Amazon Reviews Mobile Phones

In [31]:

```
import smtplib
from matplotlib import style
import seaborn as sns
sns.set(style='ticks', palette='RdBu')
import pandas as pd
import numpy as np
import time
import datetime
%matplotlib inline
import matplotlib.pyplot as plt
```

Read the data

In [32]:

```
data = pd.read_csv('Amazon_Unlocked_Mobile.csv', encoding='utf-8')
df = data
df.columns = ['ProductName', 'BrandName', 'Price', 'Rating', 'Reviews', 'Re
df.head().T
```

Out[32]:

	0	1	2	3	4
ProductName	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...
BrandName	Samsung	Samsung	Samsung	Samsung	Samsung
Price	199.99	199.99	199.99	199.99	199.99
Rating	5	4	5	4	4
Reviews	I feel so LUCKY to have found this used (phone...	nice phone, nice up grade from my pantach revu...	Very pleased	It works good but it goes slow sometimes but i...	Great phone to replace my lost phone. The only...
ReviewVotes	1.0	0.0	0.0	0.0	0.0

Describe the data

In [33]:

```
data.columns
```

Out[33]:

```
Index(['ProductName', 'BrandName', 'Price', 'Rating', 'Reviews',
       'ReviewVotes'],
      dtype='object')
```

In [34]:
```
data.head(n=2)
```

Out[34]:

	ProductName	BrandName	Price	Rating	Reviews	ReviewVotes
0	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	Samsung	199.99	5	I feel so LUCKY to have found this used (phone...	1.0
1	"CLEAR CLEAN ESN" Sprint EPIC 4G Galaxy SPH-D7...	Samsung	199.99	4	nice phone, nice up grade from my pantach revu...	0.0

In [35]:
```
df['Price'] = df['Price'].fillna(0)
df['ReviewVotes'] = df['ReviewVotes'].fillna(0)
data.describe()
```

Out[35]:

	Price	Rating	ReviewVotes
count	413840.000000	413840.000000	413840.000000
mean	223.614684	3.819578	1.462454
std	272.380590	1.548216	9.030315
min	0.000000	1.000000	0.000000
25%	78.000000	3.000000	0.000000
50%	139.950000	5.000000	0.000000
75%	269.100000	5.000000	1.000000
max	2598.000000	5.000000	645.000000

Categorical features

In [36]:
```
categorical_features = (data.select_dtypes(include=['object']).columns.valu
categorical_features
```

Out[36]:
```
array(['ProductName', 'BrandName', 'Reviews'], dtype=object)
```

Numerical Features

In [37]:
```
numerical_features = data.select_dtypes(include = ['float64', 'int64']).co
numerical_features
```

Out[37]:
```
array(['Price', 'Rating', 'ReviewVotes'], dtype=object)
```

In [38]:

```
len(list(set(df['ProductName'])))
```

Out[38]:

```
4410
```

Pivot tables

In [39]:

```
pivot = pd.pivot_table(df,
            values = ['Rating', 'ReviewVotes'],
            index = ['BrandName'],
                      columns= [],
                      aggfunc=[np.sum, np.mean, np.count_nonzero, np.std]
                      margins=True).fillna('')
pivot.head(10)
```

Out[39]:

	sum		mean		count_nonzero		
	Rating	ReviewVotes	Rating	ReviewVotes	Rating	ReviewVotes	Rating
BrandName							
AKUA	20	0.0	5.000000	0.000000	4	0	0.0
AMM Global Enterprises	44	1.0	4.888889	0.111111	9	1	0.333333
ARGOM TECH	6	0.0	3.000000	0.000000	2	0	2.828427
ASUS	2165	838.0	4.482402	1.734990	483	185	1.070735
ASUS Computers	2896	831.0	4.027816	1.155772	719	228	1.386085
AT&T	5	0.0	5.000000	0.000000	1	0	
ATT	160	25.0	3.636364	0.568182	44	17	1.792632
Acer	68	27.0	3.090909	1.227273	22	14	1.715728
Aeku	10	8.0	5.000000	4.000000	2	1	0.0
AeroAntenna	5	0.0	5.000000	0.000000	1	0	

Which are the top 10 prominent brands?

And how many ratings do they have?

