OBJECTIVE:

1.APPLY AGLOMERATIVE CLUSTERING ON FINE FOOD REVIEWS DATASET

2.FORMING CLUSTERS WITH AVG WORD2VEC VECTORIZATION

3 TRYING WITH DIFFERENT VALUES OF CLUSTERS SUCH AS 3 , 5

4 GETTING THE WORDS IN THE CLUSTER AND REPRESENTING EACH CLUSTER WORDS

In [0]:
```
from sklearn.model_selection import train_test_split  #importing the ne
cessary libraries
from sklearn.model_selection import RandomizedSearchCV
from sklearn.datasets import *
from sklearn import naive_bayes
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
import numpy as np
import pandas as pd
from sklearn import *
import warnings
warnings.filterwarnings("ignore")
from gensim.models import Word2Vec
from tqdm import tqdm
```

In [3]:
```
from google.colab import drive
drive.mount('/content/gdrive')#geeting the content from the google driv
e
```

```
Drive already mounted at /content/gdrive; to attempt to forcibly remoun
t, call drive.mount("/content/gdrive", force_remount=True).
```

In [0]:
```
final_processed_data=pd.read_csv("gdrive/My Drive/final_new_data.csv")#
loading the preprocessed data  with 100k points into dataframe
```

In [0]:
```
data=final_processed_data.sample(3000)# taking sample data
```

In [6]:
```
print("shape of our new data is ",data.shape)#printing the shape
print("data is as follows:")
print(data.head())#printing
```

```
shape of our new data is  (3000, 2)
data is as follows:
       Score                                        CleanedText
45100      1  like rememb chocol marshmallow coconut also vi...
61371      1  stori peach flavor good tast littl pricey hard...
80033      1  sinc product agav plant safer choic need care ...
62090      1  bit worri review read amazon bonsai arriv pict...
71562      1  friend gave first flake year ago father brough...
```

In [7]:
```
list_of_sent=[]
for sent in data['CleanedText'] :
 list_of_sent.append(sent.split())#splitting of sentences into words AN
D appending them to list
print(list_of_sent[0])
word_to_vector=Word2Vec(list_of_sent,min_count=50,size=50,workers=3)#co
nstructing my our word to vector
w_t_c_words=list(word_to_vector.wv.vocab)
print("****************************************************************
*******")
print("sample words ", w_t_c_words[0:50])
```

```
['like', 'rememb', 'chocol', 'marshmallow', 'coconut', 'also', 'virtua
l', 'imposs', 'find', 'store', 'buy', 'wont', 'disappoint']
***********************************************************************
sample words  ['like', 'chocol', 'also', 'find', 'store', 'buy', 'won
t', 'disappoint', 'flavor', 'good', 'tast', 'littl', 'hard', 'come', 'c
ompani', 'dont', 'make', 'product', 'kind', 'diet', 'ice', 'tea', 'mi
x', 'think', 'look', 'either', 'noth', 'sinc', 'choic', 'need', 'care',
'sugar', 'wonder', 'realli', 'know', 'could', 'differ', 'regular', 'wat
er', 'consist', 'nice', 'use', 'syrup', 'sweet', 'sweeten', 'stuff', 'g
reat', 'bit', 'review', 'read']
```

```
In [8]: ###### NOW STARTING AVERAGE WORD TO VEC FOR TRAIN DATA#################
        ################################################
        train_sent_vectors = []; # the avg-w2v for each sentence/review is stor
        ed in this list
        for sent in tqdm(list_of_sent): # for each review/sentence
         sent_vec = np.zeros(50) # as word vectors are of zero length
         cnt_words =0; # num of words with a valid vector in the sentence/revie
        w
         for word in sent: # for each word in a review/sentence
           if word in w_t_c_words:
             vec = word_to_vector.wv[word]
             sent_vec += vec
             cnt_words += 1
         if cnt_words != 0:
          sent_vec /= cnt_words
         train_sent_vectors.append(sent_vec)
        print(len(train_sent_vectors))
        print(len(train_sent_vectors[0]))
```

```
100%|██████████| 3000/3000 [00:00<00:00, 3707.43it/s]
```

```
3000
50
```

APPLYING MODEL WITH N_CLUSTERS=3

```
In [9]: #APPLYING AGLOMERATIVE CLUSTERING WITH N_CLUSTERS AS 3
        %%time
        from sklearn.cluster import AgglomerativeClustering
        model=AgglomerativeClustering(n_clusters=3).fit(train_sent_vectors)
        clustering = model.labels_
        print (clustering)
```

```
[1 2 0 ... 0 1 0]
CPU times: user 547 ms, sys: 38.7 ms, total: 585 ms
Wall time: 595 ms
```

In [10]:
```
# here appending a new column clusters in our dataset to get cluster
data['Cluster'] = clustering
print(data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
1
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
0
62090      1  bit worri review read amazon bonsai arriv pict...
1
71562      1  friend gave first flake year ago father brough...
0
```

In [11]:
```
#creating a new dataframe new_data so that varoius operations could be
 performed on it wothout affecting ou original dataframe
new_data=data.copy()
print(new_data.head())
```

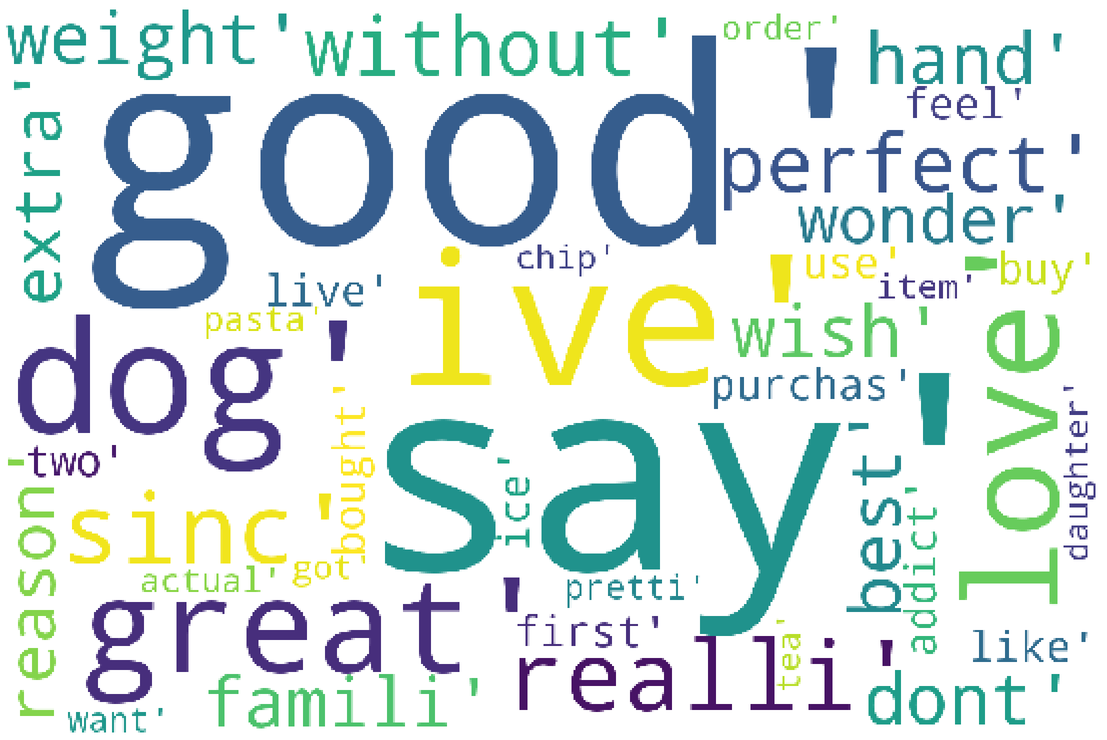
```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
1
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
0
62090      1  bit worri review read amazon bonsai arriv pict...
1
71562      1  friend gave first flake year ago father brough...
0
```

