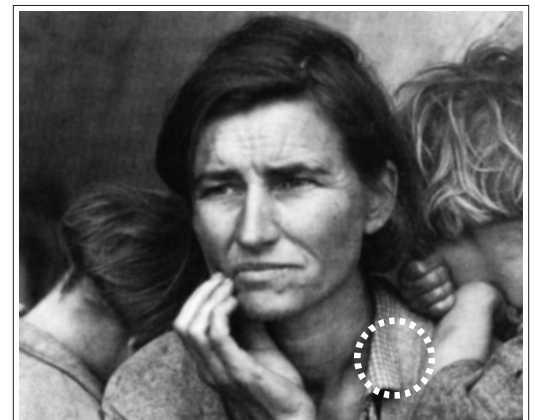


Fig. 3.4 - Descreened

Figure 3.4 has been descreened but the photographic details have been diminished as a result. (Compare circled areas in figs. 3.1 and 3.4.)

#### 4. Image Resolution for Bi-tonal Scans

Resolution determines the quality of all scans. Resolution is the number of pixels per unit of measure (inches, in the United States, hence the abbreviation ppi) used to form an image. In general, bi-tonal scans intended for print usage should be at least 1200ppi. Resolution should be determined at the scanning stage based on the qualities of the originating image: (1) whether it is continuous or bi-tonal and (2) the size of the original. See the table below for further guidance.

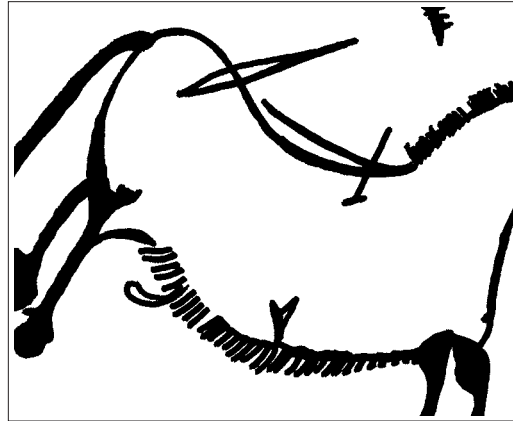


Fig. 4.1 - 1200ppi

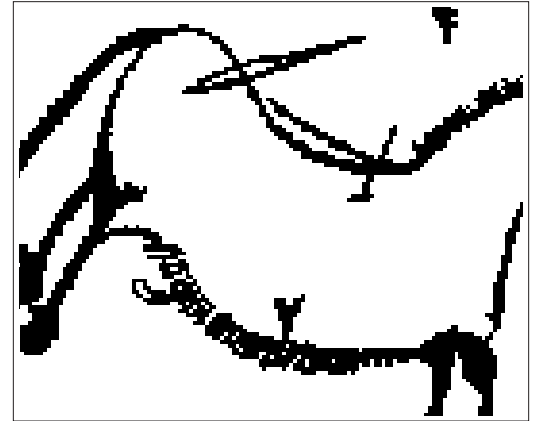


Fig. 4.2 - 72ppi

**FIGURE 4.1**

Example of properly scanned *LINE ART* at 1200 ppi. This setting is ideal for high-quality offset print production. Note the smooth curves.

**FIGURE 4.2**

Example of line art scanned at 72ppi, which results in an image that appears blocky and sharp-edged. *PIXELATION* will occur if line art is scanned at low resolutions. Low-resolution settings are *not* suitable for print.

**FIGURE 4.3**

Example of a low-resolution scan to which resolution has been artificially added. This is still inadequate for printing.



Fig. 4.3 - Scanned at 72ppi; with resolution artificially increased to 1200ppi

**LINE ART** Images that contain only solid blacks and whites.

**PIXELATION** A phenomenon in bitmap images that results from insufficient resolution or over-enlargement. Individual pixels become visible, especially on the edges of objects, creating a stair-stepped or jagged look.

#### Continuous-Tone or Bi-tonal?

To determine whether you should scan your original art in continuous-tone mode (8-bit) or in bi-tonal mode (1-bit), consider the following:

- ▶ If your original is a photograph or fine art drawing that contains multiple levels of gray tones, you should scan the original in *continuous-tone mode*.
- ▶ If the original is a line drawing without gray tonalities, and consists of only black and white lines and shapes, you should scan the original in *bi-tonal mode*.

