Visualization

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UW CSE 160

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matplotlib

- Strives to emulate MATLAB
  - Pro: familiar to MATLAB users
  - Pro: powerful
  - Con: not the best design for a plotting library
- One important function for HW6:

```
plot(xvalues, yvalues)
```

Plot

```
import matplotlib.pyplot as plt

xs = [1, 2, 3, 4, 5]
# ys = [x**2 for x in xs]
ys = []
for x in xs:
  ys.append(x**2)

plt.plot(xs, ys)

plt.show()
```

no return value?

Has a side effect on the figure (like "print" statement)

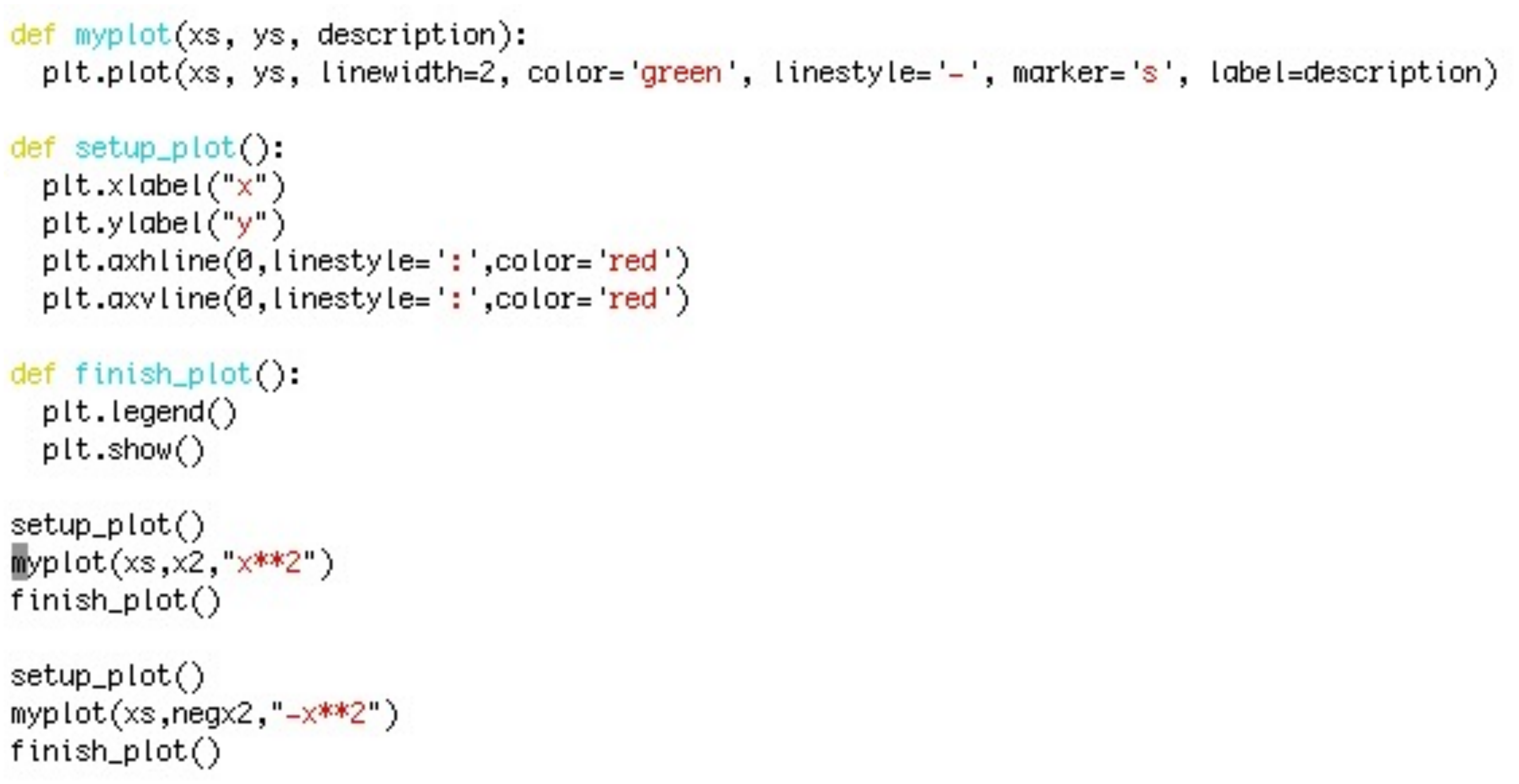
```
import matplotlib.pyplot as plt

xs = range(-100, 110, 10)
x2 = [x**2 for x in xs]
negx2 = [-x**2 for x in xs]

plt.plot(xs, x2)
plt.plot(xs, negx2)
plt.xlabel("x")
plt.ylabel("y")
plt.ylim(-2000, 2000)
plt.axhline(0) # horiz line
plt.axvline(0) # vert line
plt.savefig("quad.png")
plt.show()  # resets state
```

