

# Digital Graphics for the *Journal of Field Archaeology*

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*In addition to proper design and execution, the preparation of digital graphics for the Journal of Field Archaeology should take into account the requirements of prepress and production. Digital photographs should be taken at a file size that provides a 300 dpi image with full tonal range and sharp focus. Drawings are a more complex matter, and a series of suggestions and observations are presented to guide authors in the preparation of maps, plans, and charts.*

## Introduction

Our goal at the *Journal of Field Archaeology* is the accurate reproduction of illustrations as well as of text. We are receiving more and more art, both photographs and drawings, in digital format, and that in many cases were prepared using digital technology. Art prepared in conventional, analogue form, such as inked drawings and film photography will likely diminish or even be phased out, but our contributors should be aware that carefully-prepared, well-executed art in any medium remains welcome here. The *JEA* covers archaeology world-wide, and the articles appearing in its pages report on an enormous range of topics, areas, situations, and analyses. The scholarly traditions that produce these studies are diverse and may employ conventions of presentation that differ from those in other parts of the world.

Just as digital technology of recent decades is altering the acquisition and presentation of information in archaeology, this same technology is revolutionizing pre-press work in the printing industry. Indeed, much of what was familiar in a printing plant five or ten years ago has now disappeared. Cameras, rail-mounted behemoths that would have been familiar to Matthew Brady, are being replaced by scanners. In the 1970s molten metal was poured into matrices and formed type that Gutenberg would have recognized, but by the middle of that decade columns of type were being digitally output to paper and then pho-

tographed to provide negatives from which the printing plates for offset lithography were made. For a short span, computer files were used to create photographic negatives, replacing the camera, and now those files of text and illustrations are used directly to etch the printing plates. Current advances in digital proofing suggest that offset lithography may eventually be replaced by a form of digital printing. The quality of books produced by “print-on-demand,” however, shows that offset lithography continues to provide superior results.

The speed and scope of these changes has lightened the work in some areas, but has transferred a large amount of pre-press work from the printing plant into editorial offices. Procedures for handling digital text provided by contributors have been worked out over the last decade. Those for illustrations prepared digitally are still evolving, but we are at a point where the outlines of pre-press requirements are becoming clear. Experience has shown us that contributors are eager to provide us with appropriate materials, provided we all understand what works best.

This short article is about preparation of illustrations for our pages, and the guidelines that apply generally to art in any medium, digital or analogue. Towards that end, we provide here the current sum of our experience with what works well, and where the requirements of commercial printing differ from the expectations of consumers. A closely related topic arises from the use of digital technol-

ogy to prepare maps and plans. No one would expect professional cartographers to excavate archaeological sites, and archaeological training does not always provide cartographic skills. Happily, most maps and plans for archaeological illustration do not need to be complex, and there is a simple grammar of cartography that satisfies most archaeological situations.

## Photographs

The standard in the printing industry for reproducing conventional, full-tone photographs is for them to be screened at the equivalent of 300 dots per inch. That is, the complete range of grays from solid black to pure white is converted into black dots of varying size (down to size zero for white) that, when viewed by the eye, simulate the full range of tones present in the original. This resolution, resembling that used by pre-press cameras, provides ample scope for a full range of tones from deep black shadows to nearly white highlights. If conventional analogue photographs are available, our preference is to be supplied with a good, sharp, conventional full-tone black and white print, 5 by 7 inches or larger, matte or glossy finish, that we can scan to our requirements. In those cases where authors provides us with their own scans of analogue photographs, we are necessarily unaware of the tonal values of the original, and the fidelity of any printed reproduction is uncertain.

For photographs taken with a digital camera, we require both the file at a resolution of 300 dpi and a good, crisp printout from a device outputting at no less than 600 dpi. And the photographs must have been originally taken at a resolution no coarser than 300 dpi; a photograph taken at 72 or 150 dpi will not be improved by increasing the resolution in post-processing. The best practice is to start with at least 300 dpi, and end with no less than 300 dpi. Photographs should be taken as grayscale, which allows each pixel to take a value between black and white; a bitmap, on the other hand, attempts to emulate grays by interspersing solid black pixels with solid white ones. Our experience is that saving the file with one bit per pixel is usually satisfactory.

File formats are also a concern for photographs. Our experience has been that the most satisfactory results can be obtained with PhotoShop application files (.psd) or Encapsulated PostScript (.eps) files. The .tif format can work well enough for photographs provided that only a minimum of resizing is required for reproduction. Saving as .pdf, or Acrobat, files can work, provided that one selects the highest possible resolution while saving in an application such as PhotoShop. File formats to avoid include .jpg (jpg coding when saving to .pdf is fine), those produced by

PictureViewer, those imported into word-processing software, and anything produced by presentation software such as PowerPoint.