In [40]:

```
pivot = pd.pivot_table(df,
               values = ['Rating', 'ReviewVotes'],
               index =  ['BrandName'],
                            columns= [],
                            aggfunc=[np.sum, np.mean, np.count_nonzero, np.std]
                            margins=True, fill_value=0).sort_values(by=('count_
top_10_brands = pivot.reindex().head(n=11)
top_10_brands
```

Out[40]:

	sum		mean		count_nonzero		
	Rating	ReviewVotes	Rating	ReviewVotes	Rating	ReviewVotes	Rating
BrandName							
All	1330128	499722	3.814873	1.433228	348669	102770	1.545507
Samsung	260513	97903	3.962356	1.489087	65747	18602	1.485313
BLU	239853	58430	3.792262	0.923824	63248	15985	1.502263
Apple	228346	112280	3.924415	1.929674	58186	18388	1.57606
LG	86114	23070	3.841460	1.029130	22417	5912	1.534323
BlackBerry	63126	21114	3.741465	1.251422	16872	4058	1.599935
Nokia	64187	25964	3.819291	1.544924	16806	5530	1.490946
Motorola	51157	23107	3.812849	1.722218	13417	4392	1.524914
HTC	44094	12803	3.465420	1.006209	12724	3184	1.660243
CNPGD	39176	20151	3.106002	1.597637	12613	3502	1.618294
OtterBox	35022	2276	4.383778	0.284892	7989	743	1.16456

Lets extract data only for top 10 brands.

In [41]:

```
top_10_brands = top_10_brands.reset_index()
tt_brand = top_10_brands['BrandName']
tt_brand2 = tt_brand.reset_index()
top_10_brand_list = list(set(tt_brand2['BrandName']))
top_10_brand_list.remove('All')
```

In [42]:

```
top_10_brand_list
```

Out[42]:

```
['Apple',
 'OtterBox',
 'CNPGD',
 'BlackBerry',
 'BLU',
 'HTC',
 'Nokia',
 'LG',
 'Samsung',
 'Motorola']
```

In [43]:

```
df_small=df.loc[df['BrandName'].isin(top_10_brand_list)]
pivot = pd.pivot_table(df_small,
                values = ['Rating'],
                index =  ['BrandName'],
                              columns= [],
                              aggfunc=[np.mean, np.std],
                              margins=True, fill_value=0).sort_values(by=('mean',
pivot
```

Out[43]:

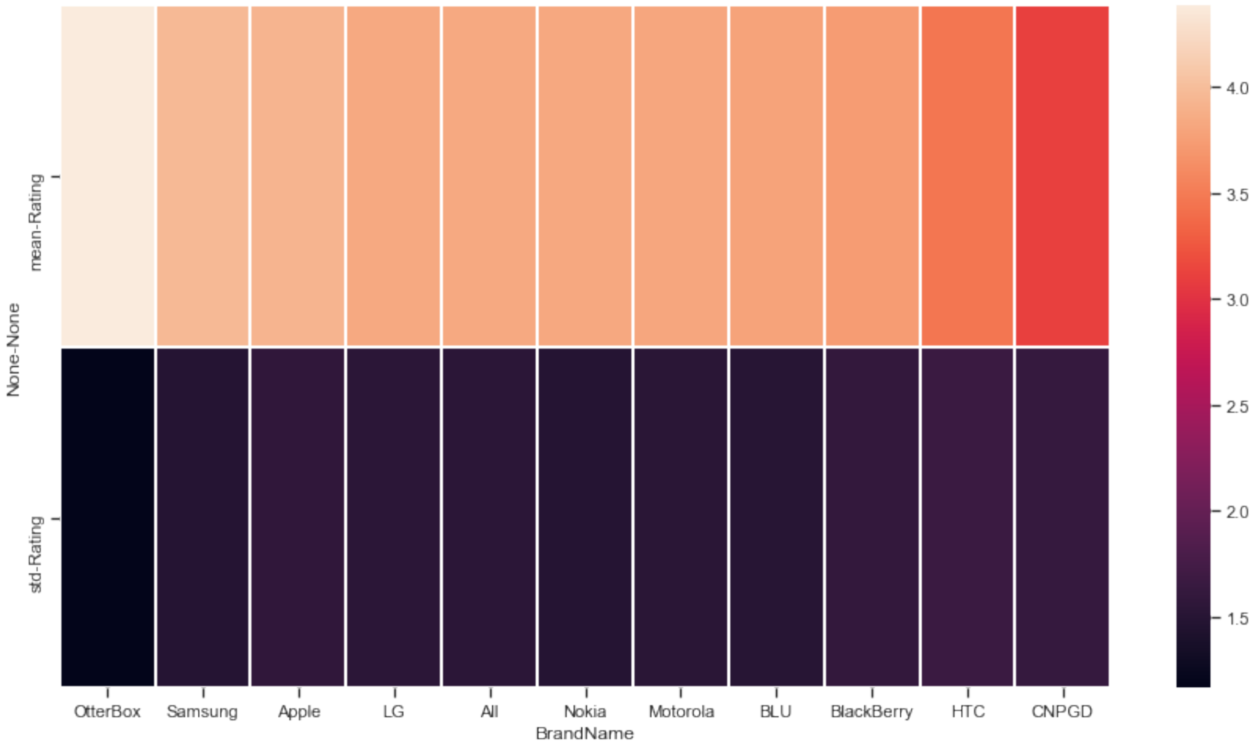
	mean	std
	Rating	Rating
BrandName		
OtterBox	4.383778	1.164561
Samsung	3.962356	1.485313
Apple	3.924415	1.576060
LG	3.841460	1.534323
All	3.832811	1.540667
Nokia	3.819291	1.490946
Motorola	3.812849	1.524914
BLU	3.792262	1.502263
BlackBerry	3.741465	1.599935
HTC	3.465420	1.660243
CNPGD	3.106002	1.618294