In [0]:
```
# here we are appending words to clusters from  word_to_vec words dicti
onary of words
i=0;
cluster_0=[]
```

```
cluster_1=[]
cluster_2=[]
for line in list_of_sent[:2999]:
    i=i+1;
    for each_word in line:
       for word in  w_t_c_words:
          if word==each_word:
            c=new_data['Cluster'][i:i+1].iloc[0]
            if c==0:
               cluster_0.append(word);
            if c==1:
               cluster_1.append(word);
            if c==2:
               cluster_2.append(word);
            break;
       break;
```

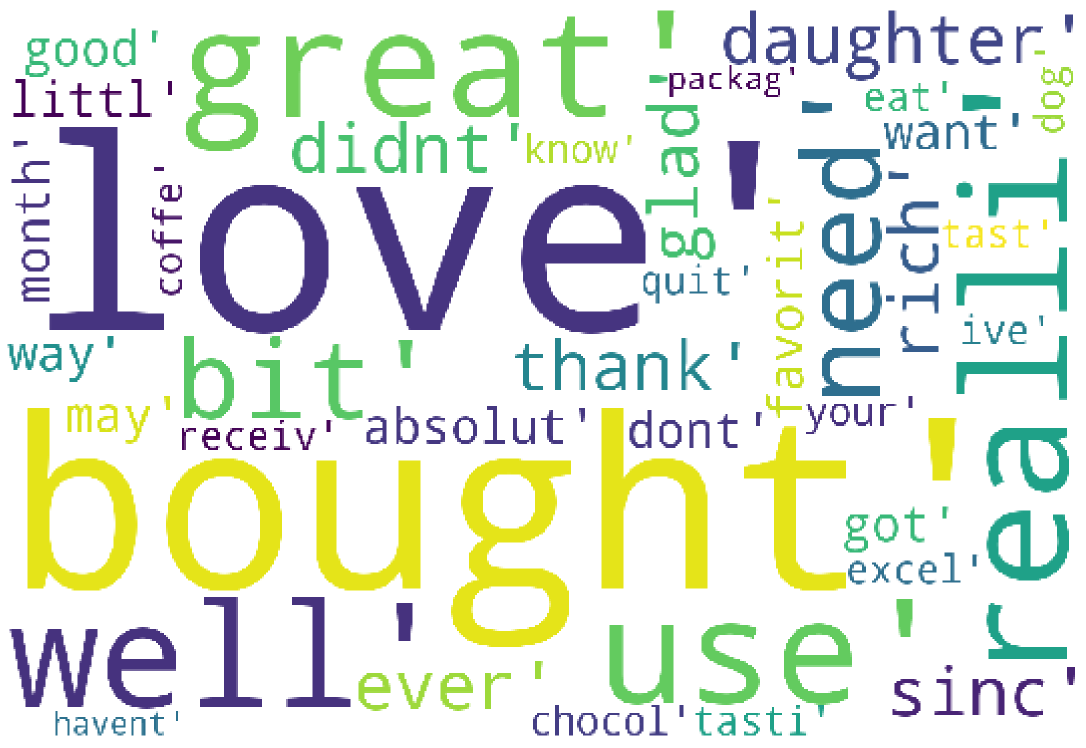
In [70]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_0[:50]))

# plot the WordCloud image
print("################################################################
######")
print("WORDS FOR CLUSTER 0 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

```
######################################################################
WORDS FOR CLUSTER 0 ARE:::
```



In [71]:
```python
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_1[:50]))

# plot the WordCloud image
print("######################################################################
######")
print("WORDS FOR CLUSTER 1 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

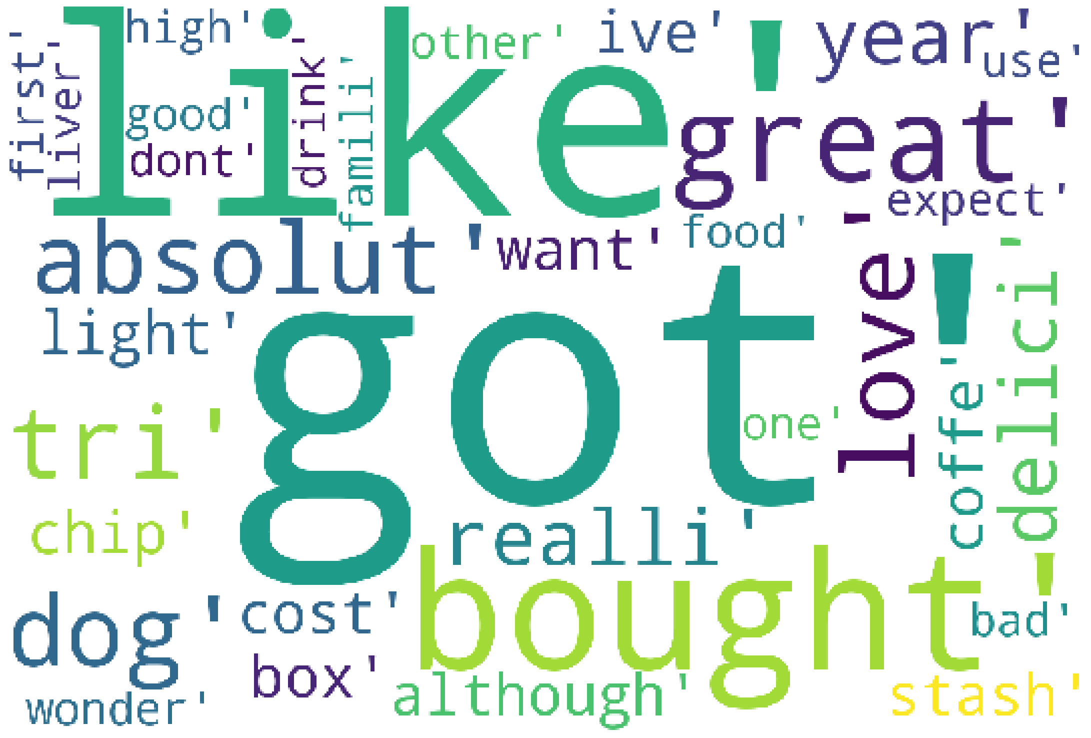
```
##############################################################################
WORDS FOR CLUSTER 1 ARE:::
```



```
In [72]: #here we are printing the top features using wordcloud library
         from wordcloud import WordCloud
         import matplotlib.pyplot as plt
         wordcloud = WordCloud(width = 1500, height = 1000,
                         background_color ='white',

                         min_font_size = 10).generate(str(cluster_2[:50]))
```

```
# plot the WordCloud image
print("################################################################
######")
print("WORDS FOR CLUSTER 2 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
print("################################################################
######")
```

```
######################################################################
WORDS FOR CLUSTER 2 ARE:::
```



```
######################################################################
```

APPLYING MODEL WITH N_CLUSTERS=5

In [54]:
```
from sklearn.cluster import AgglomerativeClustering
model=AgglomerativeClustering(n_clusters=5).fit(train_sent_vectors)
clustering = model.labels_
print (clustering)
```

```
[4 2 3 ... 1 4 3]
```

In [55]:
```
data['Cluster'] = clustering
print(data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
4
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
3
62090      1  bit worri review read amazon bonsai arriv pict...
0
71562      1  friend gave first flake year ago father brough...
1
```

In [56]:
```
new_data=data.copy()
print(new_data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
4
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
```