To summarize, photographs at 300 dpi with sharp focus and a full tonal range are usually satisfactory. They should, of course, be black and white, or grayscale, unless previous arrangements have been made for reproducing the illustrations in color. We would prefer to scan analogue photographs ourselves, but if we are given scan files for photographs at 300 dpi, they are usually acceptable, provided that they are sharp and crisp.

## Drawings

Drawings are a much more complex topic, since they involve so many more decisions than is the case with photography. Type sizes and styles, line weights, conventions, legends, and design require some thought, as well as careful execution, to produce a clean, uncluttered, well-organized drawing that will convey information quickly and unambiguously. The data in a drawing should be organized and that organization conveyed by graphical means. A very good general rule, paraphrasing Edward R. Tufte (1983: 91–105), is “use no more ink than is necessary to convey the information.”

## Proportions

The *Journal of Field Archaeology* was designed thirty years ago using a trim size of 8.5 by 11 inches to, among other things, provide ample space for the reproduction of illustrations at a scale that would not require excessive reduction. What is more, the page design is flexible, allowing illustrations to be reproduced at any width between 20.5 picas and 43 picas, depending to some degree upon proportions. A pica, for our purposes, is one-sixth of an inch, or about 4.2 mm. Indeed, illustrations may appear at even narrower widths if that best suits them, although the column space they occupy cannot be less than 20.5 picas. Occasionally, illustrations that are too wide to reproduce satisfactorily at even 42.5 picas, the full width of the page, can be accommodated by “jumping the gutter” and extending across two pages or, as an absolute last resort, being turned sideways on the page. Our preference in such cases is to spread the illustration across two pages, provided that there is a vertical area in the illustration where it may logically be split; we do not want information to appear so close to the gutter that it risks disappearing into the binding.

Authors should take these factors into account when designing drawings for our pages, keeping the proportions and level of detail such that they can be reproduced at between 20.5 picas and 43 picas wide, and that the depth

(that is, the dimension from top to bottom) will not exceed 54 picas at the reproduced size. These are generous dimensions and intended to allow a wide variety of drawings to appear at a size that best conveys the information in the illustrations.

And illustrations should be designed and prepared with the article in mind. When drawings prepared for some earlier publication are on hand, there is an understandable impulse to press them into service for the present paper. This is fine when the illustration shows information relevant to the present paper, but it is often the case that the illustration shows detail extraneous to the needs of the paper. Many additional sites may appear, for example, or room-block numbers may cover a plan when all that is needed is the identification of a few features. The best solution, usually, is to use an older drawing as a base from which a fresh illustration can be made, one that shows and emphasizes the data of the present argument. A common example of this problem is to reuse without modification a segment of a government-supplied topographical map. In such cases the amount of detail and information is invariably excessive for the present paper, and toponyms are frequently truncated at the edges. The solution is to use the topographic map as a base for preparing a simplified version to accompany the article.

### *Linework*

Linework should be smooth, even, and no heavier than necessary. Any box rule around the drawing should be no heavier than 0.5 point. Wide, heavy box rules add a distracting funereal air to an illustration. A separate box rule around an inset or legend should be lighter than the overall box rule, perhaps 0.40 point, in order to help create a hierarchy of information.

Coastlines should be heavier than rivers, and contour lines lighter than rivers. A progression from 0.40 point to 0.30 point to 0.20 point may work well, but decisions must take into account the relative amounts of different kinds of information present. Political boundaries, provided that they do not form a major element, might be 0.50 point in weight but dashed. In a map, linework should extend to the inside edge of the box rule, and not just stop in midair, somewhere near the box rule.

Contour intervals, if present, should be chosen judiciously. A small interval may end up covering the map with a dense array of fine lines that obscure the other information. If contour information is relevant to the illustration, choose an interval that displays the lay of the land so that your reader will get the idea. While the contour interval might go into the caption, or possibly into a legend, it may be useful to show the elevation of one or more lines, or

some spot elevations atop hills. The elevation figure should appear in a gap in the contour line; the line should not pass through the numerals.

