Generating, automating and processing 3D graphics with Blender's python API

blender + python™ = <3

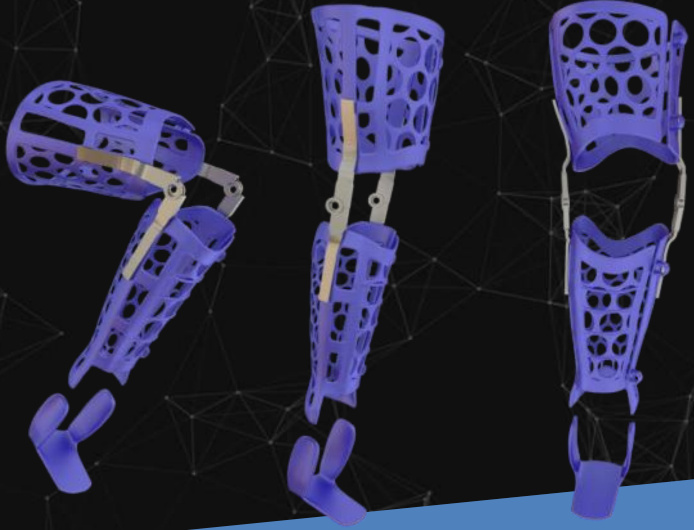
Tamir Lousky

PyCon Israel 2016

A bit about me

Was: Technical artist @ PitchiPoy

Now: CTO @ Invertex



- A fully featured 3D animation suite
- Modeling and Sculpting

- Texturing and shading
- Rigging and animation
- Lighting and rendering (incl. unbiased engine)

- Compositing and video editing
- Game engine
- Camera tracking,
  green screen tools
- Simulations (cloth, fluid, smoke, particles, bullet physics)
- Open Source, free software

Python scripting API

- Custom tools
- Automation
- Scripting

bpy

The blender-python (bpy) module

- Access scene data:
  models, cameras, lights, animations, particles, etc
- Generate and manipulate scene objects
- Use BPY operators to execute UI commands
- Load and export assets
- Create new menus, panels, addons with existing or new logics and operators

bpy

Additional modules

- bmesh: efficient module for creating and manipulating polygonal mesh objects
- bge: Blender Game Engine (BGE) scripted logics
- bgl: OpenGL wrapper for direct OpenGL scripting
- blf: Font drawing and text overlay display
- mathutils: vector, matrix and geometry functionality

bpy

Download examples at:

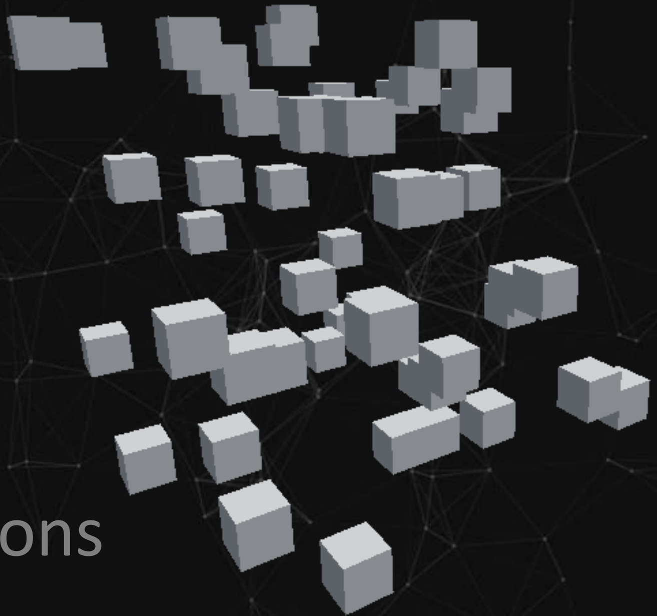
github.com/Tlousky/blender_scripts/tree/master/pycon2016il

bpy

Basic example

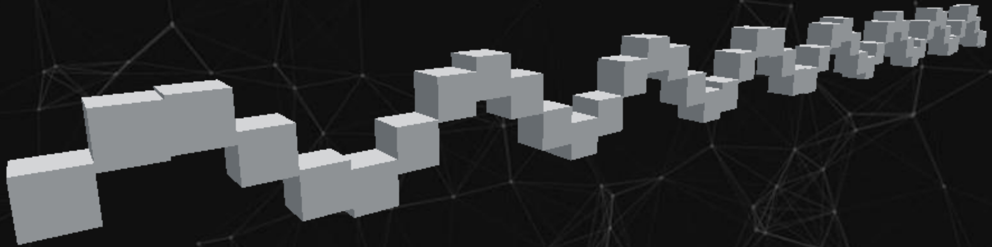
```python
import bpy
from random import randint

# Generate 50 cubes in random locations
for i in range(50):
    bpy.ops.mesh.primitive_cube_add(
        location = [ randint( -10, 10 ) for axis in 'xyz' ]
)
```



bpy

Basic example #2

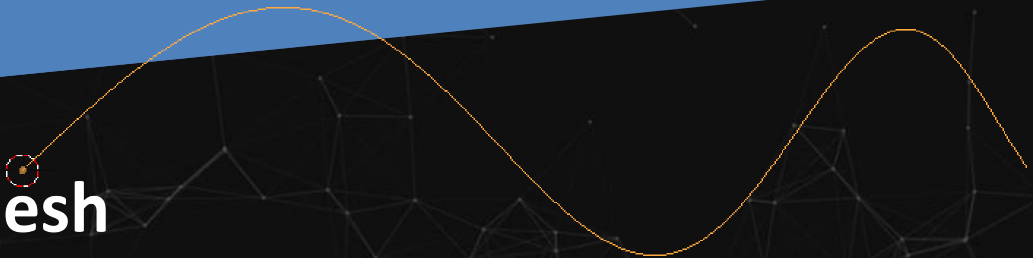


```
import bpy
from math import sin

# Generate 50 cubes along a sin curve
for i in range(50):
    x, y, z = 0, i, sin( i )
    bpy.ops.mesh.primitive_cube_add( location = (x, y, z)  )
```

bpy

Generate a polygonal mesh



```
import bpy
import numpy as np
from math import sin

m = bpy.data.meshes.new( 'sin' )

n = 100
m.vertices.add( n )
m.edges.add( n - 1 )
```

```
yVals = np.linspace( 0, 10, 100 )
for i, y in zip( range(n), yVals ):
    m.vertices[i].co = ( 0, y, sin( y ) )

    if i < n - 1:
        m.edges[i].vertices = ( i, i+1 )

o = bpy.data.objects.new( 'sin', m )
bpy.context.scene.objects.link( o )
```

bpy

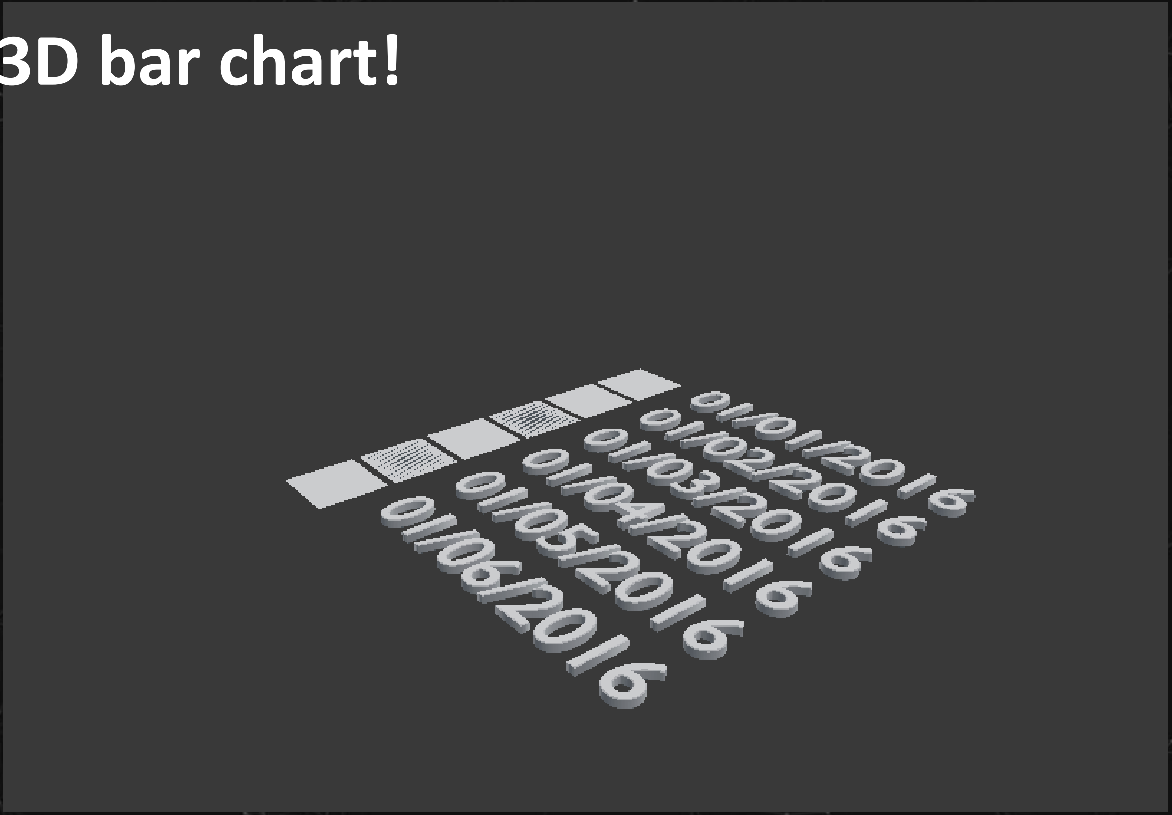
(True) 3D bar chart from CSV

01/01/2016
01/02/2016
01/03/2016
01/04/2016
01/05/2016
01/06/2016

github.com/Tlousky/blender_scripts/blob/master/pycon2016il/csv2blender.py

bpy

Animated 3D bar chart!



github.com/Tlousky/blender_scripts/blob/master/pycon2016il/csv2blender.py

bpy

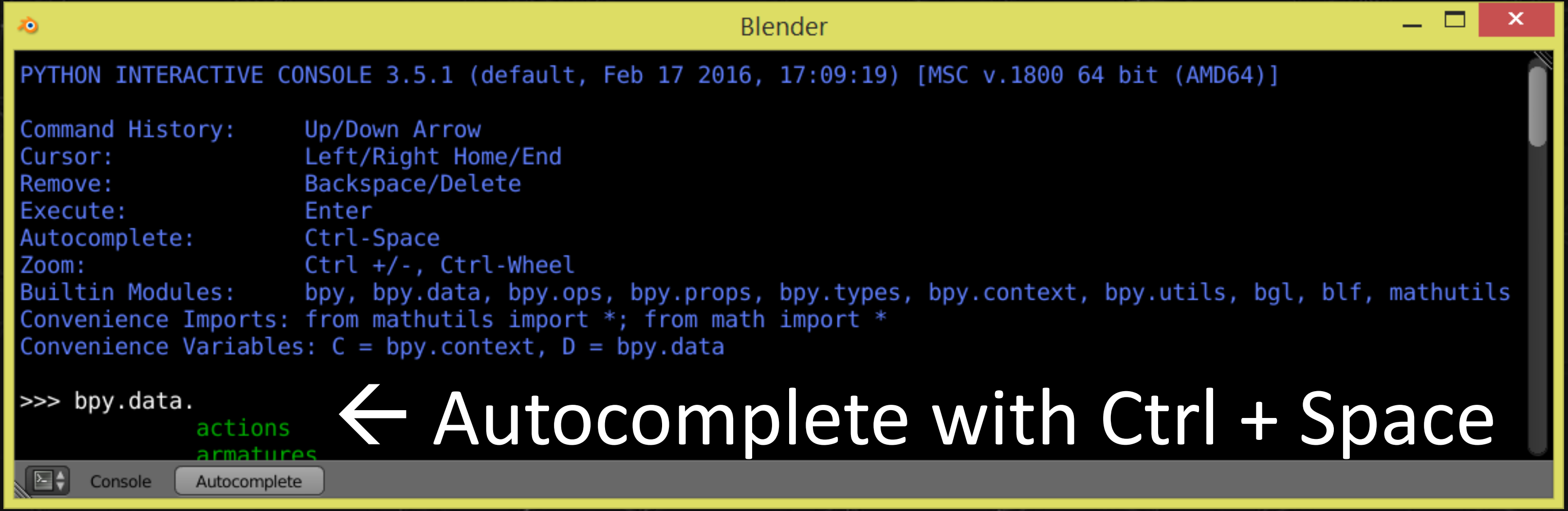
Tricky bits

- Operators vs. low level functions
- Operator context
- Non-python UI elements and operations
- Modal operations
- View dependent operations
- API changes and backward compatibility

bpy

Documentation and dev tools

Official API documentation:
blender.org/api/blender_python_api_current



```
PYTHON INTERACTIVE CONSOLE 3.5.1 (default, Feb 17 2016, 17:09:19) [MSC v.1800 64 bit (AMD64)]

Command History:     Up/Down Arrow
Cursor:              Left/Right Home/End
Remove:              Backspace/Delete
Execute:             Enter
Autocomplete:        Ctrl-Space
Zoom:                Ctrl +/-, Ctrl-Wheel
Builtin Modules:     bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports: from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> bpy.data.
             actions
             armatures
```

← Autocomplete with Ctrl + Space

bpy

Advanced dev tools

- Compile Blender as a library and import.
- Set up Eclipse debugging tools for breakpoints, syntax highlighting and auto-completion.

wiki.blender.org/index.php/Dev:Doc/Tools/Debugging/Python_Eclipse

Resources

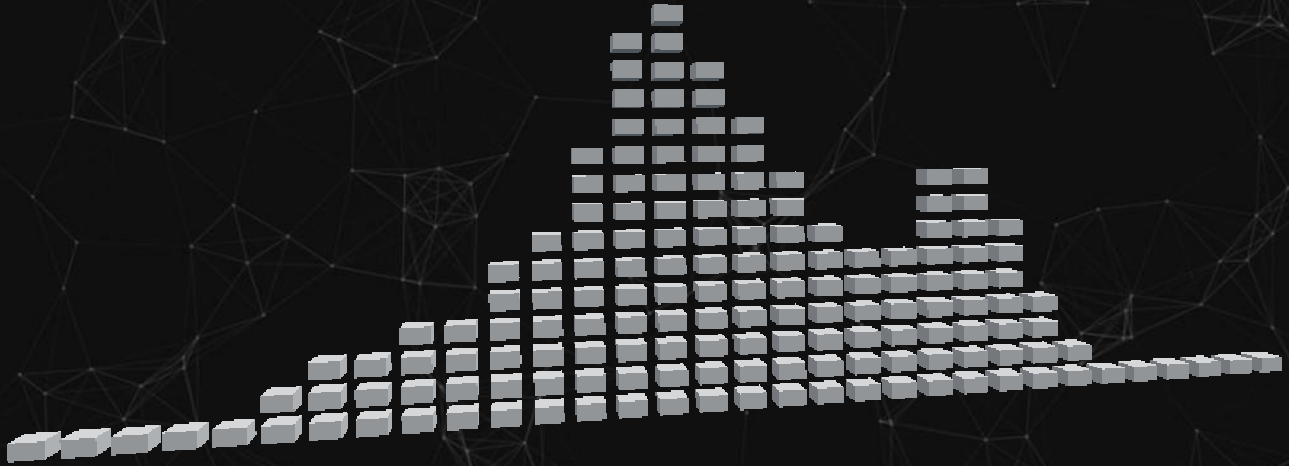
- blender.stackexchange.com
- blenderscripting.blogspot.co.il
- bioblog3d.wordpress.com
- wiki.blender.org/index.php/Dev:Py/Scripts/Cookbook/Code_snippets

bpy

Advanced Examples

GX Audio Visualizer addon by gethiox

github.com/gethiox/GXAudioVisualisation.git



bpy

Advanced Examples

Archimedian Spiral Generator

github.com/Tlousky/blender_scripts/blob/master/add_archimedian_spiral.py

Thank you for listening!