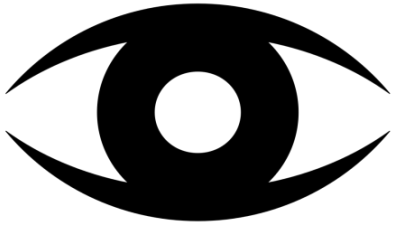
Vispy



A future tool for interactive visualization

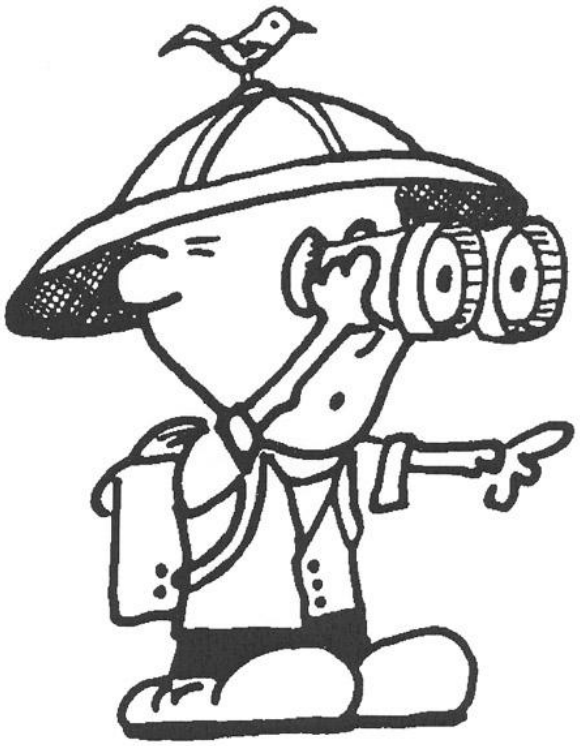
Luke Campagnola, **Almar Klein**,
Cyrille Rossant, Nicolas Rougier

Current problem

- Data is growing fast
- Explore rather than “look”

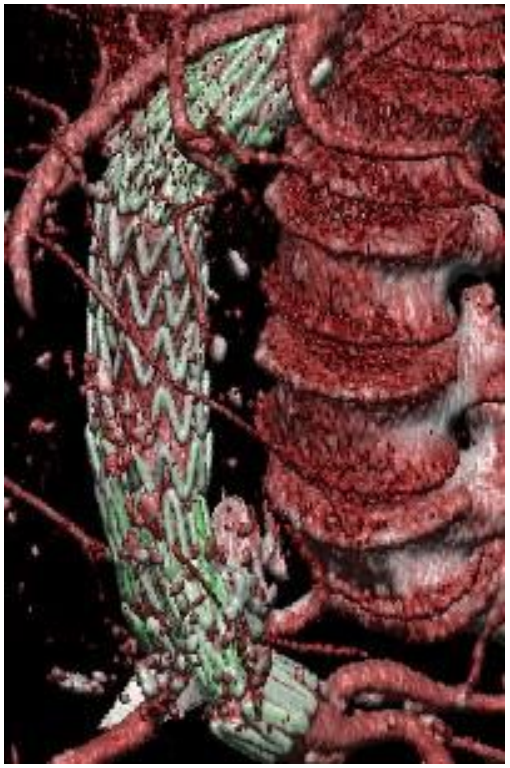
Problem:

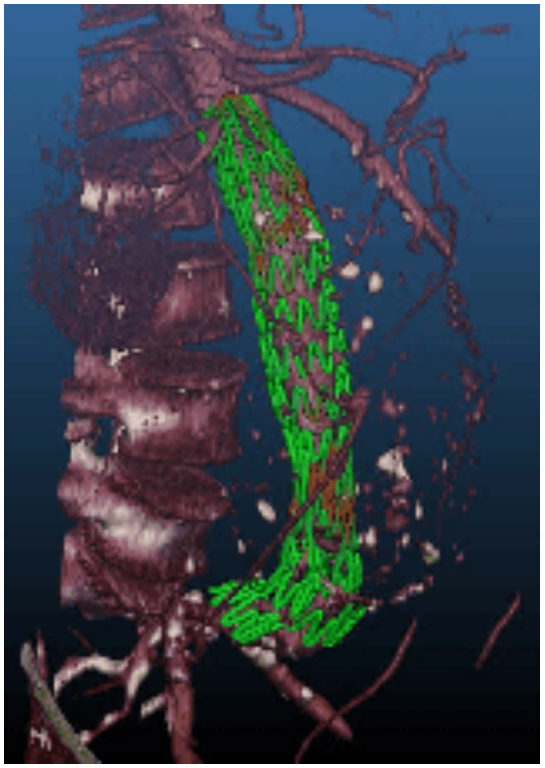
- Deal with large datasets
- Need interaction (+speed)