Normally, linework should be sharp and crisp, but there are circumstances when the illustration is best served by converting some lines to tints less than 100% black. Contour lines are a good candidate for this treatment, which helps push them into the background. The density of the tint for the contour lines depends upon their frequency and complexity, so some experimentation is in order. The ability of using layers in drawing software like Adobe Illustrator and Macromedia Freehand (we discourage the use of CorelDraw owing to its unpredictable PostScript output) is a powerful tool for developing an information hierarchy in a drawing. For example, placing all the rivers on one layer and all the contour lines on a separate layer makes it easy to alter line weights and line density (or tint) for the entire layer at once. Eventually, with trial, error, and experience one finds out what works for different situations.

There are instances where tints are useful to denote an area, as opposed to rendering a line as a tint. The classic problem of figure vs. ground occurs most frequently when land and water areas are depicted. Since most of the information normally is present on the land area, then giving a light tint of 7% to 10% gray for the water area will distinguish the two. That leaves the land area white for additional information, and the tint in the water area is light enough to bear some labels that cannot fit onto the land (some of the names for clustered towns on the coast, for example).

Linework should not interfere with other elements in the map. If two lines must cross (as with a river and contour lines) then the difference in line weights will keep the information organized for the reader. If a legend cannot be placed near its object (a site name and the solid circle showing the location), then a thin leader line may connect the two. The leader should interfere with other lines or points as little as possible.

The use of tints to demarcate different areas presents some vexing problems, not only in reproduction but also in the intelligibility of the illustration. As a rule, only about four or perhaps five tints can be distinguished easily on such an illustration. We have all seen those maps or sections where ten or a dozen different tints or patterns combine to create an unreadable array of information. In such cases, a legend with swatches of each tint will not help matters. The solution, of course, is to think through the data in the illustration, decide which support the argument, and design the illustration to convey those data in an unambiguous manner. Simply accepting the output from a charting or “visualization” application, such as Surfer, is not the solu-

tion; careful thinking about the role of the illustration is the key.

### *Type*

Type in drawings should be prepared at a size that will be no smaller than about 7 points and no larger than 11 or 12 points when reproduced. Smaller than that runs the risk of becoming illegible; larger seems to “shout” from the page. Of course, type is part of the armamentarium of the illustrator and should be used to create a hierarchy of information on the page via different sizes, weights, and even fonts in an organizing scheme. Similar kinds of information should be labeled with identical type. Rivers, for example, are conventionally labeled with an italic font, while modern cities might be given names in all upper-case letters. Archaeological sites might be labeled with initial capitals, while political designations, such as countries or states, might best appear in all upper case, bold, and letter-spaced. In this way, the reader’s eye will apprehend a logical organization of the labels and the comprehension of the drawing will proceed swiftly.

Those labels that are the most numerous (sites, for example) might appear in smaller, lighter type. The small size of the letters will be offset by the number of labels, achieving a visual balance for the eye. If there is only one site that needs to be shown in the illustration, then that bit of information becomes relatively more important and may deserve a label in a larger point size, possibly in bold face, to have it stand out. If, however, there are a dozen labels all in large bold face type, then field will be too crowded.

Given the enormous range of topics and illustrations that appear in our pages, no single solution to the matter of type hierarchy is possible, but some general considerations will help. Keep similar kinds of information with similar kinds of type, and choose point sizes and weight with the relative importance and frequency of appearance in mind. Things that are frequent may take smaller, lighter type; things that are scarce may benefit from larger, bolder type.

We have seen few instances where letter spacing or kerning (respectively, altering the conventional maximum or minimum distances between letters) for lower case is necessary. Letterforms in type are designed to work best with the default amount of space between lower case letters. Upper case letters, however, can tolerate letter spacing and for that reason can work well when the name of a country is provided in all upper case, letter-spaced characters, spread out across a geographic expanse.

Leroy lettering, frequently encountered when older drawings are reused, presents particular problems. Even in the hands of an expert, Leroy lettering uses letterforms that

are not designed to work as type and ragged, uneven edges are often present. The lack of designed stroke weights produces a tendency for counters (the enclosed areas on some letters, such as the center of “o”) to plug up, or fill in. The solution is to scan the old drawing and use that scan as a template to be traced over in a drawing application and the lettering replaced with type.

### *File Formats*

Line art that is prepared conventionally, with ink on paper, is best provided in the original, with copies provided at a size that will fit upon an 8.5 by 11 inch page to be included with the manuscript. We treat such art with care and will return it to the contributor once the article is published. Contributors may wish to provide scanned files of such illustrations, and these can work, provided that they are done properly and in .eps form with a resolution of no less than 1200 dpi (creating very large files). Art with dot patterns, such as gray tints, need to be scanned with particular care since improper alignment on the scanning bed can create a second dot pattern that is not quite in register with the original; the resulting moiré pattern of rippling waves or bands in the new image make it unfit for reproduction. We would prefer to have the original drawing on hand to scan to our requirements.

