" USE THE MATPLOTLIB, LUKE "

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A long time ago, in a galaxy far, far away ...

NO!

John Hunter

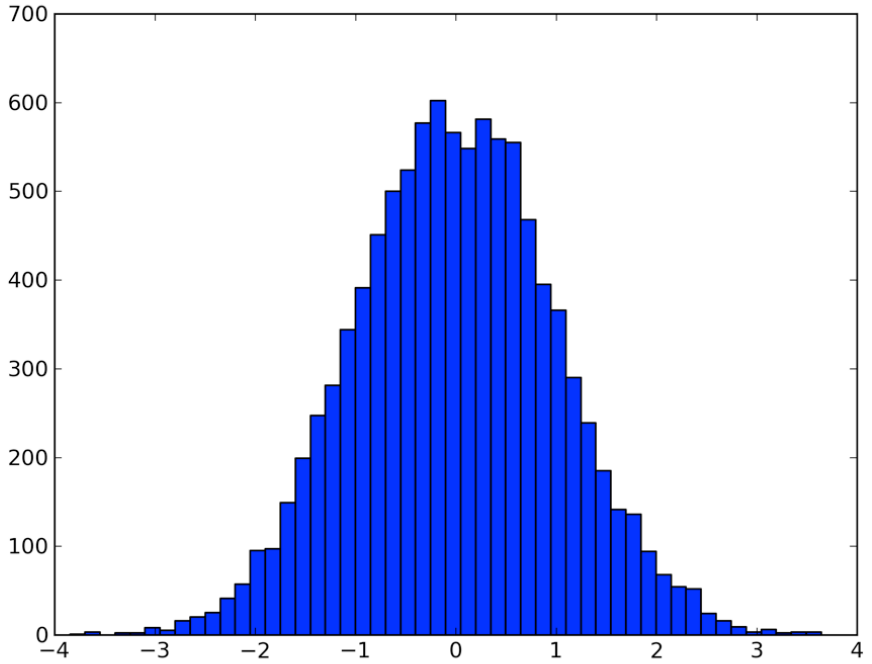
“

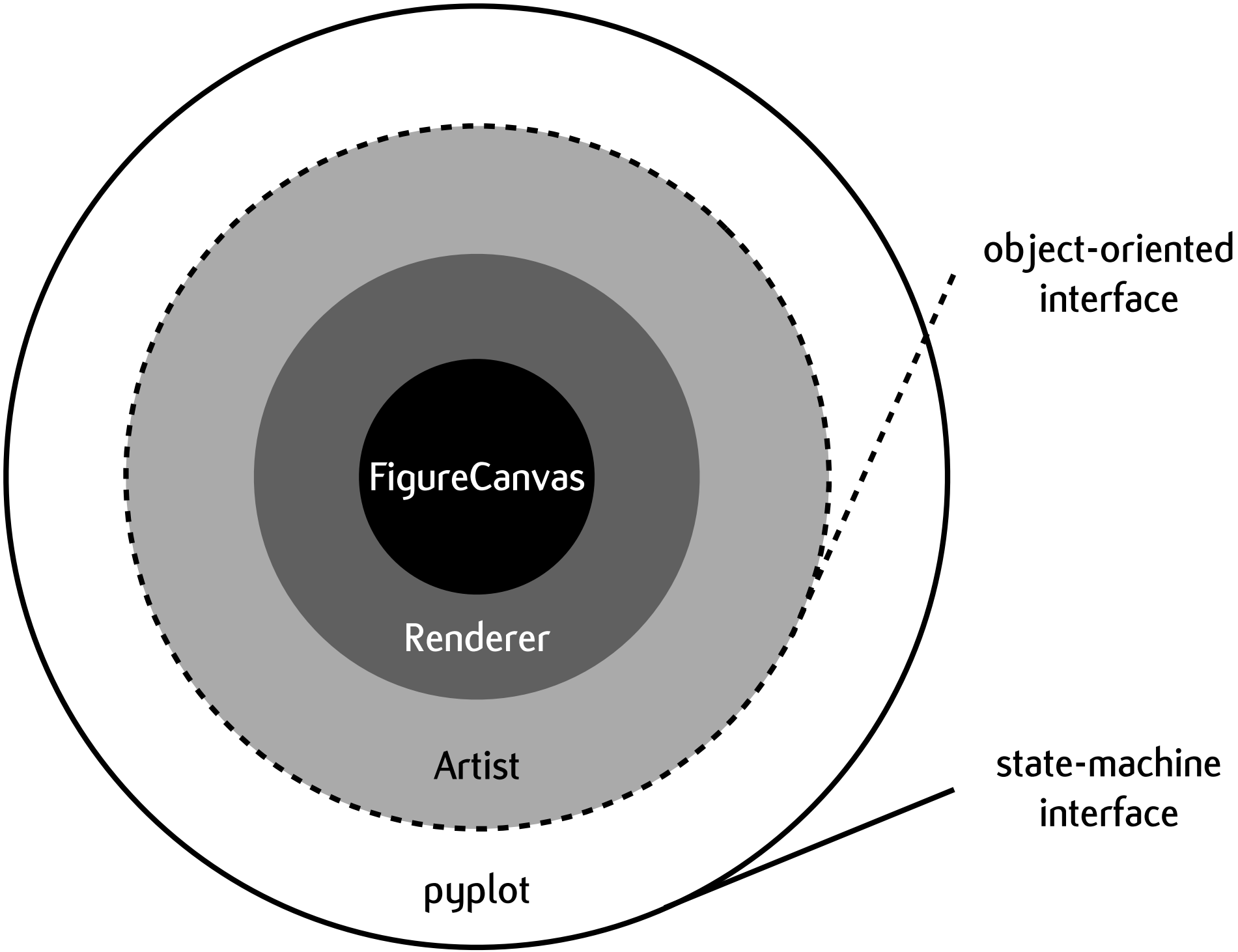
Matplotlib is a Python 2D plotting package which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.

Philosophy

create simple plots with just a few commands, or just one!

```
import numpy as np
import matplotlib.pyplot as plt

x = np.random.randn(10000)
plt.hist(x, bins=50)
plt.show()
```




FigureCanvas
Renderer
Artist
pyplot
object-oriented
interface
state-machine
interface

pyplot provides a MATLAB-style state-machine interface to the underlying object-oriented interface in matplotlib

```
import numpy as np
import matplotlib.pyplot as plt

x = np.arange(0, 10, 0.1)
y = np.sin(x)
plt.plot(x, y)
plt.show()
```

pylab lumps pyplot together with numpy in a single namespace, making that environment even more MATLAB-like

```
from pylab import *


x = arange(0, 10, 0.1)
y = sin(x)
plot(x, y)
show()
```

Explicit is better than implicit.

preferred style using pyplot convenience functions, but object-orientation for the rest

```
import numpy as np
import matplotlib.pyplot as plt

x = np.arange(0, 10, 0.1)
y = np.sin(x)
fig = plt.figure()
ax = fig.add_subplot(111)
ax.plot(x, y)
plt.show()
```

2 types of Artists

- **Primitives**: Line2D, Rectangle, Text, etc.
- **Containers**: Figure, Axes, Axis, Tick

