Necessary Packages By Lesson

Note: it is possible a few others might be added, but this should get you started.

PLEASE NOTE this is assuming you have installed Python & Jupyter Notebook using Anaconda. You are welcome to use JupyterLab instead of Jupyter Notebooks, however *we will not support JupyterLab ourselves in this class.*

See https://github.com/jnaiman/IS-452AO-Fall2019/blob/master/installation_directions.md (https://github.com/jnaiman/IS-452AO-Fall2019/blob/master/installation_directions.md) for more details about installing Anaconda (you can skip the PyCharm installation part).

Make sure you see the same plots as are saved in this plot - if something doesn't display this means something has gone wrong. Note: anything with randomly selected numbers will look a little different.

Please do not worry if you run into some things you have trouble installing -- we will help you debug in class!

Lesson01:

In [1]:
```
import matplotlib
import matplotlib.pyplot as plt
```

If the above doesn't work, you can try to install with conda by un-commenting the stuff below:

In [2]:
```
#!conda install -c conda-forge matplotlib --yes
#import matplotlib
#import matplotlib.pyplot as plt
```

In [3]:
```
import datetime
```

The below is to make inline plots:

In [4]:
```
%matplotlib inline
```

The NumPy library is for numerical analysis and using vectors/matricies:

In [5]:
```
import numpy as np
```

If the above doesn't work you can try uncommenting stuff below:

In [6]:
```
#!conda install -c anaconda numpy --yes
#import numpy as np
```

Let's make a quick plot:

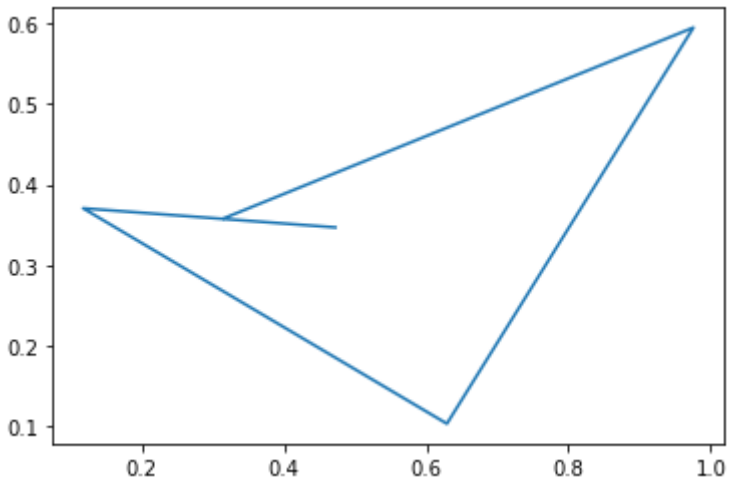
In [7]:
```
x = np.random.random(5)
x
```

Out[7]:
```
array([0.47235876, 0.11790806, 0.62913879, 0.97554772, 0.31591819])
```

In [8]:
```
y = np.random.random(5)
y
```

Out[8]:
```
array([0.34698453, 0.37066381, 0.1037509 , 0.59462143, 0.35831839])
```

In [9]:
```
plt.plot(x,y)
plt.show()
```



This is a library for importing and manipulating images.

In [10]:
```
import PIL.Image as Image
```

If you can't do the above, try uncommenting the below:

In [11]:
```
#!conda install -c anaconda pillow --yes
#import PIL.Image as Image
```

Lesson 02

In [12]:
```
import csv
import collections
```

Note: the above should be already installed in your Python distribution.

In [13]:
```
import pandas as pd
```

If the above doesn't work try uncommenting the following:

In [14]:
```
#!conda install -c anaconda pandas --yes
#import pandas as pd
```

Testing reading with pandas:

In [15]:
```
data = pd.read_csv("https://uiuc-ischool-dataviz.github.io/spring2019online/week02/building_inventory.csv")
```

In [16]:
```
data
```

Out[16]:

	Agency Name	Location Name	Address	City	Zip code	County	Congress Dist	Congressional Full Name
0	Department of Natural Resources	Anderson Lake Conservation Area - Fulton County	Anderson Lake C.a.	Astoria	61501	Fulton	17	Cheri Bustos
1	Department of Natural Resources	Anderson Lake Conservation Area - Fulton County	Anderson Lake C.a.	Astoria	61501	Fulton	17	Cheri Bustos
2	Department of Natural Resources	Anderson Lake Conservation Area - Fulton County	Anderson Lake C.a.	Astoria	61501	Fulton	17	Cheri Bustos
3	Department of Natural Resources	Anderson Lake Conservation Area - Fulton County	Anderson Lake C.a.	Astoria	61501	Fulton	17	Cheri Bustos
4	Department of Natural Resources	Anderson Lake Conservation Area - Fulton County	Anderson Lake C.a.	Astoria	61501	Fulton	17	Cheri Bustos
...	...	...	...	...	...	...	...	...
8857	Department of Transportation	Belvidere Maintenance Storage Facility - Boone...	9797 Illinois Rte. 76	Belvidere	61008	Boone	16	Adam Kinzinger
8858	Department of Transportation	Belvidere Maintenance Storage Facility - Boone...	9797 Illinois Rte 76	Belvidere	61008	Boone	16	Adam Kinzinger
8859	Department of Transportation	Quincy Maintenance Storage Facility	800 Koch's Lane	Quincy	62305	Adams	18	Darin M. LaHood
8860	Illinois Community College Board	Illinois Valley Community College - Oglesby	815 North Orlando Smith Avenue	Oglesby	61348	LaSalle	16	Adam Kinzinger
8861	Department of Military Affairs	Peoria Army Aviation Support Facility	2323 S. Airport Rd	Peoria	61607	Peoria	17	Cheri Bustos

8862 rows × 22 columns

In [17]:
```
import scipy
import scipy.misc
import scipy.cluster
```

If the above doesn't work, try uncommenting:

In [18]:
```
#!conda install -c anaconda scipy
#import scipy
#import scipy.misc
#import scipy.cluster
```

Lesson 03

Note: you may have to refresh your browser and/or close and reopen your notebook.

You may have to do this for a few of these installations (e.g. bqplot, cartopy, pyodide, etc).

In [19]:
```
import ipywidgets
```

If the above doesn't work try uncommenting the following:

In [20]:
```
#!conda install -c conda-forge ipywidgets --yes
#!jupyter nbextension enable --py widgetsnbextension

### Note, you may have to use instead:
#!jupyter nbextension enable --py widgetsnbextension --sys-prefix

#import ipywidgets
```

Test a widget:

In [21]:
```
ipywidgets.IntSlider()
```

If the above doesn't give you an interactive slider, you may want to try:

In [22]:
```
from IPython.display import display
w = ipywidgets.IntSlider()
display(w)
```

If it still doesn't work, you may have to install the jupyter notebook extensions by hand by uncommenting the below and then refreshing/restarting your jupyter notebook:

In [23]:
```
#!jupyter nbextension enable --py widgetsnbextension

### Note, you may have to use instead:
#!jupyter nbextension enable --py widgetsnbextension --sys-prefix
```

Also, try this interactive plot with a selectable dropdown menu.

In [24]:
```
@ipywidgets.interact(style = plt.style.available)
def make_plot(style):
    with plt.style.context(style):
        plt.plot(x,y)
```

In [25]:
```
import json # should be already installed
```

In [26]:
```
import palettable
```

If the above doesn't work you can try uncommenting the below and re-importing:

In [27]:
```
#!conda install -c conda-forge palettable --yes
#import palettable
```

In [28]:
```
from PIL import Image
import IPython.display
import io
from mpl_toolkits.mplot3d import Axes3D
import matplotlib.cm
import matplotlib.transforms as mpt
```

Lesson 04

In [29]:
```
import matplotlib.dates as mdates
```

In [30]:
```
import PIL.ImageFilter as ImageFilter
```

In [31]:
```
import bqplot
```

If the above doesn't work, try uncommenting below:

In [32]:
```
#!conda install -c conda-forge bqplot --yes
import bqplot
```

You may have to do:

In [33]:
```
#!jupyter nbextension enable --py bqplot

### or instead
#!jupyter nbextension enable --py widgetsnbextension --sys-prefix

#import bqplot
```

Note: it is possible you may have to refresh your browser or close and reopen anaconda and jupyter notebook after you install this.

