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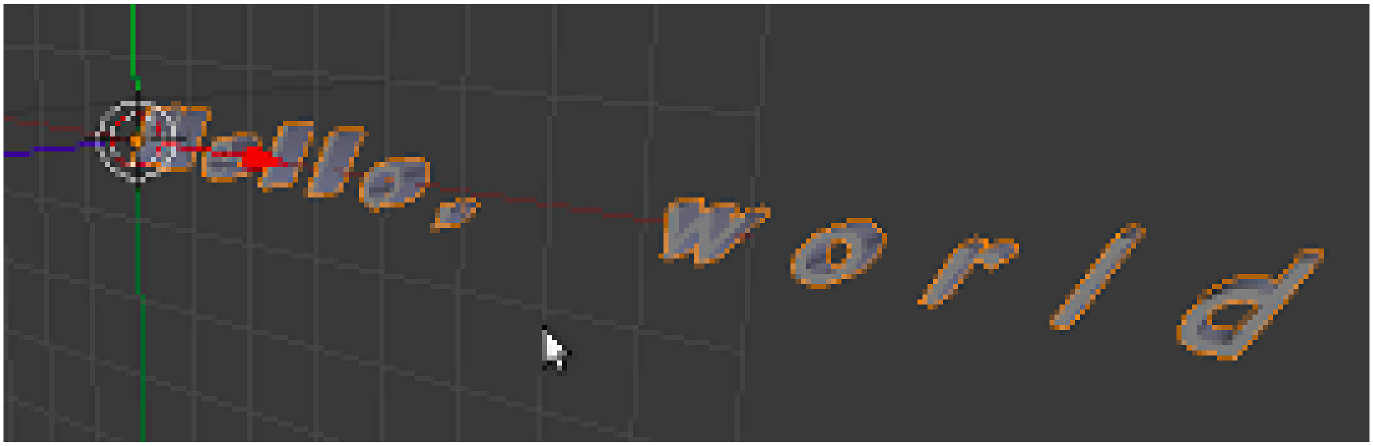
Other data types

Text

This program adds a piece of text to the viewport and sets some attributes. Note that the data type is TextCurve; the type Text is for text in the text editor.



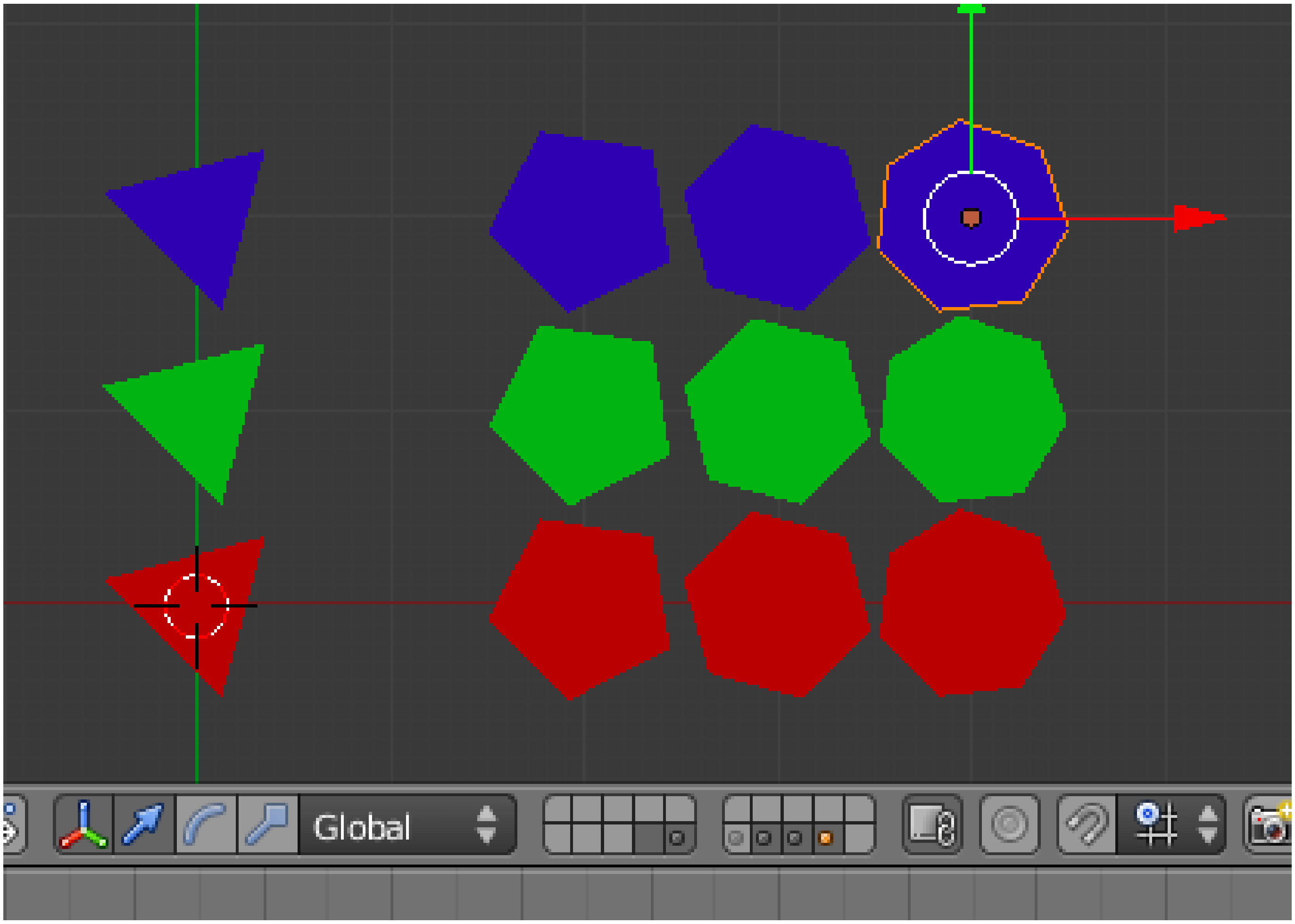
```
#----------------------------------------------------------
# File text.py
#----------------------------------------------------------
import bpy
import math
from math import pi

def run(origin):
    # Create and name TextCurve object
    bpy.ops.object.text_add(
    location=origin,
    rotation=(pi/2,0,0))
    ob = bpy.context.object
    ob.name = 'HelloWorldText'
    tcu = ob.data
    tcu.name = 'HelloWorldData'

    # TextCurve attributes
    tcu.body = "Hello, world"
    tcu.font = bpy.data.fonts[0]
    tcu.offset_x = -9
    tcu.offset_y = -0.25
    tcu.shear = 0.5
    tcu.size = 3
    tcu.space_character = 2
    tcu.space_word = 4

    # Inherited Curve attributes
    tcu.extrude = 0.2
    tcu.fill_mode="FRONT"
    tcu.use_fill_deform = True
    tcu.fill_mode="FRONT"

if __name__ == "__main__":
    run((0,0,0))
```