Analog to medical viz

- Interaction
- Speed
- Flexibility





Solution

- Leverage power of GPU
- Shaders for high quality results

Me at Cybermind

- AR in OR
- performance & quality
- medical visualization

About Vispy

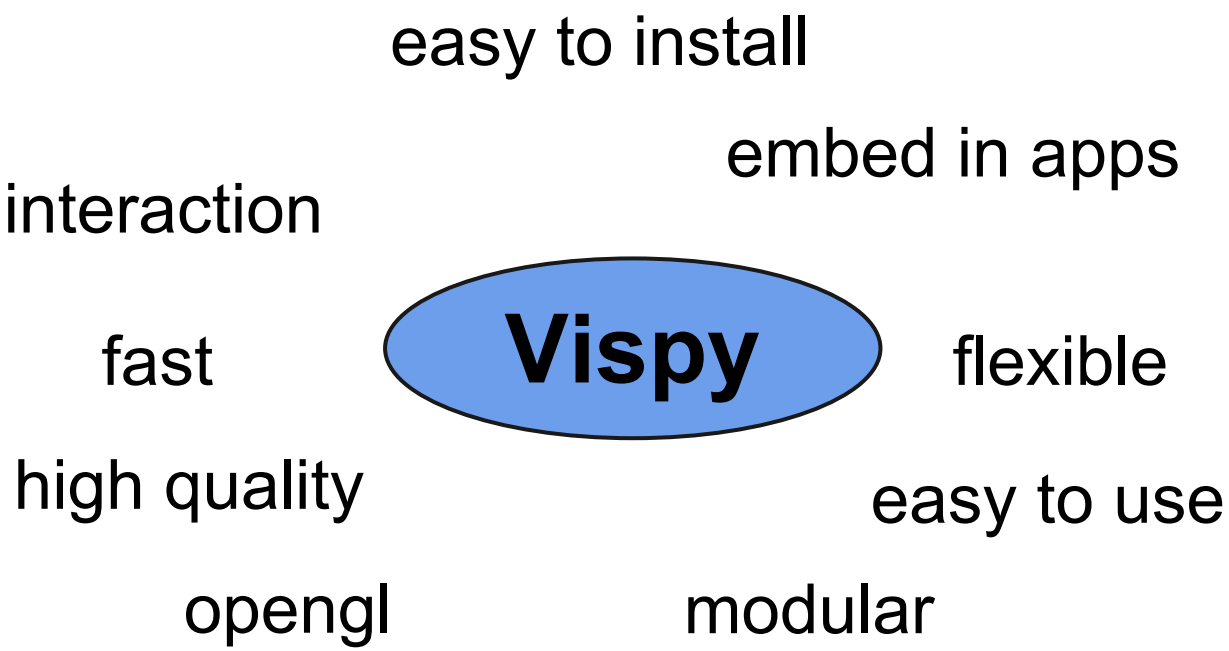
Who are we

- Luke Campagnola - Pyqtgraph
- Almar Klein - Visvis
- Cyrille Rossant - Galry
- Nicolas Rougier - Glumpy

Vispy: start from scratch:

best of all toolkits (and better)

Vispy goals


easy to install
embed in apps
interaction
Vispy
fast
flexible
high quality
easy to use
opengl
modular

