Low Cost, Computer-aided Landscape Design Using the Macintosh Computer

Caula A. Beyl¹

*Department of Plant and Soil Science, Alabama A&M University,
Normal, AL 35762*

Abstract. Computer-aided design (CAD) is rapidly becoming an indispensable tool for landscape architects and designers. This has created the need for a simple-to-use, inexpensive, and readily available configuration for introducing computer-aided design on a limited budget to landscape students. This introduction to computer-aided landscape design can be accomplished easily and accurately using the 512K Macintosh computer and the software package MacDraw. Techniques are reported for shading, layering, and customizing plant and groundcover symbols, allowing a personal touch that is lacking in some more-advanced CAD packages. Computer-generated pages can be collaged to make full-sized landscape drawings, which are then copied onto reproduction vellum. In this manner, the design capability is not limited by the size of the printer. This design configuration is currently in use and was used to generate the design and the symbol illustrated.

In an age that is characterized by the term "computer-aided", some familiarity with Computer-Aided Design (CAD) is increasingly important for students of landscape design or landscape architecture. However, implementation is a difficult task, particularly for small- to medium-sized institutions that cannot afford higher-priced CAD configurations because of budgetary considerations or lack of focus on landscape disciplines. Techniques for doing customized landscape designs using the Macintosh computer (Ap-

ple Computer, Cupertino, Calif.), with the readily available, inexpensive software package MacDraw, are reported in this paper. Techniques reported here permit the creation of symbol sets unique to the particular style of the designer. This capability avoids the drawback of some other landscape design software packages that merely supply a preprogrammed set of symbol templates with no allowance for personalized technique or that provide only relatively simple circle-line graphics (Robins et al., 1984) that cannot accommodate shadows or other specialized effects.

Configuring the system

Materials used to execute the computer-aided design featured in Fig. 1 included a Macintosh computer with 512K memory, keyboard, mouse, accessory disk drive, Imagewriter printer, the software program MacDraw, a working disk, ample paper, and

imagination. As a result of the "Apple for a Teacher" program, the configuration described above costs less than \$2500, as opposed to more than \$7500 for professional CAD systems based on IBM-compatible machines and attendant software. For schools on a limited budget, using a Macintosh for teaching landscape design, aside from other uses, provides further justification for their purchase. For large-scale production, a faster configuration could contain a hard drive with a minimum of 20 MB memory and the LaserWriter laser printer. However, the system described above is perfectly adequate for most applications and certainly for teaching the techniques described below. The Macintosh computer also has the inherent advantage of being "user friendly". Students exposed to its use adapt readily to the simple "point and click" procedure of the Macintosh graphic interface (a variation of visual learning), one of the first types of learning skills acquired (Lehrer, 1988).

Manipulation of scales and transfer of existing features

Scales are a vital part of any landscape design and must, therefore, be easy to manipulate and customize in a worthwhile CAD system. MacDraw displays rulers bordering the screen during the creation phase that do not appear when the finished product is printed. These rulers are displayed by selecting the option "Show rulers" from the "Layout" menu, and mark the position of the mouse on both horizontal and vertical scales for precise alignment of objects. The landscape ruler standard is the $1/8" = 1'0"$ of the architect's scale; however, the need for a flexible work environment is also accommodated by the feature "Custom Rulers. . ." in the Layout menu that allows scales to be adjusted to centimeters, such as the $1" = 10'$ of the engineer's scale, and permits the choice of the number of divisions between

Received for publication 10 Apr. 1989. Mention of a trademark or proprietary-product does not imply its approval to the exclusion of other products that may also be suitable. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.
¹Associate Professor.

Fig. 1. A portion of the landscape plan of 'Hillcrest', residence of the president of Alabama A&M Univ., drawn using the techniques described in this paper, printed using a LaserWriter, collaged into one large drawing, and then copied onto reproduction vellum for blueprinting.

major ruler marks. The designer can, therefore, choose the scale to correspond with the most commonly used architectural and engineering scales. The zero point of the ruler is normally "locked" into the upper lefthand corner of the screen, but it can be "unlocked" and repositioned to any point on the screen. This arrangement is convenient for drawing existing features, such as a building or house, where the measurements are taken predominantly from one corner of the building.

If the site has an existing spot survey or scale drawing, this information can be entered in one of two ways. Most simply, a grid of lines is superimposed onto the existing scale drawing. This grid should correspond to the grid found in the MacDraw work area (typically 1-inch or 1-cm intervals). Each feature of the site can then be easily transferred to the work area by drawing or "pasting" the appropriate symbols. Dimensions of the house and contour lines in the landscape design featured in Fig. 1 were transferred in this way. The contour lines were drawn using the "polygon" tool from the tools palette on the lefthand side of the MacDraw screen. The "Reshape polygon" option found in the "Edit" menu allows the

polygon's shape to be adjusted, after the initial drawing, until its shape exactly fits the desired contours. The latter can then be smoothed by using the "Smooth polygon" option found in the "Edit" menu.

The second method of entering scaled information into the computer requires the use of additional hardware. ThunderScan (Thunderware, Orinda, Calif.), a digitizer designed for the Macintosh, works well for this purpose. The original drawing must be cut into 20 x 25-cm pieces and sheet fed through the Imagewriter printer. As each piece of the entire drawing is entered, it can be enlarged or reduced proportionally to fit the chosen scale of the final drawing. The important features are then traced using the MacDraw "tools". After enough detail has been captured, the original ThunderScan image can be erased. This redrawing minimizes use of computer memory and improves picture quality over that of the original ThunderScan image, since MacDraw was designed for the production of laser-quality printing.