Layers

This program illustrates three methods to place an object on a new level:

1. Create it on the right level.
2. Create it on the layer 1, and change `Object.layer`.
3. Create it on the layer 1, and use an operator to move it.

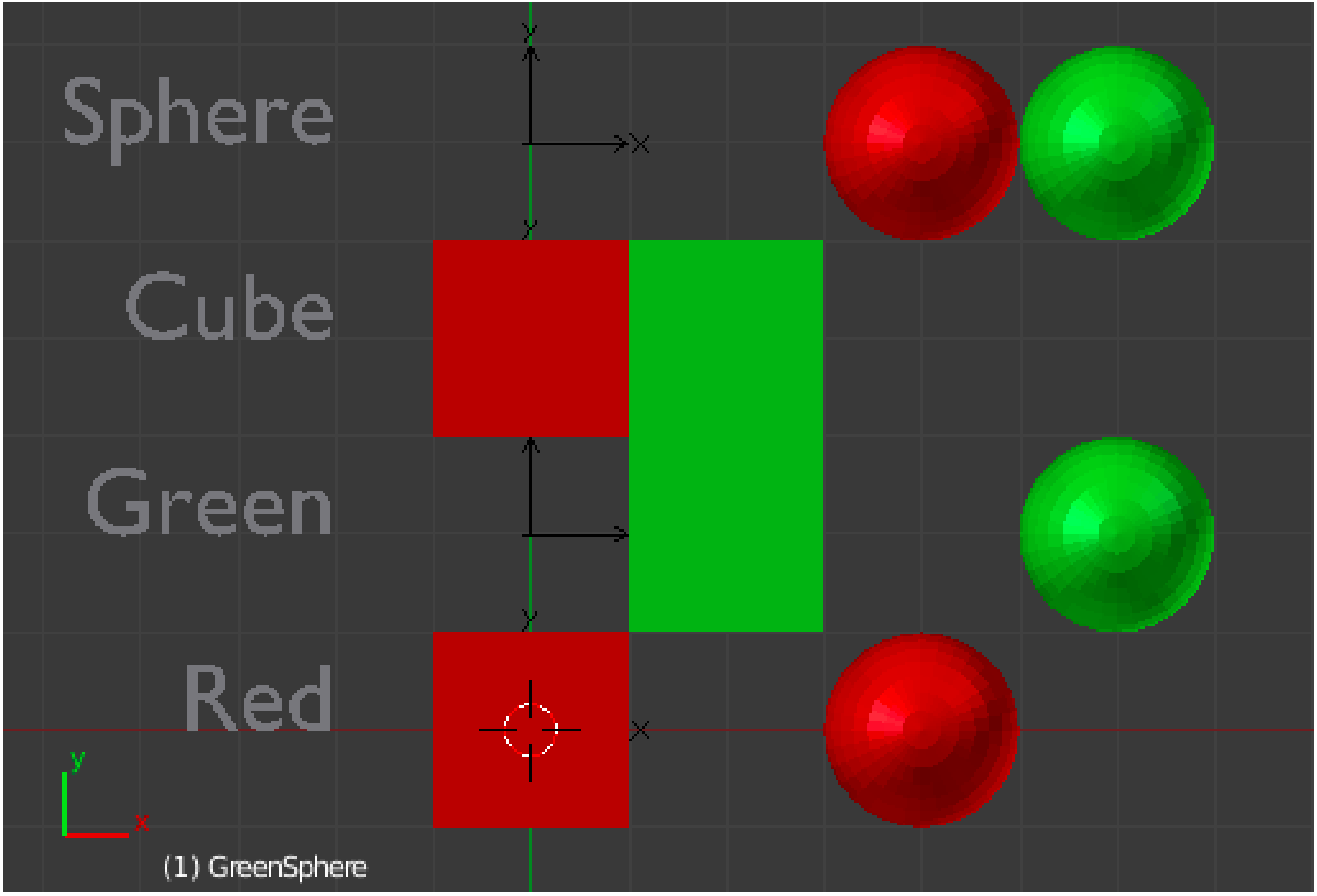
It is also shown how to change the visible layers.



```
#----------------------------------------------------------
# File layers.py
#----------------------------------------------------------
import bpy

def createOnLayer(mat):
    for n in range(3, 8):
        # Create a n-gon on layer n+11
        layers = 20*[False]
        layers[n+11] = True

        bpy.ops.mesh.primitive_circle_add(
            vertices=n,
            radius=0.5,
            fill=True,
            view_align=True,
            layers=layers,
            location=(n-3,0,0)
        )
        bpy.context.object.data.materials.append(mat)
    return

def changeLayerData(mat):
    for n in range(3, 8):
        # Create a n-gon on layer 1
        bpy.ops.mesh.primitive_circle_add(
            vertices=n,
            radius=0.5,
            fill=True,
            view_align=True,
            location=(n-3,1,0)
        )
        bpy.context.object.data.materials.append(mat)

        # Then move it to a new layer
        ob = bpy.context.object
        ob.layers[n+11] = True

        # Remove it from other layers.
        layers = 20*[False]
        layers[n+11] = True
        for m in range(20):
            ob.layers[m] = layers[m]
    return

def moveLayerOperator(mat):
    for n in range(3, 8):
        # Create a n-gon on layer 1
        bpy.ops.mesh.primitive_circle_add(
            vertices=n,
            radius=0.5,
            fill=True,
            view_align=True,
            location=(n-3,2,0)
        )
        bpy.context.object.data.materials.append(mat)

        # Then move it to a new layer
        layers = 20*[False]
        layers[n+11] = True
        bpy.ops.object.move_to_layer(layers=layers)

    return


def run():
    # Create some materials
    red = bpy.data.materials.new('Red')
    red.diffuse_color = (1,0,0)
    green = bpy.data.materials.new('Green')
    green.diffuse_color = (0,1,0)
    blue = bpy.data.materials.new('Blue')
    blue.diffuse_color = (0,0,1)

    # Three methods to move objects to new layer
    createOnLayer(red)
    changeLayerData(green)
    moveLayerOperator(blue)

    # Select layers 14 - 20
    scn = bpy.context.scene
    bpy.ops.object.select_all(action='SELECT')
    for n in range(13,19):
        scn.layers[n] = True

    # Deselect layers 1 - 13, but only afterwards.
    # Seems like at least one layer must be selected at all times.
    for n in range(0,13):
        scn.layers[n] = False
    # Deselect layer 16
    scn.layers[15] = False
    return


if __name__ == "__main__":
    run()
```

