Market Segmentation

market segmentation is a marketing strategy in which select groups of consumers are identified so that certain products or product lines can be presented to them in a way that appeals to their interests

Need is to segment the customers which are more likely to each other.Dataset contains some of the characteristics of the customer and the food ordered by them

Problem

*Customer belongs to which group of customers

*Which variables are the most significant

Importing Libraries

In [1]:
```
import pandas as pd
import numpy as  np
import seaborn as sns
import matplotlib.pyplot as plt

```

Getting Data

In [2]:
```
df=pd.read_csv('mcdonalds.csv')
df.head()
```

Out[2]:

	yummy	convenient	spicy	fattening	greasy	fast	cheap	tasty	expensive	healthy	disgusting	Like	Age	VisitFrequency	Gender
0	No	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	-3	61	Every three months	Female
1	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	+2	51	Every three months	Female
2	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	+1	62	Every three months	Female
3	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	+4	69	Once a week	Female
4	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	No	+2	49	Once a month	Male

In [3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1453 entries, 0 to 1452
Data columns (total 15 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   yummy           1453 non-null   object
 1   convenient      1453 non-null   object
 2   spicy           1453 non-null   object
 3   fattening       1453 non-null   object
 4   greasy          1453 non-null   object
 5   fast            1453 non-null   object
 6   cheap           1453 non-null   object
 7   tasty           1453 non-null   object
 8   expensive       1453 non-null   object
 9   healthy         1453 non-null   object
 10  disgusting      1453 non-null   object
 11  Like            1453 non-null   object
 12  Age             1453 non-null   int64 
 13  VisitFrequency  1453 non-null   object
 14  Gender          1453 non-null   object
dtypes: int64(1), object(14)
memory usage: 170.4+ KB
```

In [4]:
```
#checking for missing values
df.isna().sum()
```

Out[4]:
```
yummy             0
convenient        0
spicy             0
fattening         0
greasy            0
fast              0
cheap             0
tasty             0
expensive         0
healthy           0
disgusting        0
Like              0
Age               0
VisitFrequency    0
Gender            0
dtype: int64
```

*There are no missing values

In [5]:
```
df.describe().T
```

Out[5]:

	count	mean	std	min	25%	50%	75%	max
Age	1453.0	44.604955	14.221178	18.0	33.0	45.0	57.0	71.0

*Mean of the age of customers is 45

*Min Age is 18 where as maximum is 71

In [6]:
```
df.describe(include=['O']).T
```

Out[6]:

	count	unique	top	freq
yummy	1453	2	Yes	803
convenient	1453	2	Yes	1319
spicy	1453	2	No	1317
fattening	1453	2	Yes	1260
greasy	1453	2	Yes	765
fast	1453	2	Yes	1308
cheap	1453	2	Yes	870
tasty	1453	2	Yes	936
expensive	1453	2	No	933
healthy	1453	2	No	1164
disgusting	1453	2	No	1100
Like	1453	11	+3	229
VisitFrequency	1453	6	Once a month	439
Gender	1453	2	Female	788

Data Processing

In [7]:

```
category = []
for i in df.columns:
  if df[i].dtype=='O':
    category.append(i)


for i in category:
  print('Distribution of',i)
  print(df[i].value_counts())
  print('-'*60)
```

```
Distribution of yummy
Yes    803
No     650
Name: yummy, dtype: int64
------------------------------------------------------------
Distribution of convenient
Yes    1319
No      134
Name: convenient, dtype: int64
------------------------------------------------------------
Distribution of spicy
No     1317
Yes     136
Name: spicy, dtype: int64
------------------------------------------------------------
Distribution of fattening
Yes    1260
No      193
Name: fattening, dtype: int64
------------------------------------------------------------
Distribution of greasy
Yes    765
No     688
Name: greasy, dtype: int64
------------------------------------------------------------
Distribution of fast
Yes    1308
No      145
Name: fast, dtype: int64
------------------------------------------------------------
Distribution of cheap
Yes    870
No     583
Name: cheap, dtype: int64
------------------------------------------------------------
Distribution of tasty
Yes    936
No     517
Name: tasty, dtype: int64
------------------------------------------------------------
Distribution of expensive
No     933
Yes    520
Name: expensive, dtype: int64
------------------------------------------------------------
Distribution of healthy
No     1164
Yes     289
Name: healthy, dtype: int64
------------------------------------------------------------
Distribution of disgusting
No     1100
Yes     353
Name: disgusting, dtype: int64
------------------------------------------------------------
Distribution of Like
+3              229
+2              187
0               169
+4              160
+1              152
I hate it!-5    152
I love it!+5    143
-3               73
-4               71
-2               59
-1               58
Name: Like, dtype: int64
------------------------------------------------------------
Distribution of VisitFrequency
Once a month             439
Every three months       342
Once a year              252
Once a week              235
Never                    131
More than once a week     54
Name: VisitFrequency, dtype: int64
------------------------------------------------------------
Distribution of Gender
Female    788
Male      665
Name: Gender, dtype: int64
------------------------------------------------------------
```

Observations

*Majority of the customers visits once a month

*+3 is given my most of the customers

*60% customers Found the food yummy

*Approx 90 percent doesn't found convinent and spicy

*Most of the customers found the service fast and cheap

*A few customers found the food disgusting

*Majority customers are Female customers

In [8]:
```
df['Age'].value_counts().sort_values()
```

Out[8]:
```
71     1
19    10
68    13
69    14
70    15
18    16
21    16
66    17
28    18
46    19
20    21
45    22
41    23
65    23
22    23
54    24
63    25
27    25
43    25
48    26
67    26
61    26
33    26
25    26
38    27
31    27
40    27
30    28
29    28
34    28
39    29
23    30
42    30
47    30
51    30
35    30
24    30
26    31
53    31
44    32
64    32
56    32
32    33
50    34
62    34
49    34
36    35
58    35
52    36
57    36
59    36
37    37
60    38
55    53
Name: Age, dtype: int64
```

In [9]:
```
## creating bins for the age

