

Typesetting on Personal Computers

TeX-PostScript output on non-PostScript devices

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PostScript technology provides an alternative way to place typographic elements on a page. Newcomers to PostScript might feel that it and TeX are direct competitors, but they have little territory in common. For several reasons, you might want to translate a TeX dvi file into PostScript format, and several DVI-to-PostScript device drivers (for the PC) exist for this purpose. (PostScript drivers also exist for the Amiga and, of course, for the Macintosh.)

There are advantages to a PostScript way of life. Hundreds of PostScript fonts exist, and several hundred service bureaus exist to render your PostScript files on their phototypesetters to generate true typeset-quality output. (A directory listing the more than 650 such bureaus in the United States is available from Ms. Jean Miller, Electronic Publishing & Printing, Dept. SBD, 29 N. Wacker Drive, Chicago, IL 60606, for \$7.50. Request the *2nd Annual Service Bureau Directory*.) Yet this convenience has a price; PostScript-compatible equipment costs substantially more than non-PostScript equipment. (I also believe that PostScript service bureaus charge more than do TeX output services.) A PostScript Apple LaserWriter printer costs several times the non-PostScript Hewlett-Packard LaserJet II printer.

Several software bridges exist for generating PostScript output on a LaserJet (and selected dot matrix printers), and I wondered how useful they would be for doing TeX work. As it turns out, these programs are effective, but are very slow. Depending on your tolerance for pokey output, these programs may elicit rapture from those who crave font variety (but only modified rapture, as the PostScript fonts don't do math without substantial additional work).

Bitmapped versus Outline

It's important to understand the difference between *outline* fonts and *bitmapped* fonts. Normal PostScript fonts are outline fonts — PostScript specifications determine the outline of each character

which PostScript can scale to the point size you request.* A PostScript laser printer interprets the outline on the fly as it processes a document and scales the outlines up or down to get different point sizes.

Each character in a bitmapped font contains the specific pattern of pixels required to generate that character at that size at a particular resolution. Computer Modern fonts are bitmapped, and the ramified directory structure on a PC to contain them all is necessary for keeping track of files for generating fonts at different design sizes and different magnifications. When used in TeX documents, bitmapped fonts can be previewed, whereas outline fonts cannot!

PostScript Interpreters

You may choose between two programs that take the PostScript outline descriptions and transform them to bitmapped descriptions with which the LaserJet (or various other printers) feel comfortable. (Remember, though, you won't be able to preview.) These are:

1. *GoScript*, by LaserGo Inc., 9235 Trade Place, Suite A, San Diego, CA 92126; (800) 451-0088. List price is \$195, and it requires 640K RAM, 1MB hard disk space, DOS3.0 or greater; not copy protected. (One or more megabytes of EMS memory is recommended.)
2. *Freedom of Press*, by Custom Applications Inc., 5 Middlesex Technology Center, Billerica, MA 01821; (508) 667-8585. The list price is \$495, and this program requires 535K RAM, 4MB hard disk space, DOS2.1 or greater, and 512K or more of EMS memory. (The company recommends a numeric coprocessor if you plan to do extensive graphic work.)

Note Freedom of Press's special needs — it requires EMS (expanded) memory. (Be aware, though, that several utilities exist which will make your extended memory act as if it were expanded memory. This strategy works fine.)

Both programs work essentially the same way. They are easy to install. At the DOS prompt, enter the program name followed by any nonstandard PostScript fonts, followed by the name of your file. The name of your file must be complete; don't neglect the file extension if it exists! All interpreters, so far as I could tell, adequately rendered PostScript

* Editor's note: This is roughly equivalent to TeX magnification, whereas the Computer Modern fonts have different shapes for different sizes.

This is Gill Sans.
This is Gill Sans Bold.
 This is Computer Modern Roman.

This is Gill Sans.
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 This is Computer Modern Roman.

Fig. 1. Gill Sans at 30pt, together with cmr10. GoScript (top), Freedom of Press (bottom).

graphics on the LaserJet, the printer I used in these experiments. (A nonstandard font is any font not normally resident in a PostScript printer.)

Both programs are slow. I prepared a test document consisting of the abstract to Don Knuth's article "Mathematical Typography" and set entirely in 12 point Bodoni (a PostScript font). *GoScript* required about four minutes, while *Freedom of Press* took 38 minutes!

Print quality is clearly superior with *Freedom*. In large letters, curves were properly sinuous and bitmapped characters in the document appeared as they should. Large curves came out vaguely polygonal with *GoScript*, and bitmapped characters appeared much heavier and muddier than they should have been. (See Figure 1.) But *GoScript* is cheaper, faster, and does not require special EMS memory. If you use your laser printer strictly as a proofing device, and plan to print your files on a phototypesetter, you may find *GoScript* output acceptable. The customer service representatives of both companies get high marks for courtesy and helpfulness.

Of course, to use these programs with \TeX , you need to translate your \TeX output to PostScript form. DVI-to-PostScript converters are available from several sources. Nelson Beebe has prepared a public domain version (available from several sources; Jon Radel is one such. For information on Jon's offerings, send a SASE to him at POB 2276, Reston, VA 22090, USA). Commercial versions can be furnished by ArborText and by Personal \TeX . For this article, I used the Personal \TeX *ptips* converter.

Conversion to PostScript form adds another step in the \TeX life cycle. Rather than run the *dvi* file through the device driver, you must first convert the *dvi* file through the DVI-PostScript converter to create a *ps* file. It is this *ps* file that gets printed,

either directly on a PostScript printer or indirectly, if you use one of these interpreters to print the file onto a LaserJet.