```
3
62090       1  bit worri review read amazon bonsai arriv pict...
0
71562       1  friend gave first flake year ago father brough...
1
```

In [0]:
```
i=0;
cluster_0=[]
cluster_1=[]
cluster_2=[]
cluster_3=[]
cluster_4=[]
for line in list_of_sent[:2999]:
    i=i+1;
    for each_word in line:
       for word in  w_t_c_words:
          if word==each_word:
            c=new_data['Cluster'][i:i+1].iloc[0]
            if c==0:
               cluster_0.append(word);
            if c==1:
               cluster_1.append(word);
            if c==2:
               cluster_2.append(word);
            if c==3:
               cluster_3.append(word);
            if c==4:
               cluster_4.append(word);

            break;
       break;
```

In [60]:
```
print(' total words in cluster 0 are ',len(cluster_0))
print(' total words in cluster 1 are ',len(cluster_1))
print(' total words in cluster 2 are ',len(cluster_2))
print(' total words in cluster 3 are ',len(cluster_3))
print(' total words in cluster 4 are ',len(cluster_4))
```

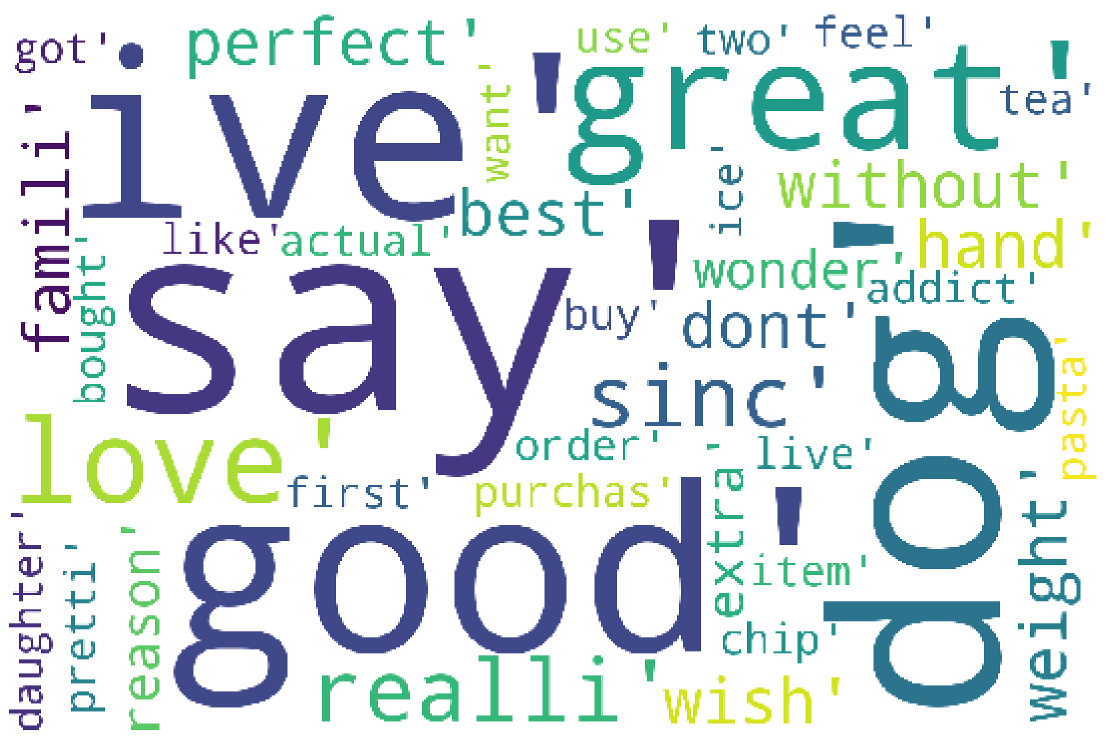
```
 total words in cluster 0 are  274
```

```
total words in cluster 1 are  670
total words in cluster 2 are  367
total words in cluster 3 are  377
total words in cluster 4 are  529
```

In [74]:

```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_0[:50]))

# plot the WordCloud image
print("########################################################################
######")
print("WORDS FOR CLUSTER 0 ARE:::")

plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
print("########################################################################
######")
```

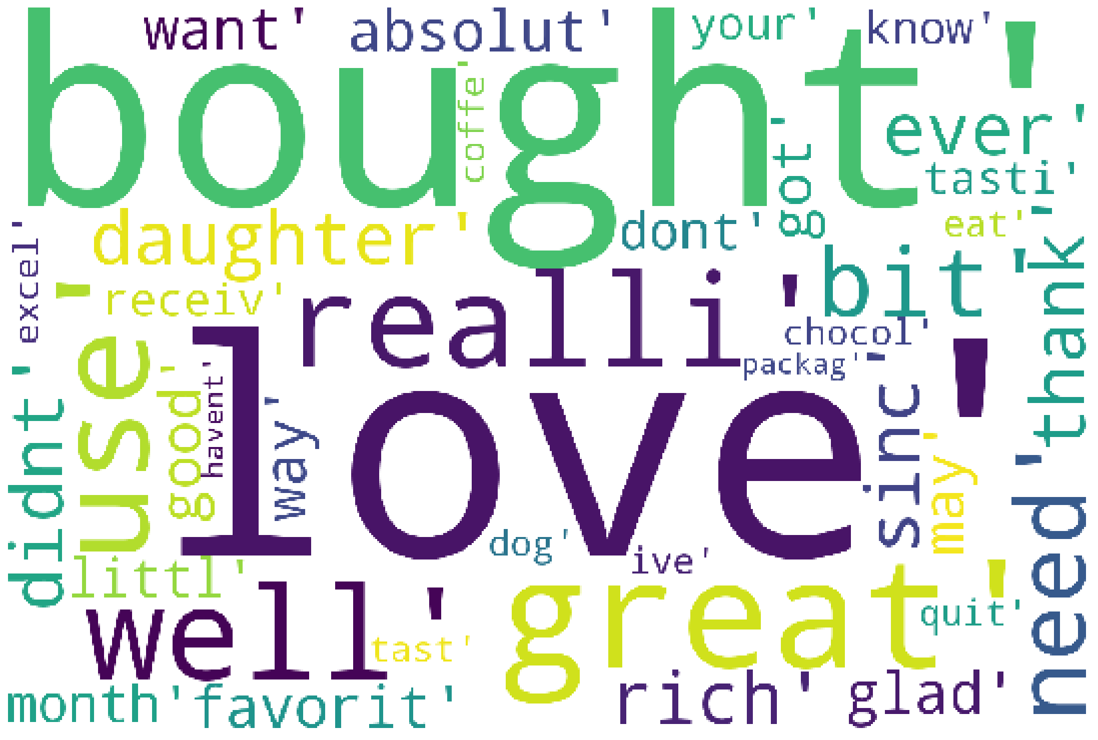
```
######################################################################
WORDS FOR CLUSTER 0 ARE:::
```



```
########################################################################
```

In [73]:
```python
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_1[:50]))