df['Agebin'] = pd.cut(df['Age'], bins = [17,25, 35, 49, 60, 75], labels = ['17-25','26-35', '36-49', '50-60', '61-75'])
```

In [10]:
```
df['Agebin'].value_counts()/len(df)*100
```

Out[10]:
```
36-49    27.253957
50-60    26.496903
26-35    18.857536
61-75    15.554026
17-25    11.837577
Name: Agebin, dtype: float64
```

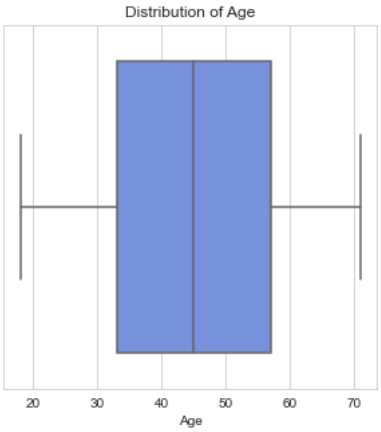
Observations

*More than 50% of the customers belongs to 36-50

*only 11% customers belongs to adult age

Data Visualization

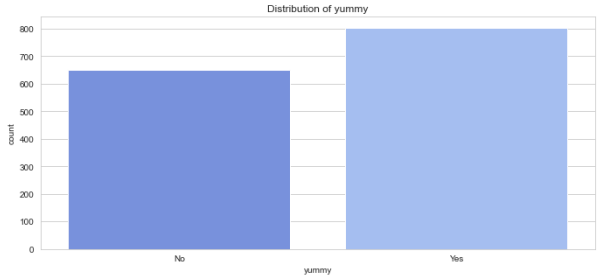
In [11]:
```
sns.set_style('whitegrid')
plt.figure(figsize=(5,5))
sns.set_palette('coolwarm')
sns.boxplot(x=df['Age'])
plt.title('Distribution of Age')
plt.show()
```

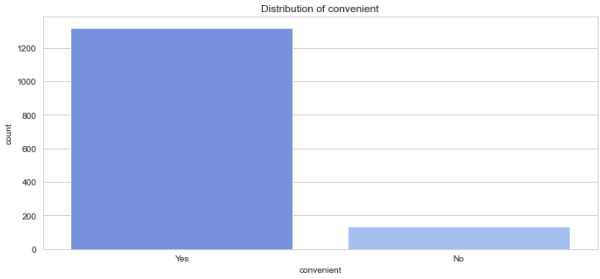


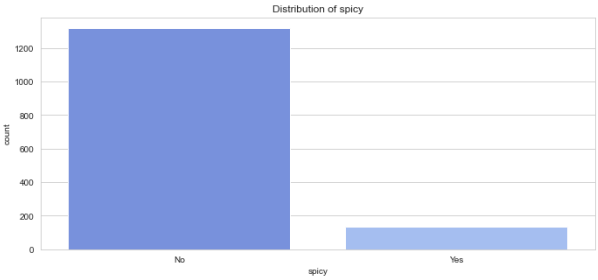
*There are no outliers in the Age

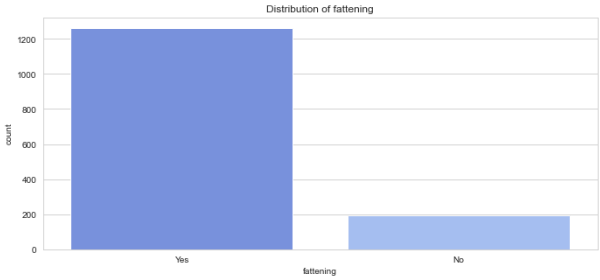
In [12]:

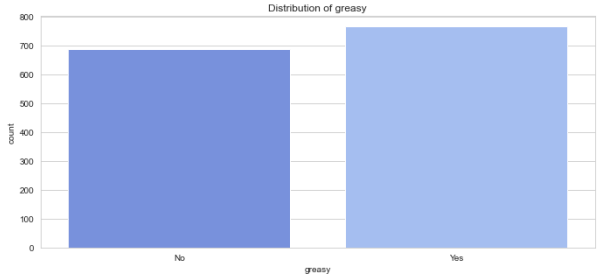
```
fig,([ax0,ax1],[ax2,ax3],[ax4,ax5],[ax6,ax7],[ax8,ax9],[ax10,ax11],[ax12,ax13]) = plt.subplots(ncols=2,nrows=7,figsize=(

ax = [ax0,ax1,ax2,ax3,ax4,ax5,ax6,ax7,ax8,ax9,ax10,ax11,ax12,ax13]
for i in range(0,14):
  sns.countplot(data=df,x=category[i],ax=ax[i])
  ax[i].set_title('Distribution of '+category[i])