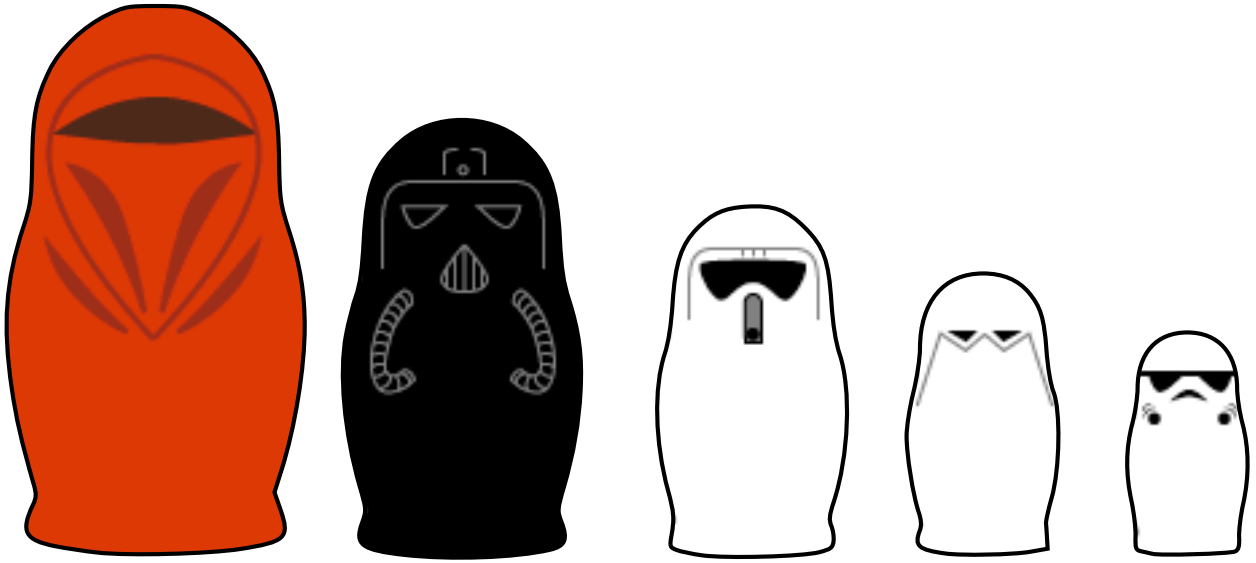
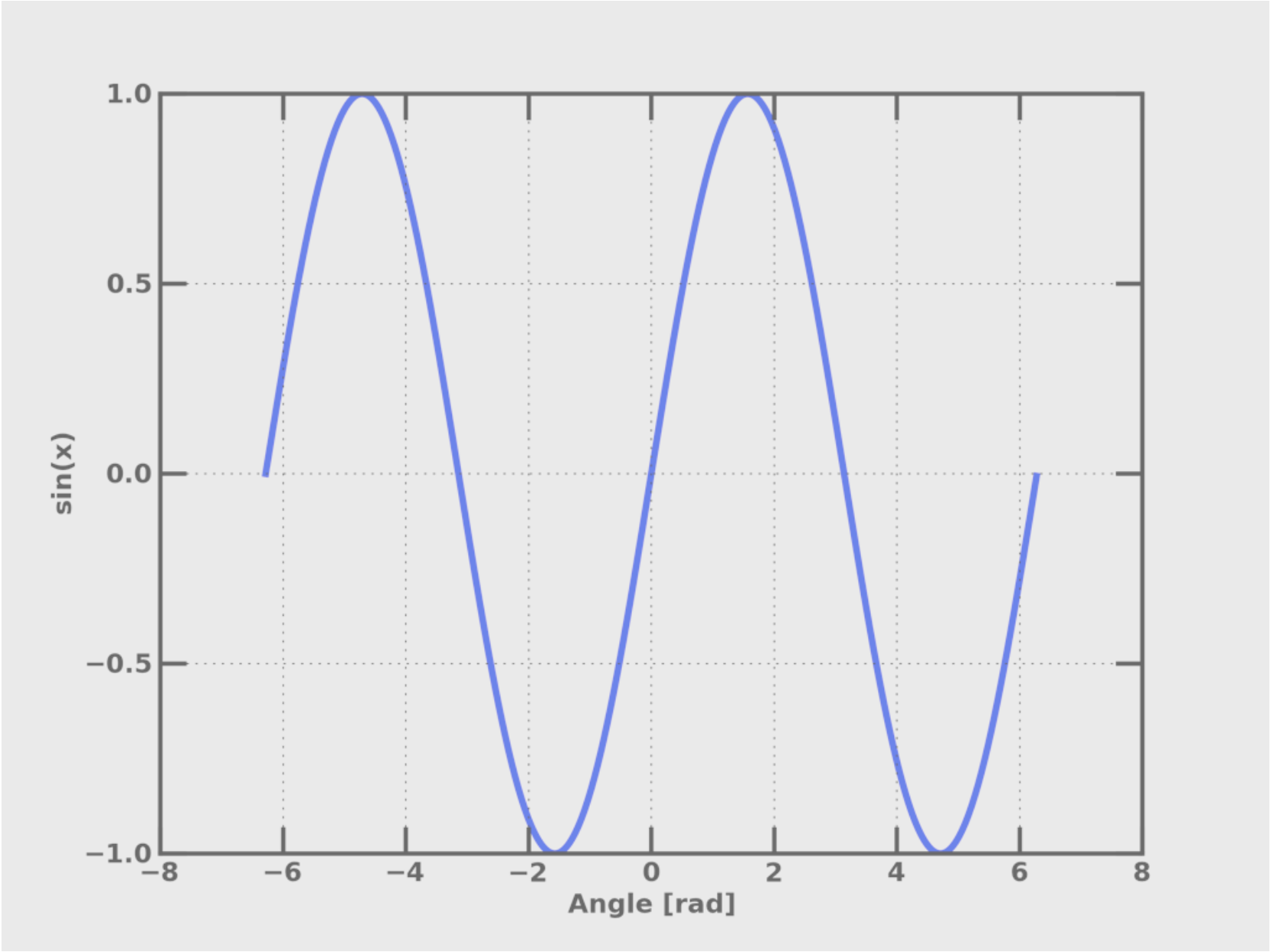