$$\left.\begin{array}{l}\texttt{plt.plot(xs, x2)} \\ \texttt{plt.plot(xs, negx2)} \\ \texttt{plt.xlabel("x")} \\ \texttt{plt.ylabel("y")} \\ \texttt{plt.ylim(-2000, 2000)} \\ \texttt{plt.axhline(0)} \\ \texttt{plt.axvline(0)}\end{array}\right\}$$ Incrementally modify the figure.

$$\left.\texttt{plt.savefig("quad.png")}\right\}$$ Save your figure to a file

$$\left.\texttt{plt.show()}\right\}$$ Display plot

Call `savefig` before `show`, `show` clears the state

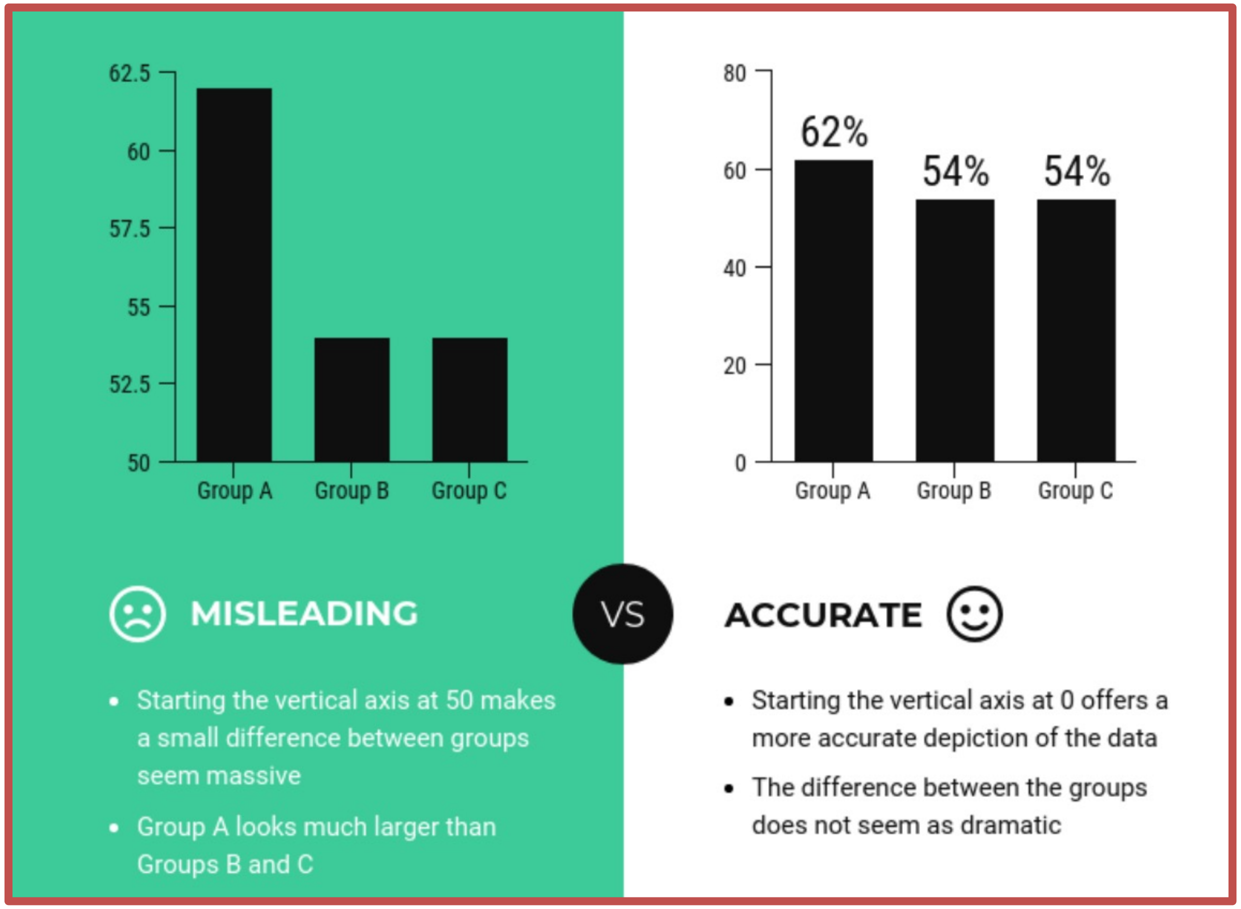


```
def myplot(xs, ys, description):
  plt.plot(xs, ys, linewidth=2, color='green', linestyle='-', marker='s', label=description)

def setup_plot():
  plt.xlabel("x")
  plt.ylabel("y")
  plt.axhline(0,linestyle=':',color='red')
  plt.axvline(0,linestyle=':',color='red')

def finish_plot():
  plt.legend()
  plt.show()

setup_plot()
myplot(xs,x2,"x**2")
finish_plot()

setup_plot()
myplot(xs,negx2,"-x**2")
finish_plot()
```