plt.savefig('count.png')
```

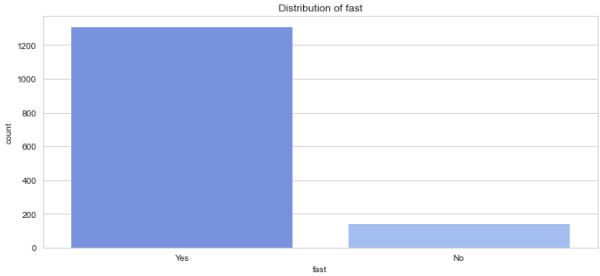


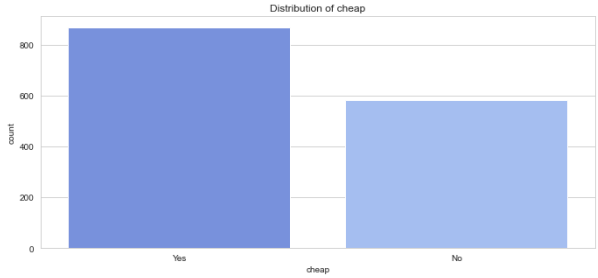


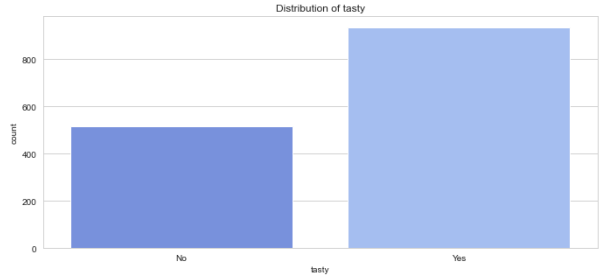


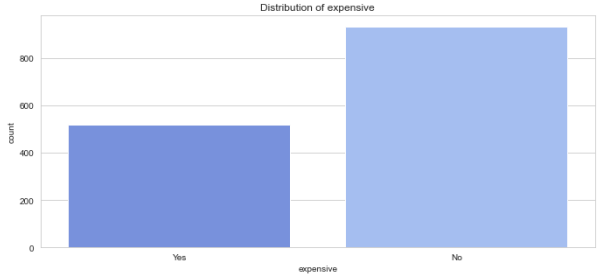


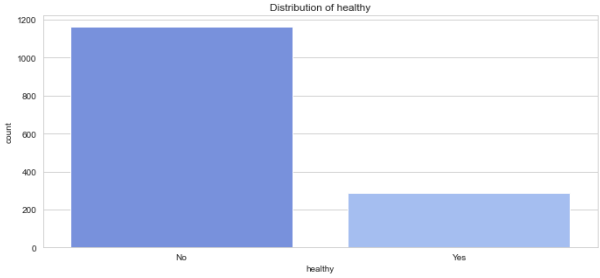


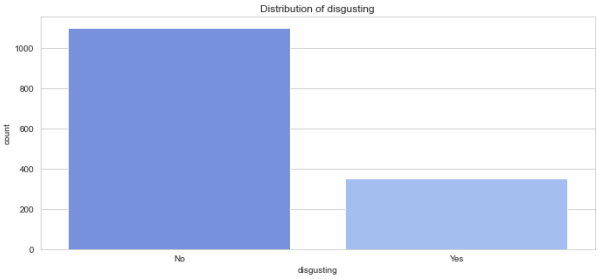


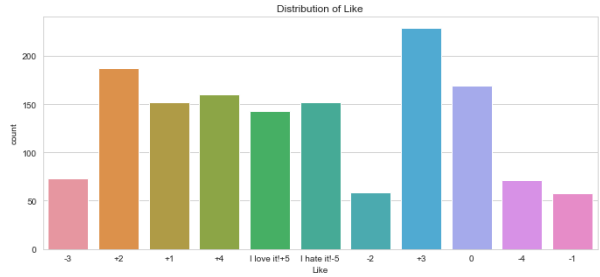


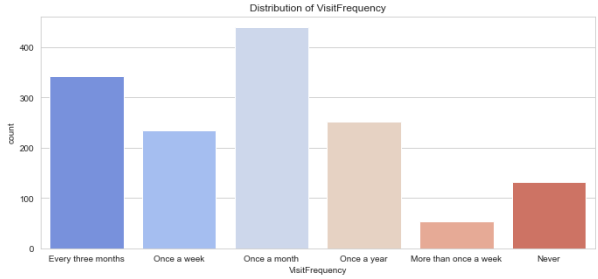


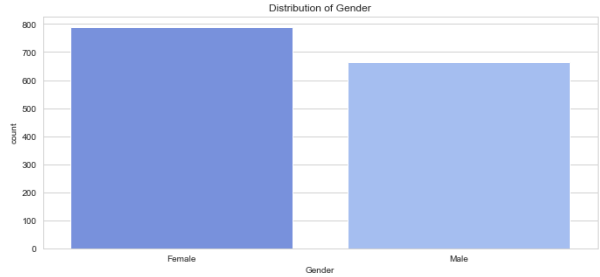












Observations

*There are many customers who have never visited once

*Majority of the customers visits once a month

*+3 and +2 is given by approx 30 percent the customers

*60% customers Found the food yummy

*Approx 90 percent doesn't found convinent and spicy

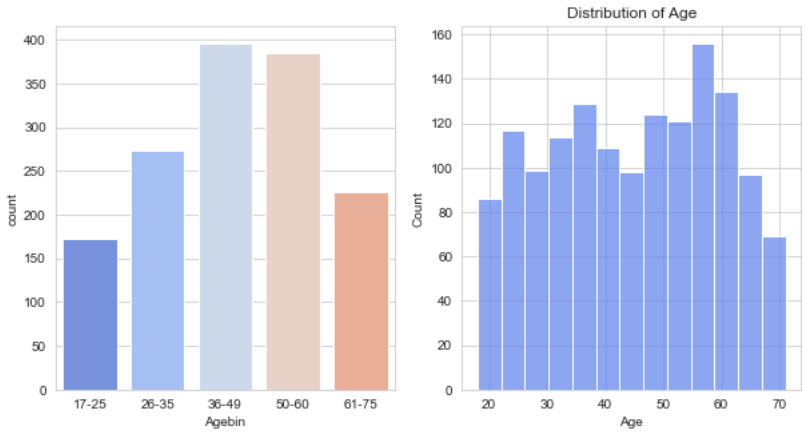
*Most of the customers found the service fast and cheap

*A few customers found the food disgusting

*Majority customers are Female customers

*A big group of customers said the food is fatty

In [13]:
```
fig,[ax0,ax1] = plt.subplots(nrows=1,ncols=2,figsize=(10,5))
sns.countplot(x=df['Agebin'],ax=ax0)
sns.histplot(x=df['Age'],ax=ax1)
plt.title('Distribution of Age')
plt.savefig('count1.png')
plt.show()
```



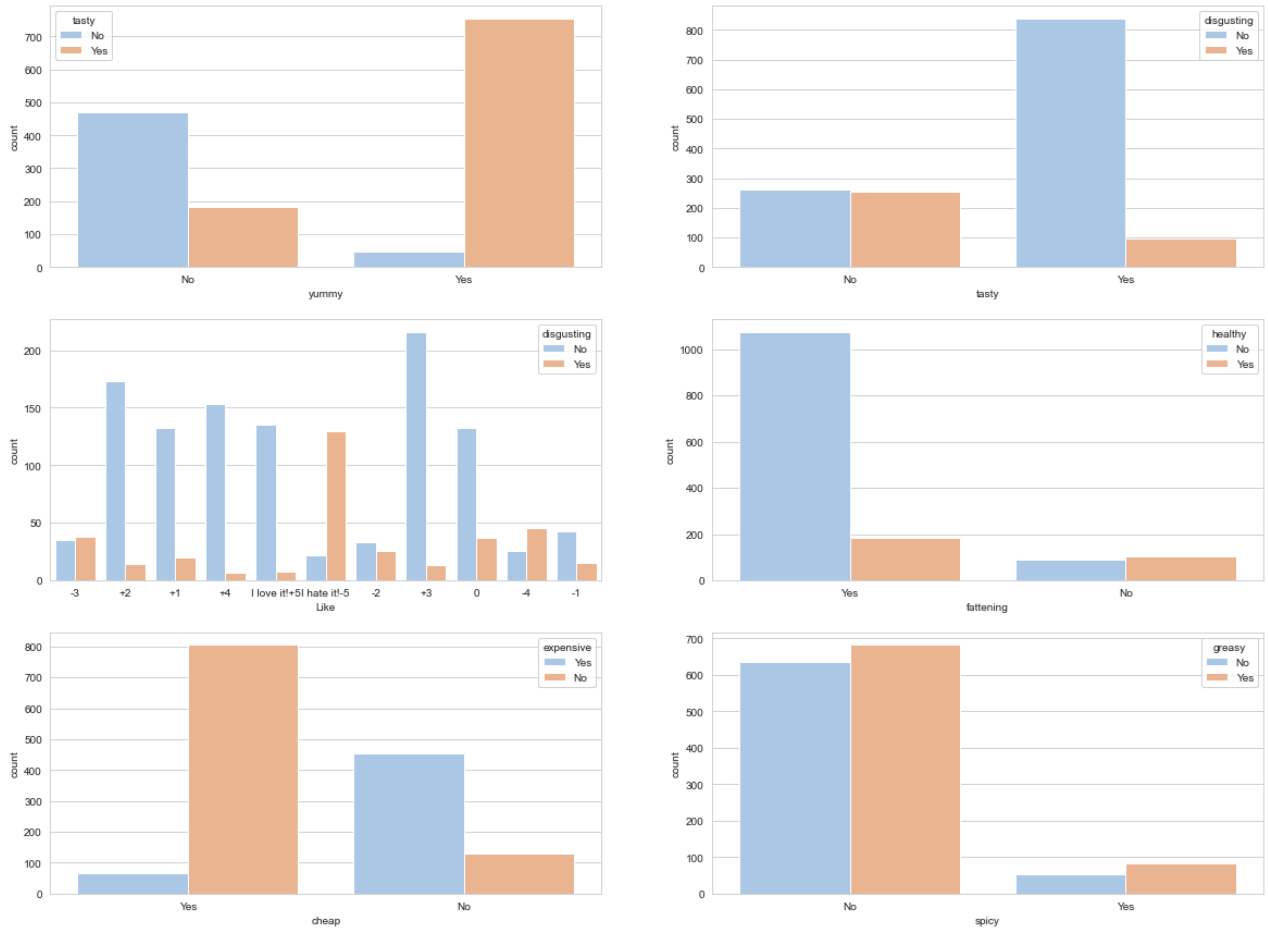
Observations

*Majority of the customers aged between 36-49

*Distribution of age is quite a normal