OpenGL ES 2.0

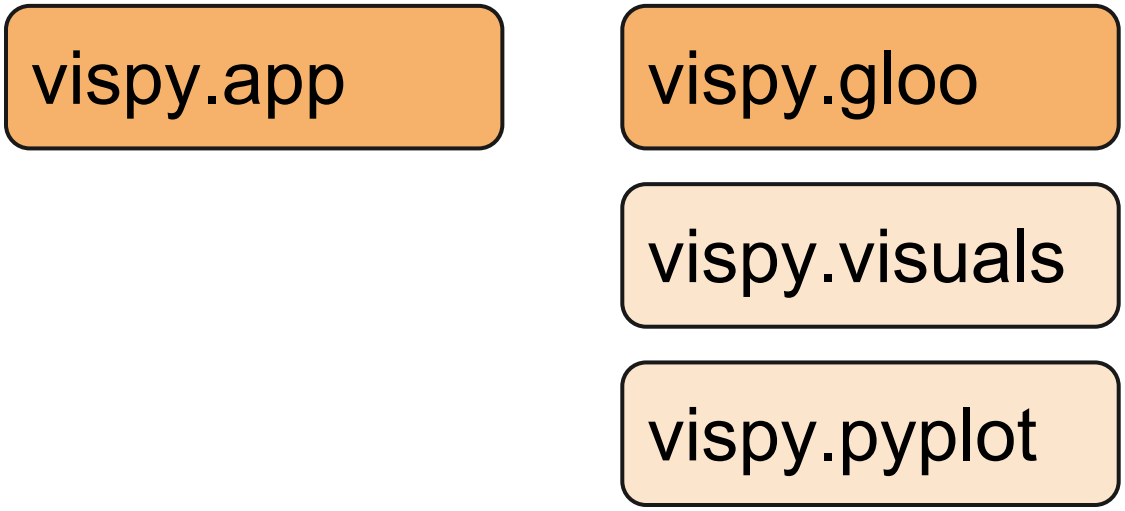
- Modern OpenGL
- Clean (just 150 functions)
- Good availability
- WebGL
- Mobile devices

Scipy ecosystem

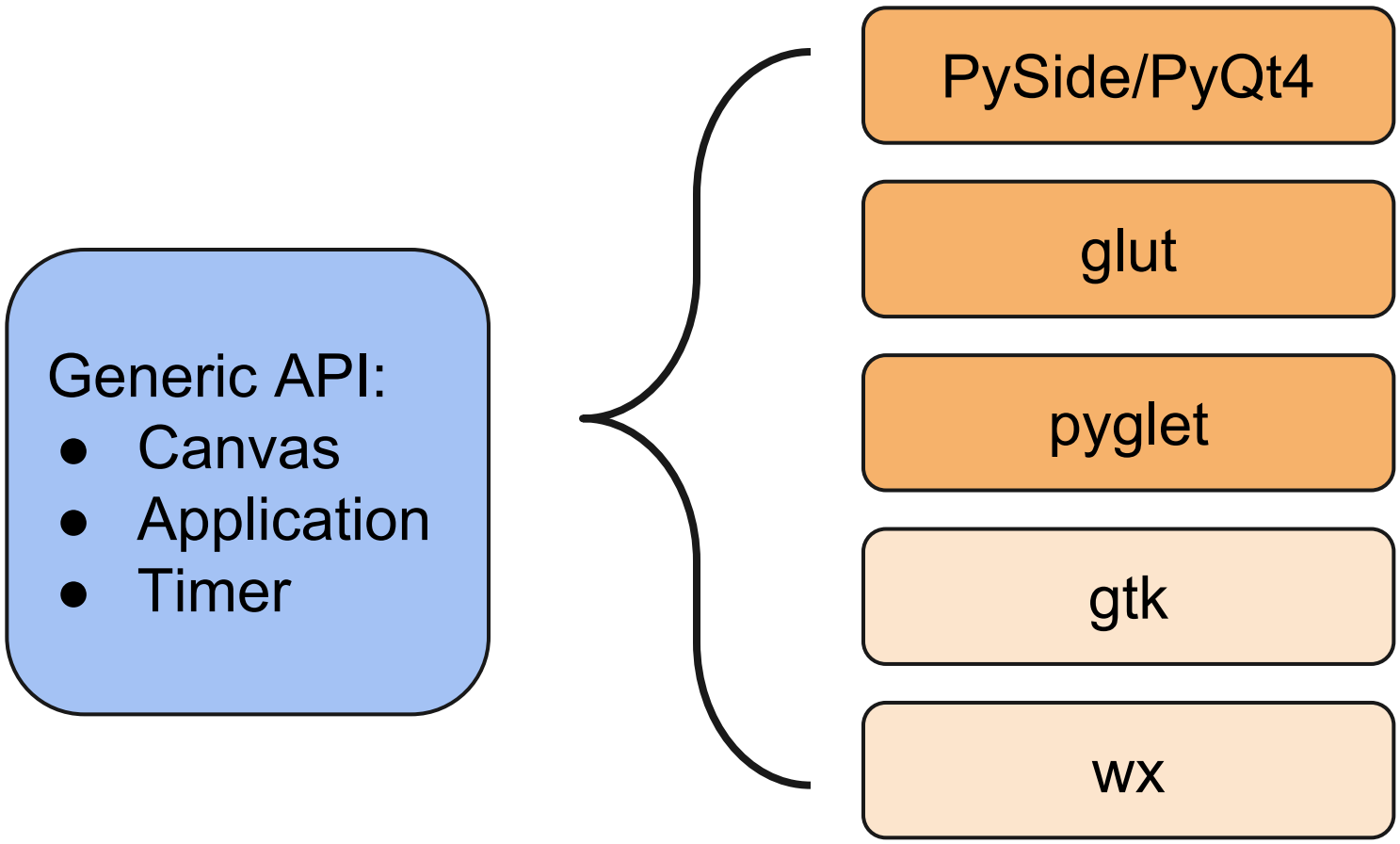
Inside Vispy

Package layout

Vispy structure



vispy.app



vispy.app.use()

vispy.gloo

API fits on one slide!

