John Romero Programming Proverbs

- 5. “We are our own best testing team and should never allow anyone else to experience bugs or see the game crash. Don’t waste others’ time. Test thoroughly before checking in your code.”

- John Romero, “The Early Days of Id Software - John Romero @ WeAreDevelopers Conference 2017”

Adding auto lights to chisel

- propose to add two options to `txt2pen.py`
  - `-l` to enable auto lights
  - `-f num` to change the default frequency of lights (default is every five squares)

Code changes to chisel/python/txt2pen.py

```
inputFile = None
defines = {}
verbose = False
debugging = False
autoLights = False
floor = []
rooms = {}
maxx, maxy = 0, 0
doorValue, wallValue, emptyValue = 0, -1, -2
versionNumber = 0.1
lightFrequency = 5
```

- notice the new global variables `autoLights` and `lightFrequency`

Code changes to chisel/python/txt2pen.py

```
def usage (code):
    print "Usage: txt2pen [-dhlvV] [-f frequency] [-o outputfile] inputfile"
    print "  -d debugging"
    print "  -h help"
    print "  -l automatic lighting"
    print "  -f frequency    (every frequency squares place a light)"
    print "  -V verbose"
    print "  -v version"
    print "  -o outputfile name"
    sys.exit (code)
```

Code changes to chisel/python/txt2pen.py

```
class roomInfo:
    def __init__ (self, w, d):
        self.walls = w
        self.doors = d
        self.doorLeadsTo = []
        self.monsters = []
        self.weapons = []
        self.ammo = []
        self.lights = []
        self.autoLights = []
        self.worldspawn = []
```

Code changes to chisel/python/txt2pen.py

```
def handleOptions ():
    global debugging, verbose, outputName, autoLights, lightFrequency

    outputName = None
    try:
        optlist, l = getopt.getopt(sys.argv[1:], ':df:hlo:vV')
        for opt in optlist:
            if opt[0] == '-d':
                debugging = True
            elif opt[0] == '-h':
                usage (0)
            elif opt[0] == '-l':
                autoLights = True
            elif opt[0] == '-f':
                lightFrequency = int (opt[1])
            elif opt[0] == '-o':
                outputName = opt[1]
etc...
```

New function checkLight

```
def checkLight (p, l, lightCount):
    if lightCount == lightFrequency:
        li = light ()       # create light
        li.settype ('MID') # on a pillar
        l += [p + [li]]     # [position and light]
        lightCount = 0
    else:
        lightCount += 1
    return l, lightCount
```

- which is called from your `introduceLights`

txt2pen changes

```
def generateRoom (r, p, mapGrid, start, i):
    global verbose, rooms, debugging

    if verbose:
        print "room", r,
    p = moveBy (p, [-1, -1], mapGrid)
    if verbose:
        print "top left is", p
    s = p
    walls, doors = scanRoom (s, p, mapGrid, [], [])
    if debugging:
        print walls
    rooms[r] = roomInfo (walls, doors)
    rooms[r].autoLights += introduceLights (p, mapGrid, [], [])
```

function printRoom changes

```
etc...
    o = printMonsters (rooms[r].monsters, o)
    o = printAmmo (rooms[r].ammo, o)
    o = printWeapons (rooms[r].weapons, o)
    if autoLights and (rooms[r].lights == []):
        o = printLights (rooms[r].autoLights, o)
    else:
        o = printLights (rooms[r].lights, o)
    o = printSpawnPlayer (rooms[r].worldspawn, o)
    o.write ("END\n\n")
    return o
```

function printRoom changes

- you need to complete `introduceLights` to make these changes take effect

pen2map

- `chisel/python/pen2map.py`
  - `pen2map` converts a `pen` file into a `map` file (doom3)

pen2map

```
$ cd $HOME/Sandpit/chisel/python
$ python pen2map.py -h
Usage: pen2map [-c filename.ss] [-dhmtvV] [-o outputfile] inputfile
  -c filename.ss    use filename.ss as the defaults for the map file
  -d                debugging
  -e                provide comments in the map file
  -g type           game type.  The type must be 'single' or 'deathmatch'
  -h                help
  -m                create a doom3 map file from the pen file
  -s                generate statistics about the map file
  -t                create a txt file from the pen file
  -V                generate verbose information
  -v                print the version
  -o outputfile     place output into outputfile
```