*Atleast 10 percent of the customers belongs to each of the age group

In [14]:
```
sns.set_palette('pastel')
fig,([ax0,ax1],[ax2,ax3],[ax4,ax5]) = plt.subplots(nrows=3,ncols=2,figsize=(20,15))
sns.countplot(x=df['yummy'],hue=df['tasty'],ax=ax0)
sns.countplot(x=df['tasty'],hue=df['disgusting'],ax=ax1)
sns.countplot(hue=df['disgusting'],x=df['Like'],ax=ax2)
sns.countplot(x=df['fattening'],hue=df['healthy'],ax=ax3)
sns.countplot(x=df['cheap'],hue=df['expensive'],ax=ax4)
sns.countplot(x=df['spicy'],hue=df['greasy'],ax=ax5)
plt.savefig('count2.png')
plt.show()
```



Observations

*From the plot it can be seen data have alot of discrepencies

*yummy and tasty are a kind of same can remove either of one

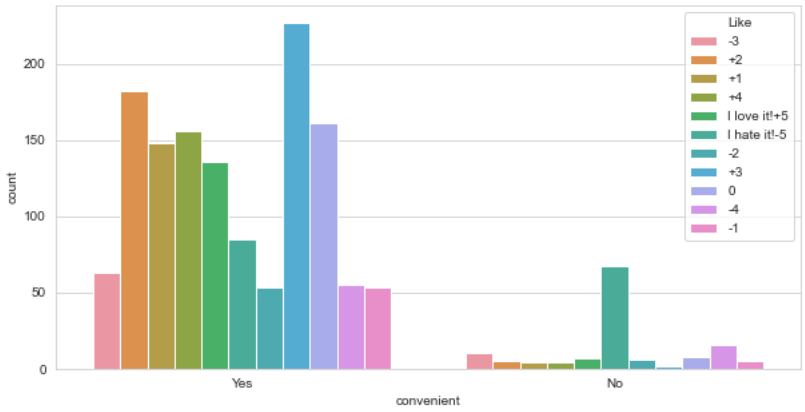
*Some of the customers rate the food tasty as well as disgusting and vice-versa, needs to check the data

*same error can be seen in cheap,expensive,disgusting,Likes,fattening,healthy

*spicy and grease are highly correlated, can remove either of them

*Needs to check the data for discrepency and if needs to remove the values than we'll

In [15]:
```
sns.set_style('whitegrid')
for i in df.drop(['Like','yummy','cheap','healthy','greasy','Age'],axis=1).columns:
  plt.figure(figsize=(10,5))
  sns.countplot(x=df[i],hue=df['Like'])
  plt.show()