GLObject

handle
activate()
deactivate()
delete()

FragmentShader
VertexShader

code
source
set_code()

Program

shaders
attributes
uniforms
activate_object()
attach()
detach()
draw()
set_vars()

VertexBuffer
ElementBuffer

nbytes
count
dtype
offset
stride
vsize
set_data()
set_nbytes()
set_subdata()
set_count()

Texture2D
Texture3D
TextureCubemap

set_data()
set_filter()
set_shape()
set_subdata()
set_wrapping()

vispy.visuals

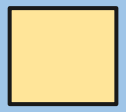
Lines

Markers

Text

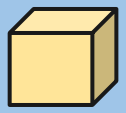
foo

Image



Mesh

Volume



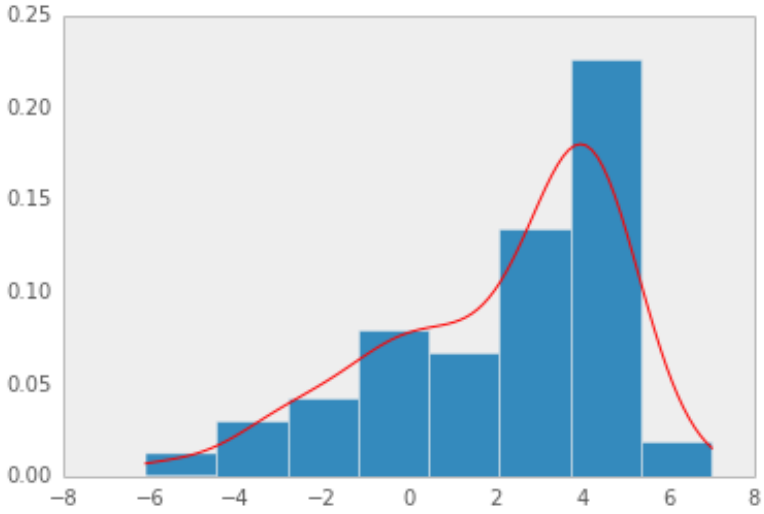
Plot

Histogram

Axis

vispy.pyplot

- Functional interface
- compatible with Matplotlib.pyplot (and Matlab)