Groups

This program shows how to create groups, add objects to groups, and empties that duplicates the groups. We add four groups, four mesh objects assigned to two groups each, and four texts assigned to a single group. Then we add four empties, which dupli-group the four groups. Finally the empties are moved so each row contains the elements in that group.

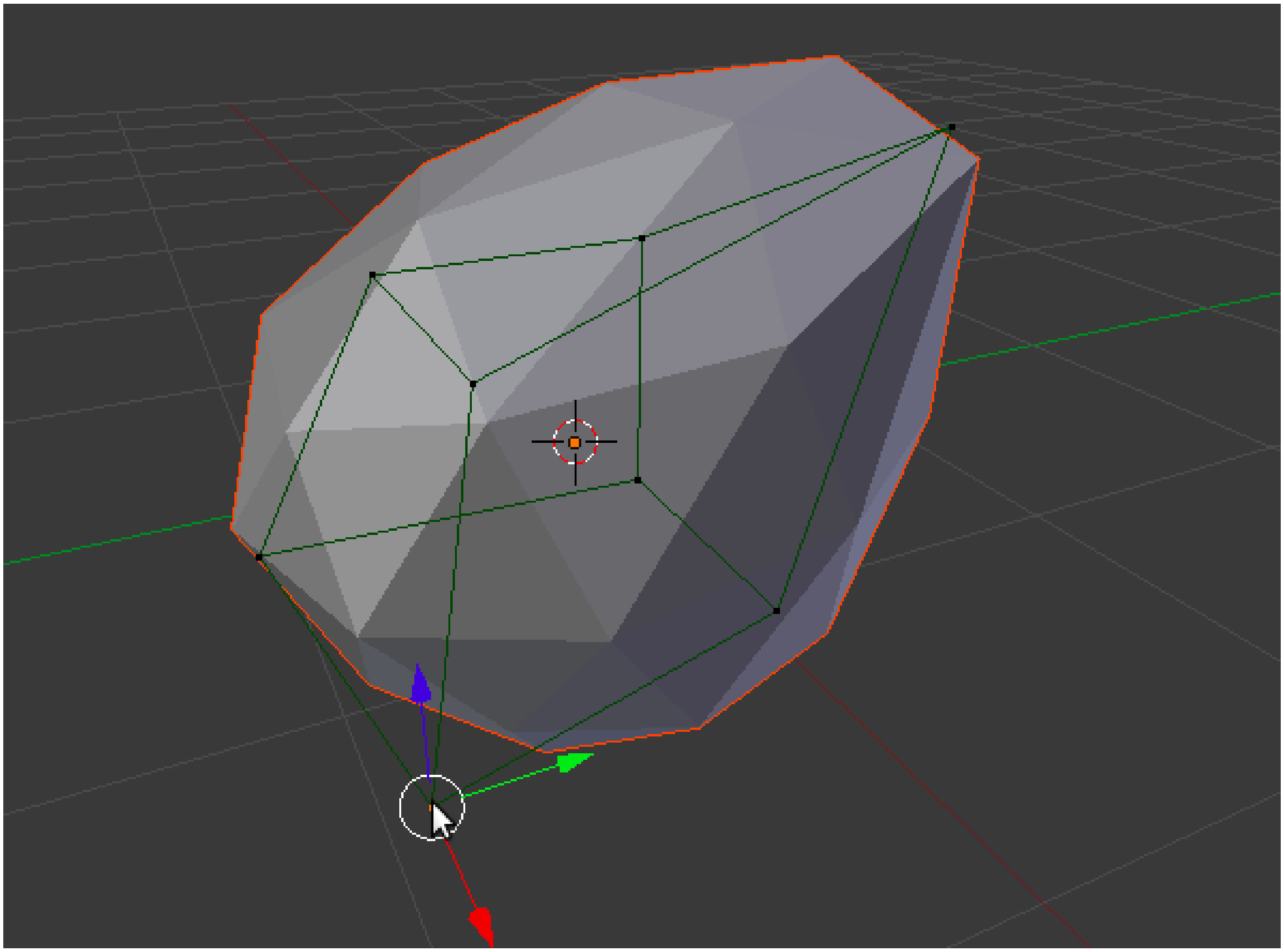


```
#----------------------------------------------------------
# File groups.py
# Create groups
#----------------------------------------------------------
import bpy
import mathutils
from mathutils import Vector

# Layers
Display = 5
Build = 6
```

```
def setObject(name, mat):
    ob = bpy.context.object
    ob.name = name
    ob.data.materials.append(mat)
    return ob

# Move object to given layer.
def moveToLayer(ob, layer):
    ob.layers[layer] = True
    for n in range(20):
        if n != layer:
            ob.layers[n] = False
    return

# Add a TextCurve object in layer 13
def addText(string, loc):
    tcu = bpy.data.curves.new(string+'Data', 'FONT')
    text = bpy.data.objects.new(string+'Text', tcu)
    tcu.body = string
    tcu.align = 'RIGHT'
    text.location = loc
    bpy.context.scene.objects.link(text)
    # Must change text.layers after text has been linked to scene,
    # otherwise the change may not stick.
    moveToLayer(text, Build)
    return text

def run():
    # Create two materials
    red = bpy.data.materials.new('RedMat')
    red.diffuse_color = (1,0,0)
    green = bpy.data.materials.new('GreenMat')
    green.diffuse_color = (0,1,0)

    # Locations
    origin = Vector((0,0,0))
    dx = Vector((2,0,0))
    dy = Vector((0,2,0))
    dz = Vector((0,0,2))

    # Put objects on the build layer
    layers = 20*[False]
    layers[Build] = True

    # Create objects
    bpy.ops.mesh.primitive_cube_add(location=dz, layers=layers)
    redCube = setObject('RedCube', red)