plt.savefig('count3.png')
```



Observations

*Customers which found food inconvenient have most the time rated I hate it!-5

*Most of the customers who doesn't liked the food have given rating of I hate it!-5

*If the food is disgusting mostly I hate it!-5 is given by the customers

*Those who never visited the store have given worst rating

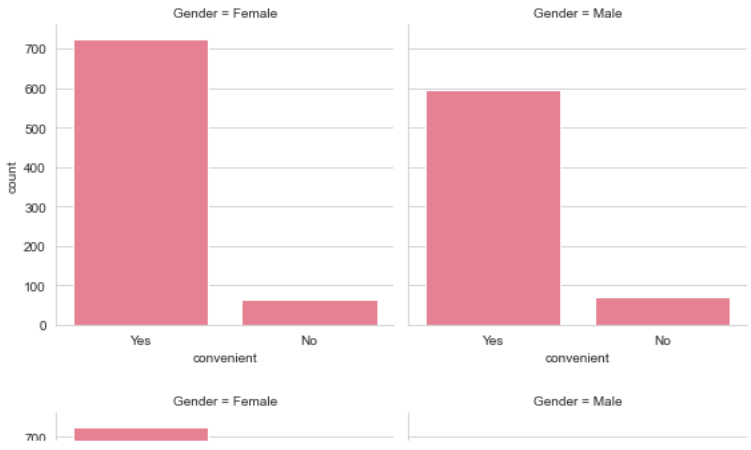
*Customers who visited once in a month majority times rated +3

*Customers visiting more than once a week more likely to rate I love it!+5

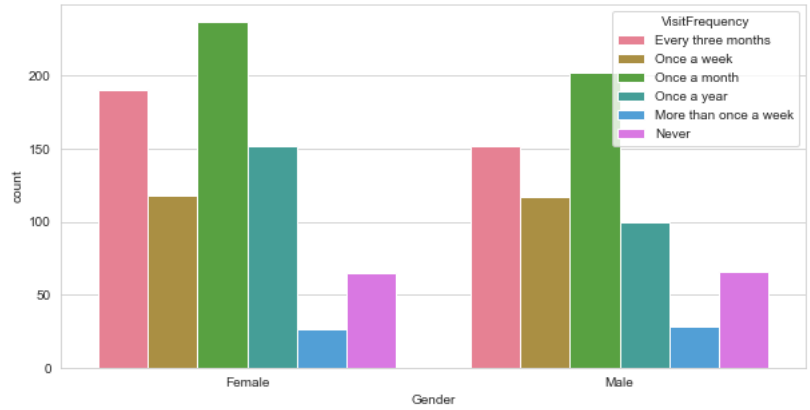
*Female customers are more likley to rate +3 where as males ratings are almost equally distributed

In [16]:
```
import warnings
warnings.filterwarnings("ignore")
```

In [17]:
```
sns.set_palette('husl')
for i in df.drop(['Gender','yummy','cheap','healthy','greasy','Age','VisitFrequency'],axis=1):
  grid = sns.FacetGrid(df,height=4,col='Gender')
  grid = grid.map(sns.countplot,i)
plt.savefig('count4.png')
plt.show()
```



In [18]:
```
plt.figure(figsize=(10,5))
sns.countplot(hue=df['VisitFrequency'],x=df['Gender'])
plt.savefig('count5.png')
```



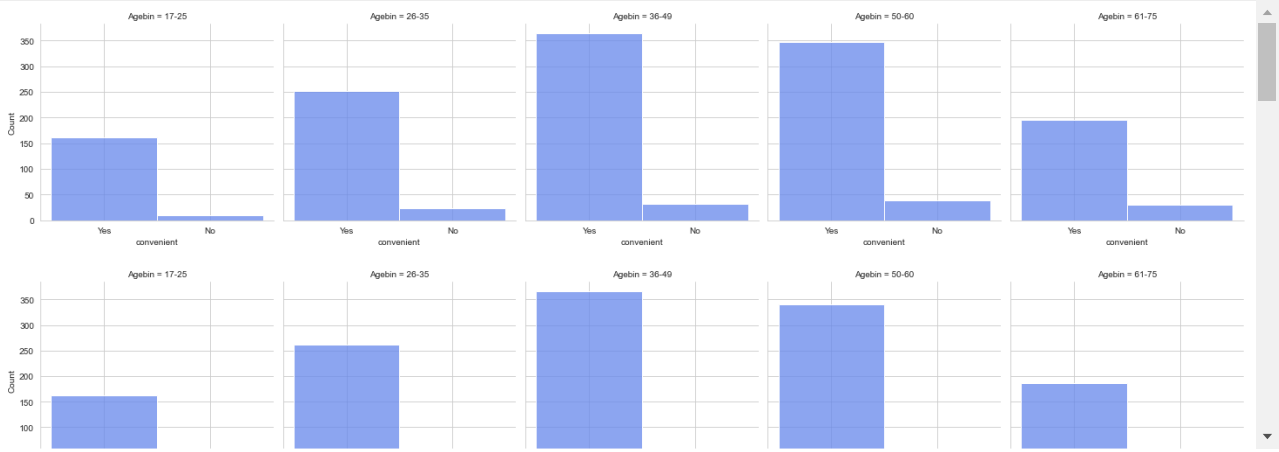
Observations

*Female customers found it less convenient than male customers

*Majority of the female customers found the food expensive where as males doesn't

*Both the male and the female customers are almost alikly distributed

In [19]:
```
sns.set_palette('coolwarm')
for i in df.drop(['Agebin','yummy','cheap','healthy','greasy','Age','VisitFrequency'],axis=1):
  grid = sns.FacetGrid(df,height=4,col='Agebin')
  grid = grid.map(sns.histplot,i,bins=30)
plt.savefig('count6.png')
plt.show()
```



Data Preprocessing

In [20]:
```
# converting into numericals
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1453 entries, 0 to 1452
Data columns (total 16 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   yummy           1453 non-null   object
 1   convenient      1453 non-null   object
 2   spicy           1453 non-null   object
 3   fattening       1453 non-null   object
 4   greasy          1453 non-null   object
