Text and Graphics

CSE 413, Autumn 2005

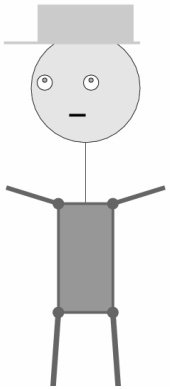
Programming Languages

http://www.cs.washington.edu/education/courses/413/05au/

Postcript is a Page Description Language!

- In the previous lectures I talked mostly about how Postscript implements the standard constructs of a programming language
  - » variables, control flow, procedures
- The main purpose of Postscript is to put marks on a page, using those constructs
  - » text
  - » graphics
  - » images

tiger.ps



StickBoy.ps

Paths

- A drawing starts with a path on the current page
- path is a set of straight lines and curves that define:
  - » a region to be filled (fill)
  - » a trajectory that is to be drawn (stroke)

```
newpath
95 700 40 0 360 arc
closepath
1 .5 0 setrgbcolor
fill
```

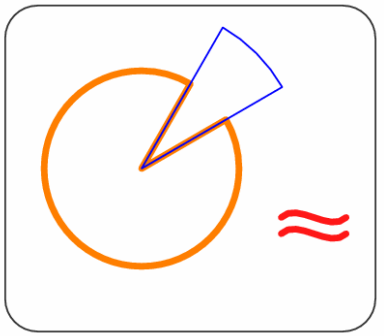
```
newpath
80 720 30 0 360 arc
closepath
0.1 setgray
gsave
5 setlinewidth
stroke
grestore
1 .9 0 setrgbcolor
fill
```

basic path construction operators

- newpath
  - » initialize current path to be empty
- closepath
  - » Connect subpath back to its starting point
- moveto, rmoveto
  - » set current point to (x,y)
  - » set current point to (curX+dx, curY+dy)
- lineto, rlineto
  - » append straight line to (x,y)
  - » append straight line to (curX+dx, curY+dy)

Curve path operators

- arc, arcn
  - » append clockwise, counterclockwise arcs
  - » x y r $angle_1$ $angle_2$ arc
- arct, arcto
  - » append tangent arcs
  - » x_1 y_1 x_2 y_2 r arct
- curveto, rcurveto
  - » append Bezier curve
  - » x_1 y_1 x_2 y_2 x_3 y_3 curveto



Arcs&Curves.ps

saving the graphics state

- Sometimes we need to save the current graphics state (including the path) so that we can reuse it
  - » the stroke and fill operators clear the current path
  - » blocks of code may change path, gray value, line width, user coordinate system, etc
- gsave
  - » save a copy of the current state on the graphics state stack
- grestore
  - » restore to the state at the time of the last save

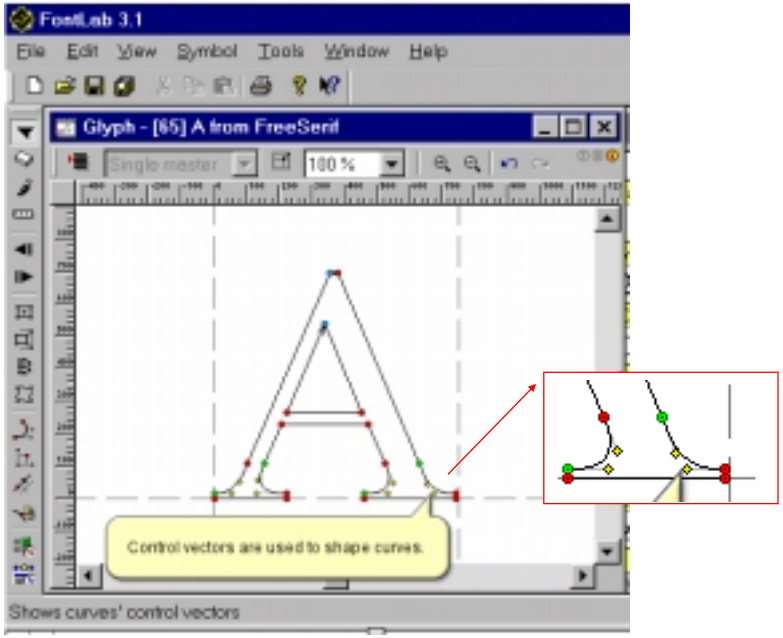
Text

- Postscript treats text as just another way to define graphics paths
  - » The content of the text is maintained in a string object
  - » The visible representation of the text is determined by the font
  - » Fonts are stored as a set of curves for each letter
    - the representation is the *glyph* for this character in this font

Font: Tannarin BT FONT DESIGN IS FUN!