How do average ratings look like for top 10 brands?

In [44]:

```
cmap = sns.cubehelix_palette(start = 1.5, rot = 1.5, as_cmap = True)
plt.subplots(figsize = (15, 8))
sns.heatmap(pivot.T,linewidths=0.2,xticklabels=True, yticklabels=True)
```

```
Out[44]: <AxesSubplot:xlabel='BrandName', ylabel='None-None'>
```



Lets find out their topmost products: For 10 Brands, what are top 10 products?

```
In [45]: df_small.columns.values
```

```
Out[45]: array(['ProductName', 'BrandName', 'Price', 'Rating', 'Reviews',
                'ReviewVotes'], dtype=object)
```

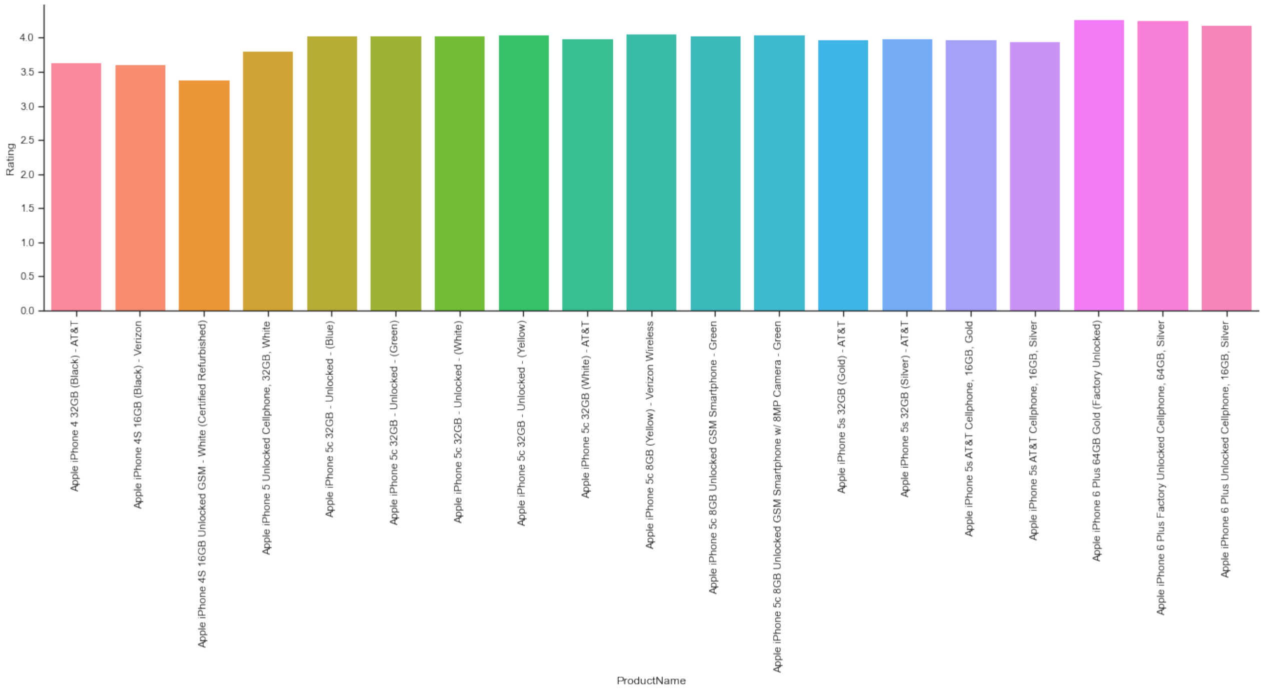
In [46]:

```
def plot_one_company(company, n=20):
    df_one_company = df_small.loc[df_small['BrandName'].isin([company])]
    pivot = pd.pivot_table(df_one_company,
            values = ['Rating', 'ReviewVotes'],
            index =  ['ProductName'],
                       columns= [],
                       aggfunc=[np.sum, np.mean, np.count_nonzero, np.std]
                       margins=True, fill_value=0).sort_values(by=('count_r
    top_10_prods = pivot.reindex().head(n=20)
    top_10_prods = top_10_prods.reset_index()
    tt_prods = top_10_prods['ProductName']
    tt_prods2 = tt_prods.reset_index()
    top_10_prods_list = list(set(tt_prods2['ProductName']))
    #top_30_prod_list

    try:
        aa= df_one_company[df_one_company['ProductName'].isin(top_10_prods_
        g = sns.factorplot(x='ProductName',
                           y='Rating',
                           data=aa,
                           saturation=1,
                           kind="bar",
                           ci=None,
                           aspect=4,
                           linewidth=1)
        locs, labels = plt.xticks()
        plt.setp(labels, rotation=90)
    except:
        pass

for i in top_10_brand_list:
    plot_one_company(i, 20)
    break
```

```
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/categorical.py:3714: UserWarning: The `factorplot` function has
been renamed to `catplot`. The original name will be removed in a future re
lease. Please update your code. Note that the default `kind` in `factorplot
` (`'point'`) has changed `'strip'` in `catplot`.
  warnings.warn(msg)
```