#### Determining Resolution Settings for Bi-tonal Resolution Scans

| Size of Original (inches) | Resolution (ppi) |
|---------------------------|------------------|
| Smaller than 5 x 7        | 2400ppi          |
| 5 x 7                     | 1200ppi          |
| 8 x 10                    | 1200ppi          |

Save all scans in the TIFF or EPS format.

### Preparing Charts and Graphs

#### PROPORTIONS

Typically, charts and graphs are printed in books at sizes ranging from 3" x 3" to 4" x 7". However, most people create their drawings at a larger size. This means the drawing will have to be reduced to fit within the dimensions of the book. The relationship between font size, rule weight, and final printed size should be considered when creating drawings. See **exhibit A** for an example of acceptable figure layouts.

#### STYLE

1. One consistent line weight is preferred, but use no more than two rule sizes.
2. Use one font point size throughout the figure. If two sizes are used, they should vary from each other only slightly—for instance, 10 pt and 12 pt as opposed to 10 pt and 18 pt.
3. Font styles should be used sparingly. In most cases, there is no reason to use bold or italic.
4. Do not use all CAPS as this decreases overall legibility.
5. Use tints sparingly and only if you are submitting digital originals using one of the recommended software programs listed below. Use solid black and white where possible. Tint variations that are not easily distinguishable from each other may confuse the reader. Use 20%, 50%, and 80% tint values.
6. Patterns: If you are submitting laser prints and areas of a figure need to be distinguished with more variation than solid black and solid white allow, then patterns should be used. Do **not** submit laser prints that include tints.

### Preparing Maps

It is strongly recommended that all maps be prepared by a professional cartographer and that they be coordinated to match a book's design.

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### How to Submit Final Art to Publishers

#### LASER PRINTS

Many of the programs used to create charts and graphs, such as *WordPerfect*, *Microsoft Word*, *PowerPoint*, and *Excel*, **cannot** output valid **POSTSCRIPT** files. These programs are meant for more limited use in presentations or for output via desktop printers. However, prints from these applications may be submitted and scanned successfully if these basic guidelines are adhered to:

1. Follow the rules of proportion and style as indicated in the section above.
2. Provide printouts on smooth, bright white laser paper.
3. Set the resolution of the laser printer at a minimum of 600dpi (dots per inch).
4. Use patterns instead of tints to distinguish different areas. See item 6 in the Style section above.
5. Label all figures clearly.

#### DIGITAL FILES

Digital files are acceptable if they have been created in one of the following programs: *Adobe Illustrator*, *Macromedia Freehand*, or *CorelDraw*. These guidelines should be adhered to:

1. Follow the rules of proportion and style as indicated in the section above.
2. Include all fonts used in digital drawings with your submission.
3. Include all images placed within digital drawings with your submission.
4. Save digital drawings in the **EPS FILE** format.
5. Include laser prints of all digital image files with your submission.

#### ANTICIPATING THE EFFECTS OF REDUCTION

##### Line Rules

1. The minimum rule size should be no smaller than 1 pt in the large original.
2. Maximum rule size should be no larger than 2 pts in the large original.

##### Typography

If you are working with oversized art, reduce your printouts by 50% to ensure that the fonts will be easily readable when sized for the book page. Refer to *Preparing Charts and Graphs: Exhibit B (page 8)* to see how these combined principles can affect a chart's clarity.

**POSTSCRIPT** An Adobe programming language used to describe pages, graphics, and fonts. The PostScript language tells output devices how to render data as pages.

**EPS FILE** An abbreviation for encapsulated PostScript file. A type of file used to encode graphics so they can be embedded in a larger PostScript file.

Proportion Sizing in Figure Layouts

Charts and graphs are usually drawn at sizes larger than can be used in a book. Reproduction sizes commonly range from 3" x 3" to 4" x 7". To fit on the pages of a book, the original drawings must be reduced in size. The relationship between font sizes, rule weights, and final printed sizes should be considered when constructing the original figures.

See the comparisons below for a clarification of the requirements of **VECTOR IMAGES**.

**VECTOR IMAGES** Vector-based drawing applications such as *Adobe Illustrator* and *Macromedia Freehand* build images by using mathematical formulas to describe points, lines, and shapes. Unlike scans, which depend on proper resolution for realistic rendering, vector graphics are resolution independent and can be enlarged to any size without loss of quality.