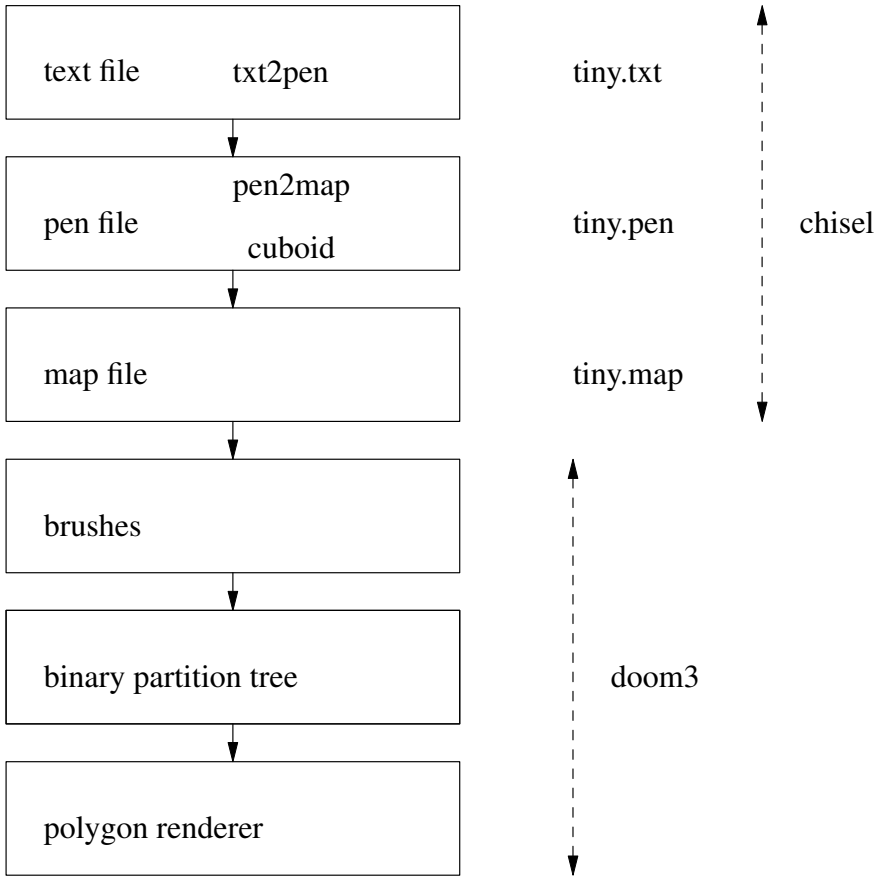
pen2map overview

- parses a pen file, creates internal data structures representing the pen map
  - it then iterates over the rooms and generates a doom3 map file
- conceptually the generation of the rooms is rather like virtualised lego (within chisel)
  - pen2map generates blocks and places these blocks into a world
  - it will attempt to join blocks together as long as this results in a bigger cuboid structure
- however the doom3 map uses planes and not blocks!

Construct the program in logical units

- Henry Legard proverb
- one way to achieve this is to layer the solution
  - divide and conquer
- consider our doom3 tools

Doom3 and chisel layering



Minimal box defined in the map format

```
brushDef3
{
  // floor of fbrick
  (0 0 -1 0) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
  // ceiling of fbrick
  (0 0 1 -288) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
  // top most horizontal of fbrick
  (-1 0 0 -480) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
  // left most vertical of fbrick
  (0 -1 0 -576) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
  // bottom most horizontal of fbrick
  (1 0 0 432) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
  // right most vertical of fbrick
  (0 1 0 528) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0
}
```

- six planes which define a cuboid

The second plane

- is the ceiling in our example
- `(0 0 1 -288) ((0.0078125 0 0.5) (0 -0.0078125 -1)) "textures/hell/cbrick2b" 0 0 0`
- (0 0 1 -288)
  - vector (0, 0, 1) and the closest it reaches the origin is -288 units
  - this infinite plane will have the texture `textures/hell/cbrick2b` applied to it

Texture transformation matrix

- the texture uses the transformation matrix, T

$$T = \begin{bmatrix} 0.0078125 & 0 & 0.5 \\ 0 & -0.0078125 & -1 \\ 0 & 0 & 1 \end{bmatrix}$$

- general transformation matrix is:

- $$T = \begin{bmatrix} xscale\cos(\theta) & -yscale\sin(\theta) & translatex \\ xscale\sin(\theta) & yscale\cos(\theta) & translatey \\ 0 & 0 & 1 \end{bmatrix}$$

Each coordinate is transformed by

- $$T = \begin{bmatrix} xscale\cos(\theta) & -yscale\sin(\theta) & translatex \\ xscale\sin(\theta) & yscale\cos(\theta) & translatey \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

- and mapped into the image file at this new grid coordinate

- fortunately we conceptualise chisel as creating a variety of lego bricks (each is a cuboid)

- `pen2map.py` generates floor bricks, wall bricks and ceiling bricks

Conclusion

- layered software is an important concept which allows large systems to be built and it can hide complexity behind well defined interfaces
- cuboids are represented by brushes in the map
  - six planes define a brush

Tutorial

- finish off your automatic light code in `txt2pen.py`
- see if you can make the floor level vary
  - by lowering slightly every odd room number floor
  - leave the even room number floor alone
- need to examine and change `pen2map.py`