    bpy.ops.mesh.primitive_cube_add(location=dx+dz, layers=layers)
    greenCube = setObject('GreenCube', green)
    bpy.ops.mesh.primitive_uv_sphere_add(location=2*dx+dz, layers=layers)
    redSphere = setObject('RedSphere', red)
    bpy.ops.mesh.primitive_uv_sphere_add(location=3*dx+dz, layers=layers)
    greenSphere = setObject('GreenSphere', green)

    # Create texts
    redText = addText('Red', -dx)
    greenText = addText('Green', -dx)
    cubeText = addText('Cube', -dx)
    sphereText = addText('Sphere', -dx)
    # Create groups
    redGrp = bpy.data.groups.new('RedGroup')
    greenGrp = bpy.data.groups.new('GreenGroup')
    cubeGrp = bpy.data.groups.new('CubeGroup')
    sphereGrp = bpy.data.groups.new('SphereGroup')

    # Table of group members
    members = {
        redGrp : [redCube, redSphere, redText],
        greenGrp : [greenCube, greenSphere, greenText],
        cubeGrp : [redCube, greenCube, cubeText],
        sphereGrp : [redSphere, greenSphere, sphereText]
    }

    # Link objects to groups
    for group in members.keys():
        for ob in members[group]:
            group.objects.link(ob)

    # List of empties
    empties = [
        ('RedEmpty', origin, redGrp),
        ('GreenEmpty', dy, greenGrp),
        ('CubeEmpty', 2*dy, cubeGrp),
        ('SphereEmpty', 3*dy, sphereGrp)
    ]

    # Create Empties and put them on the display layer
    scn = bpy.context.scene
    for (name, loc, group) in empties:
        empty = bpy.data.objects.new(name, None)
        empty.location = loc
        empty.name = name
        empty.dupli_type = 'GROUP'
        empty.dupli_group = group
        scn.objects.link(empty)
        moveToLayer(empty, Display)


    # Make display layer into the active layer
    scn.layers[Display] = True
    for n in range(20):
        if n != Display:
            scn.layers[n] = False

    return

if __name__ == "__main__":
    run()
```