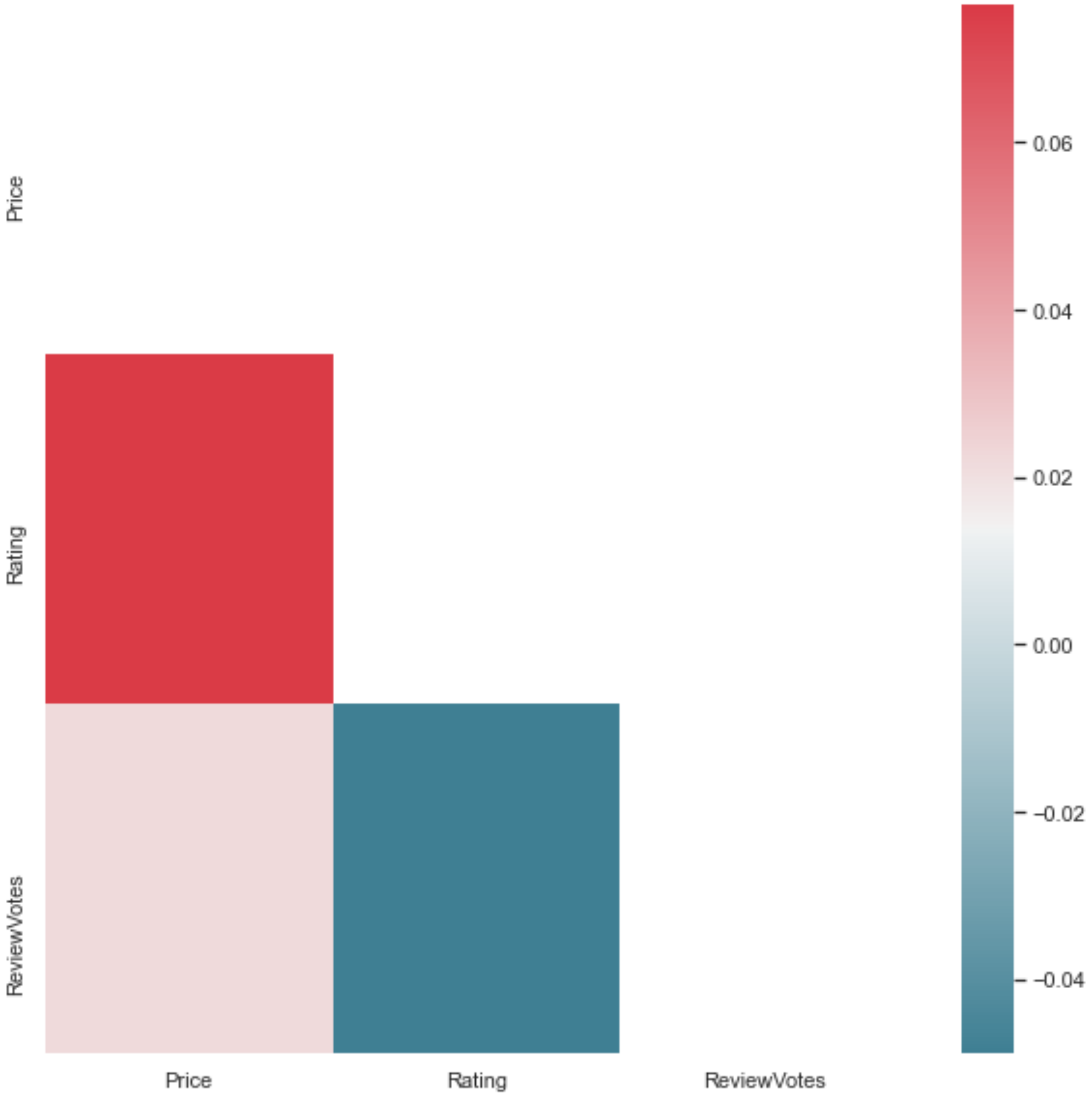
Correlations

In [47]:

```
def heat_map(corrs_mat):
    sns.set(style="white")
    f, ax = plt.subplots(figsize=(10, 10))
    mask = np.zeros_like(corrs_mat, dtype=np.bool)
    mask[np.triu_indices_from(mask)] = True
    # Generate a custom diverging colormap
    cmap = sns.diverging_palette(220, 10, as_cmap=True)
    sns.heatmap(corrs_mat, mask=mask, cmap=cmap, ax=ax)

variable_correlations = df.corr()
#variable_correlations
heat_map(variable_correlations)
```

```
/var/folders/t5/9m9lvjj92gqf_0pwjzljb7xr0000gn/T/ipykernel_75110/3007583381
.py:4: DeprecationWarning: `np.bool` is a deprecated alias for the builtin
`bool`. To silence this warning, use `bool` by itself. Doing this will not
modify any behavior and is safe. If you specifically wanted the numpy scala
r type, use `np.bool_` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/
devdocs/release/1.20.0-notes.html#deprecations
  mask = np.zeros_like(corrs_mat, dtype=np.bool)
```



In [48]:

```
df.columns.values
```

Out[48]:

```
array(['ProductName', 'BrandName', 'Price', 'Rating', 'Reviews',
       'ReviewVotes'], dtype=object)
```

How the reviews of the products depends over the price and the brand name?

