In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
plt.style.use('ggplot')
import nltk
df=pd.read_csv("Reviews.csv")
df
```

Out[1]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	Helpfulnes
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	
...	...	...	...	...	...	
568449	568450	B001EO7N10	A28KG5XORO54AY	Lettie D. Carter	0	
568450	568451	B003S1WTCU	A3I8AFVPEE8KI5	R. Sawyer	0	
568451	568452	B004I613EE	A121AA1GQV751Z	pksd "pk_007"	2	
568452	568453	B004I613EE	A3IBEVCTXKNOH	Kathy A. Welch "katwel"	1	
568453	568454	B001LR2CU2	A3LGQPJCZVL9UC	srfell17	0	

568454 rows × 10 columns

In [3]:
```
print(df.head())
df['Text'].values[0]
```

```
   Id   ProductId          UserId                      ProfileName  \
0   1  B001E4KFG0  A3SGXH7AUHU8GW                       delmartian   
1   2  B00813GRG4  A1D87F6ZCVE5NK                           dll pa   
2   3  B000LQOCH0   ABXLMWJIXXAIN  Natalia Corres "Natalia Corres"   
3   4  B000UA0QIQ  A395BORC6FGVXV                             Karl   
4   5  B006K2ZZ7K  A1UQRSCLF8GW1T    Michael D. Bigham "M. Wassir"   

   HelpfulnessNumerator  HelpfulnessDenominator  Score        Time  \
0                     1                       1      5  1303862400   
1                     0                       0      1  1346976000   
2                     1                       1      4  1219017600   
3                     3                       3      2  1307923200   
4                     0                       0      5  1350777600   

                 Summary                                               Text  
0  Good Quality Dog Food  I have bought several of the Vitality canned d...  
1      Not as Advertised  Product arrived labeled as Jumbo Salted Peanut...  
2  "Delight" says it all  This is a confection that has been around a fe...  
3         Cough Medicine  If you are looking for the secret ingredient i...  
4            Great taffy  Great taffy at a great price.  There was a wid...  
```

Out[3]:
```
'I have bought several of the Vitality canned dog food products and have found the
m all to be of good quality. The product looks more like a stew than a processed m
eat and it smells better. My Labrador is finicky and she appreciates this product
better than  most.'
```

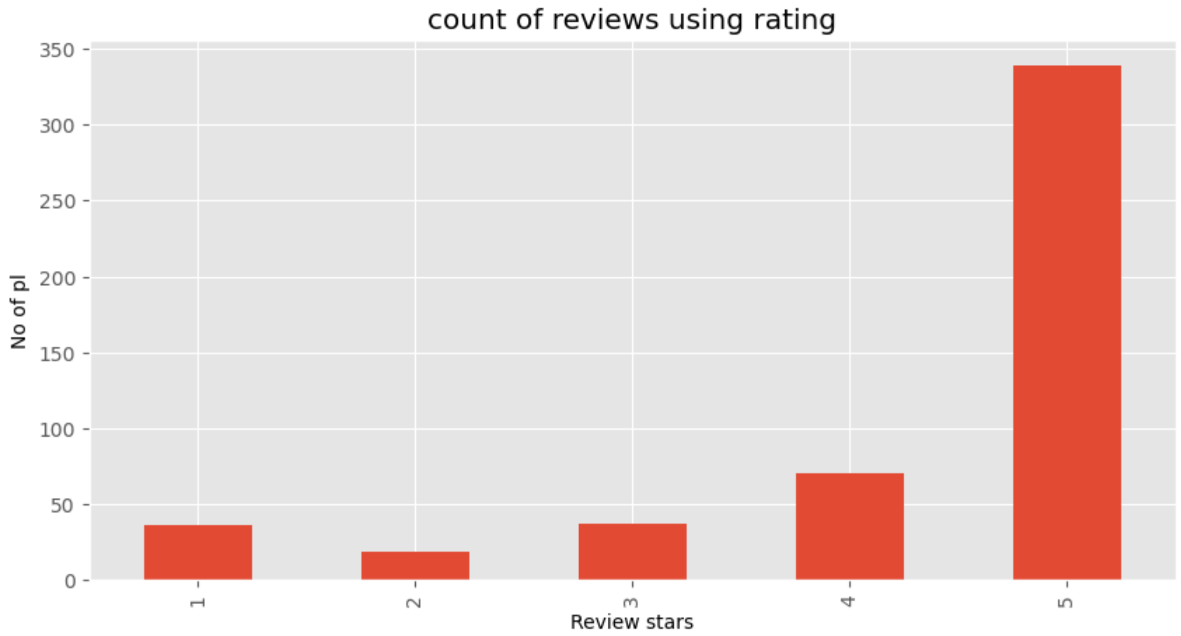
In [2]:
```
print(df.shape)
```

```
(568454, 10)
```

In [4]:
```
#reducing dataset
df=df.head(500)
df.shape
```

Out[4]:
```
(500, 10)
```

In [5]:
```
#EDA
ax= df['Score'].value_counts().sort_index().plot(kind='bar',title='count of review
ax.set_xlabel("Review stars")
ax.set_ylabel("No of pl")
plt.show()
```



```
In [6]: #Basic NLTK
        eg=df['Text'][50]
        eg
```

```
Out[6]: "This oatmeal is not good. Its mushy, soft, I don't like it. Quaker Oats is the wa
        y to go."
```

```
In [7]: #Tokenization
        tokens= nltk.word_tokenize(eg)
        print(tokens)
        print(tokens[:10])
```

```
['This', 'oatmeal', 'is', 'not', 'good', '.', 'Its', 'mushy', ',', 'soft', ',',
'I', 'do', "n't", 'like', 'it', '.', 'Quaker', 'Oats', 'is', 'the', 'way', 'to',
'go', '.']
['This', 'oatmeal', 'is', 'not', 'good', '.', 'Its', 'mushy', ',', 'soft']
```

```
In [8]: #POS Tagging
        tag=nltk.pos_tag(tokens)
        print(tag)
        print(tag[:10])
```

```
[('This', 'DT'), ('oatmeal', 'NN'), ('is', 'VBZ'), ('not', 'RB'), ('good', 'JJ'),
('.', '.'), ('Its', 'PRP$'), ('mushy', 'NN'), (',', ','), ('soft', 'JJ'), (',',
','), ('I', 'PRP'), ('do', 'VBP'), ("n't", 'RB'), ('like', 'VB'), ('it', 'PRP'),
('.', '.'), ('Quaker', 'NNP'), ('Oats', 'NNPS'), ('is', 'VBZ'), ('the', 'DT'), ('w
ay', 'NN'), ('to', 'TO'), ('go', 'VB'), ('.', '.')]
[('This', 'DT'), ('oatmeal', 'NN'), ('is', 'VBZ'), ('not', 'RB'), ('good', 'JJ'),
('.', '.'), ('Its', 'PRP$'), ('mushy', 'NN'), (',', ','), ('soft', 'JJ')]
```