Font: Murray Hill Font design is fun!

http://www.myfonts.com/



http://www.fontlab.com/html/fontlab.html

Using a font

- Find the information describing the font
  - » the info is in a font dictionary
  - » use the findfont operator
- Scale the font to the size needed
  - » original font is 1 unit high (usually 1 point)
  - » use the scalefont operator to scale
- Set the scaled font as the current font
  - » use the setfont operator

Show a text string

```
/Palatino-Italic findfont
15 scalefont
setfont
72 720 moveto
(Font design is fun!) show

/NewCenturySchlbk-Roman 15 selectfont
72 700 moveto
(Font design is fun!) show

/StandardSymL 15 selectfont
72 680 moveto
(Font design is fun!) show
```

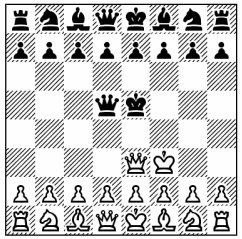
Font design is fun!

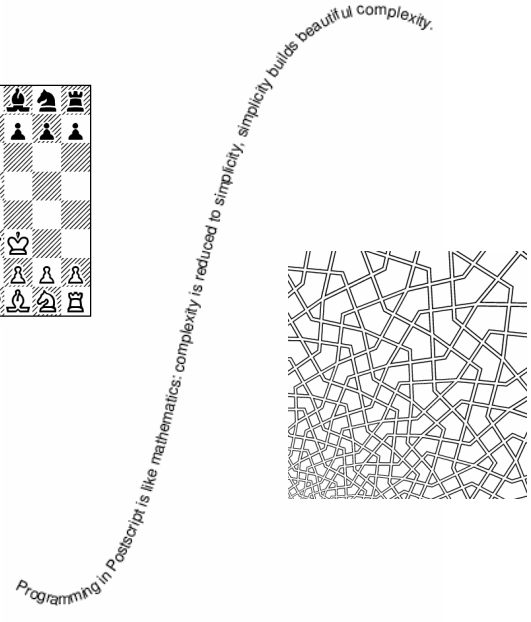
Font design is fun!

Φοντ δεσιγν ισ φυν!

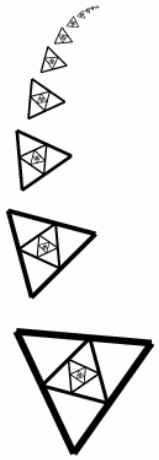
Fun with fonts

- Postscript provides much more power for dealing with fonts
  - » fonts are paths - they can be filled, stroked, clipped to, etc
  - » there are several glyph painting operators that provide a variety of width modification effects
  - » numerous font type definitions to support different ways of identifying the characters and defining the glyphs





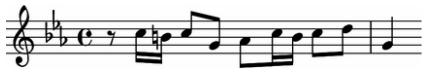
chess.ps
snake.ps
spiral.ps



logoPSfigs.ps

plant2.ps from http://www.cs.unh.edu/~charpov/Programming/L-systems/

"The name is Pond ... LilyPond"



http://lilypond.org/web/index.html

- LilyPond is an "automated engraving system." It formats music beautifully and automatically, and has a friendly syntax for its input files.
  - » input is done in the form of a textual music language
  - » content (the music) and the layout are strictly separated
  - » users can extend the program by using the built-in Scheme interpreter.
  - » PostScript output is generated via the TeX typesetting system.

Graphviz

- graphviz is a set of graph drawing tools
  - » dot - makes hierarchical layouts of directed graphs
  - » neato - makes "spring" model layouts of undirected graphs
- Graphs are described in DOT language
  - » abstract grammar defining DOT

    graph:[**strict**] (**graph** | **digraph**) [ID] '**{**' stmt_list '**}**'

    stmt_list:[stmt ['**;**'] [stmt_list]]

    etc
- Output in Postscript and other languages

http://www.graphviz.org/

```
strict graph ip_map {
        MH -- { ERC ALC WH1 HO1 IH1 };
        ALC -- MV -- AN;
        MV -- HO3 -- WH1;
        HO3 -- MT;
        MT -- LZ -- FL;
        MT -- FJ;
        MT -- ER;
        HO1 -- HR;
        MT -- DR;
        HO1 -- CB -- IH1 -- IHC;
        HO1 -- HV;
        {IHP IW IH1 IH2 IH4 } -- {IHP IW IH1 IH2 IH4 };
        {IH4 IH2} -- {MLM HV};
        HO1 -- HO3;
        HO3 -- IH1;
        IH2 -- IH4 [len=4];       // hack
}
```