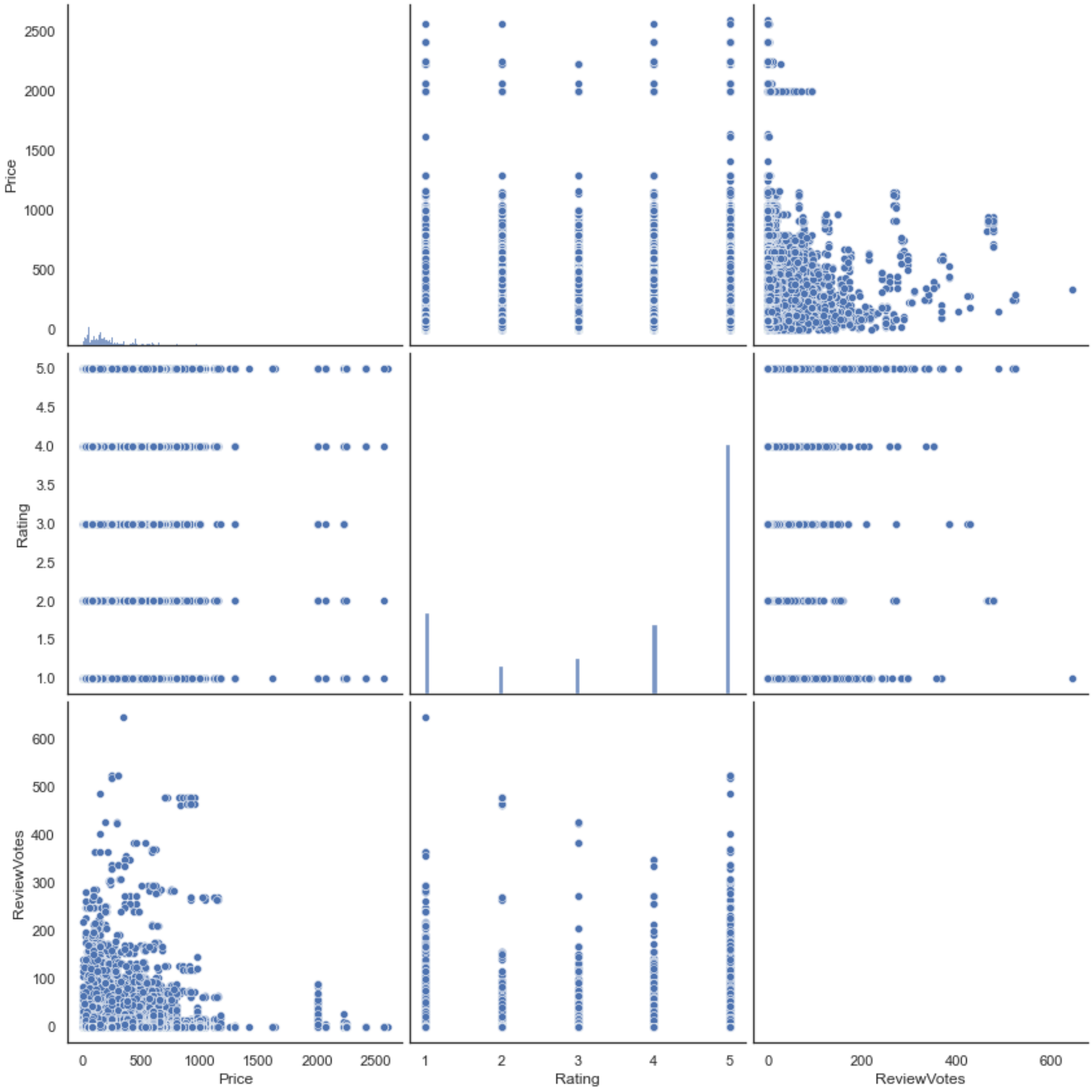
In [49]:

```
df_small = df[['BrandName',
               'Price',
               'Rating',
               'ReviewVotes']]
sns.pairplot(df_small, size=4)
```

```
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/axisgrid.py:1969: UserWarning: The `size` parameter has been ren
amed to `height`; please update your code.
  warnings.warn(msg, UserWarning)
```