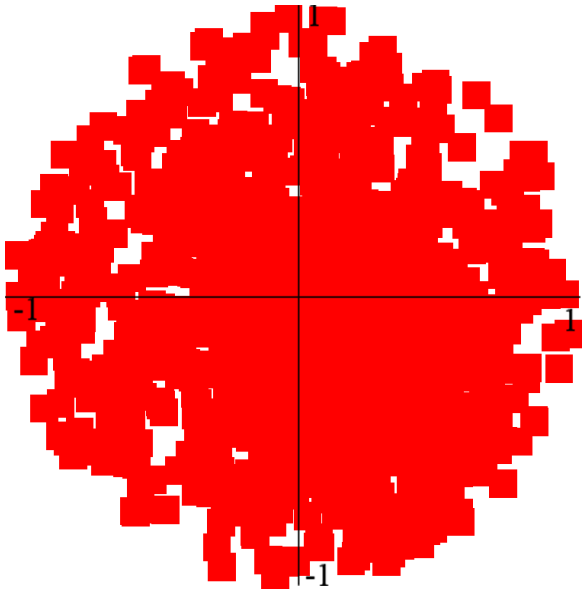


Work in progress

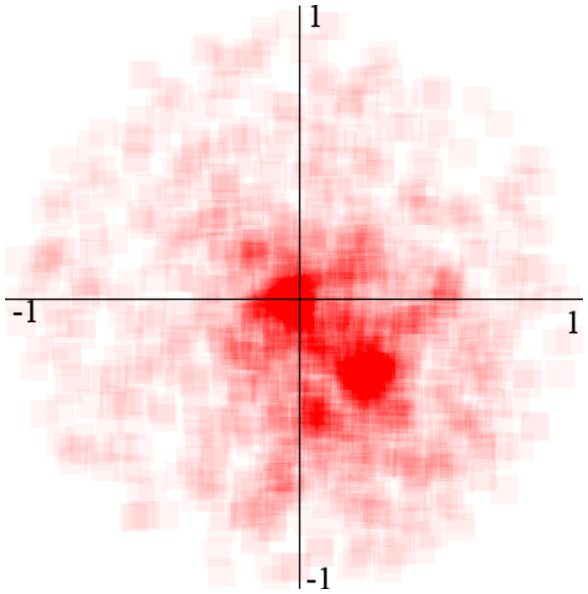
Ideas and experiments

Abstract rendering

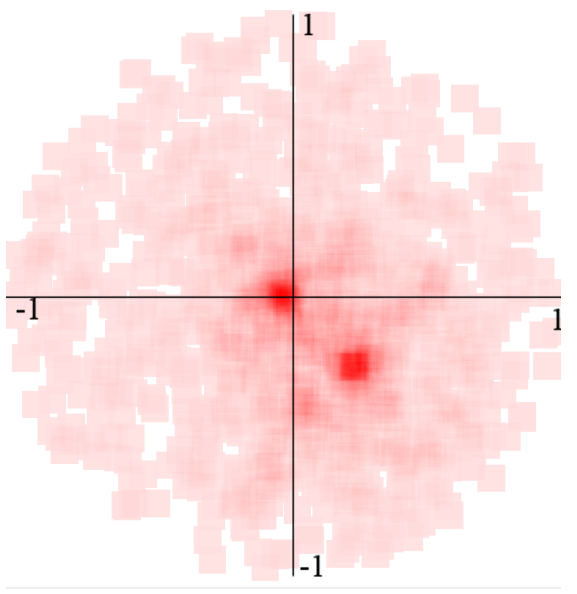
Ideas of Peter Wang



over-plot



standard alpha

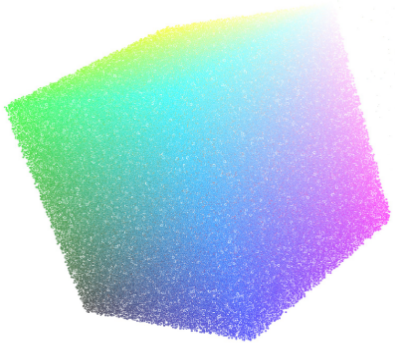


high-dev alpha

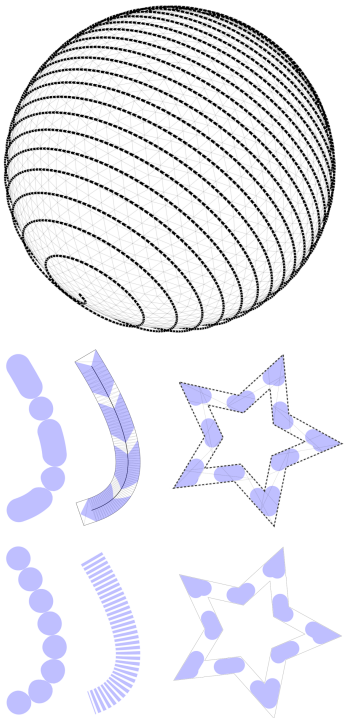
Beautiful lines / markers

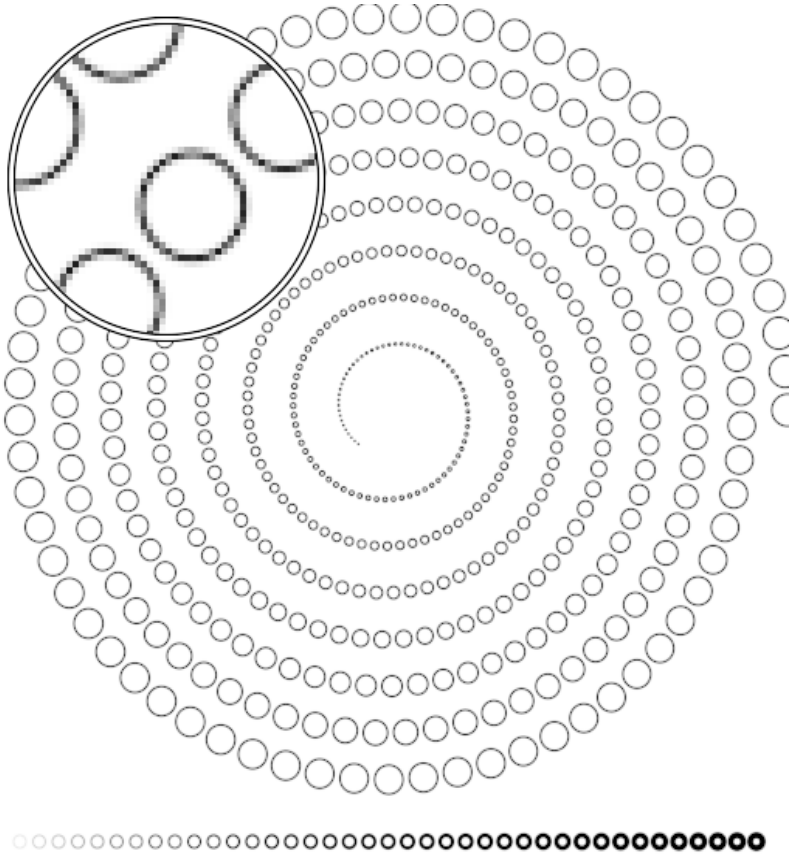
We do not (always) have to trade quality for speed