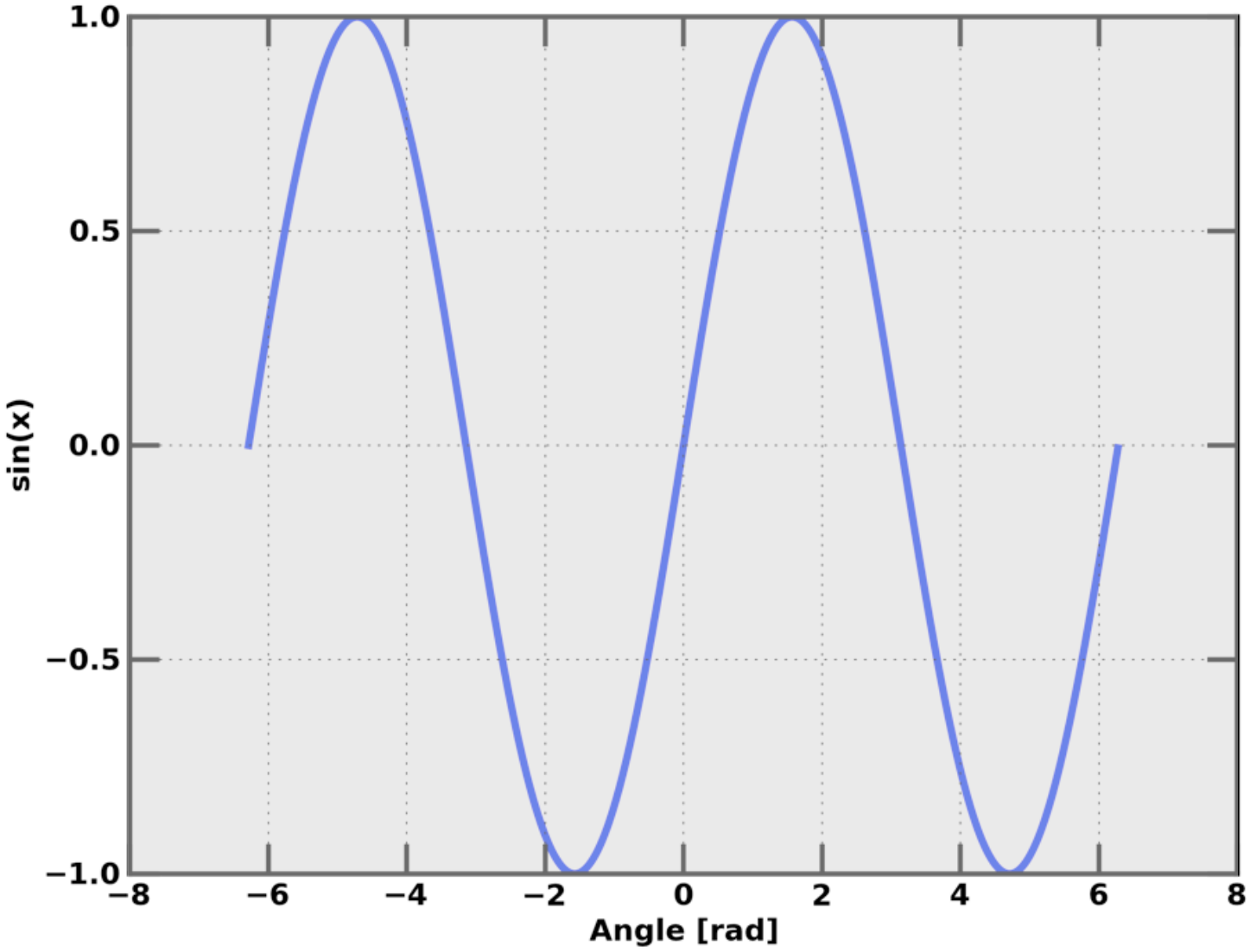
Figure Container

(matplotlib.figure.Figure)



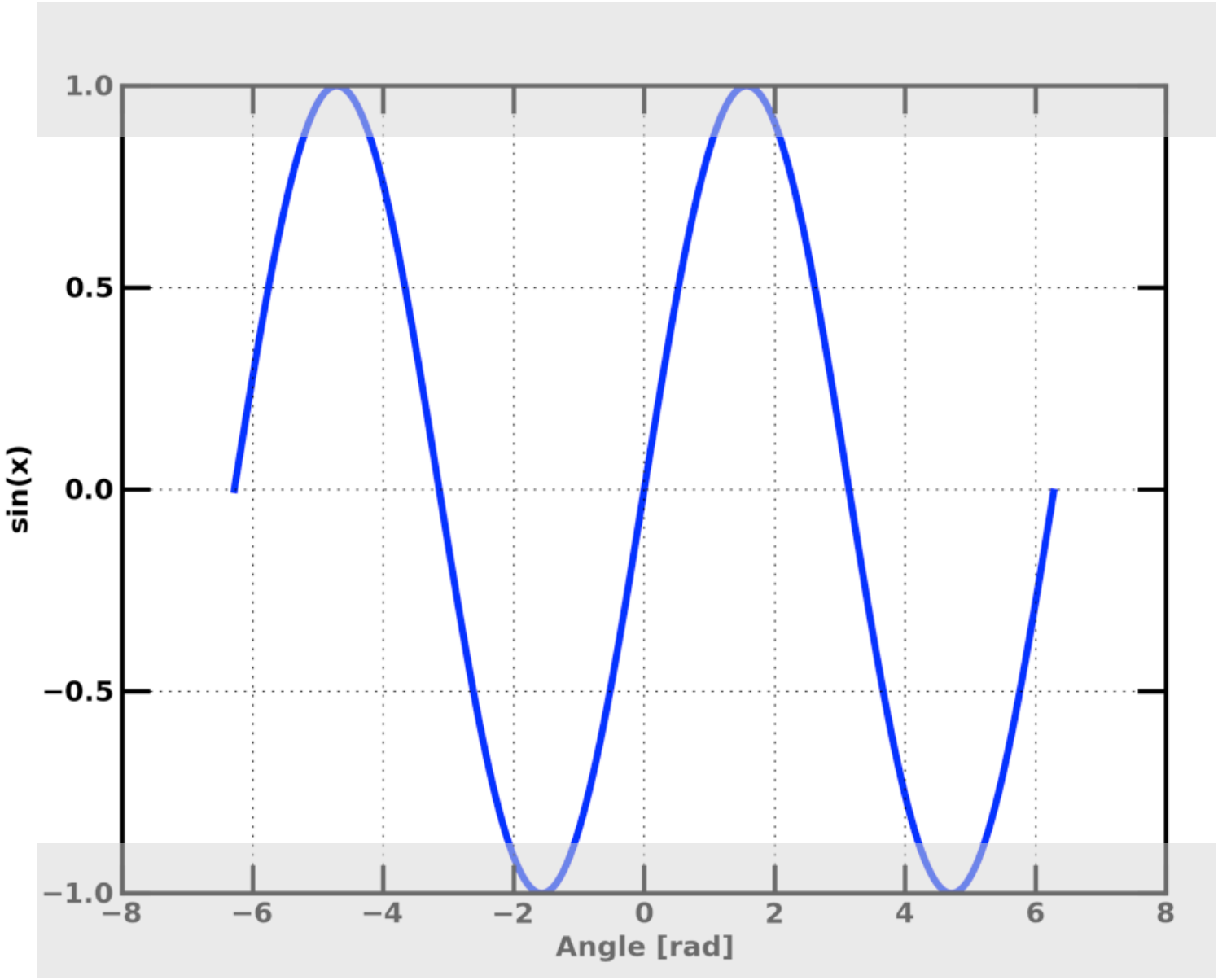
Axes Container

(matplotlib.axes.Axes)