Try out this interactive plot. You should be able to pan and zoom. Don't worry about the code right now, we'll get to it in week 03.

In [34]:
```
x = np.arange(100)
y = np.random.random(100) + 5

x_sc = bqplot.LinearScale()
y_sc = bqplot.LinearScale()

lines = bqplot.Lines(x = x, y = y, scales = {'x': x_sc, 'y': y_sc})

ax_x = bqplot.Axis(scale = x_sc, label = 'x value')
ax_y = bqplot.Axis(scale = y_sc, label = 'y value', orientation = 'verti
cal')

pz = bqplot.interacts.PanZoom( scales = {'x': [x_sc], 'y': [y_sc]} )
bqplot.Figure(marks = [lines], axes = [ax_x, ax_y], interaction = pz)
```

Note, if the above doesn't work you can try replacing:

```
bqplot.Figure(marks = [lines], axes = [ax_x, ax_y], interaction = pz)
```

with

```
display(bqplot.Figure(marks = [lines], axes = [ax_x, ax_y], interaction = pz
))
```

Lesson 05

While not strictly the importing of libraries see if you get any weird errors when you run:

In [35]:
```
%matplotlib inline
#%matplotlib notebook
#%pylab
```

In [36]:
```
import PIL.ImageFilter as ImageFilter
```

In [37]:
```
import h5py
```

If the above doesn't work try uncommenting:

In [38]:
```
#!conda install -c anaconda h5py --yes
#import h5py
```

In [39]:
```
import matplotlib.colors as colors
```

Lesson 06

In [40]:
```
import bqplot.market_map
```

In [41]:
```
import traitlets
```

Lesson 07

In [42]:
```
import requests
```

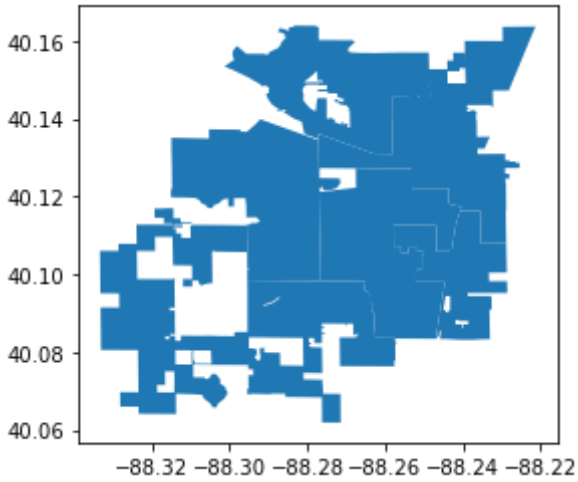
If the above doesn't work, you can try uncommenting the following:

In [43]:
```
#!conda install -c anaconda requests --yes
```

In [44]:
```
import geopandas
```

In [45]:
```
gdf = geopandas.read_file('https://opendata.arcgis.com/datasets/1f75636917604299861fb408bbf79378_1.geojson')
gdf.plot()
```

Out[45]: <matplotlib.axes._subplots.AxesSubplot at 0x7f8a8b81ec10>



If the above doesn't work, you can try uncommenting the following:

In [46]:
```
#!conda install -c conda-forge geopandas --yes
```

Install `contextify` for background maps:

In [47]:
```
import contextily as ctx
```

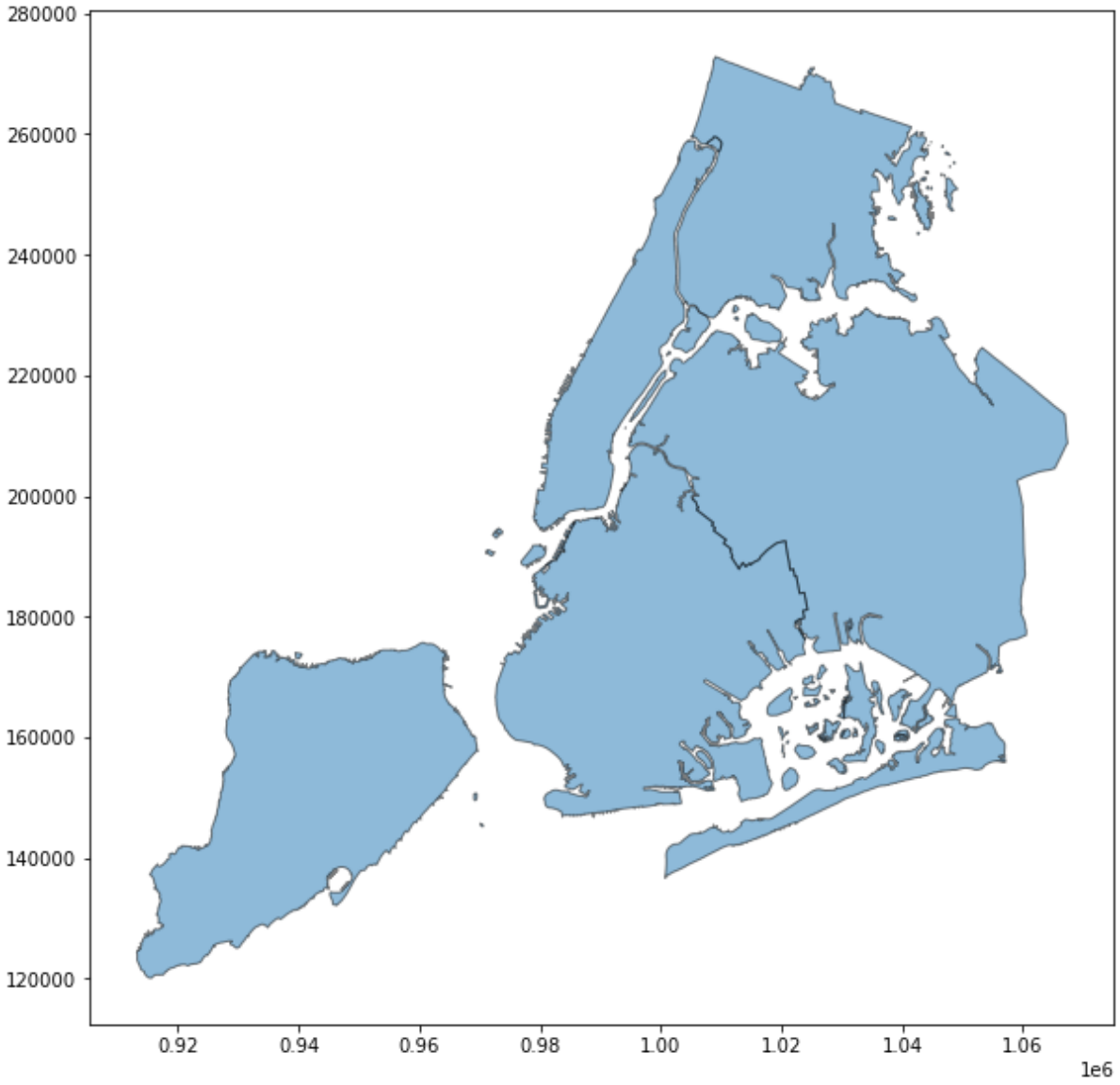
If the above doesn't work try uncommenting:

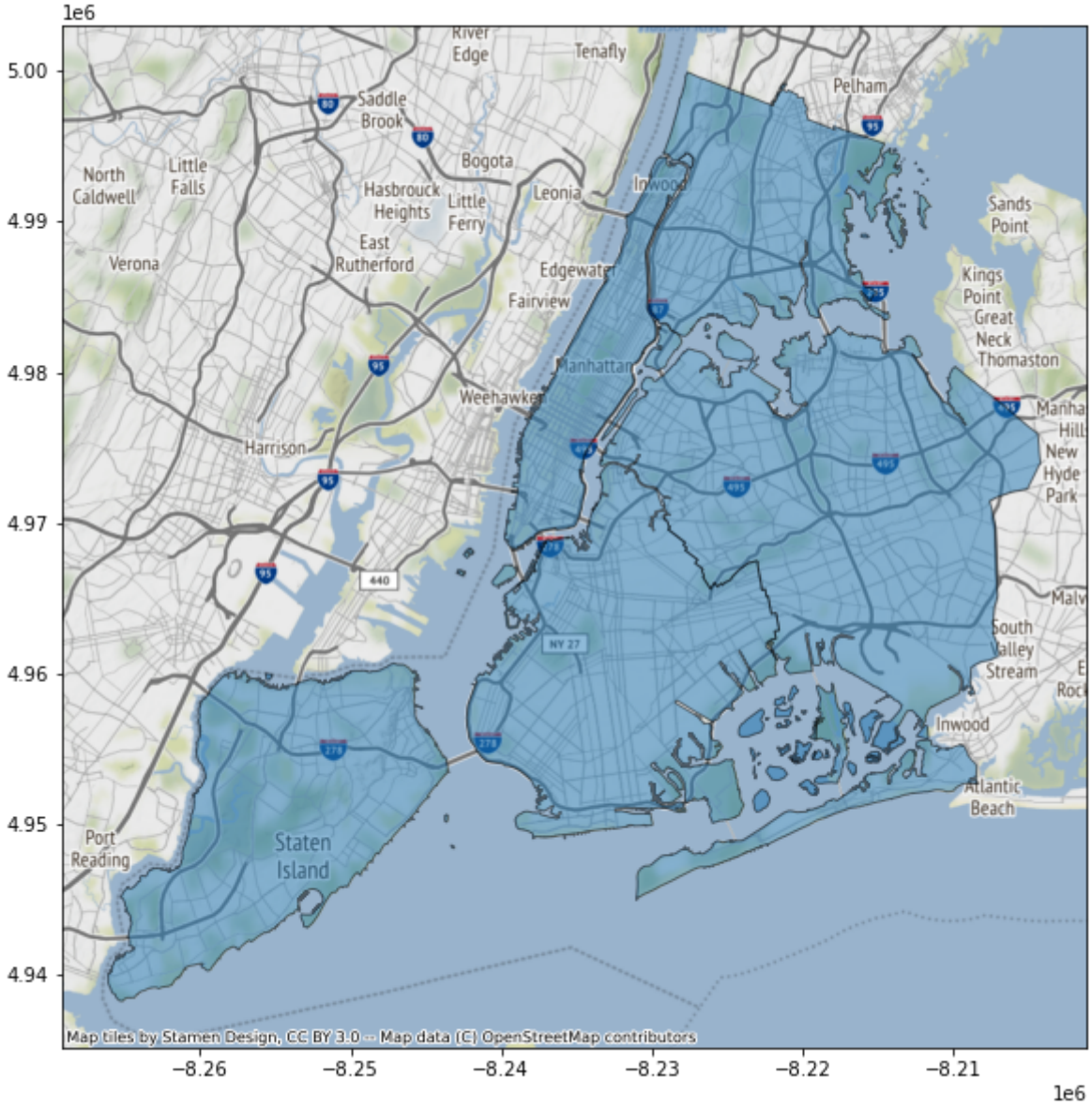
In [48]:
```
#!conda install -c conda-forge contextily --yes
```

Test with a map (there might be a warning printed out here about an +init that you can ignore):

In [49]:
```
df = geopandas.read_file(geopandas.datasets.get_path('nybb'))
ax = df.plot(figsize=(10, 10), alpha=0.5, edgecolor='k')
df = df.to_crs(epsg=3857)
ax = df.plot(figsize=(10, 10), alpha=0.5, edgecolor='k')
ctx.add_basemap(ax)
```

```
/Users/jillnaiman/opt/anaconda3/lib/python3.7/site-packages/pyproj/crs.
py:77: FutureWarning: '+init=<authority>:<code>' syntax is deprecated.
'<authority>:<code>' is the preferred initialization method.
  return _prepare_from_string(" ".join(pjargs))
```





Lesson 09

More info here: http://www2.compute.dtu.dk/projects/GEL/PyGEL/ (http://www2.compute.dtu.dk/projects/GEL/PyGEL/)

In [50]:
```
from PyGEL3D import gel
from PyGEL3D import js
```

You will probably have to pip install:

In [51]:
```
#!pip install PyGEL3D
#from PyGEL3D import gel
#from PyGEL3D import js
```

In [52]:
```
import ipyvolume
```

You will probably have to install this:

In [53]:
```
#!conda install -c conda-forge ipyvolume --yes
#import ipyvolume
```

If that doesn't work you can try:

In [54]:
```
#!pip install ipyvolume
```

You may have to uncomment the following:

In [55]:
```
#!jupyter nbextension enable --py --sys-prefix ipyvolume
#!jupyter nbextension enable --py --sys-prefix widgetsnbextension
```

Make a test box:

In [56]:
```
import numpy as np
import ipyvolume as ipv
V = np.zeros((128,128,128)) # our 3d array
# outer box
V[30:-30,30:-30,30:-30] = 0.75
V[35:-35,35:-35,35:-35] = 0.0
# inner box
V[50:-50,50:-50,50:-50] = 0.25
V[55:-55,55:-55,55:-55] = 0.0
ipv.quickvolshow(V, level=[0.25, 0.75], opacity=0.03, level_width=0.1, d
ata_min=0, data_max=1)
```

```
/Users/jillnaiman/opt/anaconda3/lib/python3.7/site-packages/ipyvolume/s
erialize.py:81: RuntimeWarning:

invalid value encountered in true_divide
```

For saving movies & making animations:

In [57]:
```
from matplotlib import animation
```

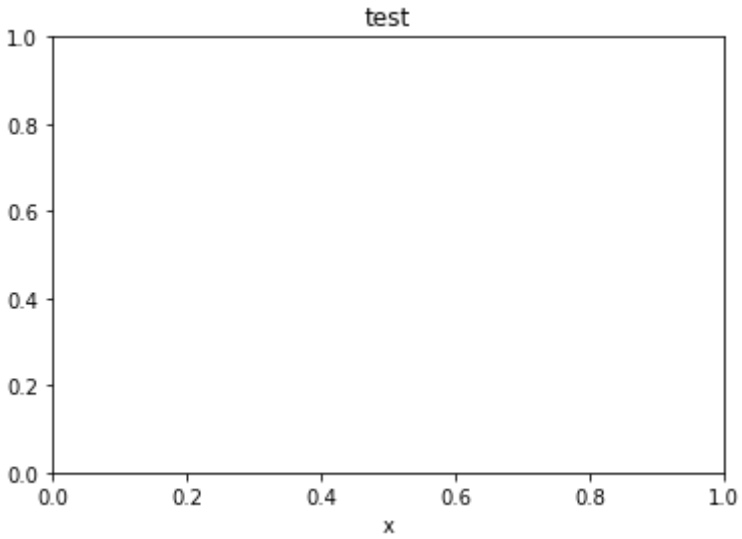
In [58]:
```
import matplotlib.pyplot as plt
import numpy as np

def update_line(num, data, line):
    line.set_data(data[..., :num])
    return line,
```

In [59]:
```
fig1 = plt.figure()

# Fixing random state for reproducibility
np.random.seed(19680801)

data = np.random.rand(2, 25)
l, = plt.plot([], [], 'r-')
plt.xlim(0, 1)
plt.ylim(0, 1)
plt.xlabel('x')
plt.title('test')
line_ani = animation.FuncAnimation(fig1, update_line, 25, fargs=(data, l
),
                                   interval=50, blit=True)
```



To save you can try:

In [60]:
```
line_ani.save('anim.mp4')
```

Or you might have to install ffmpeg and specify it as a writer:

In [61]:
```
# I think its this one
#  you might have to restart kernel after this
#!conda install -c conda-forge ffmpeg --yes

# you can also install imagemagick or use it as a writer!
```

In [62]:
```
Writer = animation.writers['ffmpeg']
writer = Writer(fps=15, metadata=dict(artist='Me'), bitrate=1800)
line_ani.save('anim.mp4')
```

Now open and look:

In [63]:
```
from IPython.display import Video
```

In [64]:
```
Video("anim.mp4",width=800)
```

Out[64]:

In [ ]:
```

```