 5   fast            1453 non-null   object
 6   cheap           1453 non-null   object
 7   tasty           1453 non-null   object
 8   expensive       1453 non-null   object
 9   healthy         1453 non-null   object
 10  disgusting      1453 non-null   object
 11  Like            1453 non-null   object
 12  Age             1453 non-null   int64
 13  VisitFrequency  1453 non-null   object
 14  Gender          1453 non-null   object
 15  Agebin          1453 non-null   category
dtypes: category(1), int64(1), object(14)
memory usage: 172.0+ KB
```

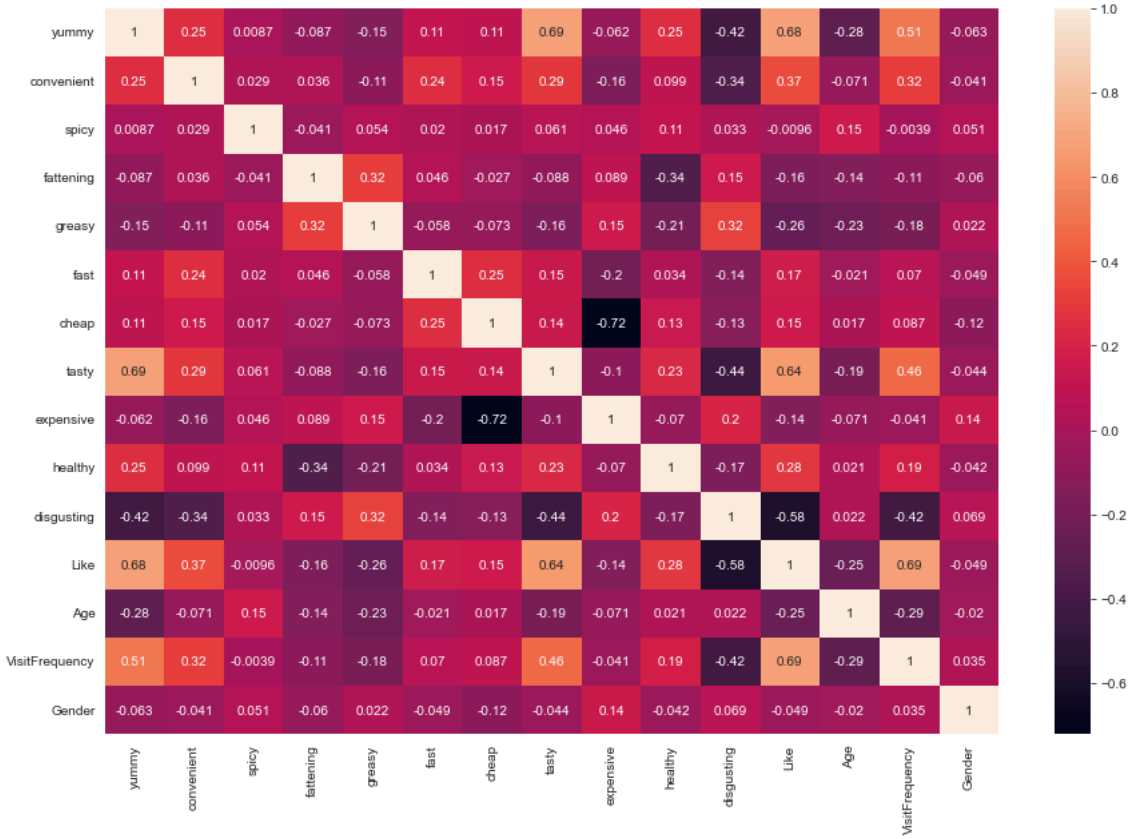
In [21]:
```
df['yummy'].replace(['Yes','No'],[1,0])
df['convenient'] = df['convenient'].replace(['Yes','No'],[1,0])
df['spicy'].replace(['Yes','No'],[1,0])
df['fattening'].replace(['Yes','No'],[1,0])
df['greasy'].replace(['Yes','No'],[1,0])
df['fast'].replace(['Yes','No'],[1,0])
df['cheap'].replace(['Yes','No'],[1,0])
df['tasty'].replace(['Yes','No'],[1,0])
df['expensive'].replace(['Yes','No'],[1,0])
df['healthy'].replace(['Yes','No'],[1,0])
df['disgusting'].replace(['Yes','No'],[1,0])
df['Gender'].replace(['Male','Female'],[1,0])
df['VisitFrequency'] = df['VisitFrequency'].replace(['Never','Once a year','Every three months','Once a month','Once a week','More tha
df['Like'].replace(['I hate it!-5','-4','-3','-2','-1','0','+1','+2','+3','+4','I love it!+5'],[-5,-4,-3,-2,-1,0,1,2,3,4,
```

In [22]:
```
df.head()
```

Out[22]:

	yummy	convenient	spicy	fattening	greasy	fast	cheap	tasty	expensive	healthy	disgusting	Like	Age	VisitFrequency	Gender	Agebin
0	0	1	0	1	0	1	1	0	1	0	0	-3	61	2	0	61-75
1	1	1	0	1	1	1	1	1	1	0	0	2	51	2	0	50-60
2	0	1	1	1	1	1	0	1	1	1	0	1	62	2	0	61-75
3	1	1	0	1	1	1	1	1	0	0	1	4	69	4	0	61-75
4	0	1	0	1	1	1	1	0	0	1	0	2	49	3	1	36-49

In [23]:
```
plt.figure(figsize=(15,10))
sns.heatmap(df.corr(),annot=True)
plt.savefig('count7.png')
```



Observations

*yummy is correlated with like and tasty

*expensive with cheap

*like is correlated with visitfrequency

Extract Segments

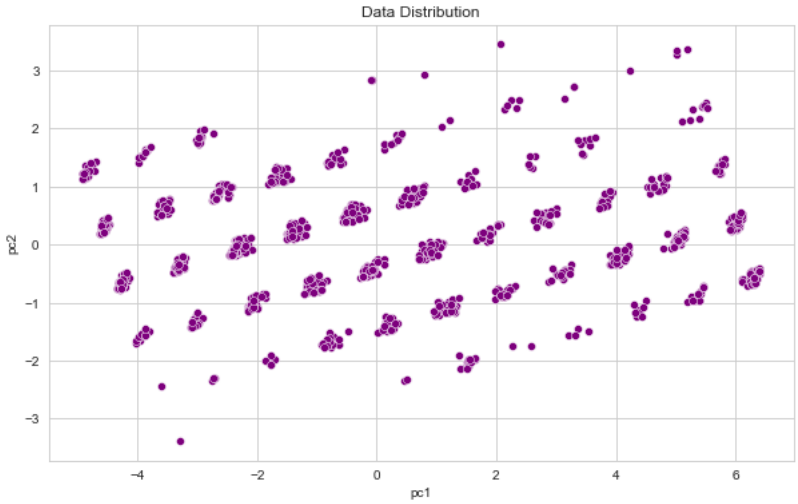
In [24]:
```
##Using k-means clustering