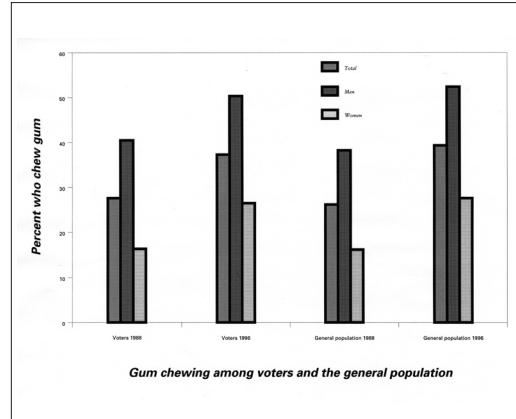


Fig. A1

Figure A1 shows a chart reduced to the size dimensions of the printed page. Note the illegibility of the legend and column/row headings. The bar shadings are too similar in tone as well.

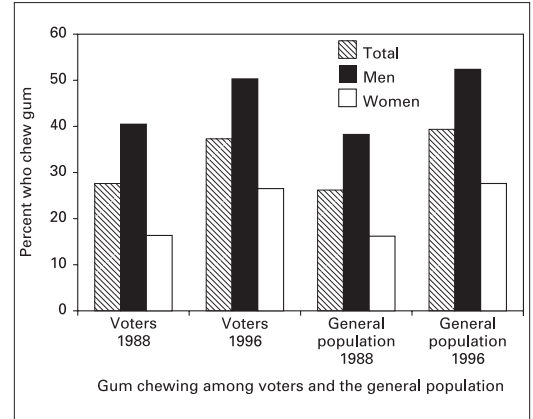


Fig. A2

Figure A2 depicts the same chart redrawn with the final production size in mind. Bars are clearly distinguishable, all text is legible, and the line rules are not faded.

**PREVIEW** reproduction size by printing out figures at a width of between 3 and 4 inches. You can also use a photocopier to reduce figures to that size.

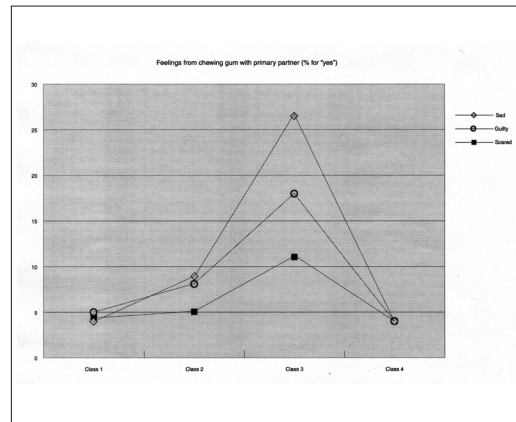


Fig. A3

Figure A3 illustrates a line graph in reduced size that will print poorly if no adjustments are made. The type is rendered unreadable. Also, the graph points are lost within the background shading.

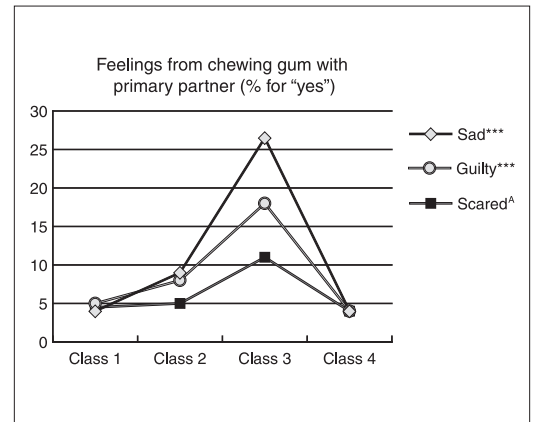


Fig. A4

Figure A4 provides the same information as figure A3 but is laid out according to the accepted guidelines. The text is now readable and the plotted points are clearly defined.