When line art is prepared digitally, it is usually best provided as application files from packages that can also write to an .eps file, specified for the Macintosh if possible. Illustrator and Freehand are the most flexible applications for preparing line art and we recommend their use. We prefer to receive uncollapsed (or unflattened) application files that can be opened in Illustrator, but .eps files *with all fonts embedded* are a good second choice. Neglecting to embed the fonts creates files that are useless for pre-press.

An alternative to .eps is to save the illustration from within its original application into a “Press Ready” .pdf, or Acrobat, file; as with .eps files, be sure to save the font information along with the line work. Do not save the .pdf file as “Web Ready.”

If the file was prepared digitally, then there is usually little reason for the author to scan it and provide us with the scan. There are exceptions, of course, when the application does not allow a file to be saved to one of the file formats we expect (see the following discussion about CAD). If a drawing has not been prepared digitally, then the author should provide us with the original so that we may scan it to our requirements. If the author cannot provide the original, then a scan at 1200 dpi can be supplied, in .eps, .pdf, or .tif format in addition to a print of that file produced by an output device at no fewer than 1200 dpi. In the event

that the file proves unsuitable, we might try scanning the printout.

Our experience with files created by CAD applications has been disappointing. The CAD drawings we have seen are very nearly always unsuitable for publication owing to undifferentiated line weights and substandard lettering, and are instantly recognizable as machine-generated, containing letterforms that bear no resemblance to type. We suspect that these illustrations show only some minimal subset of what could be produced by accomplished hands. CAD files are consistently in a format that cannot be used by our applications, and our efforts to have authors provide us with CAD drawings in .eps format have been unavailing.

Whatever the strengths and benefits of CAD for archaeological research, we are confronted with drawings that are distractingly ugly and amateurish-looking. CAD output and file format are simply inappropriate for publication and pre-press. These problems have not received a solution at JFA except to suggest that the drawings be scanned and used as a template for tracing over in an illustration application such as Illustrator or FreeHand. Obviously, such a procedure in some ways duplicates the effort of producing the CAD figure, but the alternative is to publish an illustration that fails to complement the text.

Drawings exported from presentation applications such as PowerPoint are useless for pre-press, nor should drawings be included in files produced by word-processing applications. We have not had consistent success with files created by Excel or other spreadsheet applications and authors should avoid providing those.

### Summary and Concluding Remarks

The advent of digital technology in publishing has not been an unmixed blessing. Much labor is conserved with digital text and few of us want to return to the days of paste-ups and mechanical boards, X-acto knives and wax, and the intervening stages of camera work and stripping flats. The difficulties with the new technology largely arise from disconformities between the requirements of pre-press and the expectations of contributors using consumer-level applications for illustrations.

Digital photographs should be exposed at no less than 300 dpi and contain, like their analogue cousins, a full tonal range, sharp focus, and adequate contrast. The .eps, .tif, .psd, or .pdf file provided to us should be at 300 dpi, grayscale at one bit per pixel, with no intervening alteration of resolution.

Drawings are a more complicated issue since they can be created wholly within a digital application and many choices are available to the user. Making specific guidelines for

preparing such illustrations is impractical because much depends upon decisions regarding the data that are to be presented and the design of the hierarchy of information. What works well in one situation may be disastrous in another, hence the admonition not to recycle drawings that are inappropriate for the present piece. Still, some general guidelines can be provided. First, use no more ink than is necessary to convey the information. Second, let the hierarchy of information be presented by different line weights and intelligent decisions about type. It is often wise to make the most frequent things be muted and the rarest to stand out. Avoid distracting, eye-popping patterns and, if tints are necessary, have no more than four or five of them in a single drawing.

Application files for drawings are the most welcome, especially those saved in Macintosh format. Any provided files should remain uncollapsed or unflattened. A good second choice is to provide the file as .eps for the Macintosh, or .pdf Press Ready. Saving a drawing with vector information as a bitmap, such as with a .tif file, makes no sense.

We all want to make digital technology work for us, but as fast as standards and procedures are worked out, new advances complicate the issues. This presentation will surely become outdated in a short time, so the reader is advised to consult <http://jfa-www.bu.edu> to see if a version more current than September 2003 is available.

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Tufte, Edward R.  
1983 *The Visual Display of Quantitative Information*. Cheshire, Connecticut: Graphics Press.