# plot the WordCloud image
print("##################################################################
######")
print("WORDS FOR CLUSTER 1 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
print("######################################################################
######")
```

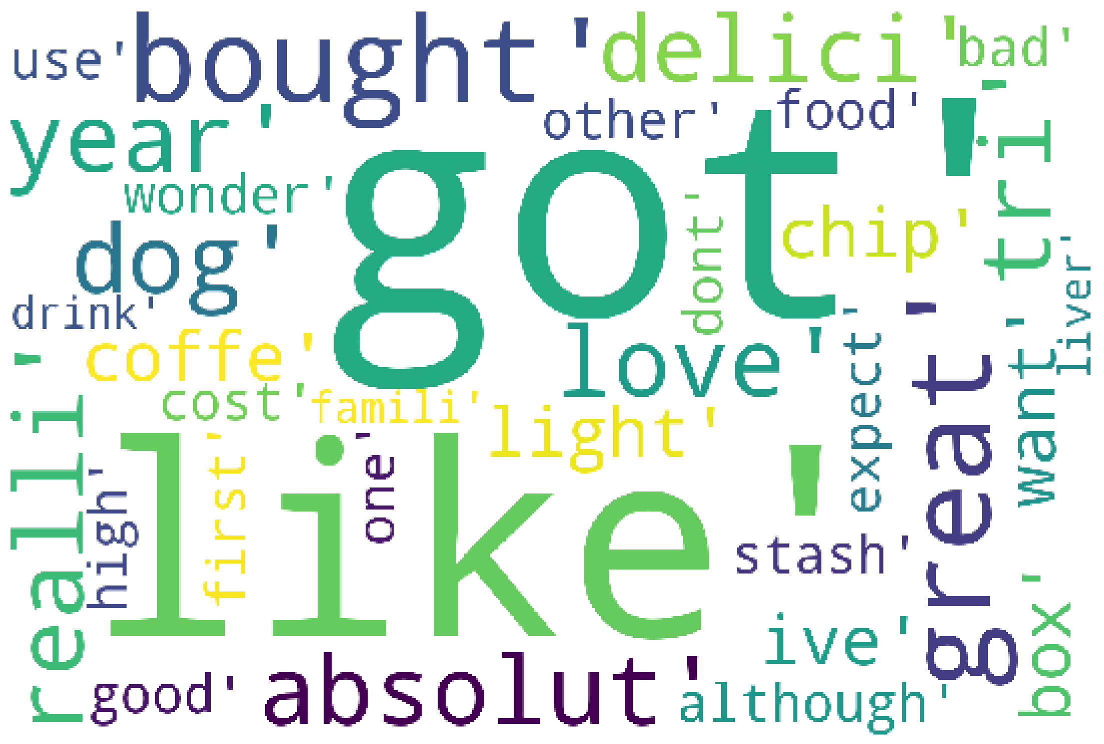
```
######################################################################
WORDS FOR CLUSTER 1 ARE:::
```



```
######################################################################
```

In [69]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_2[:50]))

# plot the WordCloud image
print("#################################################################
######")
print("WORDS FOR CLUSTER 2 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
print("#################################################################
######")
```

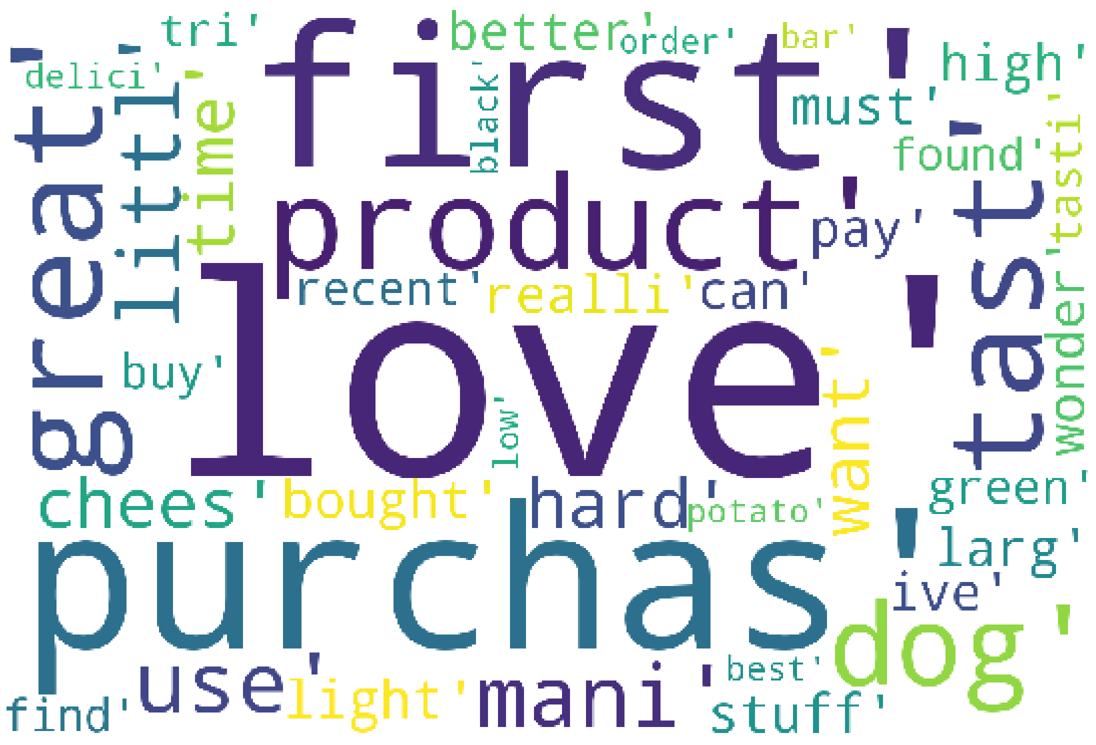
```
######################################################################
WORDS FOR CLUSTER 2 ARE:::
```



```
##########################################################################
```

In [68]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_3[:50]))

# plot the WordCloud image
print("########################################################################
######")
print("WORDS FOR CLUSTER 3 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
print("######################################################################
######")
```

```
######################################################################
WORDS FOR CLUSTER 3 ARE:::
```

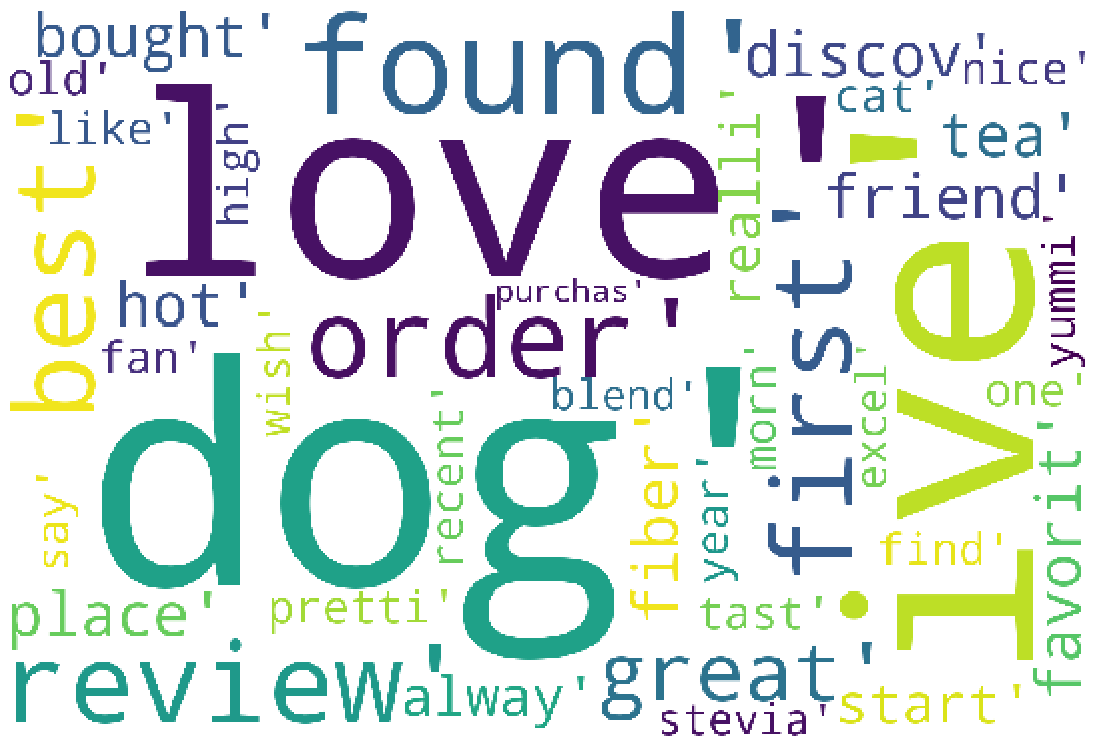


```
######################################################################
```

```
In [67]: from wordcloud import WordCloud #here we are printing the top features
          using wordcloud library
         import matplotlib.pyplot as plt
```