Creation of symbols

Symbols representing trees, shrubs, groundcover, and other aspects of the typical

landscape design are easily created using the MacDraw "tools" by constructing composites made from different geometric shapes (Fig. 2). The symbols featured show step-by-step how they were built and what commands or tools were used. Many variations on a created symbol are possible by simply changing the fill pattern slightly or by altering its contours or interior. MacDraw also accommodates the designer who wishes to draw symbols freehand on the screen using the mouse. The symbols for an "existing tree" and "existing woodland border" (Fig. 1) were made using this "freeform" tool. They were first drawn in large scale and then reduced proportionally to the final size using the MacDraw sizing handles with the shift key. Freehand drawing in a larger scale and then reducing to the desired size helps minimize the awkwardness that can accompany moving the mouse over short distances.

Symbols are easily shaded by first selecting the symbol, duplicating it, filling the duplicated version with the density pattern of shade desired, and then sending it behind the original. This ability to layer one object on top of another without destroying the one underneath is very useful in landscape design drawing.

Fig. 2. Stepwise process from left to right for making four different landscape symbols representing deciduous trees using the "tools" in MacDraw.

Fig. 3. Examples of hand-drawn symbols that have been scanned and printed as bitmapped images and then used to customize landscape drawings.

Duplication also is convenient for placing objects at even intervals. The object to be duplicated is selected, duplicated, and then positioned to where it belongs in the drawing, relative to the original. When it, in turn, is duplicated, its duplicate is placed at the same interval from the second as the second was from the first. This process can be repeated as many times as necessary and is a

tremendous labor-saving device when any evenly spaced series of objects must be drawn, such as a row of trees, paver pattern, fence, or trellis grid.

Groundcover areas are easily drawn using the "polygon", "square", or "circle" tools and then filling in with any of the 36 standard patterns available. The perimeter of the groundcover area can also be drawn with an

invisible border or any one of the fill patterns.

If a designer wishes to use a particular hand-drawn symbol, it can be scanned and used later in the landscape drawing in a manner similar to that described above for entering site information. Examples of hand-drawn graphics, scanned and then used to create a virtually unlimited library of available graphics symbols, are shown in Fig. 3.

Labeling

Labeling and titles can be placed directly on the drawing using the "text" tool. Text, like any other symbol, can be repositioned at will. An arrow can be positioned at the end of a line, or specialized symbols can be drawn using, for example, the Taliesin font set. Various styles of lettering, such as italics, boldface, shadow, and outline, are available.

Printing and transfer to vellum

Printing a full-sized drawing does not require a printer that conforms to a specific size. The drawing can be any size from 20 × 25 to 122 × 244 cm. When the drawing is printed, it is divided into pages that can then be collaged together to make the full-size drawing. This collaged version can then be duplicated on reproduction vellum for making blueprint copies.

The LaserWriter printer has the capability of variably shrinking images down to 25% or enlarging up to 400% without loss of quality, a useful feature for providing page-sized proof copies of the landscape design to a prospective client. The Imagewriter can also reduce the drawing by 50% without loss of printing quality.

Drawbacks and advantages

One of the drawbacks of this configuration is the time required to print, which is a function of the drawing's complexity and would be more of a handicap if the entire drawing were printed more frequently. The Macintosh screen is clear, however, and shows exactly what will be printed, thus printing is only necessary at the end of the design phase. Many professional CAD systems suffer from this same deficiency, requiring up to 12 hr to print, depending on the complexity of the drawing. Another drawback for the inexperienced user is that it is not easy to get the whole perspective of the landscape from the limited portion displayed on the screen. If the scale is 1/8" = 1'0", then the part of the drawing displayed on the screen at one time corresponds to only 28 × 52 ft at that scale. The user, however, easily can change the portion of the design that is viewed on the screen by use of the scroll bars displayed on the screen. Also, some idea of the entire drawing can be obtained by using the "Reduce to Fit" feature in the "Layout" menu that shrinks the drawing to the size of the screen for viewing, but detail is lost. There is another aspect of the system that can be

irritating: the entire picture is redrawn when some operations are performed, such as cutting and pasting of symbols, or moving objects within the screen. This operation takes time and reduces operator efficiency, especially with complex drawings. Figure 1 required 121K of disk space and occupied about one-sixth of the diskette. A 3.5-inch double-density, microdiskette contains 800K (K = 2048 bytes) of disk space; therefore, only five or six complicated drawings can be saved on a given diskette.

With the Macintosh, designers can save the symbols that they use most frequently in

the "Scrapbook". This means that subsequent drawings can be done even faster because the landscape symbols for trees and shrubs can simply be copied from the "Scrapbook" to the new drawing. Revisions of the drawing can be performed easily because drawings are saved on a diskette and a new drawing printed without the need for tedious redrawing of the entire landscape by hand, one of the biggest arguments for adopting CAD systems in generating landscape designs.

The approach explained is being suggested primarily as an excellent means of

introducing landscape students to CAD systems, but it could also be tremendously valuable to the landscape designer who cannot invest a large amount of money, but would still like some of the advantages of a higher-priced professional CAD system.

Literature Cited

- Lehrer, A. 1988. Macintosh in high schools. Technological horizons in education, Macintosh Special Issue. p. 44-45.
- Robbins, N.S., R.G. Halfacre, and K.D. Robbins. 1984. Microcomputer implementation of landscape graphics. HortScience 19:174-177.