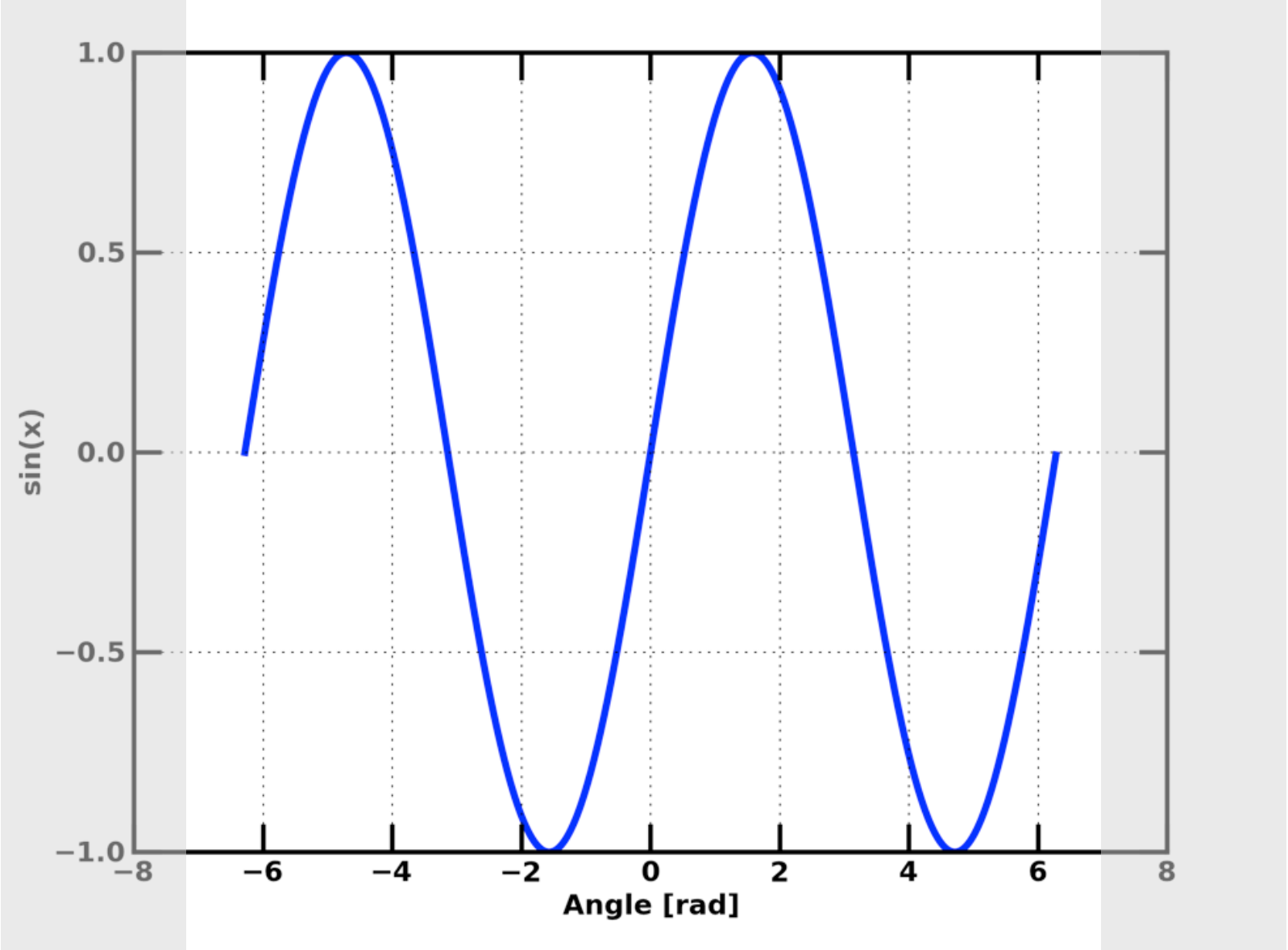
XAxis Container

(matplotlib.axis.Axis)



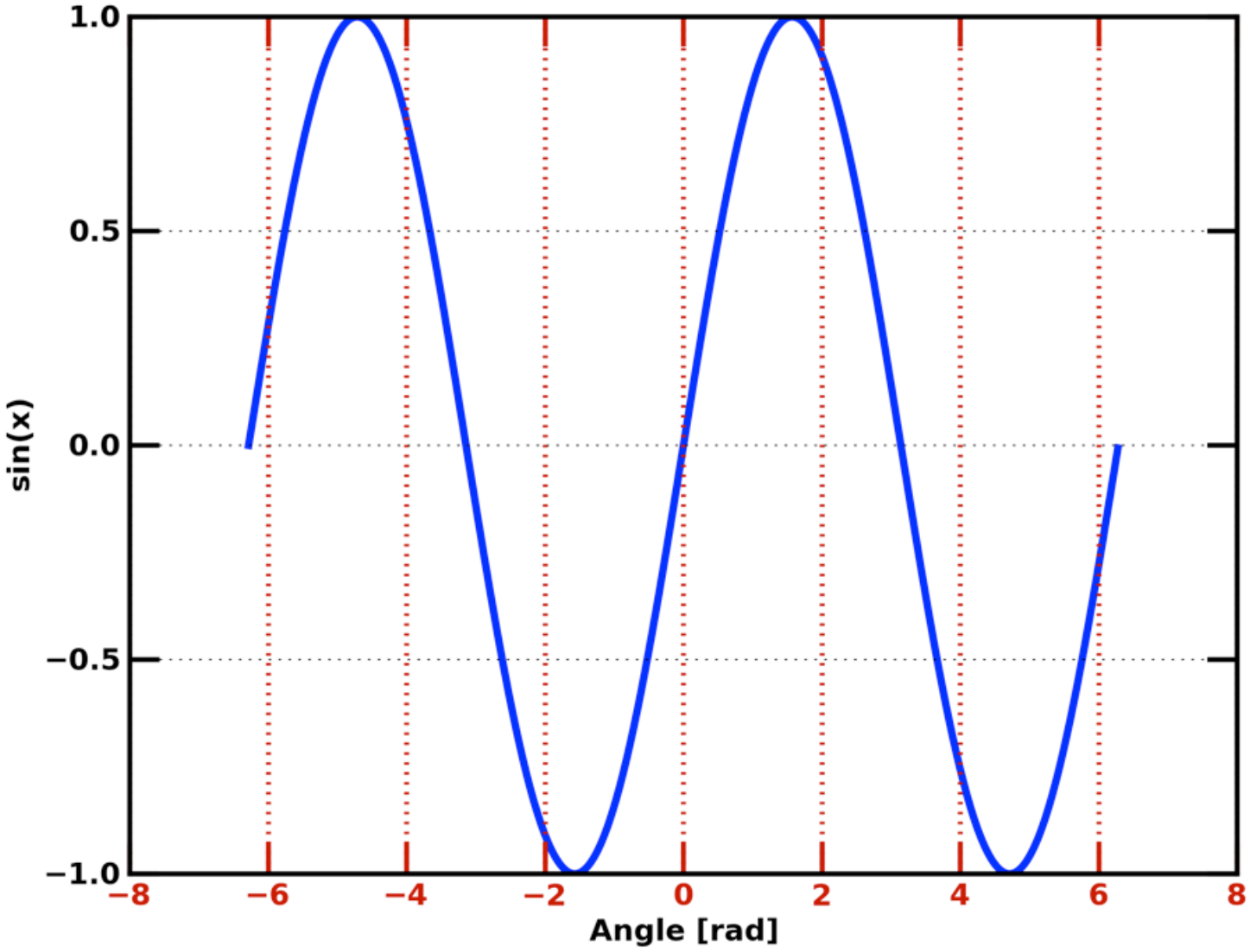
YAxis Container

(matplotlib.axis.Axis)



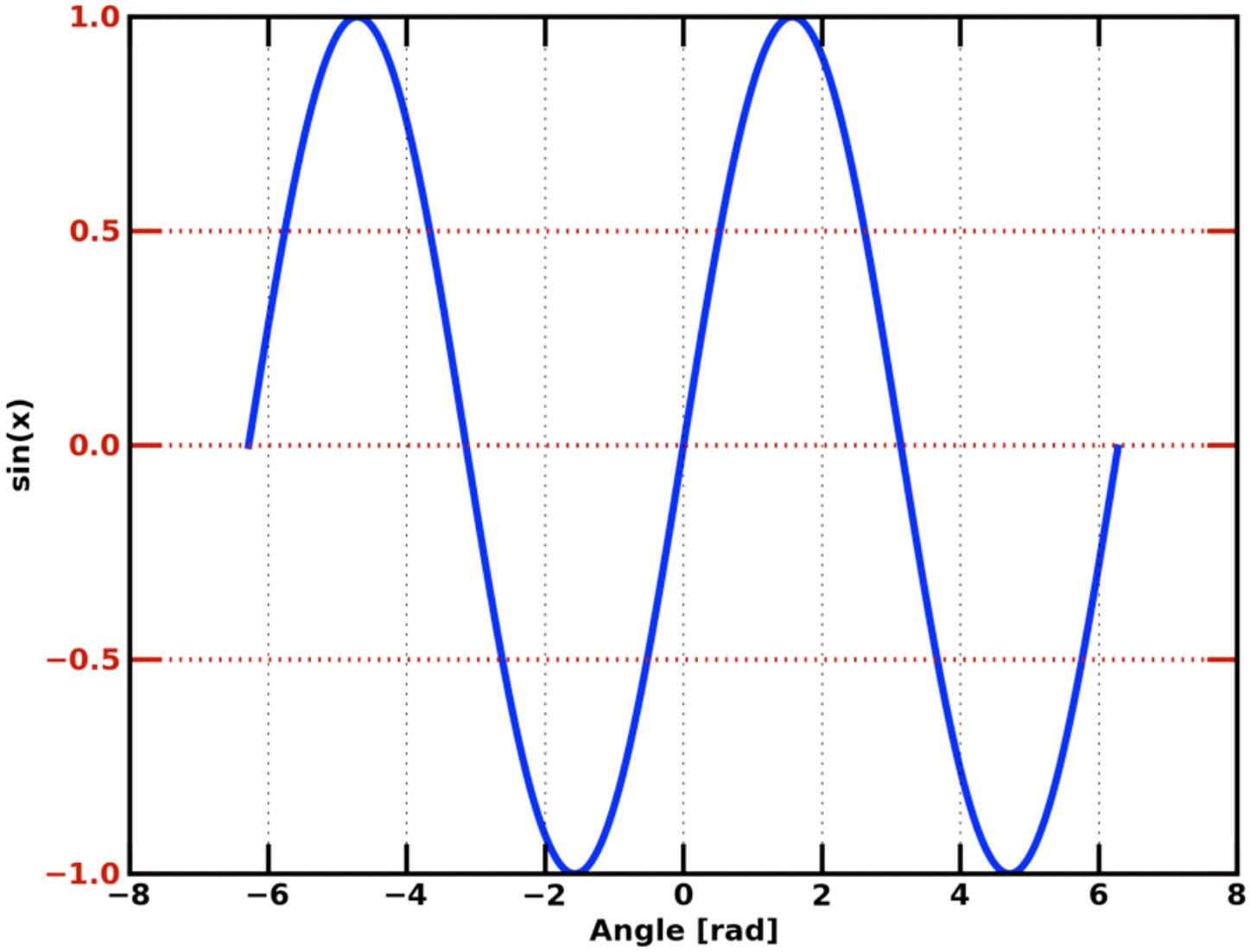
XTick Container

(matplotlib.axis.Tick)



YTick Container

(matplotlib.axis.Tick)



Customizing your objects

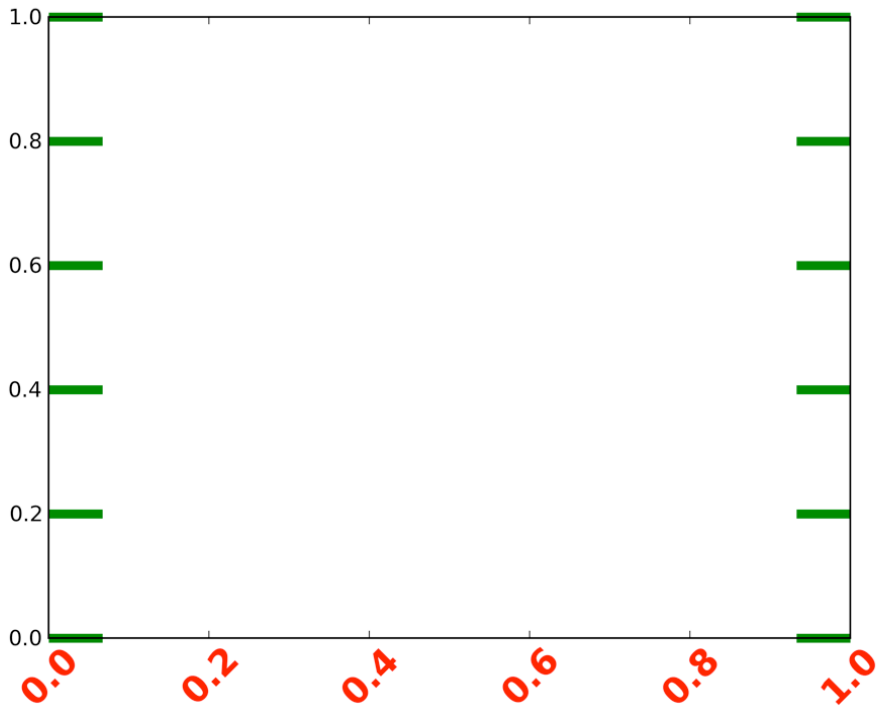
each of the properties is accessed with an old-fashioned setter or getter

```
a = o.get_alpha()
o.set_alpha(0.5*a)
```

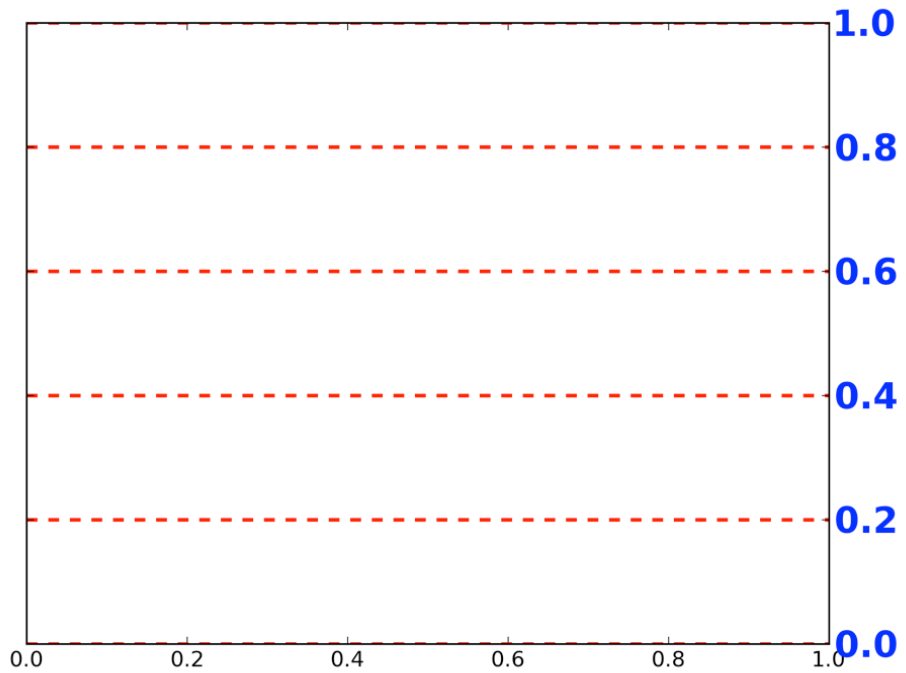
set a number of properties at once

```
o.set(alpha=0.5, zorder=2)
```

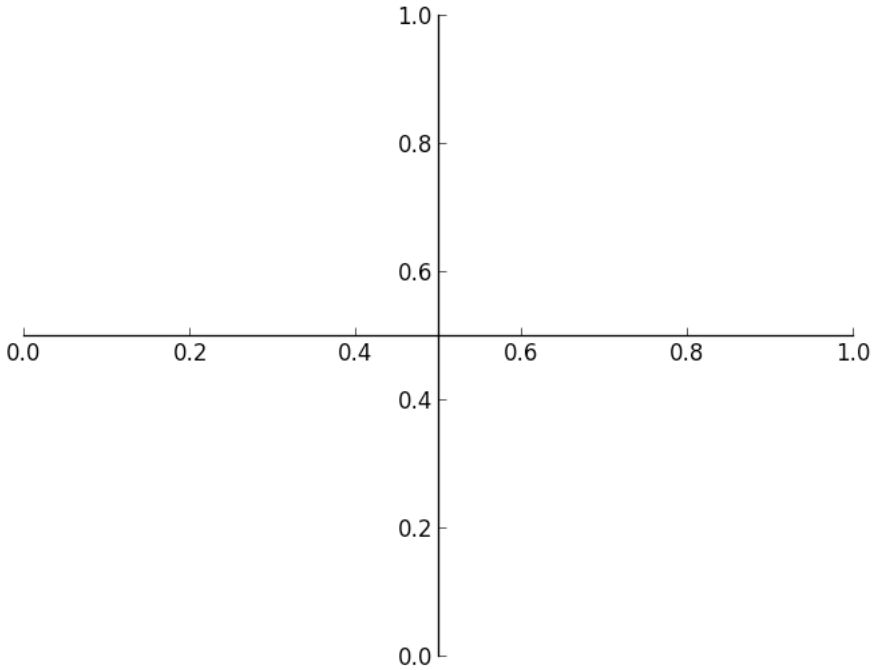
```
import matplotlib.pyplot as plt

fig = plt.figure()
ax = fig.add_subplot(111)

for label in ax.xaxis.get_ticklabels():
    # label is a Text instance
    label.set_color('red')
    label.set_rotation(45)
    label.set_fontsize(20)
    label.set_fontweight('bold')

for line in ax.yaxis.get_ticklines():
    # line is a Line2D instance
    line.set_color('green')
    line.set_markersize(30)
    line.set_markeredgewidth(5)

plt.show()
```



```
import matplotlib.pyplot as plt

fig = plt.figure()
ax = fig.add_subplot(111)

for tick in ax.yaxis.get_major_ticks():
    tick.label1On = False
    tick.label2On = True
    tick.label2.set_color('blue')
    tick.label2.set_fontsize(20)
    tick.label2.set_fontweight('bold')

    tick.gridOn = True
    tick.gridline.set_color('red')
    tick.gridline.set_linewidth(2)
    tick.gridline.set_linestyle('--')

plt.show()
```



```
import matplotlib.pyplot as plt

fig = plt.figure()
ax = fig.add_subplot(111)

ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.spines['bottom'].set_position('center')
ax.spines['left'].set_position('center')

for tick in ax.xaxis.get_major_ticks():
    tick.tick2On = False

for tick in ax.yaxis.get_major_ticks():
    tick.tick2On = False

plt.show()
```



Find all objects in a figure of a certain type

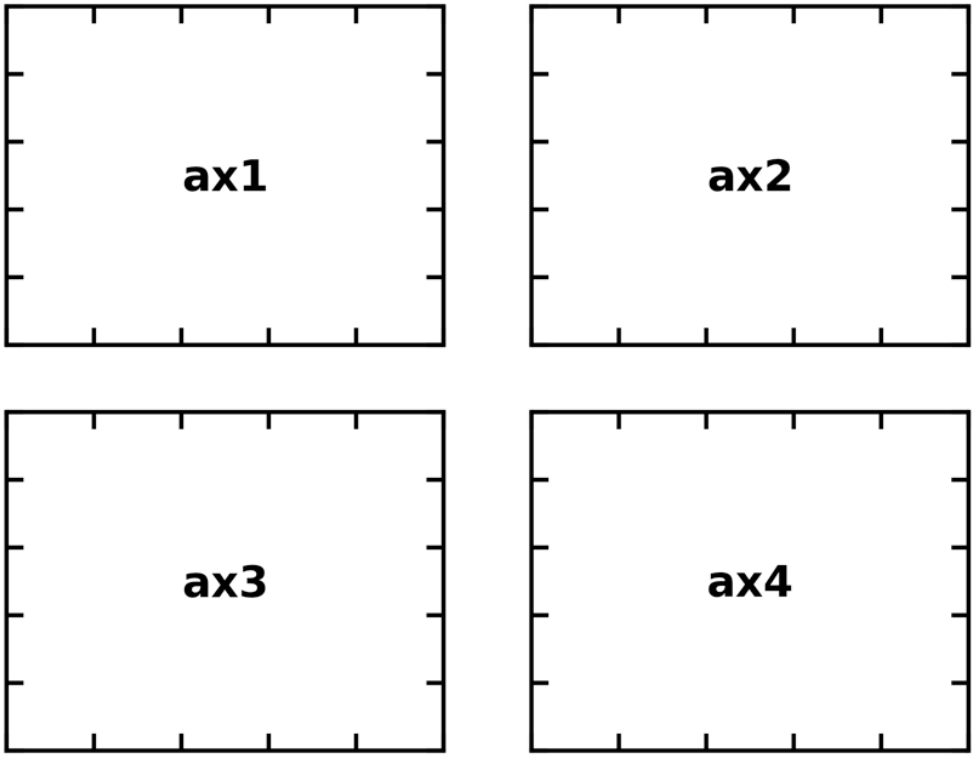
Find every object in the figure which has a set_color property and makes the object blue

```
def myfunc(x):
    return hasattr(x, 'set_color')

for o in fig.findobj(myfunc):
    o.set_color('blue')
```

Filter on class instances

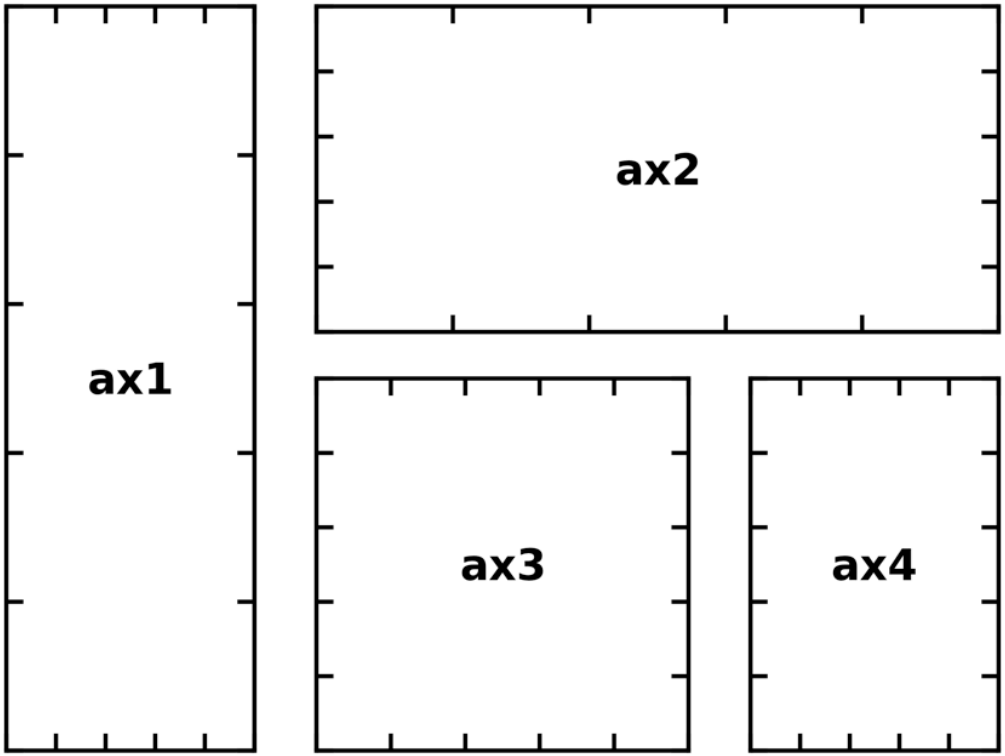
```
import matplotlib.text as text

for o in fig.findobj(text.Text):
    o.set_fontstyle('italic')
```

Customizing location of Axes




```
ax1 = fig.add_subplot(221)
ax2 = fig.add_subplot(222)
ax3 = fig.add_subplot(223)
ax4 = fig.add_subplot(224)
```

Customizing location of Axes



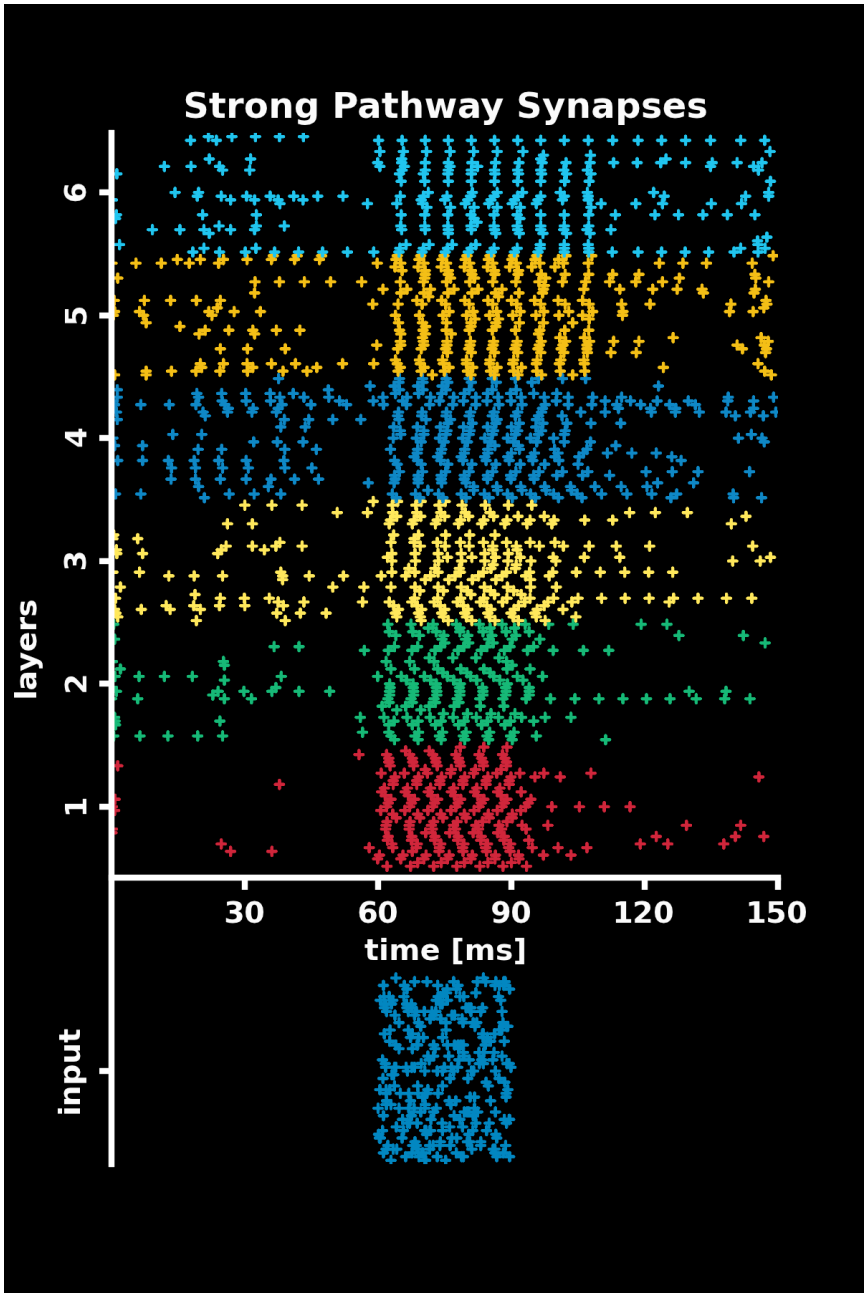

```
# add_axes((left, bottom, width, height))

ax1 = fig.add_axes((0.1, 0.1, 0.2, 0.8))
ax2 = fig.add_axes((0.35, 0.55, 0.55, 0.35))
ax3 = fig.add_axes((0.35, 0.1, 0.3, 0.4))
ax4 = fig.add_axes((0.7, 0.1, 0.2, 0.4))
```

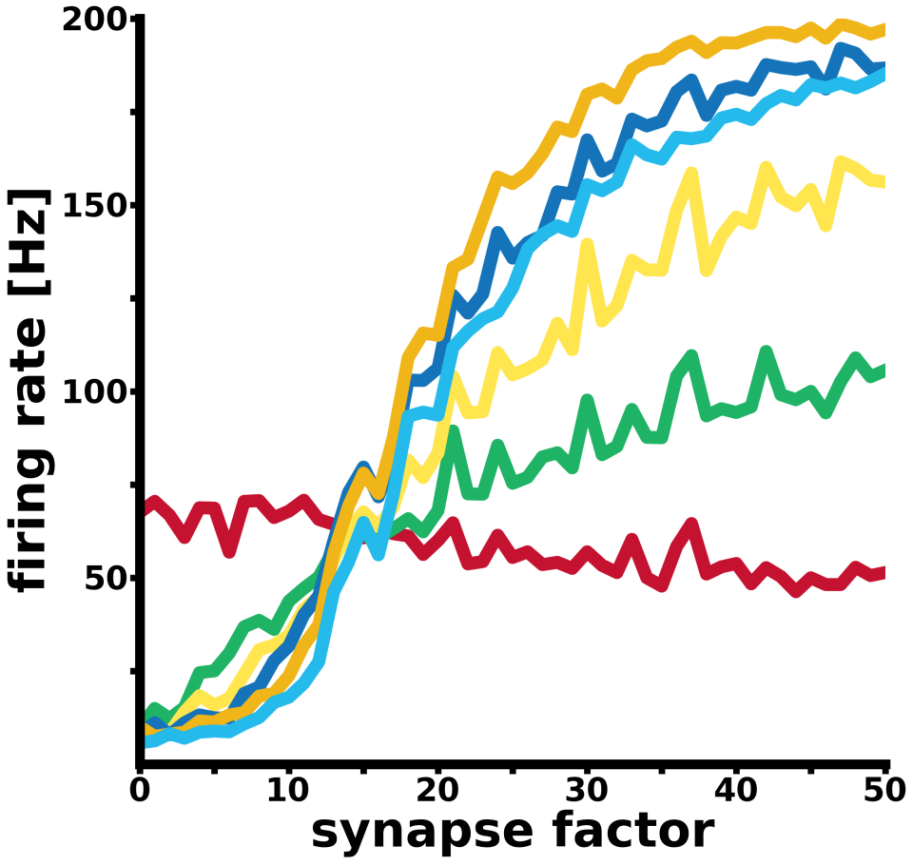

FREE!

The memory required for a figure is not completely released until the figure is explicitly closed with close().

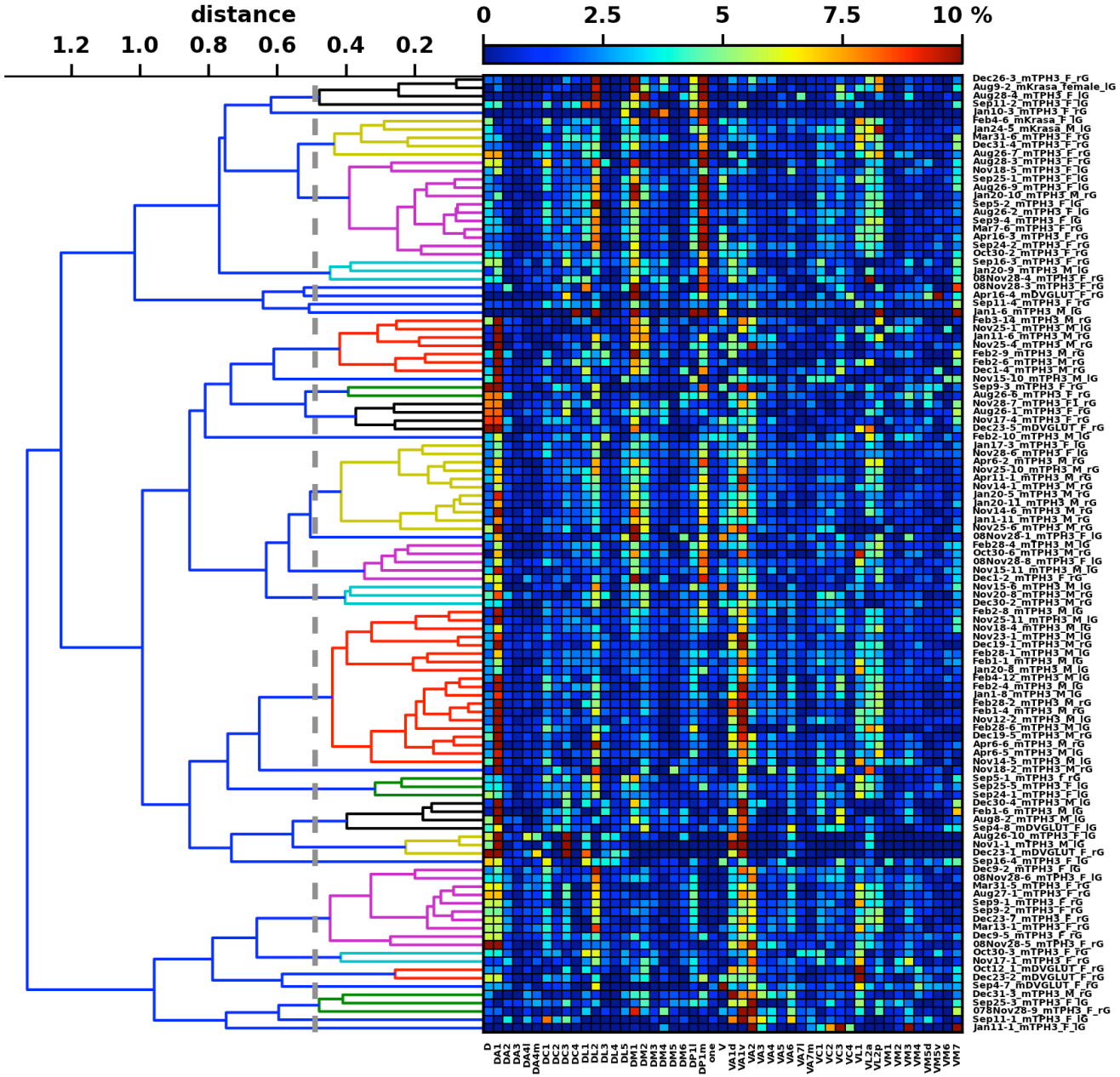
```
import os
import glob
import matplotlib.pyplot as plt

filelist = glob.glob('*.txt')
for fname in filelist:

            ...
            ...
            ...

    fig = plt.figure()
    ax = fig.add_subplot(111)
    ax.plot(x, y)
    plt.savefig(os.path.splitext(fname)[0])
    plt.close(fig)
```

Signal propagation



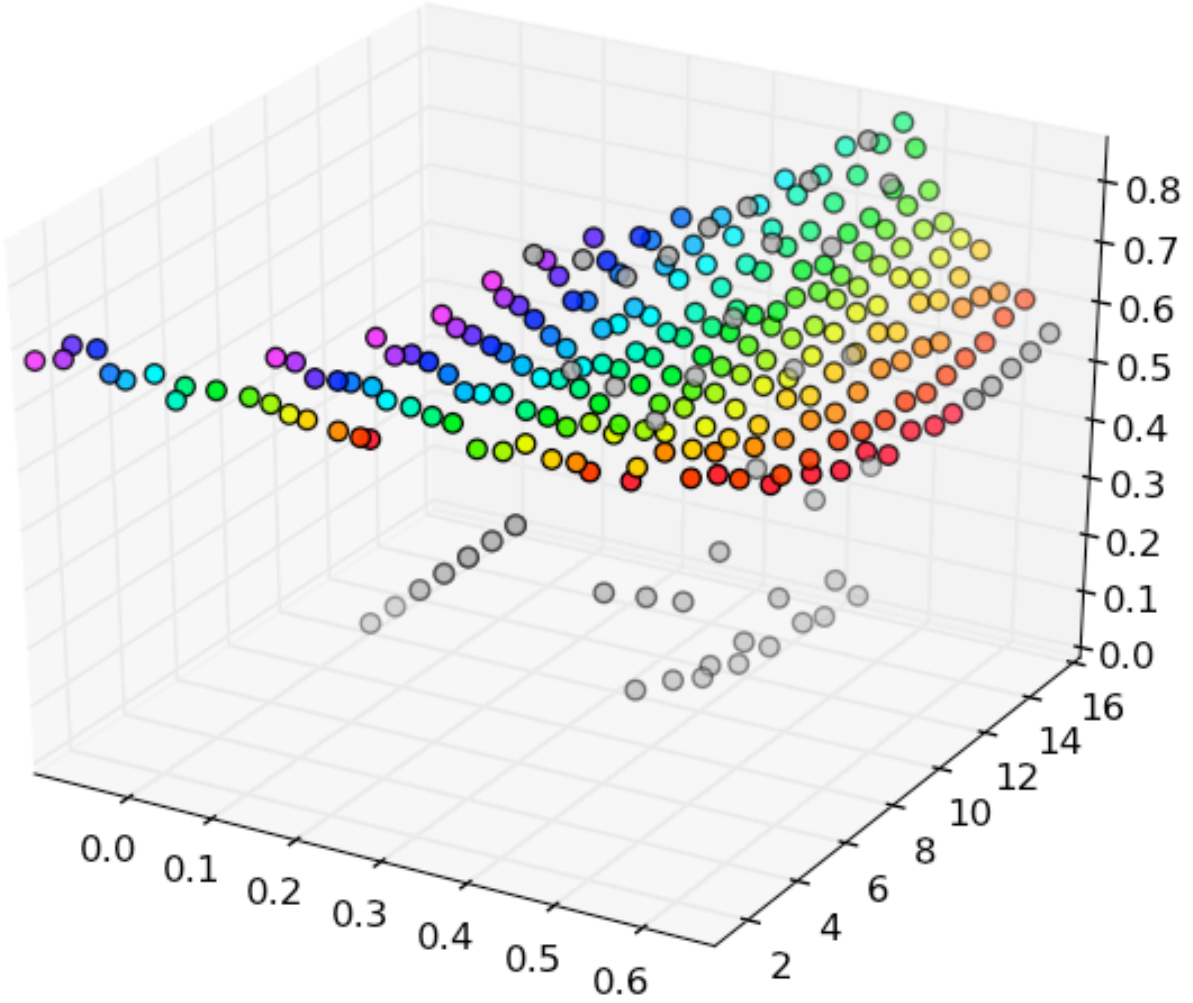


Hierarchical clustering



mpl_toolkits.mplot3d

provides some basic 3D plotting tools



May the Matplotlib be with You :)