```
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_4[:50]))

# plot the WordCloud image
print("#################################################################
######")
print("WORDS FOR CLUSTER 4 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
print("#################################################################
######")
```

```
######################################################################
WORDS FOR CLUSTER 4 ARE:::
```



##

OBJECTIVE:

1.APPLY AGLOMERATIVE CLUSTERING ON FINE FOOD REVIEWS DATASET

2.FORMING CLUSTERS WITH TDIDF WORD2VEC VECTORIZATION

3.GETTING THE WORDS IN THE CLUSTER AND REPRESENTING EACH CLUSTER WORDS USING WORDCLOUD

In [77]:
```
# Training my own Word2Vec model using your own text corpus
list_of_sent=[]
```

```
for sent in data['CleanedText']:
 list_of_sent.append(sent.split())#splitting of sentences into words AN
D appending them to list
print(list_of_sent[0])
word_to_vector=Word2Vec(list_of_sent,min_count=50,size=100,workers=2)#c
onstructing my our word to vector
w_t_c_words=list(word_to_vector.wv.vocab)
print("*****************************************************************
*******")
print("sample words ", w_t_c_words[0:20])
```

```
['like', 'rememb', 'chocol', 'marshmallow', 'coconut', 'also', 'virtua
l', 'imposs', 'find', 'store', 'buy', 'wont', 'disappoint']
*************************************************************************
sample words  ['like', 'chocol', 'also', 'find', 'store', 'buy', 'won
t', 'disappoint', 'flavor', 'good', 'tast', 'littl', 'hard', 'come', 'c
ompani', 'dont', 'make', 'product', 'kind', 'diet']
```

In [78]:

```
###### NOW STARTING TFIDF WORD TO VEC FOR TRAIN DATA##################
##############################################
#NOW STARTING TF-IDF WEIGHTED WORD-TO-VEC
model = TfidfVectorizer()
tf_idf_matrix = model.fit_transform(data['CleanedText'])
# we are converting a dictionary with word as a key, and the idf as a v
alue
dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
train_tfidf_sent_vectors =[]# the tfidf-w2v for each sentence/review is
 stored in this list

for sent in tqdm(list_of_sent): # for each review/sentence
  sent_vec = np.zeros(100) # as word vectors are of zero length
  weight_sum =0; # num of words with a valid vector in the sentence/rev
iew
  for word in sent: # for each word in a review/sentence
   if word in w_t_c_words:
     vec = word_to_vector.wv[word]
     tf_idf = dictionary[word]*(sent.count(word)/len(sent))# dictionary
[word] = idf value of word in whole courpus
     sent_vec += (vec * tf_idf)# sent.count(word) = tf valeus of word i
```

```
n this review
        weight_sum += tf_idf
    if weight_sum != 0:
      sent_vec /= weight_sum
      train_tfidf_sent_vectors.append(sent_vec)
```

```
100%|██████████| 3000/3000 [00:01<00:00, 2545.71it/s]
```

APPLYING MODEL WITH N_CLUSTERS=3

In [79]:
```
#APPLYING AGLOMERATIVE CLUSTERING WITH N_CLUSTERS AS 3
%%time
from sklearn.cluster import AgglomerativeClustering
model=AgglomerativeClustering(n_clusters=3).fit(train_tfidf_sent_vector
s)
clustering = model.labels_
print (clustering)
```

```
[0 2 2 ... 2 0 1]
CPU times: user 625 ms, sys: 11.8 ms, total: 637 ms
Wall time: 641 ms
```

In [80]:
```
# here appending a new column clusters in our dataset to get cluster
data['Cluster'] = clustering
print(data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
0
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
2
62090      1  bit worri review read amazon bonsai arriv pict...
0
71562      1  friend gave first flake year ago father brough...
2
```

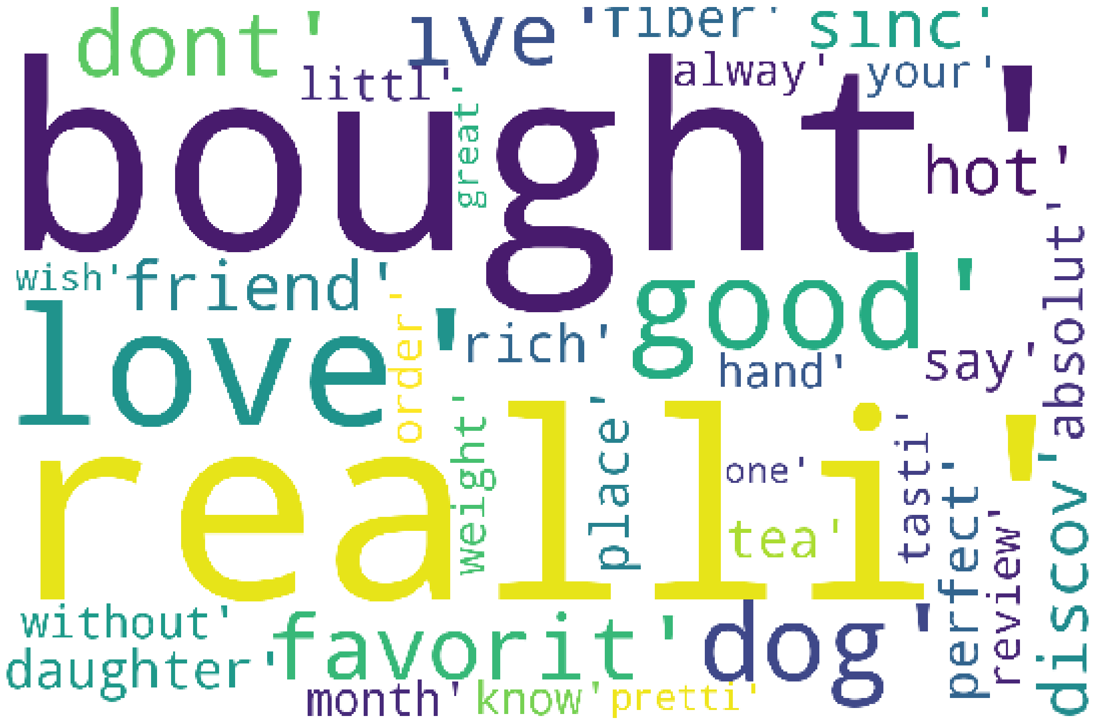
In [81]:
```
#creating a new dataframe new_data so that varoius operations could be
 performed on it wothout affecting ou original dataframe
new_data=data.copy()
print(new_data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
0
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
2
62090      1  bit worri review read amazon bonsai arriv pict...
0
71562      1  friend gave first flake year ago father brough...
2
```

In [0]:
```
# here we are appending words to each clusters through w_t_v_words
i=0;
cluster_0=[]
cluster_1=[]
cluster_2=[]
for line in list_of_sent[:2999]:
    i=i+1;
    for each_word in line:
       for word in  w_t_c_words:
          if word==each_word:
            c=new_data['Cluster'][i:i+1].iloc[0]
            if c==0:
               cluster_0.append(word);
            if c==1:
               cluster_1.append(word);
            if c==2:
               cluster_2.append(word);
            break;
       break;
```

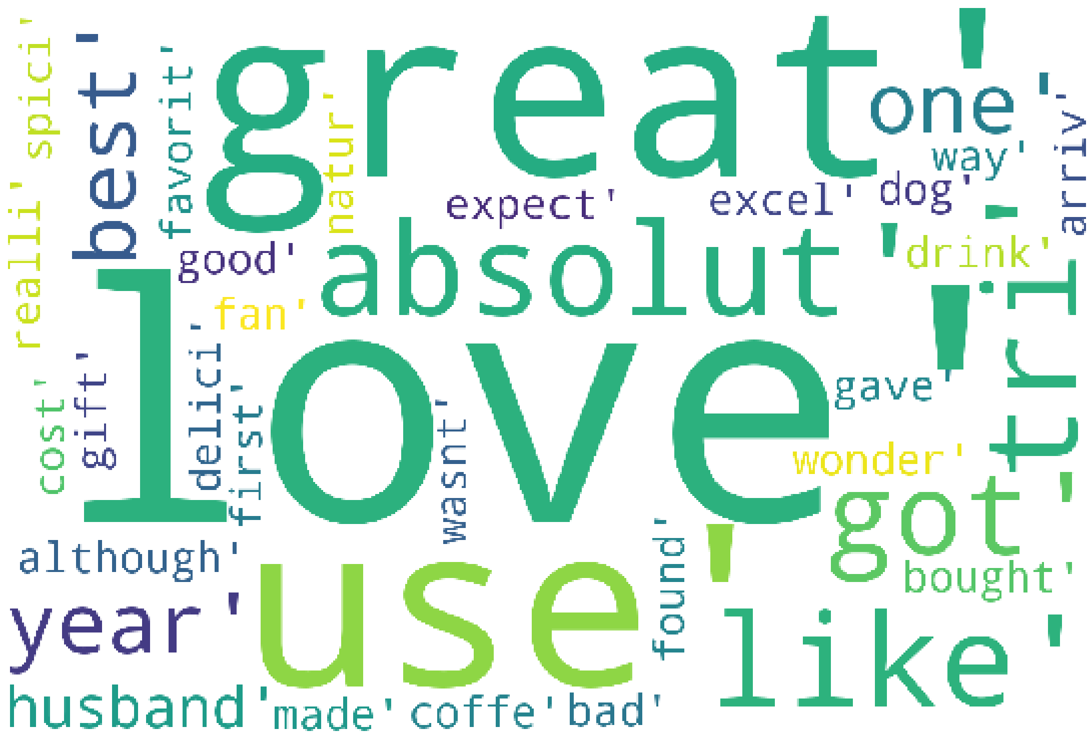
```
In [83]: from wordcloud import WordCloud #here we are printing the top features
          using wordcloud library
         import matplotlib.pyplot as plt
         wordcloud = WordCloud(width = 1500, height = 1000,
                         background_color ='white',

                         min_font_size = 10).generate(str(cluster_0[:50]))

         # plot the WordCloud image
         print("################################################################
         ######")
         print("WORDS FOR CLUSTER 0 ARE:::")
         plt.figure(figsize = (8, 8), facecolor = None)
         plt.imshow(wordcloud)
         plt.axis("off")
         plt.tight_layout(pad = 0)
         plt.show()
```

```
######################################################################
WORDS FOR CLUSTER 0 ARE:::
```



In [84]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_1[:50]))

# plot the WordCloud image
print("######################################################################
######")
print("WORDS FOR CLUSTER 0 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

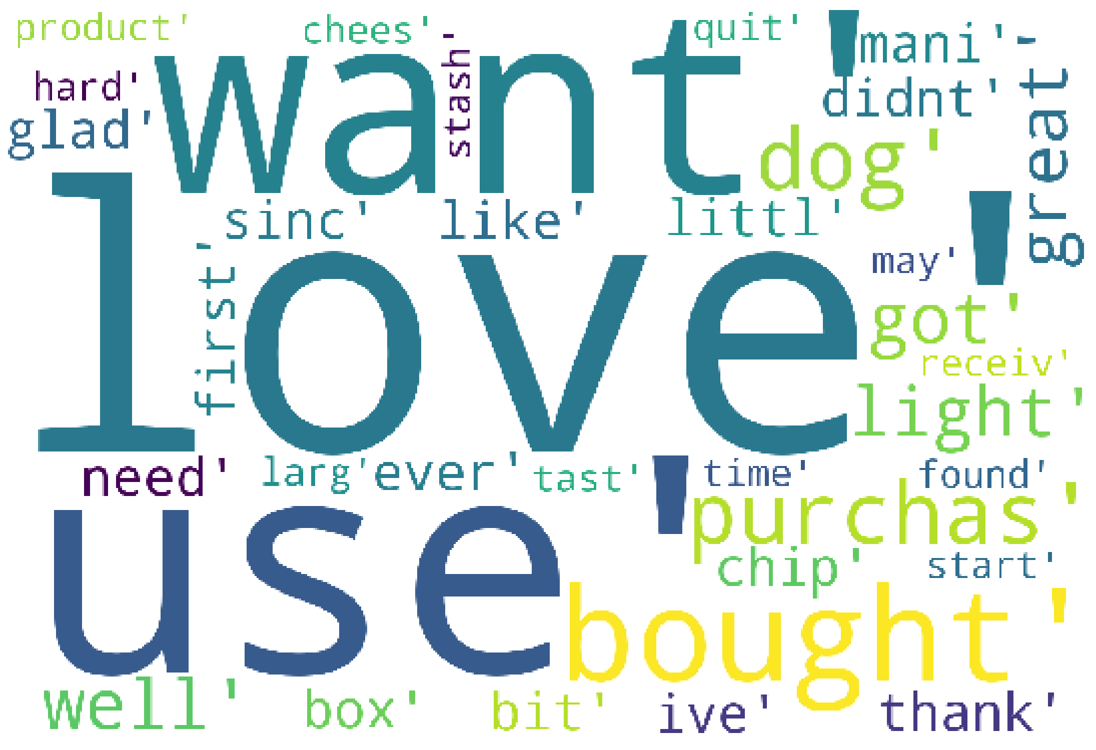
```
########################################################################
WORDS FOR CLUSTER 0 ARE:::
```



In [85]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_2[:50]))

# plot the WordCloud image
```

```
print("######################################################################")
print("WORDS FOR CLUSTER 0 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

```
######################################################################
WORDS FOR CLUSTER 0 ARE:::
```



APPLYING MODEL FOR 5 CLUSTERS

In [87]:
```
#APPLYING AGLOMERATIVE CLUSTERING WITH N_CLUSTERS AS 5
%%time
from sklearn.cluster import AgglomerativeClustering
model=AgglomerativeClustering(n_clusters=5).fit(train_tfidf_sent_vector
s)
clustering = model.labels_
print (clustering)
```

```
[3 2 2 ... 2 3 1]
```

In [88]:
```
data['Cluster'] = clustering
print(data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
3
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
2
62090      1  bit worri review read amazon bonsai arriv pict...
0
71562      1  friend gave first flake year ago father brough...
2
```

In [89]:
```
#creating a new dataframe new_data so that varoius operations could be
 performed on it wothout affecting ou original dataframe
new_data=data.copy()
print(new_data.head())
```

```
       Score                                        CleanedText  Cluste
r
45100      1  like rememb chocol marshmallow coconut also vi...
3
61371      1  stori peach flavor good tast littl pricey hard...
2
80033      1  sinc product agav plant safer choic need care ...
2
```

```
62090       1  bit worri review read amazon bonsai arriv pict...
0
71562       1  friend gave first flake year ago father brough...
2
```

In [0]:
```python
i=0;
cluster_0=[]
cluster_1=[]
cluster_2=[]
cluster_3=[]
cluster_4=[]
for line in list_of_sent[:2999]:
    i=i+1;
    for each_word in line:
       for word in  w_t_c_words:
          if word==each_word:
            c=new_data['Cluster'][i:i+1].iloc[0]
            if c==0:
               cluster_0.append(word);
            if c==1:
               cluster_1.append(word);
            if c==2:
               cluster_2.append(word);
            if c==3:
               cluster_3.append(word);
            if c==4:
               cluster_4.append(word);

            break;
       break;
```

In [91]:
```python
print(' total words in cluster 0 are ',len(cluster_0))
print(' total words in cluster 1 are ',len(cluster_1))
print(' total words in cluster 2 are ',len(cluster_2))
print(' total words in cluster 3 are ',len(cluster_3))
print(' total words in cluster 4 are ',len(cluster_4))
```

```
 total words in cluster 0 are  383
 total words in cluster 1 are  226
```

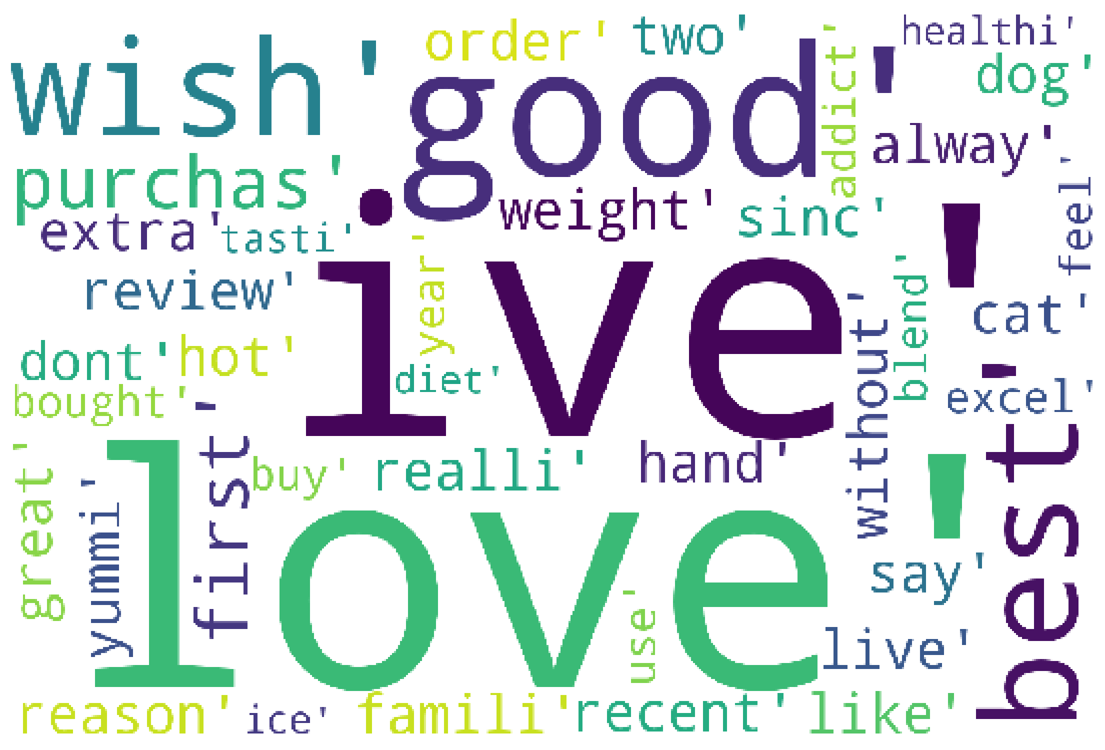
```
total words in cluster 2 are  917
total words in cluster 3 are  653
total words in cluster 4 are  38
```

REPRESENTING WORDS FOR DIFFERNET CLUSTERS

In [92]:

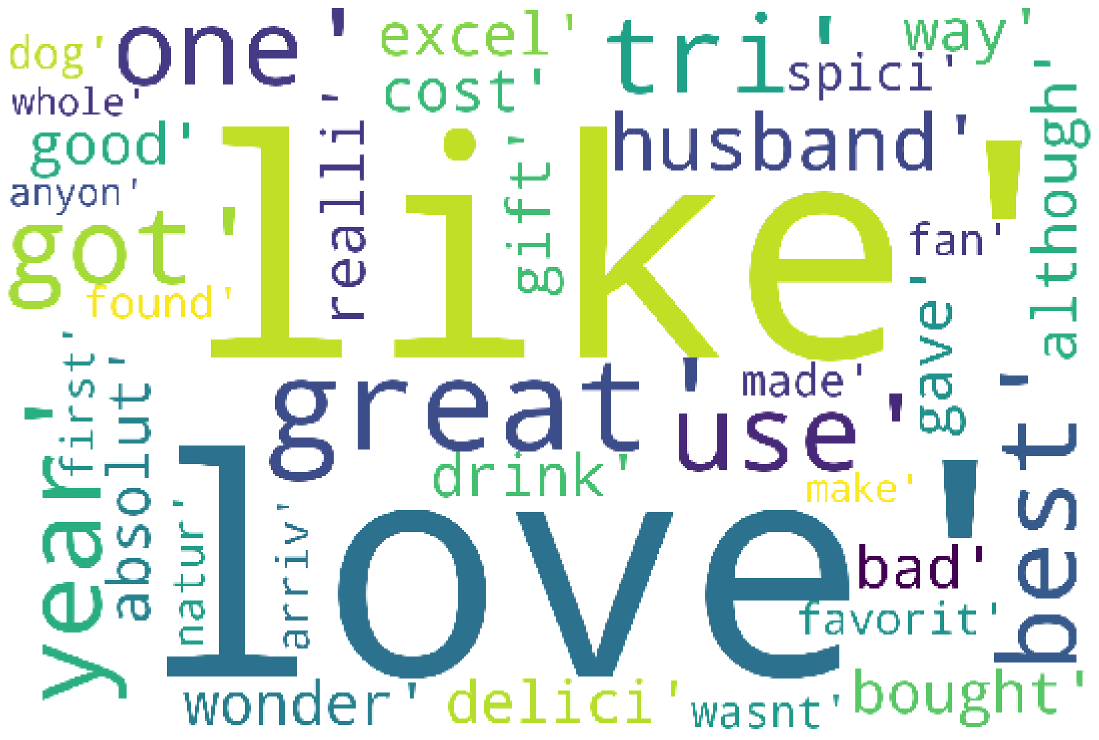
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_0[:50]))

# plot the WordCloud image
print("#######################################################################
######")
print("WORDS FOR CLUSTER 0 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

```
###############################################################################
WORDS FOR CLUSTER 0 ARE:::
```



In [93]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_1[:50]))

# plot the WordCloud image
print("######################################################################
######")
print("WORDS FOR CLUSTER 1 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

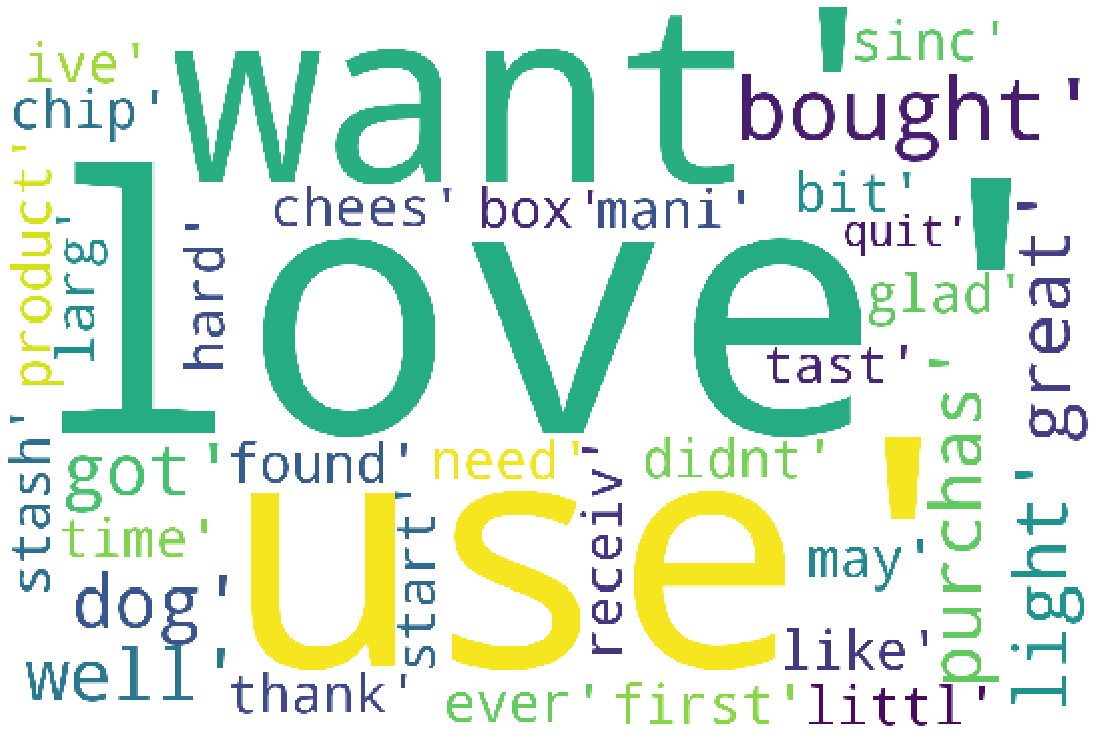
```
##########################################################################
WORDS FOR CLUSTER 1 ARE:::
```