Anticipating the Effects of Reducing Image Size

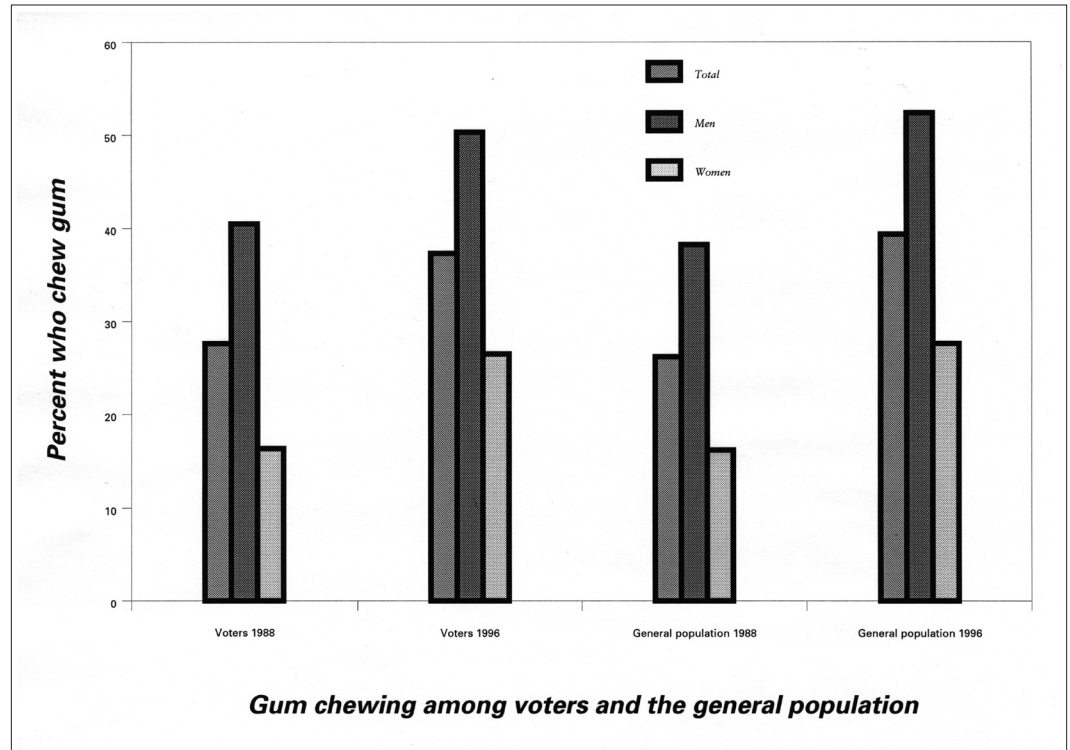


Fig. B1 - Original size chart before reduction

**LINE RULES**

Bounding rules that appear **thin** in the reduced image may fade and disappear when printed. The **minimum** rule size should be no smaller than 1 pt in the large original.

The boldness of rules that are too **thick** around data columns adds unnecessary emphasis. The **maximum** rule size should be no larger than 2 pts in the large original.

**FONT SIZES**

Column and row headings that are legible at full size may become unreadable when reduced to fit in a book. If you are working with oversized art, reduce your printouts to the width that will be used in the book to make sure your type is clear.

Use one font throughout the figure. If two different sizes are utilized, they should vary from each other only slightly (e.g., 10 pt and 12 pt, not 10 pt and 18 pt).

Font styles should be used sparingly. Generally, there is no reason to use bold or italic.

Do **not** use all CAPS as this decreases overall legibility.

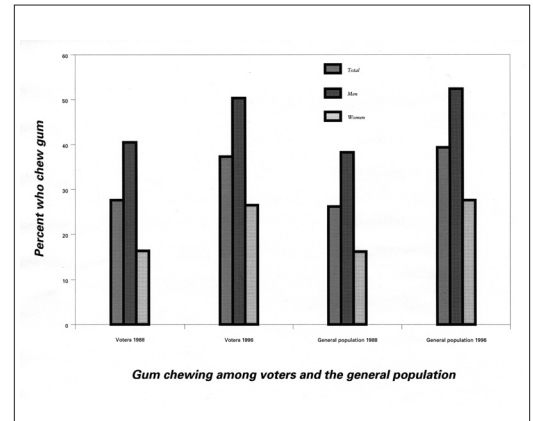


Fig. B2 - Illegible chart after reduction

**TINT VARIATIONS**

Tint variations that are not easily distinguishable from each other may confuse the reader. To avoid identical columns or graph points, use 20%, 50%, and 80% tint values.

Legibility of the accompanying chart legends and keys should also be confirmed.