from sklearn.decomposition import PCA

pca = PCA(n_components=14)
data = pca.fit_transform(df.drop(['Age','Agebin'],axis=1))
pc = pd.DataFrame(data=data,columns=['pc1','pc2','pc3','pc4','pc5','pc6','pc7','pc8','pc9','pc10','pc11','pc12','pc13','
```

In [25]:
```
pc.head()
```

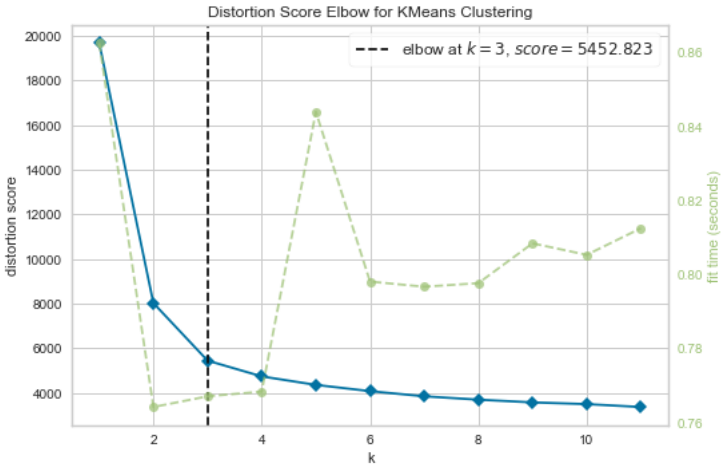
Out[25]:

	pc1	pc2	pc3	pc4	pc5	pc6	pc7	pc8	pc9	pc10	pc11	pc12	pc13	pc14
0	3.746578	0.711531	-0.340867	0.442599	0.615926	-0.337585	-0.319521	-0.242126	-0.376609	-0.188142	0.138768	0.184291	0.539076	-0.553440
1	-1.112208	-0.719394	0.251637	-0.675627	0.340507	0.356094	-0.151875	-0.086281	-0.079150	-0.089554	-0.036662	0.126941	0.507671	-0.531743
2	-0.078865	-0.393926	0.747944	-0.168268	0.539078	0.203277	0.720776	-0.885240	-0.623744	0.597505	0.321975	-0.321744	0.068764	0.222372
3	-3.519994	0.537511	-0.321155	-1.034471	0.080770	-0.120180	0.274559	0.801217	-0.103357	0.065294	-0.222402	-0.082562	-0.214825	-0.005298
4	-1.252794	0.234411	-0.340806	-0.131475	-0.792487	-0.645553	0.788675	-0.647022	-0.106097	-0.472202	0.208451	-0.096126	0.023990	0.136414

In [26]:
```
plt.figure(figsize=(10,6))
sns.scatterplot(data=pc,x='pc1',y='pc2',color='purple')
plt.title('Data Distribution')
plt.savefig('count8.png')
```



In [27]:
```
from sklearn.cluster import KMeans
from yellowbrick.cluster import KElbowVisualizer
kmeans = KMeans()
visualizer = KElbowVisualizer(kmeans, k=(1,12)).fit(pc)
visualizer.show()
plt.savefig('count9.png')
```




```
<Figure size 576x396 with 0 Axes>
```

Observation

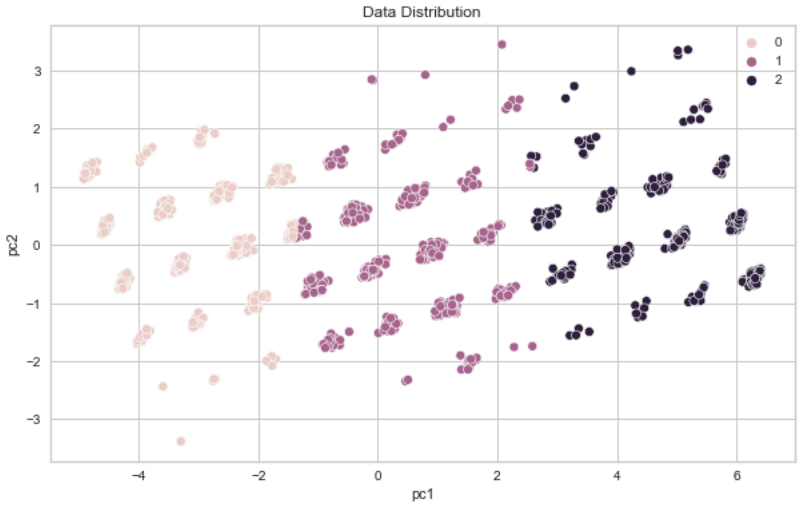
*Chossing 3 as value of k

In [30]:
```
# training the model with 3 clusters
kmeans = KMeans(n_clusters=3)
kmeans.fit(pc)
```

Out[30]:
```
KMeans(n_clusters=3)
```

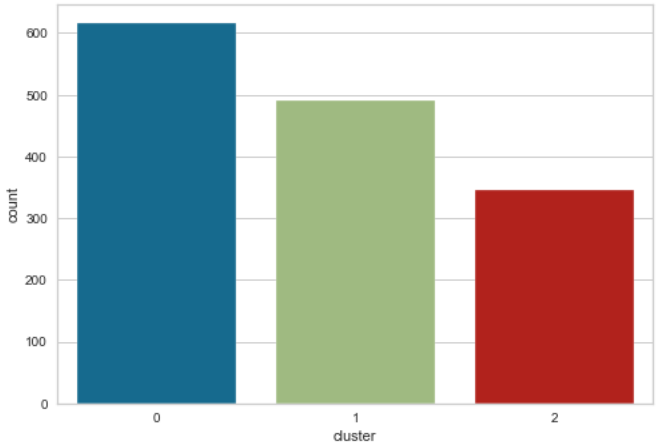
In [31]:
```
# predicting the clusters
np.random.seed(42)
preds = kmeans.predict(pc)
```

In [32]:
```
# plotting the clusters
plt.figure(figsize=(10,6))
sns.scatterplot(x=pc['pc1'],y=pc['pc2'],hue=preds)
plt.title('Data Distribution')
plt.savefig('count10.png')
plt.show()
```



In [33]:
```
df['cluster'] = preds
```

In [34]:
```
sns.countplot(x = df['cluster'])
plt.savefig('count11.png')
```



In [35]:
```
df['cluster'].value_counts()/len(df)*100
```

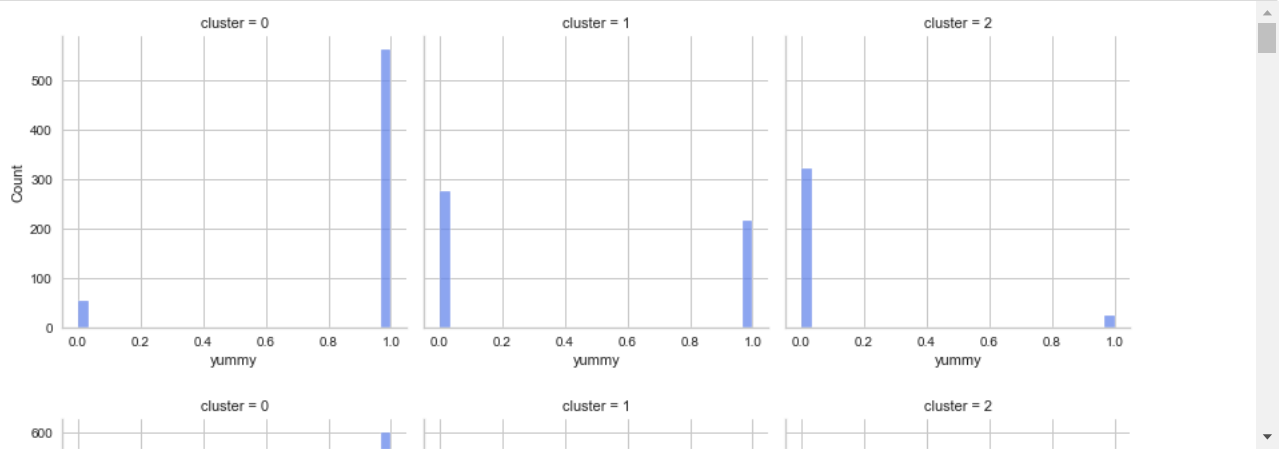
Out[35]:
```
0    42.395045
1    33.792154
2    23.812801
Name: cluster, dtype: float64
```

Observations

*maximum customers belongs to cluster 0

*approx 25 percent of the customers comes under cluster 0

In [36]:
```
sns.set_palette('coolwarm')
for i in df.drop(['cluster'],axis=1):
  grid = sns.FacetGrid(df,height=4,col='cluster')
  grid = grid.map(sns.histplot,i,bins=30)
plt.show()
```



Observations

*cluster 0 contains most of the customers who voted for not yummy where as in cluster 1 customers mostly voted yummy

*same is for tasty, cluster 0 customers almost doesn't find the food tasty

*customers belonging to cluster 1 doesn't find the food convienent

*Like is distributed with in intervals

*Like -5 to -2 belongs to cluster 0

*+2 to +5 belongs to cluster 1

*-2 to +2 belongs to cluster 2

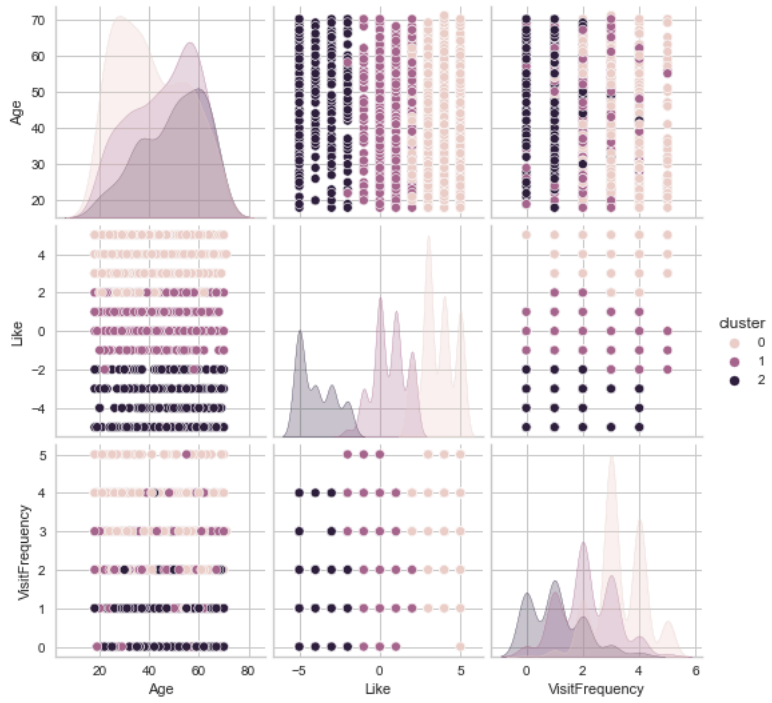
*cluster 0 doesn't contain customers visited more than once in a month

*cluster 1 does not contain who have never visited the store

*most of the customers of cluster 2 have not visited more than once in a week

In [38]:
```
# selecting Target variables

df_1 = df[['Age','Like','VisitFrequency','cluster']]
sns.pairplot(data=df_1,hue='cluster')
```

Out[38]: <seaborn.axisgrid.PairGrid at 0x223002f28e0>



Classification

In [39]:
```
from sklearn.model_selection import train_test_split
```

In [40]:
```
x = df.drop(['Agebin','cluster'],axis=1)
y = df['cluster']
```

In [41]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.2,random_state=42,stratify=y)
x_train.shape,y_train.shape
```

Out[41]: ((1162, 15), (1162,))

In [42]:
```
## scaling the features
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

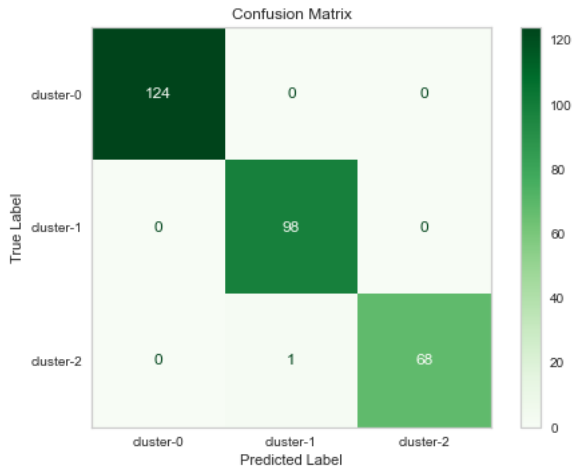
In [43]:
```
#using logisitc regression for classification
from sklearn.linear_model import LogisticRegression

clf = LogisticRegression()
clf.fit(x_train,y_train)

## predictions
preds = clf.predict(x_test)
```

In [44]:
```
## performmance of the model
from sklearn.metrics import classification_report,confusion_matrix,ConfusionMatrixDisplay

print(classification_report(y_test,preds))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00       124
           1       0.99      1.00      0.99        98
           2       1.00      0.99      0.99        69

    accuracy                           1.00       291
   macro avg       1.00      1.00      1.00       291
weighted avg       1.00      1.00      1.00       291
```

```
Observation

*Model is performing great

*Need not to tune parameters
```

In [45]:
```
sns.set_style("whitegrid", {'axes.grid' : False})

cm = confusion_matrix(y_test,preds,labels=[0,1,2])
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
                              display_labels=["cluster-0","cluster-1",'cluster-2'])
disp.plot(cmap='Greens',colorbar=True,)
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.title('Confusion Matrix')
plt.savefig('count12.png')
plt.show()
```



In [ ]:
```

```