We can group these options into functions as usual, but remember that they are operating on a global, hidden variable (the figure)

Visualization: Pros and Cons

- Visualizations can Mislead (link):



MISLEADING

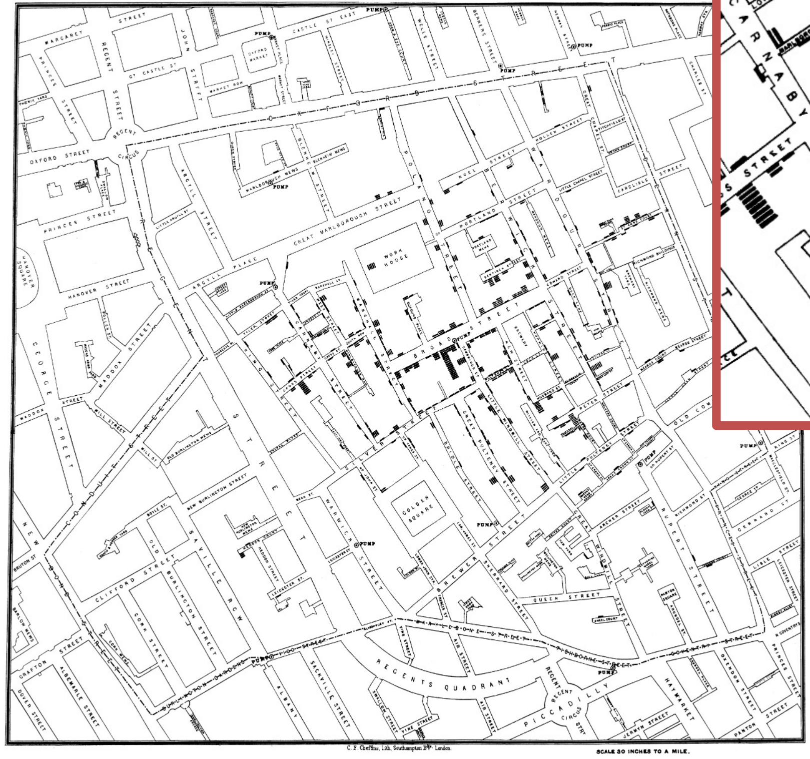
- Starting the vertical axis at 50 makes a small difference between groups seem massive
- Group A looks much larger than Groups B and C

