

# Visualizations

March 19, 2022

## 1 Visualizations - HP Books

For word frequency, contextual diversity, and burstingness measures

### 1.1 1. Import Libraries and Load Data

```
[1]: import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import CountVectorizer
import os
import ast
import json
import math

import plotly
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
import cufflinks as cf
cf.go_offline()
cf.set_config_file(offline=False, world_readable=True)
```

```
[2]: def read_chapter(path):
    with open(path, "r", encoding="utf8") as current_file:
        text = current_file.read()
        text = text.replace("\n", " ").replace("\r", "")
    return text

hp_texts = pd.DataFrame(columns = ['Book No.', 'Chapter No.', 'Text', 'Word_
↵Count'])
book_dir = "./data/HP_book_texts/"

for i in range(1,8):
    filepath = book_dir + "HPBook" + str(i) + "/"
    chapters = sorted([f for f in os.listdir(filepath)])
    for c in range(len(chapters)):
        text = read_chapter(filepath+chapters[c])
        wc = len(text.split())
        hp_texts = hp_texts.append({'Book No.' : i,
                                    'Chapter No.' : c+1,
```

```
        'Text' : text,  
        'Word Count': wc},  
        ignore_index = True)  
hp_texts
```

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```
[2]:      Book No.  Chapter No.      Text \
0          1          1  THE BOY WHO LIVED      Mr. and Mrs. Dursley o...
1          1          2    THE VANISHING GLASS      Nearly ten years ...
2          1          3    THE LETTERS FROM NO ONE      The escape of...
3          1          4    THE KEEPER OF THE KEYS      BOOM. They kno...
```

4	1	5	DIAGON ALLEY	Harry woke early the nex...
..	...	...		...
193	7	32	THE ELDER WAND	The world had ended so...
194	7	33	THE PRINCES TALE	Harry remained kneel...
195	7	34	THE FOREST AGAIN	Finally the truth. L...
196	7	35	KINGS CROSS	He lay facedown listening...
197	7	36	THE FLAW IN THE PLAN	He was lying fac...

	Word Count
0	4723
1	3502
2	3921
3	3809
4	6713
..	...
193	5677
194	8460
195	3950
196	5098
197	8916

[198 rows x 4 columns]

```
[3]: word_count = []
for index, row in hp_texts.iterrows():
    chapter = list(filter(None, hp_texts.iloc[index][2].strip().split(" ")))
    word_count.append(len(chapter))

total_word_count = sum(word_count)
total_word_count
```

[3]: 1118639

```
[4]: measures_df = pd.read_csv(r'output/20220319_DomainWords_Measures.csv').
    ↪drop(columns="index")
measures_df
```

```
[4]:
```

	Word	Occurrences \
0	rat	{1: [(2, 1), (6, 5)], 2: [(3, 1), (5, 1), (8, ...
1	dog	{1: [(1, 1), (3, 1), (5, 2), (9, 4), (10, 3), ...
2	frog	{1: [(4, 1), (6, 2), (7, 1), (12, 2), (13, 2),...
3	monkey	{5: [(35, 1)], 6: [(10, 1)], 7: [(23, 1)]}
4	motorcycle	{1: [(1, 5), (2, 3)], 5: [(7, 1)], 7: [(4, 1),...
..	...	...
162	Harry	{1: [(1, 19), (2, 73), (3, 64), (4, 45), (5, 1...
163	Avis	{4: [(18, 1)]}
164	hexes	{4: [(20, 1), (26, 1), (29, 3), (31, 4)], 5: [...

```

165     jinxes  {3: [(11, 1), (12, 1)], 4: [(37, 1)], 5: [(5, ...
166     spider  {1: [(2, 1)], 2: [(9, 1), (15, 9)], 3: [(1, 1)]...

```

	Word Count By Book	Book of Acquisition	\
0	{1: 6, 2: 6, 3: 49, 4: 3, 5: 4}		1
1	{1: 22, 2: 4, 3: 41, 4: 20, 5: 18, 6: 4, 7: 2}		1
2	{1: 9, 2: 3, 3: 3, 4: 9, 5: 20, 6: 1, 7: 2}		1
3	{5: 1, 6: 1, 7: 1}		5
4	{1: 8, 5: 1, 7: 2}		1
..	...	...	
162	{1: 1213, 2: 1513, 3: 1868, 4: 2929, 5: 3731, ...		1
163	{4: 1}		4
164	{4: 9, 5: 5, 6: 5}		4
165	{3: 2, 4: 1, 5: 13, 6: 11, 7: 3}		3
166	{1: 1, 2: 10, 3: 5, 4: 30, 5: 2, 6: 9, 7: 9}		1

	WF	Lg10WF	Lg10WF (SUBTLEX)	CD	Lg10CD	\
0	6.078815e-05	-4.216181	3.2212	0.121212	-0.916454	
1	9.922772e-05	-4.003367	3.9928	0.242424	-0.615424	
2	4.201534e-05	-4.376592	2.7810	0.146465	-0.834267	
3	2.681830e-06	-5.571569	3.2330	0.015152	-1.819544	
4	9.833378e-06	-5.007297	2.6590	0.025253	-1.597695	
..	...	...	...	...	...	
162	1.498070e-02	-1.824468	3.6226	1.000000	0.000000	
163	8.939434e-07	-6.048690	1.2553	0.005051	-2.296665	
164	1.698493e-05	-4.769936	0.7782	0.070707	-1.150537	
165	2.681830e-05	-4.571569	0.7782	0.116162	-0.934937	
166	5.900027e-05	-4.229146	2.7126	0.095960	-1.017912	

	Burstingness	Lg10 Burstingness
0	11119.966667	4.046103
1	11430.118280	4.058051
2	25834.361111	4.412198
3	321452.000000	5.507116
4	106621.888889	5.027846
..	...	...
162	73.755200	1.867793
163	NaN	NaN
164	29811.611111	4.474385
165	32860.111111	4.516669
166	18688.413793	4.271572

[167 rows x 11 columns]

## 1.2 2. Word Frequency

```
[5]: def get_top_n_words(corpus, n=None):
    vec = CountVectorizer(stop_words = 'english').fit(corpus)
    bag_of_words = vec.transform(corpus)
    sum_words = bag_of_words.sum(axis=0)
    words_freq = [(word, sum_words[0, idx]) for word, idx in vec.vocabulary_.
    ↪items()]
    words_freq = sorted(words_freq, key = lambda x: x[1], reverse=True)
    return words_freq[:n]
```

### 1.2.1 2.1 Word Frequency for All Words (Unigram)

```
[6]: all_unigrams = get_top_n_words(hp_texts['Text'], 50)
au_counts_df = pd.DataFrame(all_unigrams, columns = ['Unigram' , 'count'])
au_counts_df.groupby('Unigram').sum()['count'].sort_values(ascending=False).
↪plot(
    color='red', kind='bar', yTitle='Count', linecolor='black', title='Top 50_
↪unigrams from all HP books (after removing stop words) - Word Count')
```

```
[7]: all_unigrams_wf = []
for i in range(len(all_unigrams)):
    word, count = all_unigrams[i][0], all_unigrams[i][1]
    wf = count/total_word_count
    lg10wf = math.log10(wf)
    all_unigrams_wf.append(tuple([word, wf, lg10wf]))

au_wf_df = pd.DataFrame(all_unigrams_wf, columns = ['Unigram' , 'WF',
↪'Lg10WF']).set_index('Unigram')
au_wf_df.plot(asFigure=True, kind='scatter', yTitle='Measure Score'
    ,title='Top 50 unigrams from all HP books (after removing stop_
↪words - WF vs Lg10WF)')
```

### 1.2.2 2.2 Word Frequency for Critical Words (Unigram)

```
[8]: critical_unigrams = []

for index, row in measures_df.iterrows():
    word, occurrence = row["Word"], ast.literal_eval(row["Word Count By Book"])
    count = sum(occurrence.values())
    critical_unigrams.append((word, count))
    critical_unigrams = sorted(critical_unigrams, key = lambda x: x[1],
    ↪reverse=True)[:50]
```

```
[9]: cu_counts_df = pd.DataFrame(critical_unigrams, columns = ['Unigram' , 'count'])
cu_counts_df.groupby('Unigram').sum()['count'].sort_values(ascending=False).
↪plot(
```

```

        color='red', kind='bar', yTitle='Count', linecolor='black', title='Top 50_
↳critical* unigrams from all HP books (after removing stop words) - Word_
↳Count')

```

```

[10]: critical_unigrams_wf = []
      for i in range(len(critical_unigrams)):
          word, count = critical_unigrams[i][0], critical_unigrams[i][1]
          wf = count/total_word_count
          lg10wf = math.log10(wf)
          critical_unigrams_wf.append(tuple([word, wf, lg10wf]))

      cu_wf_df = pd.DataFrame(critical_unigrams_wf, columns = ['Unigram' , 'WF',_
↳'Lg10WF']).set_index('Unigram')
      cu_wf_df.iplot(asFigure=True, kind='scatter',yTitle='Measure Score'
                    ,title='Top 50 *critical* unigrams from all HP_
↳books (after removing stop words) - WF vs Lg10WF')

```

### 1.2.3 2.3 Word Frequency for All Phrases (Bigram)

```

[11]: def get_top_ngram(corpus, ngram_range, n=None):
      vec = CountVectorizer(ngram_range=ngram_range, stop_words = 'english').
↳fit(corpus)
      bag_of_words = vec.transform(corpus)
      sum_words = bag_of_words.sum(axis=0)
      words_freq = [(word, sum_words[0, idx]) for word, idx in vec.vocabulary_.
↳items()]
      words_freq =sorted(words_freq, key = lambda x: x[1], reverse=True)
      return words_freq

```

```

[12]: all_bigrams = get_top_ngram(hp_texts['Text'], (2,2))[:50]
      ab_counts_df = pd.DataFrame(all_bigrams, columns = ['Bigram' , 'count'])
      ab_counts_df.groupby('Bigram').sum()['count'].sort_values(ascending=False).
↳iplot(
          color='red', kind='bar', yTitle='Count', linecolor='black', title='Top 50_
↳bigrams from all HP books (after removing stop words) - Word Count')

```

```

[13]: all_bigrams_wf = []
      for i in range(len(all_bigrams)):
          word, count = all_bigrams[i][0], all_bigrams[i][1]
          total_bigrams = total_word_count-1
          wf = count/total_bigrams
          lg10wf = math.log10(wf)
          all_bigrams_wf.append(tuple([word, wf, lg10wf]))

      ab_wf_df = pd.DataFrame(all_bigrams_wf, columns = ['Bigram' , 'WF', 'Lg10WF']).
↳set_index('Bigram')
      ab_wf_df.iplot(asFigure=True, kind='scatter', yTitle='Measure Score'

```

```
,title='Top 50 bigrams from all HP books (after_
↳removing stop words) - WF vs Lg10WF')
```

```
[14]: all_ngrams = get_top_ngram(hp_texts['Text'], (3,4))[:50]
an_counts_df = pd.DataFrame(all_ngrams, columns = ['n-gram' , 'count'])
an_counts_df.groupby('n-gram').sum()['count'].sort_values(ascending=False).
↳iplot(
    color='blue', kind='bar', yTitle='Count', linecolor='black', title='Top 50_
↳n-grams from all HP books (after removing stop words) - Word Count')
```

```
[16]: all_ngrams = get_top_ngram(hp_texts['Text'], (3,4))[50:200]
an_counts_df = pd.DataFrame(all_ngrams, columns = ['n-gram' , 'count'])
an_counts_df.groupby('n-gram').sum()['count'].sort_values(ascending=False).
↳iplot(
    color='green', kind='bar', yTitle='Count', linecolor='black', title='Next_
↳top 150 n-grams from all HP books (after removing stop words) - Word Count')
```

### 1.3 3. Contextual Diversity

#### 1.3.1 3.1 Contextual Diversity for All Words (Unigram)

- Backburner - might be more time consuming to accomplish

#### 1.3.2 3.2 Contextual Diversity for Critical Words (Unigram)

```
[17]: critical_unigrams_cd = []

for index, row in measures_df.iterrows():
    word, cd, lg10cd = row["Word"], row["CD"], row["Lg10CD"]
    critical_unigrams_cd.append(tuple([word, cd, lg10cd]))

critical_unigrams_cd =sorted(critical_unigrams_cd, key = lambda x: x[1],
↳reverse=True)[:50]
cu_cd_df = pd.DataFrame(critical_unigrams_cd, columns = ['Unigram' , 'CD',
↳'Lg10CD']).set_index('Unigram')
cu_cd_df.iplot(asFigure=True, kind='scatter',yTitle='Measure Score'
    ,title='Top 50 *critical* unigrams from all HP books (after_
↳removing stop words) - CD vs Lg10CD')
```

### 1.4 4. Burstingness

#### 1.4.1 4.1 Burstingness for All Words (Unigram)

- Backburner - might be more time consuming to accomplish

### 1.4.2 4.2 Burstingness for Critical Words (Unigram)

```
[19]: critical_unigrams_b = []

for index, row in measures_df.iterrows():
    word, b, lg10b = row["Word"], row["Burstingness"], row["Lg10 Burstingness"]
    if np.isnan(b)==False or np.isnan(lg10b)==False:
        critical_unigrams_b.append(tuple([word, b, lg10b]))

critical_unigrams_b = sorted(critical_unigrams_b, key = lambda x: x[1],
                             ↪reverse=True)[:50]
cu_b_df = pd.DataFrame(critical_unigrams_b, columns = ['Unigram' ,
               ↪'Burstingness', 'Lg10 Burstingness']).set_index('Unigram')
cu_b_df.iplot(asFigure=True, kind='scatter',yTitle='Measure Score'
              ,title='Top 50 *critical* unigrams from all HP books (after
               ↪removing stop words) - Burstingness vs Lg10 Burstingness')
```