```
In [9]: #Chunking- storing all the POS in entites (giving entities to the words)
        entity=nltk.chunk.ne_chunk(tag)
        entity.pprint()
```

```
(S
  This/DT
  oatmeal/NN
  is/VBZ
  not/RB
  good/JJ
  ./.
  Its/PRP$
  mushy/NN
  ,/,
  soft/JJ
  ,/,
  I/PRP
  do/VBP
  n't/RB
  like/VB
  it/PRP
  ./.
  (ORGANIZATION Quaker/NNP Oats/NNPS)
  is/VBZ
  the/DT
  way/NN
  to/TO
  go/VB
  ./.)
```

In [10]:

```
#VADER VAlence aware dictionary and sentiment reasoner
#We use SentimentIntensityAnalyzer lib to get pos,neg,neutral scores of text
#VADER Sentiment Scoring
from nltk.sentiment import SentimentIntensityAnalyzer
from tqdm.notebook import tqdm
sia= SentimentIntensityAnalyzer()
```

In [11]:

```
sia.polarity_scores('I am so happy')
```

Out[11]:

```
{'neg': 0.0, 'neu': 0.334, 'pos': 0.666, 'compound': 0.6115}
```

In [12]:

```
sia.polarity_scores('I am so sad')
```

Out[12]:

```
{'neg': 0.629, 'neu': 0.371, 'pos': 0.0, 'compound': -0.5256}
```

In [13]:

```
print(eg)
sia.polarity_scores(eg)
```

```
This oatmeal is not good. Its mushy, soft, I don't like it. Quaker Oats is the way
to go.
```

Out[13]:

```
{'neg': 0.22, 'neu': 0.78, 'pos': 0.0, 'compound': -0.5448}
```

In [14]:

```
res={}
for i,row in tqdm(df.iterrows(),total=len(df)):
    text=row['Text']
    myid=row["Id"]
    res[myid]=sia.polarity_scores(text)
```

```
  0%|          | 0/500 [00:00<?, ?it/s]
```

In [15]:

```
res
```

```
Out[15]: {1: {'neg': 0.0, 'neu': 0.695, 'pos': 0.305, 'compound': 0.9441},
          2: {'neg': 0.138, 'neu': 0.862, 'pos': 0.0, 'compound': -0.5664},
          3: {'neg': 0.091, 'neu': 0.754, 'pos': 0.155, 'compound': 0.8265},
          4: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          5: {'neg': 0.0, 'neu': 0.552, 'pos': 0.448, 'compound': 0.9468},
          6: {'neg': 0.029, 'neu': 0.809, 'pos': 0.163, 'compound': 0.883},
          7: {'neg': 0.034, 'neu': 0.693, 'pos': 0.273, 'compound': 0.9346},
          8: {'neg': 0.0, 'neu': 0.52, 'pos': 0.48, 'compound': 0.9487},
          9: {'neg': 0.0, 'neu': 0.851, 'pos': 0.149, 'compound': 0.6369},
          10: {'neg': 0.0, 'neu': 0.705, 'pos': 0.295, 'compound': 0.8313},
          11: {'neg': 0.017, 'neu': 0.846, 'pos': 0.137, 'compound': 0.9746},
          12: {'neg': 0.113, 'neu': 0.887, 'pos': 0.0, 'compound': -0.7579},
          13: {'neg': 0.031, 'neu': 0.923, 'pos': 0.046, 'compound': 0.296},
          14: {'neg': 0.0, 'neu': 0.355, 'pos': 0.645, 'compound': 0.9466},
          15: {'neg': 0.104, 'neu': 0.632, 'pos': 0.264, 'compound': 0.6486},
          16: {'neg': 0.0, 'neu': 0.861, 'pos': 0.139, 'compound': 0.5719},
          17: {'neg': 0.097, 'neu': 0.694, 'pos': 0.209, 'compound': 0.7481},
          18: {'neg': 0.0, 'neu': 0.61, 'pos': 0.39, 'compound': 0.8883},
          19: {'neg': 0.012, 'neu': 0.885, 'pos': 0.103, 'compound': 0.8957},
          20: {'neg': 0.0, 'neu': 0.863, 'pos': 0.137, 'compound': 0.6077},
          21: {'neg': 0.0, 'neu': 0.865, 'pos': 0.135, 'compound': 0.6249},
          22: {'neg': 0.0, 'neu': 0.739, 'pos': 0.261, 'compound': 0.9153},
          23: {'neg': 0.0, 'neu': 0.768, 'pos': 0.232, 'compound': 0.7687},
          24: {'neg': 0.085, 'neu': 0.771, 'pos': 0.143, 'compound': 0.2617},
          25: {'neg': 0.038, 'neu': 0.895, 'pos': 0.068, 'compound': 0.3939},
          26: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          27: {'neg': 0.128, 'neu': 0.872, 'pos': 0.0, 'compound': -0.296},
          28: {'neg': 0.04, 'neu': 0.808, 'pos': 0.152, 'compound': 0.5956},
          29: {'neg': 0.022, 'neu': 0.669, 'pos': 0.309, 'compound': 0.9913},
          30: {'neg': 0.017, 'neu': 0.846, 'pos': 0.137, 'compound': 0.9746},
          31: {'neg': 0.041, 'neu': 0.692, 'pos': 0.267, 'compound': 0.9713},
          32: {'neg': 0.0, 'neu': 0.484, 'pos': 0.516, 'compound': 0.9153},
          33: {'neg': 0.069, 'neu': 0.839, 'pos': 0.092, 'compound': 0.7103},
          34: {'neg': 0.024, 'neu': 0.72, 'pos': 0.256, 'compound': 0.9779},
          35: {'neg': 0.0, 'neu': 0.874, 'pos': 0.126, 'compound': 0.9091},
          36: {'neg': 0.024, 'neu': 0.821, 'pos': 0.155, 'compound': 0.7622},
          37: {'neg': 0.0, 'neu': 0.754, 'pos': 0.246, 'compound': 0.9196},
          38: {'neg': 0.0, 'neu': 0.938, 'pos': 0.062, 'compound': 0.4457},
          39: {'neg': 0.05, 'neu': 0.846, 'pos': 0.104, 'compound': 0.7638},
          40: {'neg': 0.0, 'neu': 0.856, 'pos': 0.144, 'compound': 0.8114},
          41: {'neg': 0.033, 'neu': 0.82, 'pos': 0.147, 'compound': 0.9301},
          42: {'neg': 0.03, 'neu': 0.848, 'pos': 0.122, 'compound': 0.9435},
          43: {'neg': 0.0, 'neu': 0.588, 'pos': 0.412, 'compound': 0.9441},
          44: {'neg': 0.0, 'neu': 0.685, 'pos': 0.315, 'compound': 0.9161},
          45: {'neg': 0.031, 'neu': 0.778, 'pos': 0.191, 'compound': 0.8421},
          46: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          47: {'neg': 0.0, 'neu': 0.737, 'pos': 0.263, 'compound': 0.9169},
          48: {'neg': 0.0, 'neu': 0.868, 'pos': 0.132, 'compound': 0.4404},
          49: {'neg': 0.0, 'neu': 0.821, 'pos': 0.179, 'compound': 0.747},
          50: {'neg': 0.056, 'neu': 0.865, 'pos': 0.079, 'compound': 0.2363},
          51: {'neg': 0.22, 'neu': 0.78, 'pos': 0.0, 'compound': -0.5448},
          52: {'neg': 0.047, 'neu': 0.735, 'pos': 0.218, 'compound': 0.9194},
          53: {'neg': 0.09, 'neu': 0.858, 'pos': 0.052, 'compound': -0.8259},
          54: {'neg': 0.075, 'neu': 0.925, 'pos': 0.0, 'compound': -0.3612},
          55: {'neg': 0.0, 'neu': 0.857, 'pos': 0.143, 'compound': 0.8761},
          56: {'neg': 0.071, 'neu': 0.708, 'pos': 0.221, 'compound': 0.8908},
          57: {'neg': 0.029, 'neu': 0.694, 'pos': 0.277, 'compound': 0.908},
          58: {'neg': 0.0, 'neu': 0.701, 'pos': 0.299, 'compound': 0.91},
          59: {'neg': 0.0, 'neu': 0.611, 'pos': 0.389, 'compound': 0.9323},
          60: {'neg': 0.0, 'neu': 0.638, 'pos': 0.362, 'compound': 0.8807},
          61: {'neg': 0.0, 'neu': 0.9, 'pos': 0.1, 'compound': 0.4404},
          62: {'neg': 0.0, 'neu': 0.741, 'pos': 0.259, 'compound': 0.8442},
          63: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          64: {'neg': 0.055, 'neu': 0.765, 'pos': 0.179, 'compound': 0.9817},
          65: {'neg': 0.046, 'neu': 0.75, 'pos': 0.205, 'compound': 0.8674},
          66: {'neg': 0.04, 'neu': 0.822, 'pos': 0.138, 'compound': 0.5165},
          67: {'neg': 0.057, 'neu': 0.869, 'pos': 0.073, 'compound': 0.492},
          68: {'neg': 0.183, 'neu': 0.776, 'pos': 0.041, 'compound': -0.9116},
          69: {'neg': 0.135, 'neu': 0.71, 'pos': 0.155, 'compound': -0.0096},
          70: {'neg': 0.344, 'neu': 0.52, 'pos': 0.136, 'compound': -0.7345},
          71: {'neg': 0.036, 'neu': 0.916, 'pos': 0.048, 'compound': 0.2228},
          72: {'neg': 0.078, 'neu': 0.701, 'pos': 0.222, 'compound': 0.9733},
          73: {'neg': 0.025, 'neu': 0.653, 'pos': 0.323, 'compound': 0.9787},
          74: {'neg': 0.093, 'neu': 0.762, 'pos': 0.144, 'compound': 0.9665},
          75: {'neg': 0.0, 'neu': 0.872, 'pos': 0.128, 'compound': 0.2263},
          76: {'neg': 0.106, 'neu': 0.768, 'pos': 0.126, 'compound': 0.1098},
          77: {'neg': 0.019, 'neu': 0.898, 'pos': 0.083, 'compound': 0.5647},
          78: {'neg': 0.034, 'neu': 0.798, 'pos': 0.168, 'compound': 0.8303},
          79: {'neg': 0.0, 'neu': 0.763, 'pos': 0.237, 'compound': 0.7814},
          80: {'neg': 0.087, 'neu': 0.589, 'pos': 0.324, 'compound': 0.8636},
          81: {'neg': 0.0, 'neu': 0.723, 'pos': 0.277, 'compound': 0.9098},
          82: {'neg': 0.0, 'neu': 0.663, 'pos': 0.337, 'compound': 0.9041},
          83: {'neg': 0.04, 'neu': 0.794, 'pos': 0.165, 'compound': 0.9957},
          84: {'neg': 0.055, 'neu': 0.767, 'pos': 0.178, 'compound': 0.8642},
          85: {'neg': 0.109, 'neu': 0.676, 'pos': 0.214, 'compound': 0.8431},
          86: {'neg': 0.035, 'neu': 0.698, 'pos': 0.267, 'compound': 0.9487},
          87: {'neg': 0.019, 'neu': 0.855, 'pos': 0.126, 'compound': 0.8797},
          88: {'neg': 0.05, 'neu': 0.735, 'pos': 0.215, 'compound': 0.7424},
          89: {'neg': 0.048, 'neu': 0.762, 'pos': 0.19, 'compound': 0.9716},
          90: {'neg': 0.029, 'neu': 0.645, 'pos': 0.326, 'compound': 0.9554},
          91: {'neg': 0.0, 'neu': 0.833, 'pos': 0.167, 'compound': 0.7351},
          92: {'neg': 0.0, 'neu': 0.837, 'pos': 0.163, 'compound': 0.6249},
          93: {'neg': 0.069, 'neu': 0.663, 'pos': 0.268, 'compound': 0.8255},
          94: {'neg': 0.01, 'neu': 0.781, 'pos': 0.208, 'compound': 0.9882},
          95: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          96: {'neg': 0.031, 'neu': 0.732, 'pos': 0.237, 'compound': 0.9273},
          97: {'neg': 0.0, 'neu': 0.818, 'pos': 0.182, 'compound': 0.982},
          98: {'neg': 0.053, 'neu': 0.793, 'pos': 0.154, 'compound': 0.7729},
          99: {'neg': 0.024, 'neu': 0.91, 'pos': 0.066, 'compound': 0.5106},
          100: {'neg': 0.173, 'neu': 0.735, 'pos': 0.092, 'compound': -0.5267},
          101: {'neg': 0.0, 'neu': 0.807, 'pos': 0.193, 'compound': 0.7717},
          102: {'neg': 0.103, 'neu': 0.752, 'pos': 0.145, 'compound': 0.2285},
          103: {'neg': 0.0, 'neu': 0.75, 'pos': 0.25, 'compound': 0.9287},
          104: {'neg': 0.0, 'neu': 0.859, 'pos': 0.141, 'compound': 0.7249},
          105: {'neg': 0.051, 'neu': 0.577, 'pos': 0.372, 'compound': 0.9313},
          106: {'neg': 0.0, 'neu': 0.696, 'pos': 0.304, 'compound': 0.9603},
          107: {'neg': 0.0, 'neu': 0.791, 'pos': 0.209, 'compound': 0.5719},
          108: {'neg': 0.0, 'neu': 0.804, 'pos': 0.196, 'compound': 0.9503},
          109: {'neg': 0.059, 'neu': 0.676, 'pos': 0.265, 'compound': 0.9116},
          110: {'neg': 0.014, 'neu': 0.764, 'pos': 0.222, 'compound': 0.9841},
          111: {'neg': 0.059, 'neu': 0.879, 'pos': 0.062, 'compound': 0.0176},
          112: {'neg': 0.0, 'neu': 0.81, 'pos': 0.19, 'compound': 0.8769},
          113: {'neg': 0.037, 'neu': 0.786, 'pos': 0.177, 'compound': 0.9946},
          114: {'neg': 0.0, 'neu': 0.631, 'pos': 0.369, 'compound': 0.8779},
          115: {'neg': 0.027, 'neu': 0.727, 'pos': 0.245, 'compound': 0.9379},
          116: {'neg': 0.0, 'neu': 0.645, 'pos': 0.355, 'compound': 0.872},
          117: {'neg': 0.0, 'neu': 0.892, 'pos': 0.108, 'compound': 0.6573},
          118: {'neg': 0.0, 'neu': 0.781, 'pos': 0.219, 'compound': 0.9751},
          119: {'neg': 0.05, 'neu': 0.872, 'pos': 0.079, 'compound': 0.8972},
          120: {'neg': 0.013, 'neu': 0.785, 'pos': 0.203, 'compound': 0.9828},
          121: {'neg': 0.026, 'neu': 0.759, 'pos': 0.215, 'compound': 0.9509},
          122: {'neg': 0.102, 'neu': 0.822, 'pos': 0.076, 'compound': -0.3626},
          123: {'neg': 0.025, 'neu': 0.803, 'pos': 0.172, 'compound': 0.9022},
          124: {'neg': 0.017, 'neu': 0.795, 'pos': 0.188, 'compound': 0.9769},
          125: {'neg': 0.079, 'neu': 0.67, 'pos': 0.252, 'compound': 0.9678},
          126: {'neg': 0.035, 'neu': 0.87, 'pos': 0.095, 'compound': 0.5709},
          127: {'neg': 0.0, 'neu': 0.721, 'pos': 0.279, 'compound': 0.9258},
          128: {'neg': 0.067, 'neu': 0.633, 'pos': 0.299, 'compound': 0.9022},
          129: {'neg': 0.043, 'neu': 0.728, 'pos': 0.229, 'compound': 0.8142},
          130: {'neg': 0.114, 'neu': 0.676, 'pos': 0.21, 'compound': 0.6721},
          131: {'neg': 0.0, 'neu': 0.755, 'pos': 0.245, 'compound': 0.8658},
          132: {'neg': 0.135, 'neu': 0.76, 'pos': 0.105, 'compound': -0.3612},
          133: {'neg': 0.046, 'neu': 0.772, 'pos': 0.181, 'compound': 0.7902},
          134: {'neg': 0.02, 'neu': 0.878, 'pos': 0.103, 'compound': 0.8082},
          135: {'neg': 0.0, 'neu': 0.877, 'pos': 0.123, 'compound': 0.4215},
          136: {'neg': 0.0, 'neu': 0.9, 'pos': 0.1, 'compound': 0.6503},
          137: {'neg': 0.0, 'neu': 0.695, 'pos': 0.305, 'compound': 0.9661},
          138: {'neg': 0.0, 'neu': 0.689, 'pos': 0.311, 'compound': 0.8591},
          139: {'neg': 0.15, 'neu': 0.773, 'pos': 0.077, 'compound': -0.4199},
          140: {'neg': 0.043, 'neu': 0.833, 'pos': 0.125, 'compound': 0.835},
          141: {'neg': 0.098, 'neu': 0.787, 'pos': 0.114, 'compound': 0.2023},
          142: {'neg': 0.0, 'neu': 0.782, 'pos': 0.218, 'compound': 0.7814},
          143: {'neg': 0.0, 'neu': 0.763, 'pos': 0.237, 'compound': 0.9296},
          144: {'neg': 0.059, 'neu': 0.667, 'pos': 0.274, 'compound': 0.9653},
          145: {'neg': 0.058, 'neu': 0.841, 'pos': 0.102, 'compound': 0.6124},
          146: {'neg': 0.144, 'neu': 0.677, 'pos': 0.178, 'compound': 0.6341},
          147: {'neg': 0.087, 'neu': 0.783, 'pos': 0.13, 'compound': 0.7567},
          148: {'neg': 0.058, 'neu': 0.867, 'pos': 0.075, 'compound': 0.1533},
          149: {'neg': 0.04, 'neu': 0.833, 'pos': 0.127, 'compound': 0.6956},
          150: {'neg': 0.0, 'neu': 0.709, 'pos': 0.291, 'compound': 0.9231},
          151: {'neg': 0.0, 'neu': 0.564, 'pos': 0.436, 'compound': 0.9858},
          152: {'neg': 0.0, 'neu': 0.784, 'pos': 0.216, 'compound': 0.765},
          153: {'neg': 0.0, 'neu': 0.775, 'pos': 0.225, 'compound': 0.7269},
          154: {'neg': 0.12, 'neu': 0.76, 'pos': 0.12, 'compound': 0.2502},
          155: {'neg': 0.0, 'neu': 0.647, 'pos': 0.353, 'compound': 0.9803},
          156: {'neg': 0.0, 'neu': 0.768, 'pos': 0.232, 'compound': 0.9681},
          157: {'neg': 0.191, 'neu': 0.809, 'pos': 0.0, 'compound': -0.7269},
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          380: {'neg': 0.036, 'neu': 0.695, 'pos': 0.269, 'compound': 0.9468},
          381: {'neg': 0.074, 'neu': 0.715, 'pos': 0.212, 'compound': 0.8349},
          382: {'neg': 0.318, 'neu': 0.515, 'pos': 0.167, 'compound': -0.7184},
          383: {'neg': 0.0, 'neu': 0.905, 'pos': 0.095, 'compound': 0.6369},
          384: {'neg': 0.027, 'neu': 0.78, 'pos': 0.193, 'compound': 0.9913},
          385: {'neg': 0.0, 'neu': 0.767, 'pos': 0.233, 'compound': 0.8065},
          386: {'neg': 0.0, 'neu': 0.774, 'pos': 0.226, 'compound': 0.9796},
          387: {'neg': 0.0, 'neu': 0.839, 'pos': 0.161, 'compound': 0.8625},
          388: {'neg': 0.089, 'neu': 0.75, 'pos': 0.161, 'compound': 0.8201},
          389: {'neg': 0.088, 'neu': 0.537, 'pos': 0.375, 'compound': 0.755},
          390: {'neg': 0.031, 'neu': 0.764, 'pos': 0.205, 'compound': 0.9183},
          391: {'neg': 0.248, 'neu': 0.636, 'pos': 0.116, 'compound': -0.8174},
          392: {'neg': 0.0, 'neu': 0.642, 'pos': 0.358, 'compound': 0.8591},
          393: {'neg': 0.0, 'neu': 0.661, 'pos': 0.339, 'compound': 0.8481},
          394: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0},
          395: {'neg': 0.0, 'neu': 0.83, 'pos': 0.17, 'compound': 0.8016},
          396: {'neg': 0.0, 'neu': 0.502, 'pos': 0.498, 'compound': 0.9677},
          397: {'neg': 0.0, 'neu': 0.638, 'pos': 0.362, 'compound': 0.9682},
          398: {'neg': 0.046, 'neu': 0.703, 'pos': 0.251, 'compound': 0.867},
          399: {'neg': 0.0, 'neu': 0.8, 'pos': 0.2, 'compound': 0.9885},
          400: {'neg': 0.0, 'neu': 0.787, 'pos': 0.213, 'compound': 0.7644},
          401: {'neg': 0.234, 'neu': 0.556, 'pos': 0.211, 'compound': 0.0},
          402: {'neg': 0.093, 'neu': 0.813, 'pos': 0.095, 'compound': 0.0258},
          403: {'neg': 0.215, 'neu': 0.697, 'pos': 0.088, 'compound': -0.6351},
          404: {'neg': 0.194, 'neu': 0.771, 'pos': 0.035, 'compound': -0.9058},
          405: {'neg': 0.0, 'neu': 0.691, 'pos': 0.309, 'compound': 0.8172},
          406: {'neg': 0.019, 'neu': 0.702, 'pos': 0.279, 'compound': 0.9622},
          407: {'neg': 0.0, 'neu': 0.954, 'pos': 0.046, 'compound': 0.6249},
          408: {'neg': 0.036, 'neu': 0.772, 'pos': 0.192, 'compound': 0.9477},
          409: {'neg': 0.0, 'neu': 0.713, 'pos': 0.287, 'compound': 0.9257},
          410: {'neg': 0.05, 'neu': 0.758, 'pos': 0.192, 'compound': 0.8316},
          411: {'neg': 0.016, 'neu': 0.879, 'pos': 0.105, 'compound': 0.8681},
          412: {'neg': 0.0, 'neu': 0.802, 'pos': 0.198, 'compound': 0.8555},
          413: {'neg': 0.0, 'neu': 0.815, 'pos': 0.185, 'compound': 0.7777},
          414: {'neg': 0.0, 'neu': 0.914, 'pos': 0.086, 'compound': 0.4118},
          415: {'neg': 0.0, 'neu': 0.722, 'pos': 0.278, 'compound': 0.8902},
          416: {'neg': 0.0, 'neu': 0.594, 'pos': 0.406, 'compound': 0.9612},
          417: {'neg': 0.07, 'neu': 0.799, 'pos': 0.131, 'compound': 0.9222},
          418: {'neg': 0.166, 'neu': 0.809, 'pos': 0.025, 'compound': -0.8957},
          419: {'neg': 0.0, 'neu': 0.784, 'pos': 0.216, 'compound': 0.8876},
          420: {'neg': 0.148, 'neu': 0.815, 'pos': 0.037, 'compound': -0.5983},
          421: {'neg': 0.035, 'neu': 0.754, 'pos': 0.211, 'compound': 0.9561},
          422: {'neg': 0.0, 'neu': 0.861, 'pos': 0.139, 'compound': 0.4404},
          423: {'neg': 0.223, 'neu': 0.68, 'pos': 0.096, 'compound': -0.3314},
          424: {'neg': 0.055, 'neu': 0.687, 'pos': 0.258, 'compound': 0.9106},
          425: {'neg': 0.017, 'neu': 0.821, 'pos': 0.161, 'compound': 0.9576},
          426: {'neg': 0.0, 'neu': 0.806, 'pos': 0.194, 'compound': 0.7717},
          427: {'neg': 0.029, 'neu': 0.817, 'pos': 0.154, 'compound': 0.7845},
          428: {'neg': 0.0, 'neu': 0.761, 'pos': 0.239, 'compound': 0.9337},
          429: {'neg': 0.0, 'neu': 0.739, 'pos': 0.261, 'compound': 0.9741},
          430: {'neg': 0.0, 'neu': 0.617, 'pos': 0.383, 'compound': 0.9876},
          431: {'neg': 0.04, 'neu': 0.786, 'pos': 0.174, 'compound': 0.9847},
          432: {'neg': 0.0, 'neu': 0.73, 'pos': 0.27, 'compound': 0.9516},
          433: {'neg': 0.083, 'neu': 0.751, 'pos': 0.166, 'compound': 0.8044},
          434: {'neg': 0.108, 'neu': 0.593, 'pos': 0.299, 'compound': 0.8655},
          435: {'neg': 0.0, 'neu': 0.771, 'pos': 0.229, 'compound': 0.9179},
          436: {'neg': 0.0, 'neu': 0.829, 'pos': 0.171, 'compound': 0.8519},
          437: {'neg': 0.0, 'neu': 0.926, 'pos': 0.074, 'compound': 0.7383},
          438: {'neg': 0.0, 'neu': 0.887, 'pos': 0.113, 'compound': 0.6369},
          439: {'neg': 0.0, 'neu': 0.728, 'pos': 0.272, 'compound': 0.87},
          440: {'neg': 0.072, 'neu': 0.781, 'pos': 0.147, 'compound': 0.9307},
          441: {'neg': 0.078, 'neu': 0.793, 'pos': 0.129, 'compound': 0.5176},
          442: {'neg': 0.054, 'neu': 0.69, 'pos': 0.257, 'compound': 0.9683},
          443: {'neg': 0.0, 'neu': 0.616, 'pos': 0.384, 'compound': 0.9603},
          444: {'neg': 0.044, 'neu': 0.898, 'pos': 0.058, 'compound': 0.1882},
          445: {'neg': 0.055, 'neu': 0.873, 'pos': 0.072, 'compound': 0.0935},
          446: {'neg': 0.077, 'neu': 0.78, 'pos': 0.143, 'compound': 0.3699},
          447: {'neg': 0.042, 'neu': 0.763, 'pos': 0.195, 'compound': 0.9883},
          448: {'neg': 0.0, 'neu': 0.713, 'pos': 0.287, 'compound': 0.967},
          449: {'neg': 0.0, 'neu': 0.737, 'pos': 0.263, 'compound': 0.8531},
          450: {'neg': 0.0, 'neu': 0.845, 'pos': 0.155, 'compound': 0.6908},
          451: {'neg': 0.034, 'neu': 0.743, 'pos': 0.223, 'compound': 0.9873},
          452: {'neg': 0.054, 'neu': 0.782, 'pos': 0.164, 'compound': 0.9337},
          453: {'neg': 0.0, 'neu': 0.5, 'pos': 0.5, 'compound': 0.943},
          454: {'neg': 0.0, 'neu': 0.603, 'pos': 0.397, 'compound': 0.8811},
          455: {'neg': 0.0, 'neu': 0.699, 'pos': 0.301, 'compound': 0.9619},
          456: {'neg': 0.082, 'neu': 0.854, 'pos': 0.064, 'compound': -0.4854},
          457: {'neg': 0.0, 'neu': 0.684, 'pos': 0.316, 'compound': 0.926},
          458: {'neg': 0.0, 'neu': 0.564, 'pos': 0.436, 'compound': 0.9642},
          459: {'neg': 0.045, 'neu': 0.717, 'pos': 0.239, 'compound': 0.8455},
          460: {'neg': 0.066, 'neu': 0.743, 'pos': 0.19, 'compound': 0.9481},
          461: {'neg': 0.08, 'neu': 0.821, 'pos': 0.099, 'compound': 0.4883},
          462: {'neg': 0.037, 'neu': 0.87, 'pos': 0.093, 'compound': 0.34},
          463: {'neg': 0.099, 'neu': 0.794, 'pos': 0.108, 'compound': 0.5983},
          464: {'neg': 0.019, 'neu': 0.868, 'pos': 0.113, 'compound': 0.8443},
          465: {'neg': 0.0, 'neu': 0.838, 'pos': 0.162, 'compound': 0.7823},
          466: {'neg': 0.0, 'neu': 0.772, 'pos': 0.228, 'compound': 0.9606},
          467: {'neg': 0.009, 'neu': 0.845, 'pos': 0.147, 'compound': 0.9874},
          468: {'neg': 0.008, 'neu': 0.818, 'pos': 0.174, 'compound': 0.9926},
          469: {'neg': 0.049, 'neu': 0.951, 'pos': 0.0, 'compound': -0.3595},
          470: {'neg': 0.0, 'neu': 0.957, 'pos': 0.043, 'compound': 0.25},
          471: {'neg': 0.051, 'neu': 0.676, 'pos': 0.273, 'compound': 0.9749},
          472: {'neg': 0.0, 'neu': 0.565, 'pos': 0.435, 'compound': 0.9649},
          473: {'neg': 0.0, 'neu': 0.686, 'pos': 0.314, 'compound': 0.7506},
          474: {'neg': 0.013, 'neu': 0.75, 'pos': 0.237, 'compound': 0.9828},
          475: {'neg': 0.0, 'neu': 0.585, 'pos': 0.415, 'compound': 0.9095},
          476: {'neg': 0.066, 'neu': 0.614, 'pos': 0.32, 'compound': 0.9684},
          477: {'neg': 0.034, 'neu': 0.728, 'pos': 0.238, 'compound': 0.8555},
          478: {'neg': 0.0, 'neu': 0.823, 'pos': 0.177, 'compound': 0.6239},
          479: {'neg': 0.245, 'neu': 0.652, 'pos': 0.103, 'compound': -0.3855},
          480: {'neg': 0.0, 'neu': 0.435, 'pos': 0.565, 'compound': 0.9935},
          481: {'neg': 0.022, 'neu': 0.728, 'pos': 0.249, 'compound': 0.9451},
          482: {'neg': 0.0, 'neu': 0.605, 'pos': 0.395, 'compound': 0.9079},
          483: {'neg': 0.0, 'neu': 0.862, 'pos': 0.138, 'compound': 0.3384},
          484: {'neg': 0.088, 'neu': 0.767, 'pos': 0.145, 'compound': 0.4516},
          485: {'neg': 0.0, 'neu': 0.761, 'pos': 0.239, 'compound': 0.8547},
          486: {'neg': 0.0, 'neu': 0.818, 'pos': 0.182, 'compound': 0.9224},
          487: {'neg': 0.0, 'neu': 0.909, 'pos': 0.091, 'compound': 0.296},
          488: {'neg': 0.179, 'neu': 0.707, 'pos': 0.114, 'compound': -0.3723},
          489: {'neg': 0.0, 'neu': 0.861, 'pos': 0.139, 'compound': 0.9598},
          490: {'neg': 0.0, 'neu': 0.763, 'pos': 0.237, 'compound': 0.9788},
          491: {'neg': 0.055, 'neu': 0.704, 'pos': 0.241, 'compound': 0.9287},
          492: {'neg': 0.0, 'neu': 0.717, 'pos': 0.283, 'compound': 0.9367},
          493: {'neg': 0.056, 'neu': 0.855, 'pos': 0.089, 'compound': 0.5976},
          494: {'neg': 0.1, 'neu': 0.645, 'pos': 0.254, 'compound': 0.6486},
          495: {'neg': 0.0, 'neu': 0.788, 'pos': 0.212, 'compound': 0.9743},
          496: {'neg': 0.0, 'neu': 0.554, 'pos': 0.446, 'compound': 0.9725},
          497: {'neg': 0.059, 'neu': 0.799, 'pos': 0.142, 'compound': 0.7833},
          498: {'neg': 0.025, 'neu': 0.762, 'pos': 0.212, 'compound': 0.9848},
          499: {'neg': 0.041, 'neu': 0.904, 'pos': 0.055, 'compound': 0.128},
          500: {'neg': 0.0, 'neu': 0.678, 'pos': 0.322, 'compound': 0.9811}}
```

In [16]:

```
vaders = pd.DataFrame(res).T
vaders = vaders.reset_index().rename(columns={'index': 'Id'})
vaders = vaders.merge(df, how='left')
```

In [17]:

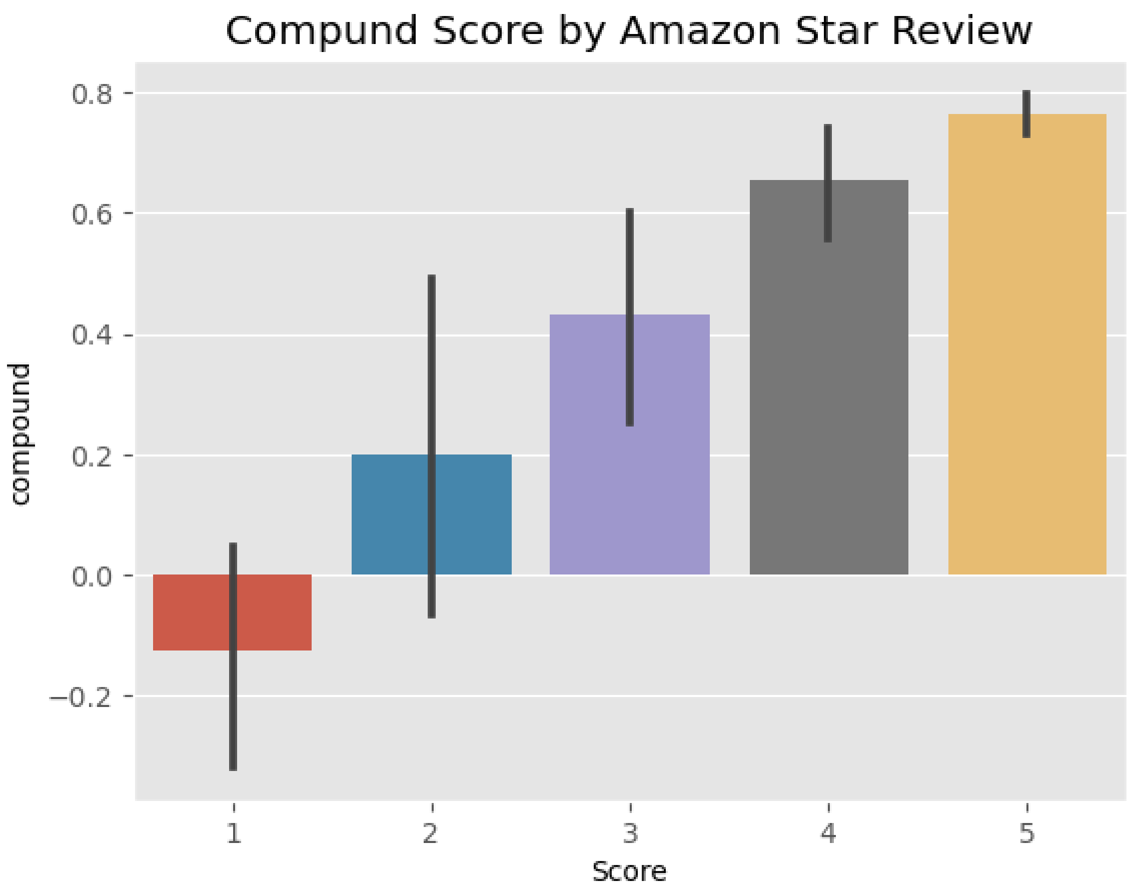
```
vaders.head()
```

Out[17]:

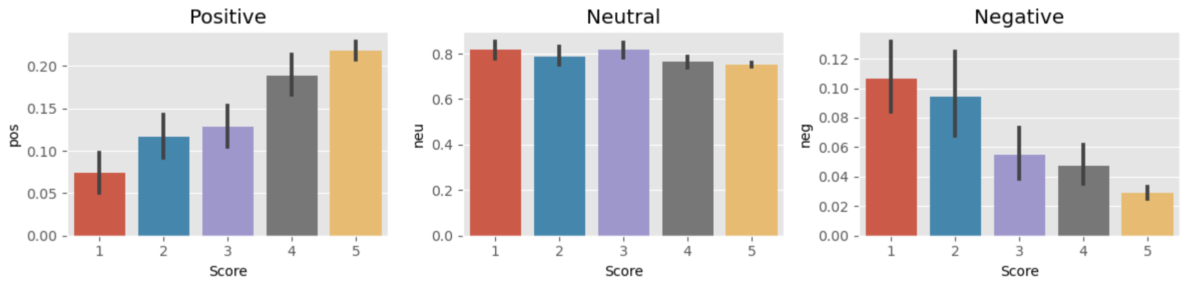
	Id	neg	neu	pos	compound	ProductId	UserId	ProfileName	Helpfulness
0	1	0.000	0.695	0.305	0.9441	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	
1	2	0.138	0.862	0.000	-0.5664	B00813GRG4	A1D87F6ZCVE5NK	dll pa	
2	3	0.091	0.754	0.155	0.8265	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	
3	4	0.000	1.000	0.000	0.0000	B000UA0QIQ	A395BORC6FGVXV	Karl	
4	5	0.000	0.552	0.448	0.9468	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	

In [18]:

```
ax = sns.barplot(data=vaders, x='Score', y='compound')
ax.set_title('Compund Score by Amazon Star Review')
plt.show()
```



In [19]:
```
fig, axs = plt.subplots(1, 3, figsize=(12, 3))
sns.barplot(data=vaders, x='Score', y='pos', ax=axs[0])
sns.barplot(data=vaders, x='Score', y='neu', ax=axs[1])
sns.barplot(data=vaders, x='Score', y='neg', ax=axs[2])
axs[0].set_title('Positive')
axs[1].set_title('Neutral')
axs[2].set_title('Negative')
plt.tight_layout()
plt.show()
```



In [20]:
```
from transformers import AutoTokenizer
from transformers import AutoModelForSequenceClassification
from scipy.special import softmax
```

In [21]:
```
MODEL = f"cardiffnlp/twitter-roberta-base-sentiment"
tokenizer = AutoTokenizer.from_pretrained(MODEL)
model = AutoModelForSequenceClassification.from_pretrained(MODEL)
```

```
Downloading:   0%|          | 0.00/747 [00:00<?, ?B/s]
```

```
C:\ProgramData\anaconda3\lib\site-packages\huggingface_hub\file_download.py:123: U
serWarning: `huggingface_hub` cache-system uses symlinks by default to efficiently
store duplicated files but your machine does not support them in C:\Users\Sumanth
\.cache\huggingface\hub. Caching files will still work but in a degraded version t
hat might require more space on your disk. This warning can be disabled by setting
the `HF_HUB_DISABLE_SYMLINKS_WARNING` environment variable. For more details, see
https://huggingface.co/docs/huggingface_hub/how-to-cache#limitations.
To support symlinks on Windows, you either need to activate Developer Mode or to r
un Python as an administrator. In order to see activate developer mode, see this a
rticle: https://docs.microsoft.com/en-us/windows/apps/get-started/enable-your-devi
ce-for-development
  warnings.warn(message)
Downloading:   0%|          | 0.00/899k [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/456k [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/150 [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/499M [00:00<?, ?B/s]
```

In [23]:

```python
# VADER results on example
print(eg)
sia.polarity_scores(eg)
```

```
This oatmeal is not good. Its mushy, soft, I don't like it. Quaker Oats is the way
to go.
```

Out[23]:

```
{'neg': 0.22, 'neu': 0.78, 'pos': 0.0, 'compound': -0.5448}
```

In [26]:

```python
# Run for Roberta Model
encoded_text = tokenizer(eg, return_tensors='pt')
output = model(**encoded_text)
scores = output[0][0].detach().numpy()
scores = softmax(scores)
scores_dict = {
    'roberta_neg' : scores[0],
    'roberta_neu' : scores[1],
    'roberta_pos' : scores[2]
}
print(scores_dict)
```

```
{'roberta_neg': 0.97635514, 'roberta_neu': 0.020687481, 'roberta_pos': 0.002957375
3}
```

In [27]:

```python
def polarity_scores_roberta(example):
    encoded_text = tokenizer(example, return_tensors='pt')
    output = model(**encoded_text)
    scores = output[0][0].detach().numpy()
    scores = softmax(scores)
    scores_dict = {
        'roberta_neg' : scores[0],
        'roberta_neu' : scores[1],
        'roberta_pos' : scores[2]
    }
    return scores_dict
```

In [28]:

```python
res = {}
for i, row in tqdm(df.iterrows(), total=len(df)):
    try:
        text = row['Text']
        myid = row['Id']
        vader_result = sia.polarity_scores(text)
        vader_result_rename = {}
        for key, value in vader_result.items():
            vader_result_rename[f"vader_{key}"] = value
        roberta_result = polarity_scores_roberta(text)
        both = {**vader_result_rename, **roberta_result}
        res[myid] = both
    except RuntimeError:
        print(f'Broke for id {myid}')
```

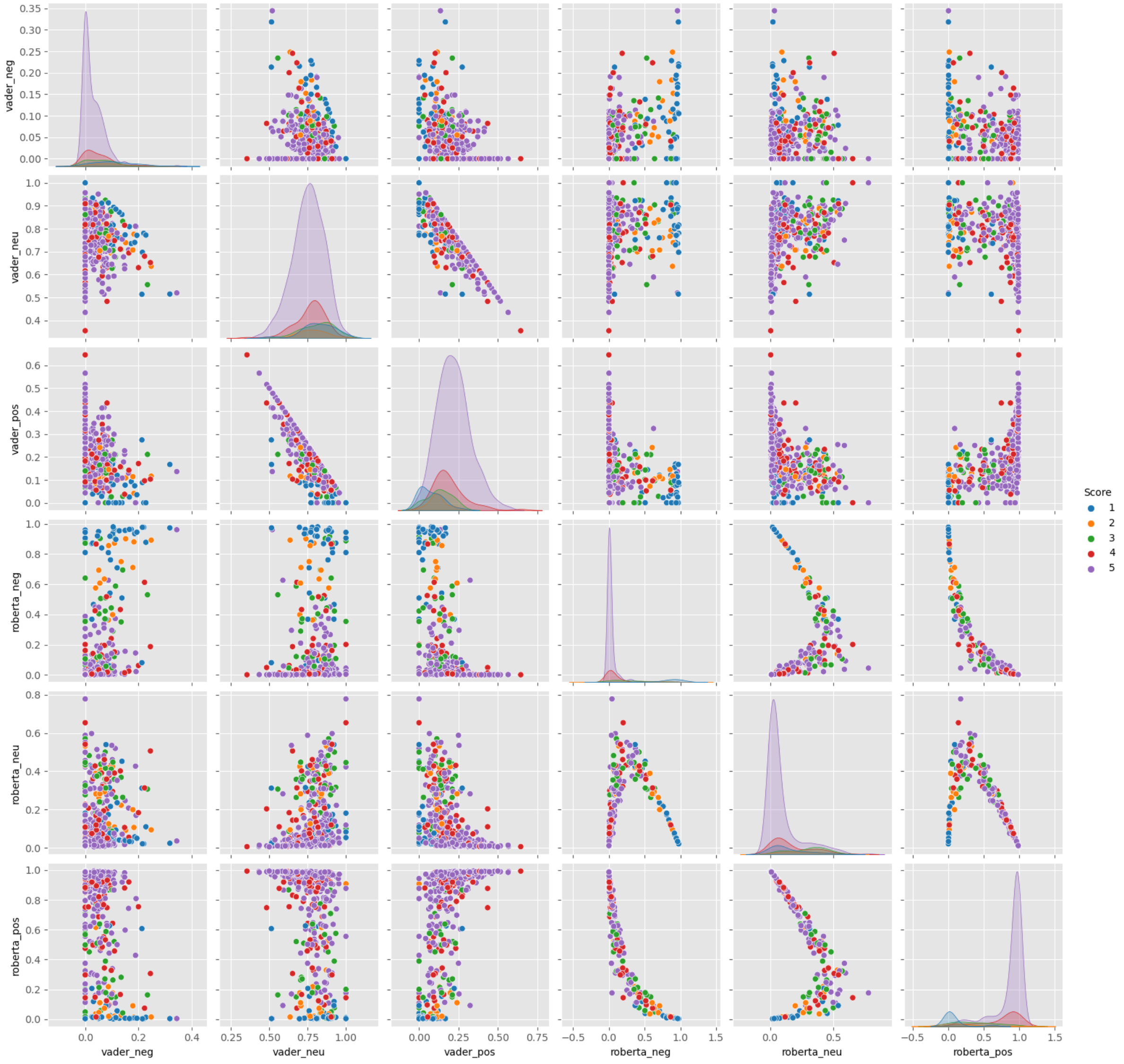
```
  0%|          | 0/500 [00:00<?, ?it/s]
Broke for id 83
Broke for id 187
```

In [29]:
```
results_df = pd.DataFrame(res).T
results_df = results_df.reset_index().rename(columns={'index': 'Id'})
results_df = results_df.merge(df, how='left')
```

In [31]:
```
#Compare scores between models
results_df.columns
```

Out[31]:
```
Index(['Id', 'vader_neg', 'vader_neu', 'vader_pos', 'vader_compound',
       'roberta_neg', 'roberta_neu', 'roberta_pos', 'ProductId', 'UserId',
       'ProfileName', 'HelpfulnessNumerator', 'HelpfulnessDenominator',
       'Score', 'Time', 'Summary', 'Text'],
      dtype='object')
```

In [32]:
```
#Combine and compare
sns.pairplot(data=results_df,
             vars=['vader_neg', 'vader_neu', 'vader_pos',
                   'roberta_neg', 'roberta_neu', 'roberta_pos'],
            hue='Score',
            palette='tab10')
plt.show()
```



In [33]:

```
#Review examples
results_df.query('Score == 1') \
    .sort_values('roberta_pos', ascending=False)['Text'].values[0]
```

Out[33]:

```
'I felt energized within five minutes, but it lasted for about 45 minutes. I paid
$3.99 for this drink. I could have just drunk a cup of coffee and saved my money.'
```

In [34]:

```
results_df.query('Score == 1') \
    .sort_values('vader_pos', ascending=False)['Text'].values[0]
```

Out[34]:

```
'So we cancelled the order.  It was cancelled without any problem.  That is a posi
tive note...'
```

In [35]:

```
# nevative sentiment 5-Star view
results_df.query('Score == 5') \
    .sort_values('roberta_neg', ascending=False)['Text'].values[0]
```

Out[35]:

```
'this was sooooo deliscious but too bad i ate em too fast and gained 2 pds! my fau
lt'
```

In [36]:

```
results_df.query('Score == 5') \
    .sort_values('vader_neg', ascending=False)['Text'].values[0]
```

Out[36]:

```
'this was sooooo deliscious but too bad i ate em too fast and gained 2 pds! my fau
lt'
```

In [37]:

```
#Extra: The Transformers Pipeline
from transformers import pipeline

sent_pipeline = pipeline("sentiment-analysis")
```

```
No model was supplied, defaulted to distilbert-base-uncased-finetuned-sst-2-englis
h and revision af0f99b (https://huggingface.co/distilbert-base-uncased-finetuned-s
st-2-english).
Using a pipeline without specifying a model name and revision in production is not
recommended.
Downloading:   0%|          | 0.00/629 [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/268M [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/48.0 [00:00<?, ?B/s]
Downloading:   0%|          | 0.00/232k [00:00<?, ?B/s]
```

In [38]:

```
sent_pipeline('I love sentiment analysis!')
```

Out[38]:

```
[{'label': 'POSITIVE', 'score': 0.9997853636741638}]
```

In [39]:

```
sent_pipeline('Hope you liked it!')
```

Out[39]:

```
[{'label': 'POSITIVE', 'score': 0.9997842907905579}]
```

In [41]:

```
sent_pipeline('booo')
```

Out[41]:

```
[{'label': 'NEGATIVE', 'score': 0.9936267137527466}]
```

In [ ]:

```
#THE END
```