Out[49]:

```
<seaborn.axisgrid.PairGrid at 0x7faa1b6a3880>
```

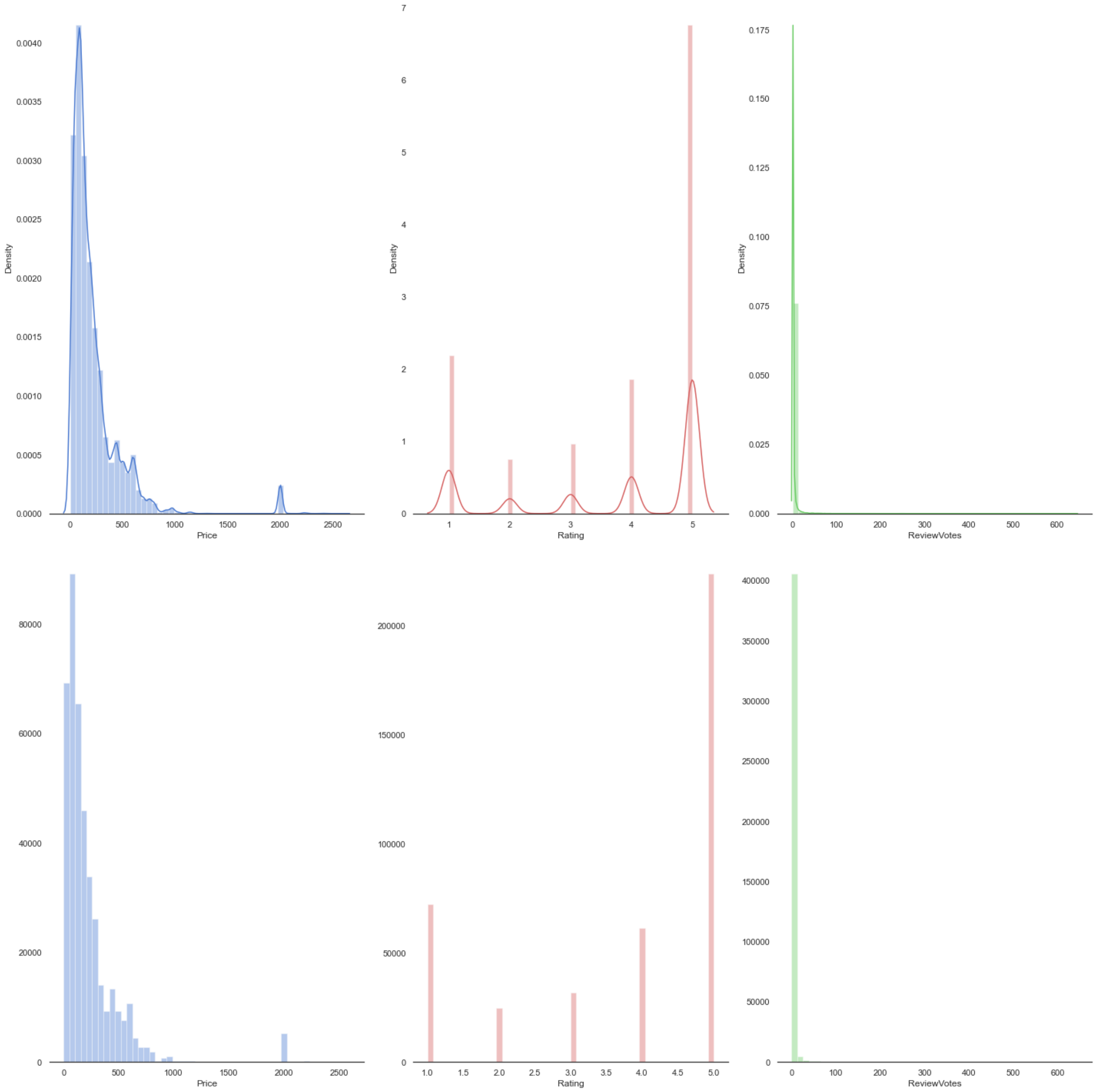


Complex plots

In [50]:

```
#data = df
sns.set(style="white", palette="muted", color_codes=True)
f, axes = plt.subplots(2, 3, figsize=(20,20))
sns.despine(left=True)
sns.distplot(df['Price'],            color="b", ax=axes[0, 0])
sns.distplot(df['Rating'],           color="r", ax=axes[0, 1])
sns.distplot(df['ReviewVotes'],      color="g", ax=axes[0, 2])
sns.distplot(df['Price'],            kde=False, color="b", ax=axes[1, 0])
sns.distplot(df['Rating'],           kde=False, color="r", ax=axes[1, 1])
sns.distplot(df['ReviewVotes'],      kde=False, color="g", ax=axes[1, 2])
#sns.distplot(df['hour'],                  kde=False, color="b", ax=axes[1
plt.tight_layout()
```

```
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated
function and will be removed in a future version. Please adapt your code to
use either `displot` (a figure-level function with similar flexibility) or
`histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated
function and will be removed in a future version. Please adapt your code to
use either `displot` (a figure-level function with similar flexibility) or
`histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated
function and will be removed in a future version. Please adapt your code to
use either `displot` (a figure-level function with similar flexibility) or
`histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated
function and will be removed in a future version. Please adapt your code to
use either `displot` (a figure-level function with similar flexibility) or
`histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



Lets find out something about the products and rating of the Apple.

In [51]:

```
df_apple = df.loc[df['BrandName'].isin(['Apple'])]
pivot = pd.pivot_table(df_apple,
         values = ['Rating', 'ReviewVotes'],
         index =  ['ProductName'],
                    columns= [],
                    aggfunc=[np.sum, np.mean, np.count_nonzero],
                    margins=True, fill_value=0).sort_values(by=('count_nonze
topmost_prods = pivot.reindex().head(n=30)
topmost_prods = topmost_prods.reset_index()
```

In [52]:

```
tt_brand = topmost_prods['ProductName']
tt_brand2 = tt_brand.reset_index()
top_10_prod_list = list(set(tt_brand2['ProductName']))
```

Is Apple is earning more income from customer or its Samsung

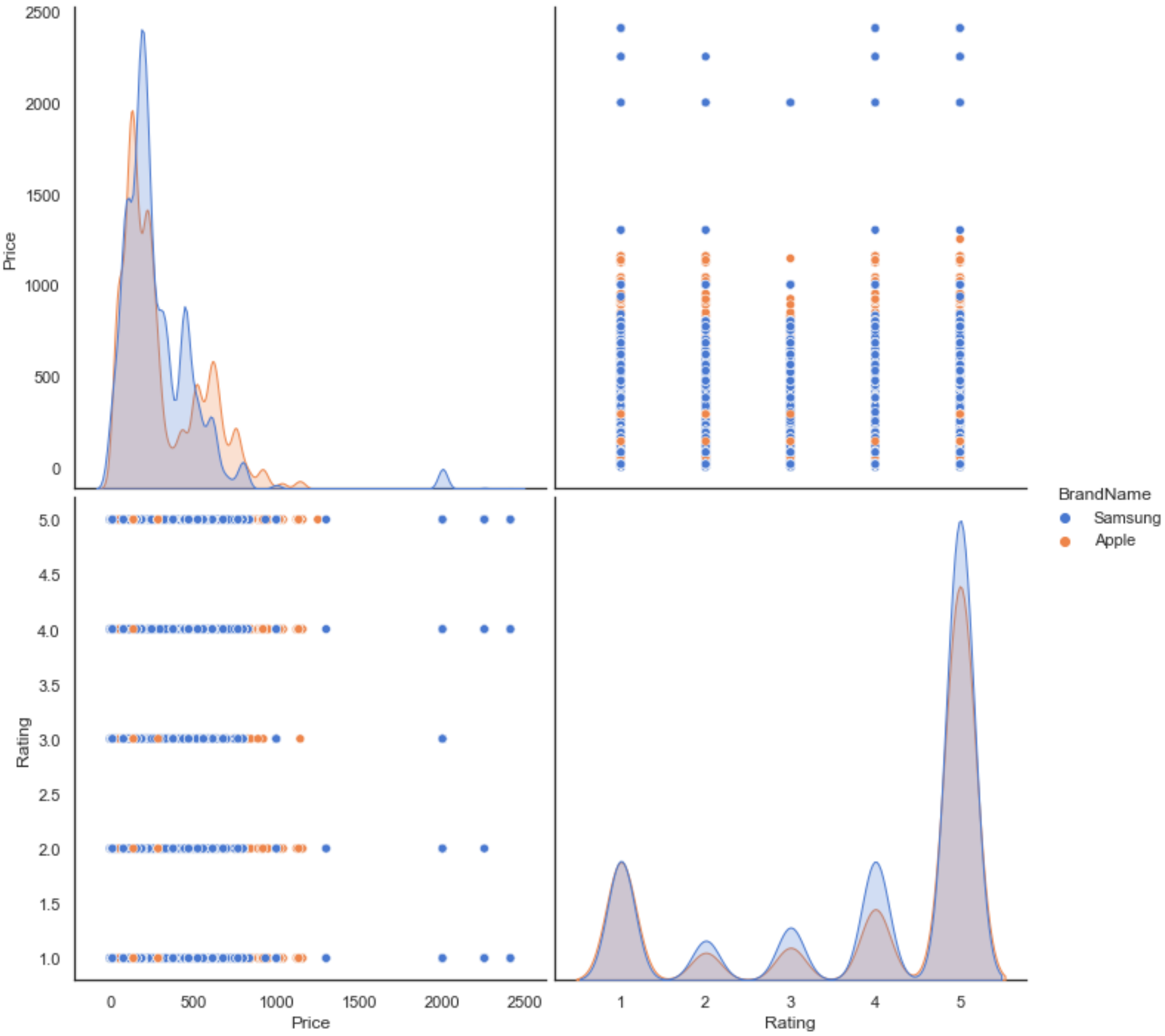
In [53]:

```
apple_samsumg = ['Apple', 'Samsung']
df_top_ten = df.loc[df['BrandName'].isin(apple_samsumg)]
df_small = df_top_ten[['BrandName',
               'Price',
               'Rating'
              ]]
sns.pairplot(df_small, hue='BrandName', size=5)
```

```
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packag
es/seaborn/axisgrid.py:1969: UserWarning: The `size` parameter has been ren
amed to `height`; please update your code.
  warnings.warn(msg, UserWarning)
```

Out[53]:

```
<seaborn.axisgrid.PairGrid at 0x7faa79b61e80>
```



In [ ]: