5.1) Principles of Visualization

Vitor Kamada

January 2020

Reference

Tables, Graphics, and Figures from

Principles and Techniques of Data Science

Lau et al. (2019): Ch 6 Data Visualization

https://www.textbook.ds100.org/ch/06/viz_intro.html

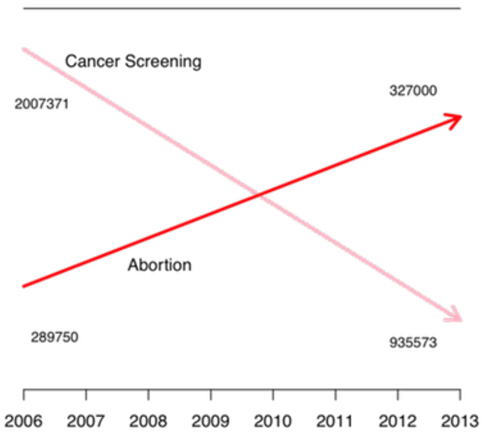
Report by Americans United for Life

```python
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
%matplotlib inline
sns.set()
sns.set_context('talk')
```

```python
path ='https://github.com/DS-100/textbook/raw/master/content/'
pp = pd.read_csv(path + 'ch/06/data/plannedparenthood.csv')
```

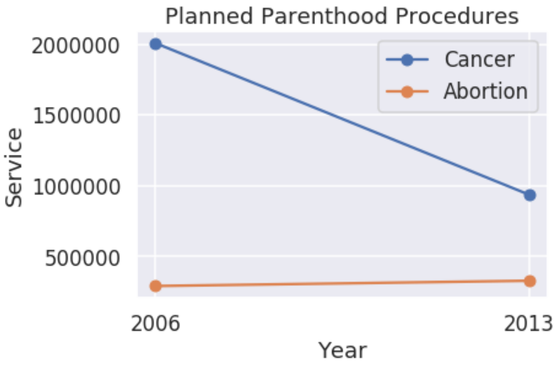
	year	screening	abortion
0	2006	2007371	289750
1	2013	935573	327000

Principles of Scale

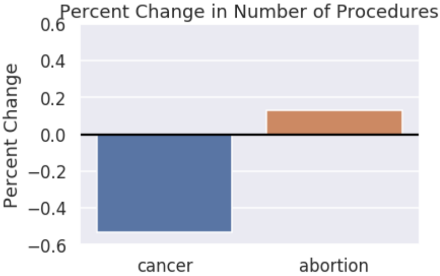


How many data points are plotted?

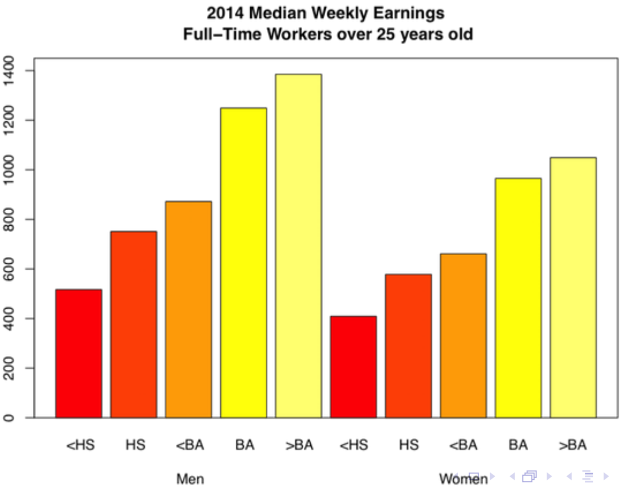
```
plt.plot(pp['year'], pp['screening'],
         linestyle="solid", marker="o", label='Cancer')
plt.plot(pp['year'], pp['abortion'],
         linestyle="solid", marker="o", label='Abortion')
plt.title('Planned Parenthood Procedures')
plt.xlabel("Year")
plt.ylabel("Service")
plt.xticks([2006, 2013])
plt.legend();
```



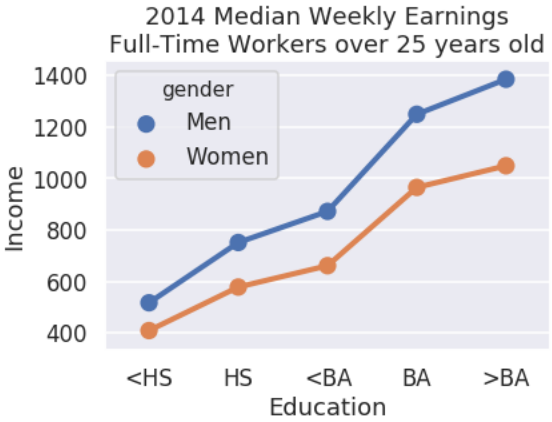
```python
percent_change = pd.DataFrame({
    'percent_change': [
        pp['screening'].iloc[1] / pp['screening'].iloc[0] - 1,
        pp['abortion'].iloc[1] / pp['abortion'].iloc[0] - 1,
    ],
    'procedure': ['cancer', 'abortion'],
    'type': ['percent_change', 'percent_change'],
})
ax = sns.barplot(x='procedure', y='percent_change', data=percent_change)
plt.title('Percent Change in Number of Procedures')
plt.xlabel('')
plt.ylabel('Percent Change')
plt.ylim(-0.6, 0.6)
plt.axhline(y=0, c='black');
```



US Bureau of Labor Statistics

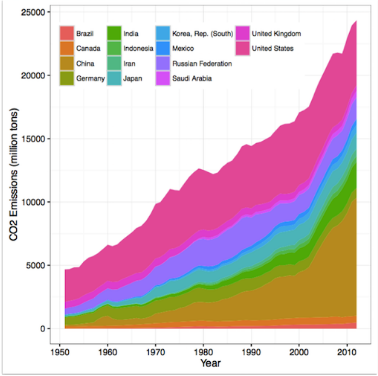


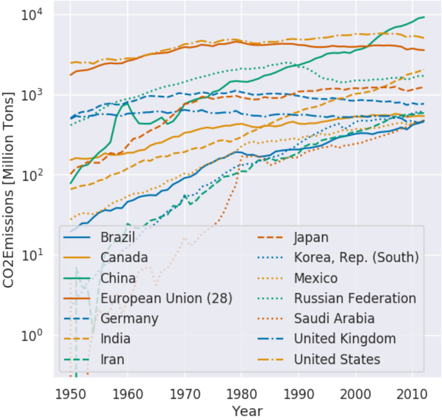
```python
cps = pd.read_csv(path + "ch/06/data/edInc2.csv")
ax = sns.pointplot(x="educ", y="income", hue="gender", data=cps)
ticks = ["<HS", "HS", "<BA", "BA", ">BA"]
ax.set_xticklabels(ticks)
ax.set_xlabel("Education")
ax.set_ylabel("Income")
ax.set_title("2014 Median Weekly Earnings\nFull-Time Workers over 25 years old");
```



Principles of Conditioning

Carbon dioxide emissions over time split by country





Code for Previous Chart

```
co2 = pd.read_csv(path + "ch/06/data/CAITcountryCO2.csv", skiprows = 2,
                  names = ["Country", "Year", "CO2"])
last_year = co2.Year.iloc[-1]
q = f"Country != 'World' and Country != 'European Union (15)' and Year == {last_year}"
top14_lasty = co2.query(q).sort_values('CO2', ascending=False).iloc[:14]
top14 = co2[co2.Country.isin(top14_lasty.Country) & (co2.Year >= 1950)]

from cycler import cycler
linestyles = (['-', '--', ':', '-.']*3)[:7]
colors = sns.color_palette('colorblind')[:4]
lines_c = cycler('linestyle', linestyles)
color_c = cycler('color', colors)
fig, ax = plt.subplots(figsize=(9, 9))
ax.set_prop_cycle(lines_c * color_c)
x, y ='Year', 'CO2'
for name, df in top14.groupby('Country'):
    ax.semilogy(df[x], df[y], label=name)
ax.set_xlabel(x)
ax.set_ylabel(y + "Emissions [Million Tons]")
ax.legend(ncol=2, frameon=True);
```

In 1619, Kepler recorded down this data to discover the Third Law of Planetary Motion

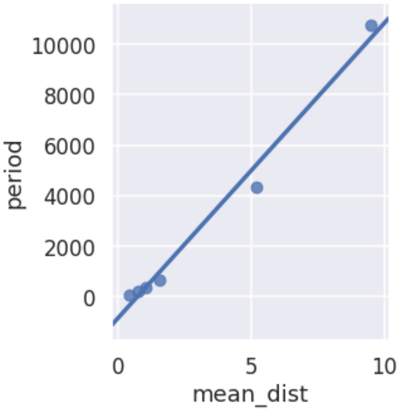
```python
planets = pd.read_csv(path + "ch/06/data/planets.data",
        delim_whitespace=True, comment="#", usecols=[0, 1, 2])
```

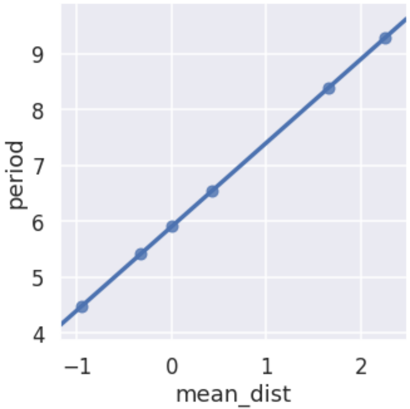
	planet	mean_dist	period
0	Mercury	0.389	87.77
1	Venus	0.724	224.70
2	Earth	1.000	365.25
3	Mars	1.524	686.95
4	Jupiter	5.200	4332.62
5	Saturn	9.510	10759.20

$$\log(period) = m\log(dist) + b$$
$$period = e^{m\log(dist)+b}$$
$$period = e^{b} dist^{m}$$
$$period = C \cdot dist^{m}$$

sns.lmplot(x='mean_dist', y='period', data=planets, ci=False)

```
sns.lmplot(x='mean_dist', y='period',
  data=np.log(planets.iloc[:, [1, 2]]), ci=False);
```





Cherry Blossom Run, an annual 10-mile run in Washington D.C.

```
runners = pd.read_csv(path + 'ch/06/data/cherryBlossomMen.csv')
```

	year	place	age	time
0	1999	1	28.0	2819.0
1	1999	2	24.0	2821.0
2	1999	3	27.0	2823.0

70045 rows $\times$ 4 columns

Principles of Smoothing

```
sns.lmplot(x='age', y='time', data=runners, fit_reg=False);
```

```
sns.kdeplot(runners['age'], runners['time'])
plt.xlim(-10, 70)
plt.ylim(3000, 8000);
```