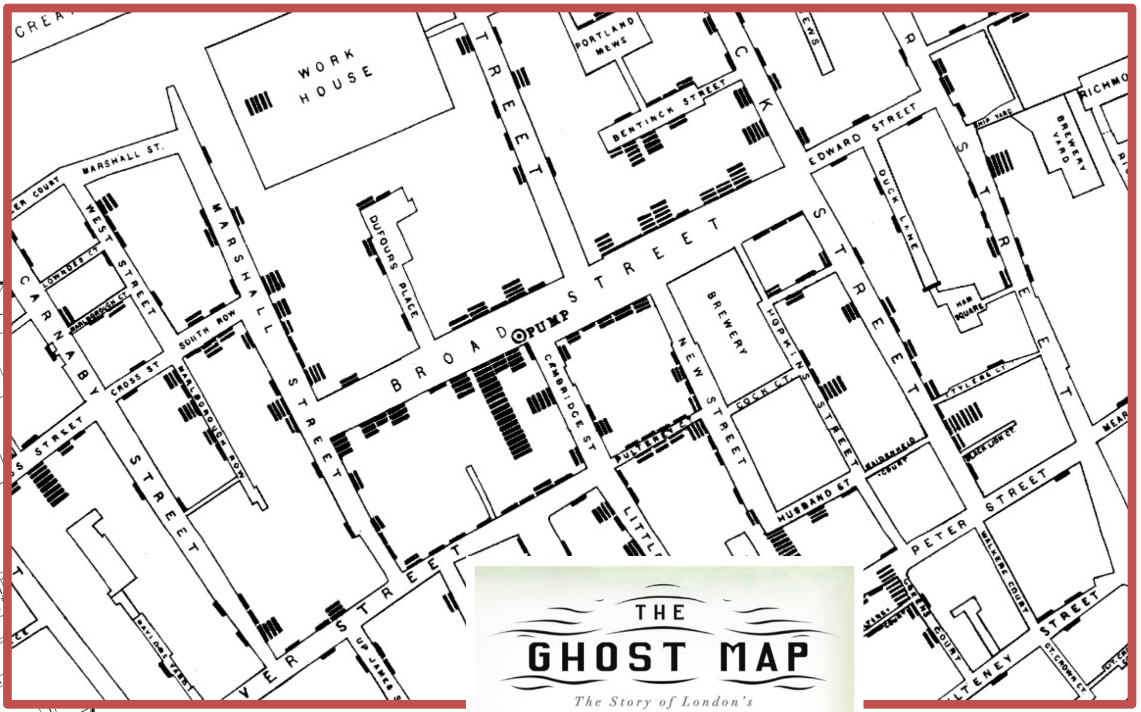
ACCURATE

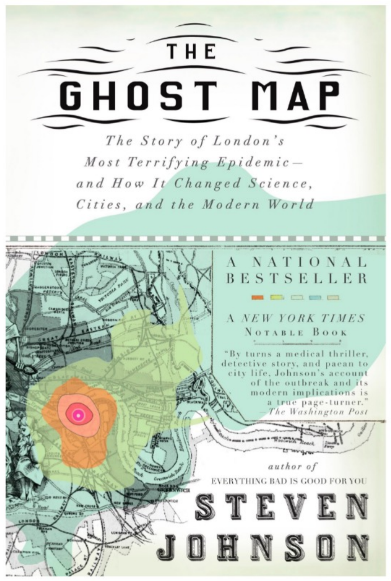
- Starting the vertical axis at 0 offers a more accurate depiction of the data
- The difference between the groups does not seem as dramatic

• Visualizations can be powerful:

London cholera epidemic
Map by Dr. John Snow
1854






THE
GHOST MAP
The Story of London's Most Terrifying Epidemic— and How It Changed Science, Cities, and the Modern World

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