10,000 pts - 403 FPS

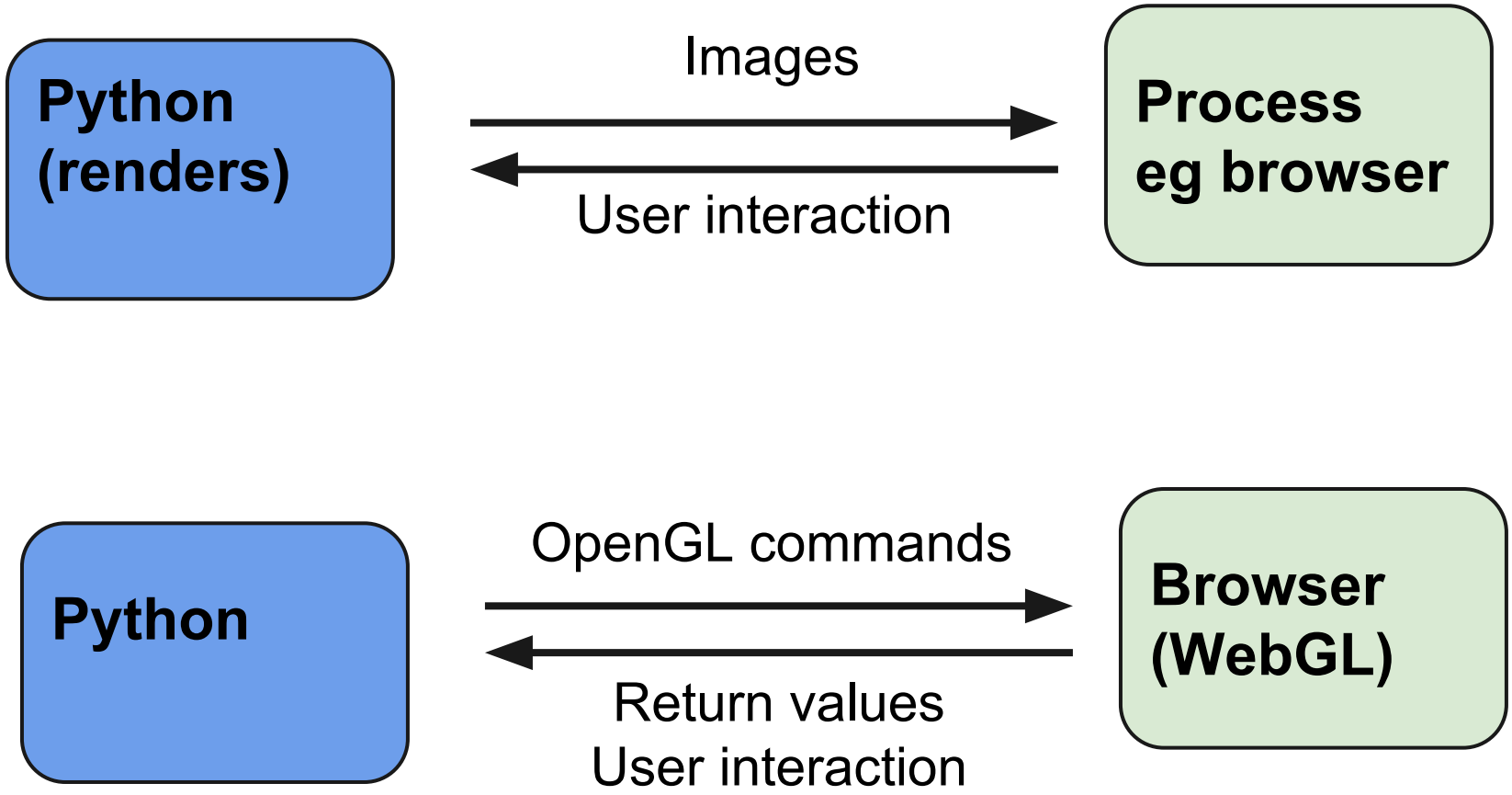


1,000,000 pts - 40 FPS



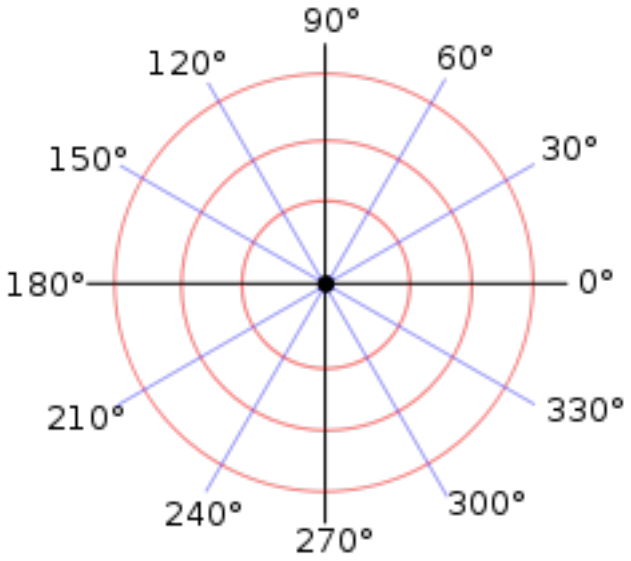


Remote rendering



Transformations

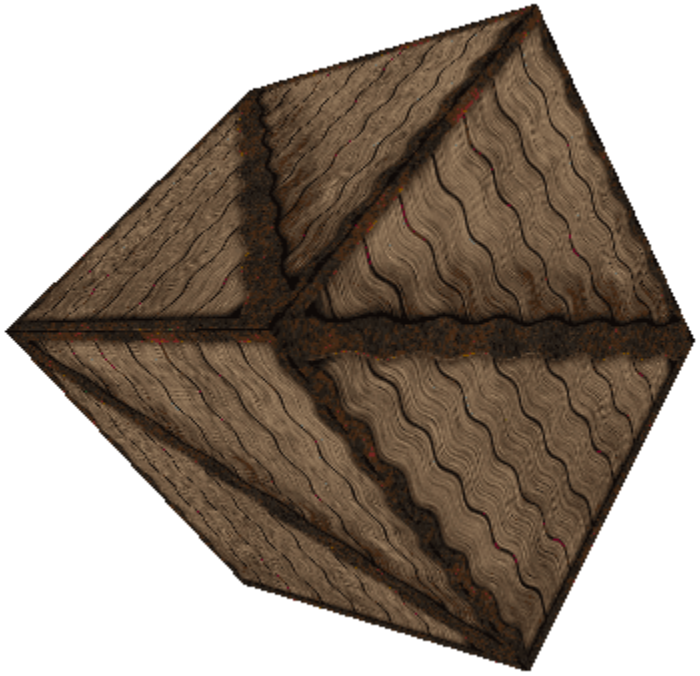
- Object hierarchy
- Complex transformations
  - log
  - polar
  - maps?



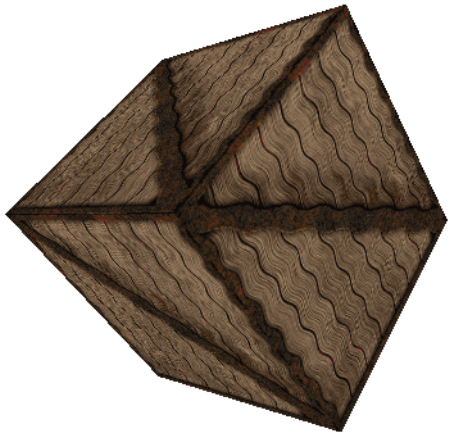
Dealing with transparency

- Doing it well is hard
- Depth sorting costs CP
- Two 'smart' techniques
  - (Dual) depth peeling
  - Weighted average

Demo time!



Further information

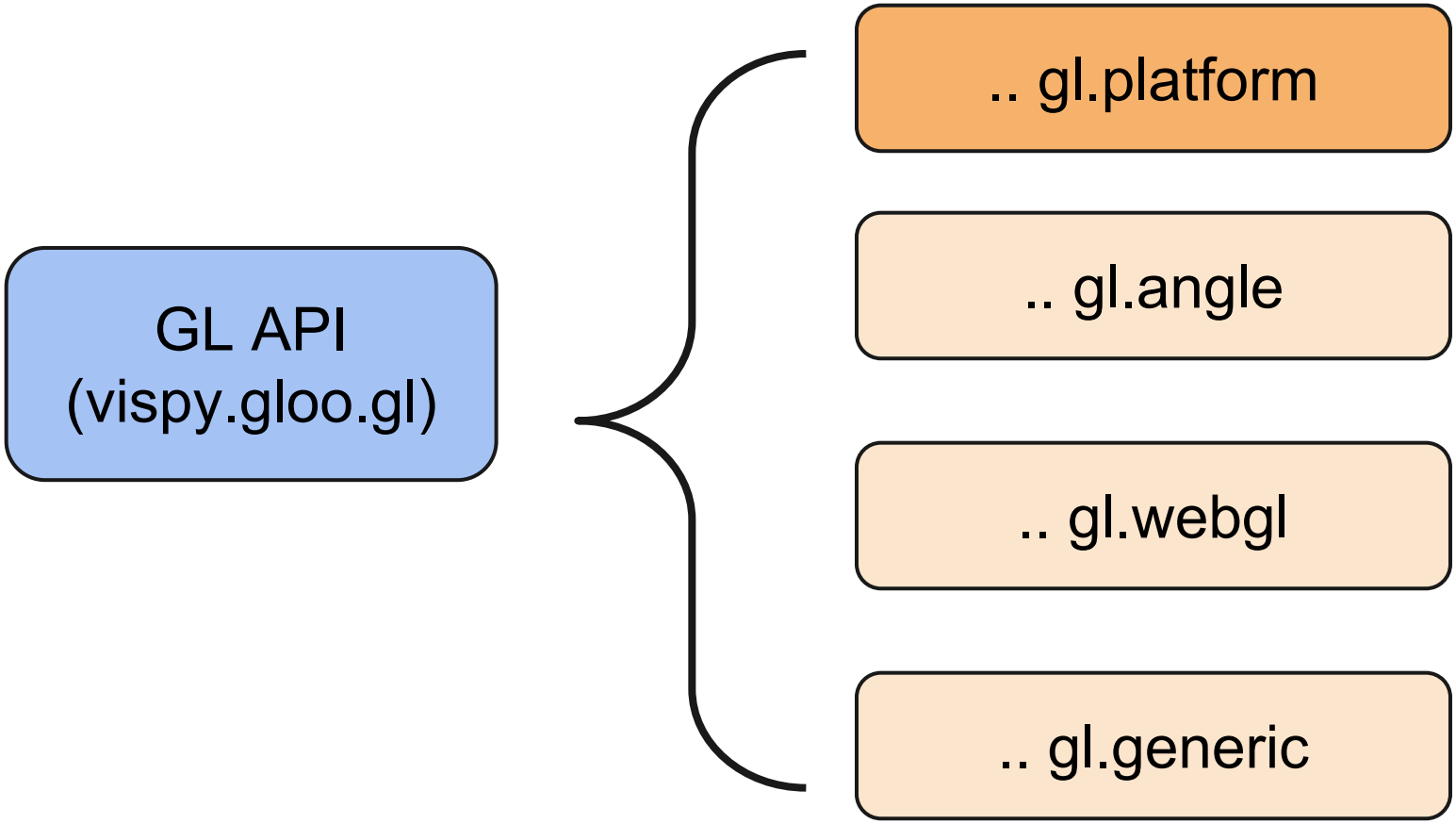


Website: vispy.org

Code repo: github.com/vispy/vispy

Extra slides

vispy.gloo.gl



Minimal example

```
from vispy import app, gl

c = app.Canvas(show=True)

@c.connect
def on_paint(event):
    gl.glClearColor(0,1,0,1)
    gl.glClear(gl.GL_COLOR_BUFFER_BIT)

app.run()
```

Minimal example (future)

```
from vispy import pyplot as plt
import numpy as np

data = np.random.random((100000,3))

plt.scatter(data)
```

Shader example

Vertex shader

```
attribute vec3 position;
void main()
{
    gl_Position = vec4(position,1.0);
}
```

Fragment shader

```
uniform vec4 color;
void main()
{
    gl_FragmentColor = color;
}
```

Full Screen AA (FSAA)