But note that before you may use your DVI-to-PostScript converter, you will probably have to make an entry into some auxiliary file. For *ptips*, this file is *font.sub*. PostScript fonts typically own lengthy names, such as *MGillSans-Bold*. Because of the DOS limitation on the length of file names, you cannot name this file with the same name. The outline file for this file might be called *gilb.psf*, and the auxiliary file contains the data which matches the file *gilb* to the font *MGillSans-Bold*. (Check your documentation carefully.)

Calling PostScript Fonts in Your \TeX Document

You set your font calls for PostScript fonts almost the way you do for Computer Modern fonts. The *tfm* file must be with your other *tfm* files, and the outline font file must be somewhere where the interpreter knows to find it. It's a good idea to keep all outline font files together in one hard-disk directory. In your source file, you might have a \TeX statement like \font\gilbf=gilb at 30 pt, and thereafter you switch to this font with the command \gilbf . (Don't forget also the change to the font substitution file so the DVI-to-PostScript converter can make the equivalence between the font file and the font name.)

Both interpreters boast that they can duplicate some subset or superset of the standard complement of resident fonts in a true PostScript laser printer. These lookalike fonts are inaccessible to \TeX users, as they do not come with font metric information. If you want a PostScript Times Roman (one of the standard resident fonts), you will have to purchase it separately. Both converter programs know where

to find your bitmapped fonts, but you will have to tell them where the outline files reside. Your GoScript command line might look like this:

```
gs \psfonts\bodoni.pfa myfile.ps
```

assuming the Bodoni face is contained in the file `bodoni.pfa` in the directory `\psfonts`. Each font needs a separate mention on the command line and there is no way to continue an invocation. Therefore, you won't be able to include too many PostScript fonts in a file you interpret with GoScript. Freedom of Press requires the same mention in its command line, but it's smart enough to understand DOS wild cards. This is acceptable:

```
fp! \psfonts\*.pfa myfile.ps
```

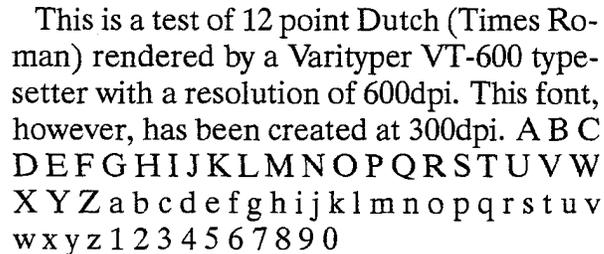
Bitmapped Fonts in PostScript Output

DVI-to-PostScript converters make it easy to combine bitmapped fonts, such as Computer Modern or Bitstream fonts (rendered with Fontware software), with PostScript outline fonts — the `ps` file that your DVI-to-PostScript creates explicitly contains the instructions for each bit-mapped character. Too many bit-mapped characters can really swell your `ps` file. When you use PostScript interpreters to render your file, you normally have to tell these programs where to find information about each non-standard *outline* font (that is, those fonts that are not normally resident in a PostScript printer). Interpreters render bit-mapped files properly without needing to be told where to find them.

If you use bit-mapped fonts, your PostScript file is no longer device independent. You doubtless have fonts on your computer appropriate to your output device. I use a laser printer, so my Computer Modern font files are appropriate to 300 dpi printers. But these are not right for your service bureau, whose phototypesetters are capable of much greater resolution. Before you ship your file to a service bureau, re-compile it making sure that \TeX uses fonts appropriate to the resolution of the phototypesetter. See figure 2 to see what happens when a `ps` file in which are embedded 300 dpi fonts is printed on a 600 dpi device (Varityper VT600).

Phototypeset Output

In theory, your `ps` file is ready for rendering on a phototypesetter, but in fact there are some things to watch out for. Foremost, make sure that your service bureau has the same fonts you used, and that they are from the same digital foundry! But another problem has its roots in the fact that PostScript, like \TeX , is a macro language. Unlike



This is a test of 12 point Dutch (Times Roman) rendered by a Varityper VT-600 typesetter with a resolution of 600dpi. This font, however, has been created at 300dpi. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 1 2 3 4 5 6 7 8 9 0

Fig. 2. Varityper PostScript output combined with `cmr10`.

\TeX , PostScript users do not share a generally agreed upon standard such as `plain.tex`, so many DVI-to-PostScript converters create and use their own macro definitions for the `ps` file. You will need to convey this file to the service bureau as well, for otherwise those macros will be meaningless to the PostScript interpreter. For example, the ArborText driver relies on a file called `psload.ps` whereas Personal \TeX 's `ptips` seems to incorporate an equivalent body of macros into your `ps` file, so you needn't worry about porting anything additional to the service bureau.

Everyone knows that one of PostScript's strong points is graphics. The PostScript language includes a great facility for generating graphic images. Although this facility is greater than anything \TeX can do, it is (in my opinion) much less sophisticated than `METAFONT`. Nevertheless, should you desire to include a graphic image into a \TeX document, you can do so with your DVI-PostScript driver. With `ptips`, for example, you create the image and store it in a separate file. When preparing your source file, leave a hook for this file by including the command `\special{:(filename)}`. It's the job of `ptips` to incorporate the graphic into the document. Bear in mind that `\special` leaves no extra space for the graphic, so if (for example) the graphic is 8 centimeters tall, you should precede your `\special` command with a `\vskip 8 cm`, or something similar.

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