Lattice

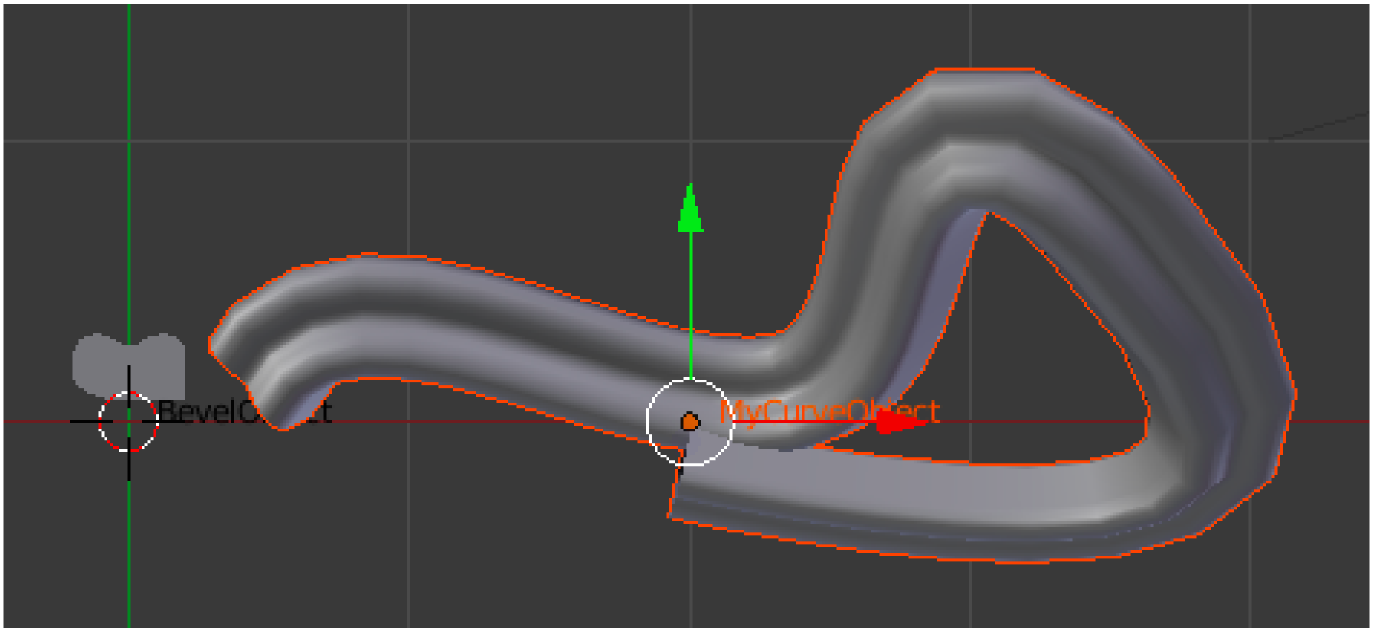
This program adds an icosphere deformed by a lattice. The lattice modifier only acts on the vertex group on the upper half of the sphere.



```
#----------------------------------------------------------
# File lattice.py
#----------------------------------------------------------
import bpy

def createIcoSphere(origin):
    # Create an icosphere
    bpy.ops.mesh.primitive_ico_sphere_add(location=origin)
    ob = bpy.context.object
    me = ob.data

    # Create vertex groups
    upper = ob.vertex_groups.new('Upper')
    lower = ob.vertex_groups.new('Lower')
    for v in me.vertices:
        if v.co[2] > 0.001:
            upper.add([v.index], 1.0, 'REPLACE')
        elif v.co[2] < -0.001:
            lower.add([v.index], 1.0, 'REPLACE')
        else:
            upper.add([v.index], 0.5, 'REPLACE')
            lower.add([v.index], 0.5, 'REPLACE')
    return ob

def createLattice(origin):
    # Create lattice and object
    lat = bpy.data.lattices.new('MyLattice')
    ob = bpy.data.objects.new('LatticeObject', lat)
    ob.location = origin
    ob.show_x_ray = True
    # Link object to scene
    scn = bpy.context.scene
    scn.objects.link(ob)
    scn.objects.active = ob
    scn.update()

    # Set lattice attributes
    lat.interpolation_type_u = 'KEY_LINEAR'
    lat.interpolation_type_v = 'KEY_CARDINAL'
    lat.interpolation_type_w = 'KEY_BSPLINE'
    lat.use_outside = False
    lat.points_u = 2
    lat.points_v = 2
    lat.points_w = 2

    # Set lattice points
    s = 1.0
    points = [
        (-s,-s,-s), (s,-s,-s), (-s,s,-s), (s,s,-s),
        (-s,-s,s), (s,-s,s), (-s,s,s), (s,s,s)
    ]
    for n,pt in enumerate(lat.points):
        for k in range(3):
            #pt.co[k] = points[n][k]
            pass
    return ob

def run(origin):
    sphere = createIcoSphere(origin)
    lat = createLattice(origin)
    # Create lattice modifier
    mod = sphere.modifiers.new('Lat', 'LATTICE')
    mod.object = lat
    mod.vertex_group = 'Upper'
    # Lattice in edit mode for easy deform
    bpy.context.scene.update()
    bpy.ops.object.mode_set(mode='EDIT')
    return

if __name__ == "__main__":
    run((0,0,0))
```

Curve

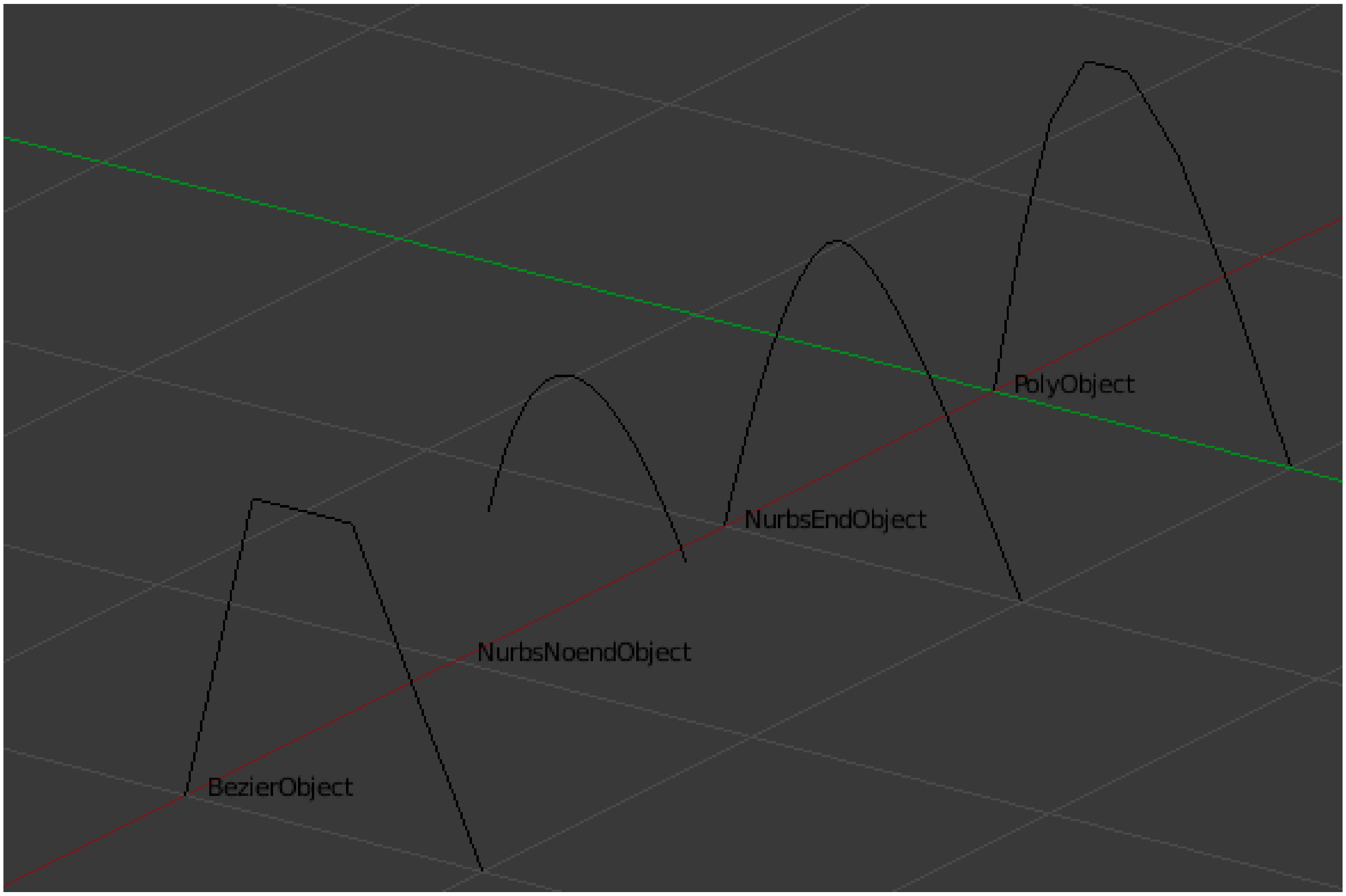
This program adds a Bezier curve. It also adds a Nurbs circle which is used as a bevel object.



```
#----------------------------------------------------------
# File curve.py
#----------------------------------------------------------
import bpy

def createBevelObject():
    # Create Bevel curve and object
    cu = bpy.data.curves.new('BevelCurve', 'CURVE')
    ob = bpy.data.objects.new('BevelObject', cu)
    bpy.context.scene.objects.link(ob)

    # Set some attributes
    cu.dimensions = '2D'
    cu.resolution_u = 6
    cu.twist_mode = 'MINIMUM'
    ob.show_name = True

    # Control point coordinates
    coords = [
        (0.00,0.08,0.00,1.00),
        (-0.20,0.08,0.00,0.35),
        (-0.20,0.19,0.00,1.00),
        (-0.20,0.39,0.00,0.35),
        (0.00,0.26,0.00,1.00),
        (0.20,0.39,0.00,0.35),
        (0.20,0.19,0.00,1.00),
        (0.20,0.08,0.00,0.35)
    ]

    # Create spline and set control points
    spline = cu.splines.new('NURBS')
    nPointsU = len(coords)
    spline.points.add(nPointsU)
    for n in range(nPointsU):
        spline.points[n].co = coords[n]

    # Set spline attributes. Points probably need to exist here.
    spline.use_cyclic_u = True
    spline.resolution_u = 6
    spline.order_u = 3

    return ob


def createCurveObject(bevob):
    # Create curve and object
    cu = bpy.data.curves.new('MyCurve', 'CURVE')
    ob = bpy.data.objects.new('MyCurveObject', cu)
    bpy.context.scene.objects.link(ob)

    # Set some attributes
    cu.bevel_object = bevob
    cu.dimensions = '3D'
    cu.use_fill_back = True
    cu.use_fill_front = True
    ob.show_name = True

    # Bezier coordinates
    beziers = [
        ((-1.44,0.20,0.00), (-1.86,-0.51,-0.36), (-1.10,0.75,0.28)),
        ((0.42,0.13,-0.03), (-0.21,-0.04,-0.27), (1.05,0.29,0.21)),
        ((1.20,0.75,0.78), (0.52,1.36,1.19), (2.76,-0.63,-0.14))
    ]

    # Create spline and set Bezier control points
    spline = cu.splines.new('BEZIER')
    nPointsU = len(beziers)
    spline.bezier_points.add(nPointsU)
    for n in range(nPointsU):
        bpt = spline.bezier_points[n]
        (bpt.co, bpt.handle_left, bpt.handle_right) = beziers[n]
    return ob

def run(origin):
    bevob = createBevelObject()
    bevob.location = origin

    curveob = createCurveObject(bevob)
    curveob.location = origin
    bevob.select = False
    curveob.select = True
    bpy.ops.transform.translate(value=(2,0,0))
    return

if __name__ == "__main__":
    run((0,0,0))
```

Curve types

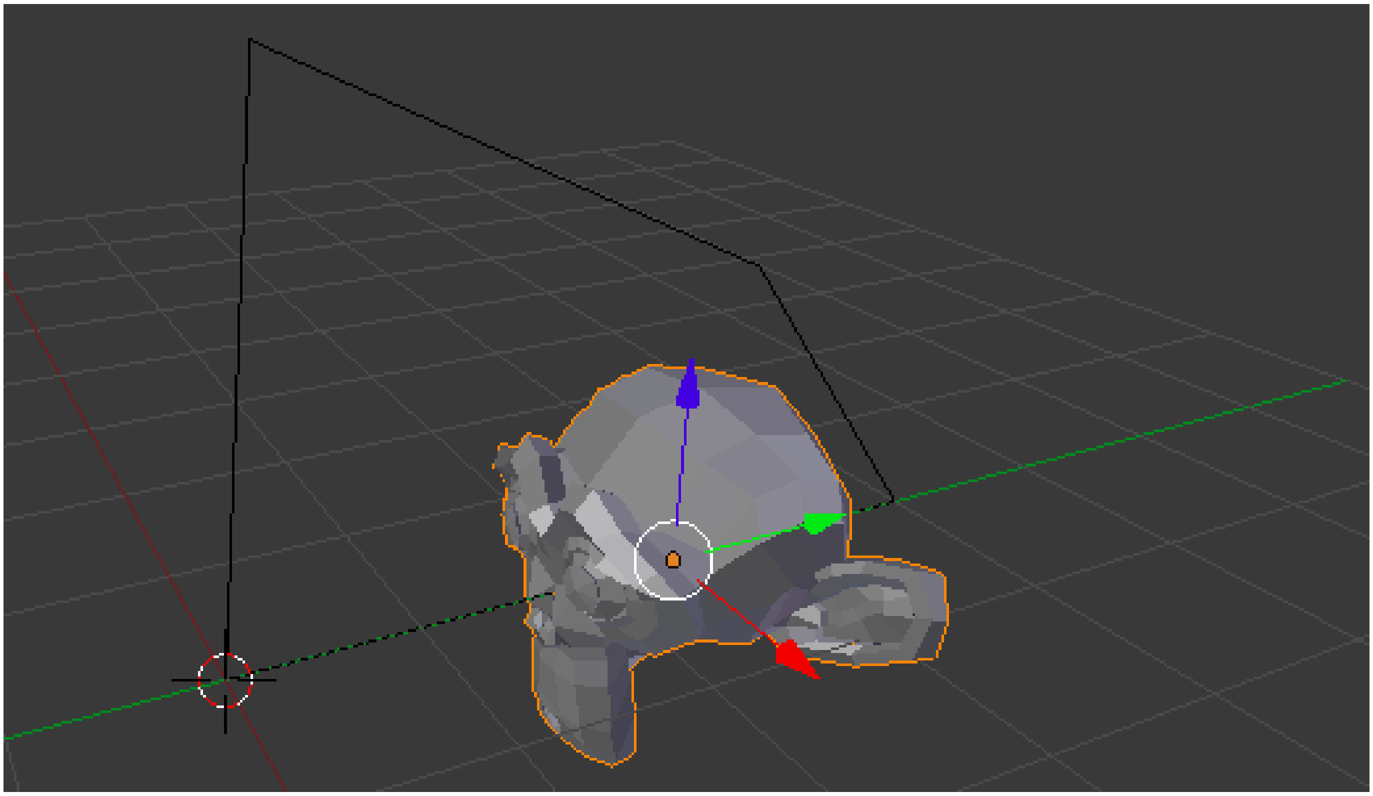
This program illustrates the difference between the curve types: POLY, NURBS and BEZIER.



```
#----------------------------------------------------------
# File curve_types.py
#----------------------------------------------------------
import bpy
from math import sin, pi

# Poly and nurbs
def makePolySpline(cu):
    spline = cu.splines.new('POLY')
    cu.dimensions = '3D'
    addPoints(spline, 8)

def makeNurbsSpline(cu):
    spline = cu.splines.new('NURBS')
    cu.dimensions = '3D'
    addPoints(spline, 4)
    spline.order_u = 3
    return spline

def addPoints(spline, nPoints):
    spline.points.add(nPoints-1)
    delta = 1/(nPoints-1)
    for n in range(nPoints):
        spline.points[n].co = (0, n*delta, sin(n*pi*delta), 1)

# Bezier
def makeBezierSpline(cu):
    spline = cu.splines.new('BEZIER')
    cu.dimensions = '3D'
    order = 3
    addBezierPoints(spline, order+1)
    spline.order_u = order

def addBezierPoints(spline, nPoints):
    spline.bezier_points.add(nPoints-1)
    bzs = spline.bezier_points
    delta = 1/(nPoints-1)
    for n in range(nPoints):
        bzs[n].co = (0, n*delta, sin(n*pi*delta))
        print(bzs[n].co)
    for n in range(1, nPoints):
        bzs[n].handle_left = bzs[n-1].co
    for n in range(nPoints-1):
        bzs[n].handle_right = bzs[n+1].co
    return spline

# Create curve and object and link to scene
def makeCurve(name, origin, dx):
    cu = bpy.data.curves.new('%sCurve' % name, 'CURVE')
    ob = bpy.data.objects.new('%sObject' % name, cu)
    (x,y,z) = origin
    ob.location = (x+dx,y,z)
    ob.show_name = True
    bpy.context.scene.objects.link(ob)
    return cu

def run(origin):
    polyCurve = makeCurve("Poly", origin, 0)
    makePolySpline(polyCurve)
    nurbsCurve = makeCurve("NurbsEnd", origin, 1)
    spline = makeNurbsSpline(nurbsCurve)
    spline.use_endpoint_u = True
    nurbsCurve = makeCurve("NurbsNoend", origin, 2)
    spline = makeNurbsSpline(nurbsCurve)
    spline.use_endpoint_u = False
    bezierCurve = makeCurve("Bezier", origin, 3)
    makeBezierSpline(bezierCurve)
    return

if __name__ == "__main__":
    run((0,0,0))
```

Path

This program adds a path and a monkey with a follow path constraint.



```
#----------------------------------------------------------
# File path.py
#----------------------------------------------------------
import bpy

def run(origin):
    # Create path data and object
    path = bpy.data.curves.new('MyPath', 'CURVE')
    pathOb = bpy.data.objects.new('Path', path)
    pathOb.location = origin
    bpy.context.scene.objects.link(pathOb)

    # Set path data
    path.dimensions = '3D'
    path.use_path = True
    path.use_path_follow = True
    path.path_duration = 100

    # Animate path
    path.eval_time = 0
    path.keyframe_insert(data_path="eval_time", frame=0)
    path.eval_time = 100
    path.keyframe_insert(data_path="eval_time", frame=250)

    # Add a spline to path
    spline = path.splines.new('POLY')
    spline.use_cyclic_u = True
    spline.use_endpoint_u = False

    # Add points to spline
    pointTable = [(0,0,0,0), (1,0,3,0),
        (1,2,2,0), (0,4,0,0), (0,0,0,0)]
    nPoints = len(pointTable)
    spline.points.add(nPoints-1)
    for n in range(nPoints):
        spline.points[n].co = pointTable[n]

    # Add a monkey
    bpy.ops.mesh.primitive_monkey_add()
    monkey = bpy.context.object

    # Add follow path constraint to monkey
    cns = monkey.constraints.new('FOLLOW_PATH')
    cns.target = pathOb
    cns.use_curve_follow = True
    cns.use_curve_radius = True
    cns.use_fixed_location = False
    cns.forward_axis = 'FORWARD_Z'
    cns.up_axis = 'UP_Y'

    return

if __name__ == "__main__":
    run((0,0,0))
    bpy.ops.screen.animation_play(reverse=False, sync=False)
```

Camera and lights

This program adds a sun light to the scene, and a spot light for every render object in the scene. Each spot has a TrackTo constraint making to point to its object, whereas the sun tracks the center of all objects in the scene.

```
#----------------------------------------------------------
# File camera.py
# Adds one camera and several lights
#----------------------------------------------------------
import bpy, mathutils, math
from mathutils import Vector
from math import pi

def findMidPoint():
    sum = Vector((0,0,0))
    n = 0
    for ob in bpy.data.objects:
        if ob.type not in ['CAMERA', 'LAMP', 'EMPTY']:
            sum += ob.location
            n += 1
    if n == 0:
        return sum
    else:
        return sum/n

def addTrackToConstraint(ob, name, target):
    cns = ob.constraints.new('TRACK_TO')
    cns.name = name
    cns.target = target
    cns.track_axis = 'TRACK_NEGATIVE_Z'
    cns.up_axis = 'UP_Y'
    cns.owner_space = 'WORLD'
    cns.target_space = 'WORLD'
    return

def createLamp(name, lamptype, loc):
    bpy.ops.object.add(
        type='LAMP',
        location=loc)
    ob = bpy.context.object
    ob.name = name
    lamp = ob.data
    lamp.name = 'Lamp'+name
    lamp.type = lamptype
    return ob

def createLamps(origin, target):
    deg2rad = 2*pi/360

    sun = createLamp('sun', 'SUN', origin+Vector((0,20,50)))
    lamp = sun.data
    lamp.type = 'SUN'
    addTrackToConstraint(sun, 'TrackMiddle', target)

    for ob in bpy.context.scene.objects:
        if ob.type == 'MESH':
            spot = createLamp(ob.name+'Spot', 'SPOT', ob.location+Vector((0,2,1)))
            bpy.ops.transform.resize(value=(0.5,0.5,0.5))
            lamp = spot.data

            # Lamp
            lamp.type = 'SPOT'
            lamp.color = (0.5,0.5,0)
            lamp.energy = 0.9
            lamp.falloff_type = 'INVERSE_LINEAR'
            lamp.distance = 7.5

            # Spot shape
            lamp.spot_size = 30*deg2rad
            lamp.spot_blend = 0.3

            # Shadows
            lamp.shadow_method = 'BUFFER_SHADOW'
            lamp.use_shadow_layer = True
            lamp.shadow_buffer_type = 'REGULAR'
            lamp.shadow_color = (0,0,1)

            addTrackToConstraint(spot, 'Track'+ob.name, ob)
    return

def createCamera(origin, target):
    # Create object and camera
    bpy.ops.object.add(
        type='CAMERA',
        location=origin,
        rotation=(pi/2,0,pi))
    ob = bpy.context.object
    ob.name = 'MyCamOb'
    cam = ob.data
    cam.name = 'MyCam'
    addTrackToConstraint(ob, 'TrackMiddle', target)


    # Lens
    cam.type = 'PERSP'
    cam.lens = 75
    cam.lens_unit = 'MILLIMETERS'
    cam.shift_x = -0.05
    cam.shift_y = 0.1
    cam.clip_start = 10.0
    cam.clip_end = 250.0

    empty = bpy.data.objects.new('DofEmpty', None)
    empty.location = origin+Vector((0,10,0))
    cam.dof_object = empty

    # Display
    cam.show_title_safe = True
    cam.show_name = True

    # Make this the current camera
    scn = bpy.context.scene
    scn.camera = ob
    return ob

def run(origin):
    # Delete all old cameras and lamps
    scn = bpy.context.scene
    for ob in scn.objects:
        if ob.type == 'CAMERA' or ob.type == 'LAMP':
            scn.objects.unlink(ob)

    # Add an empty at the middle of all render objects
    midpoint = findMidPoint()
    bpy.ops.object.add(
        type='EMPTY',
        location=midpoint),
    target = bpy.context.object
    target.name = 'Target'

    createCamera(origin+Vector((50,90,50)), target)
    createLamps(origin, target)
    return

if __name__ == "__main__":
    run(Vector((0,0,0)))
```

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