```
In [97]: from wordcloud import WordCloud #here we are printing the top features
          using wordcloud library
         import matplotlib.pyplot as plt
         wordcloud = WordCloud(width = 1500, height = 1000,
                         background_color ='white',

                         min_font_size = 10).generate(str(cluster_2[:50]))

         # plot the WordCloud image
```

```
print("######################################################################
######")
print("WORDS FOR CLUSTER 2 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

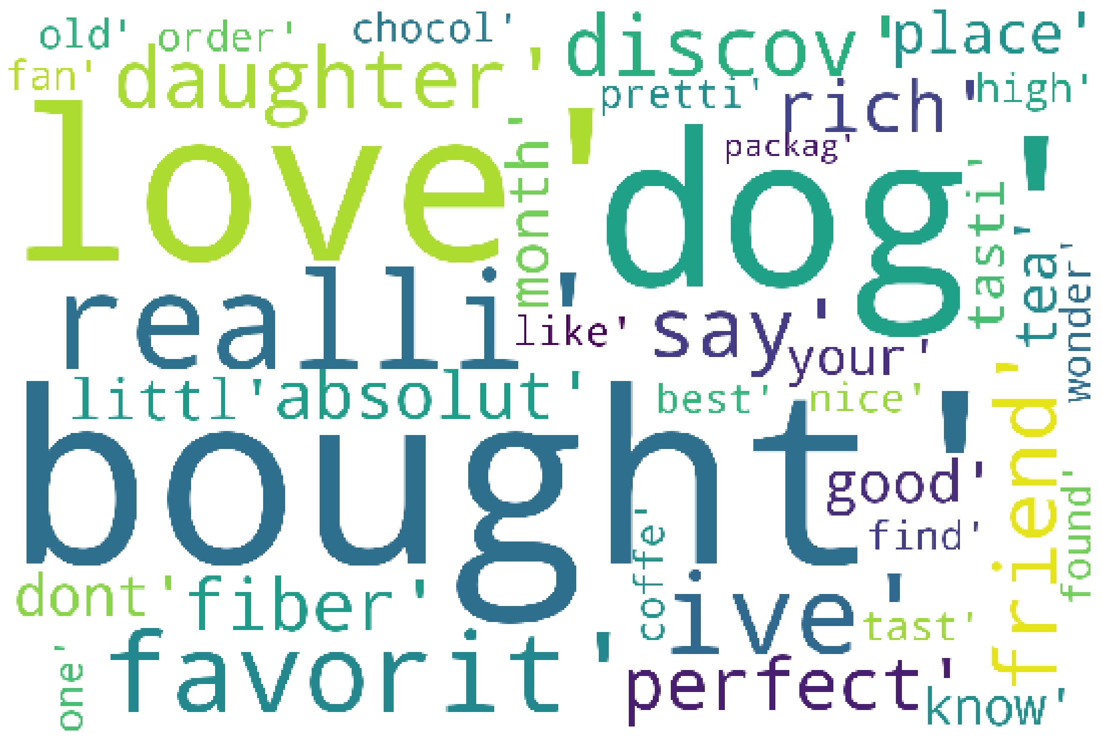
```
######################################################################
WORDS FOR CLUSTER 2 ARE:::
```



```
In [96]: from wordcloud import WordCloud #here we are printing the top features
          using wordcloud library
         import matplotlib.pyplot as plt
```

```
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_3[:50]))

# plot the WordCloud image
print("########################################################################")
print("WORDS FOR CLUSTER 3 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
plt.show()
```

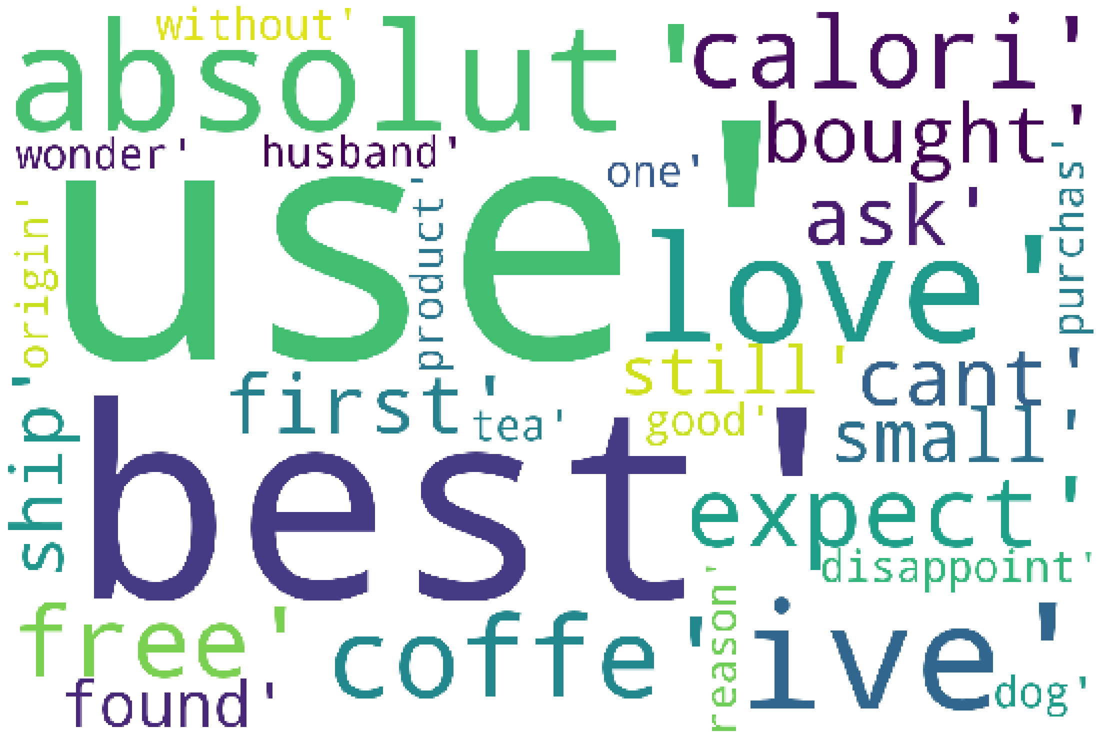
```
########################################################################
WORDS FOR CLUSTER 3 ARE:::
```



In [98]:
```
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster_4[:50]))

# plot the WordCloud image
print("#################################################################
######")
print("WORDS FOR CLUSTER 4 ARE:::")
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
```

```python
plt.tight_layout(pad = 0)
plt.show()
```

```
######################################################################
WORDS FOR CLUSTER 4 ARE:::
```



In [100]:
```python
print("##############################completed###########################################")
```

```
##############################completed###########################################
```

AGLOMERATIVE CLUSTERING IS FINISHED

FOR BOTH AVG WORD2VEC AND TFIDF WORD2VECTORIZATION