In [1]:

```
#read in data
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
from datetime import datetime

user = pd.read_csv('C:/Users/jinwe/Desktop/Insight/dc_2/yammer_users.csv')
event = pd.read_csv('C:/Users/jinwe/Desktop/Insight/dc_2/yammer_events.csv')
email = pd.read_csv('C:/Users/jinwe/Desktop/Insight/dc_2/yammer_emails.csv')
period = pd.read_csv('C:/Users/jinwe/Desktop/Insight/dc_2/dimension_rollup_periods.csv')
```

In [2]:

```
user.head()
```

Out[2]:

	user_id	created_at	company_id	language	activated_at	state
0	0.0	2013-01-01 20:59:39	5737.0	english	2013-01-01 21:01:07	active
1	1.0	2013-01-01 13:07:46	28.0	english	NaN	pending
2	2.0	2013-01-01 10:59:05	51.0	english	NaN	pending
3	3.0	2013-01-01 18:40:36	2800.0	german	2013-01-01 18:42:02	active
4	4.0	2013-01-01 14:37:51	5110.0	indian	2013-01-01 14:39:05	active

In [3]:

```
user.describe()
```

Out[3]:

	user_id	company_id
count	19066.000000	19066.000000
mean	9532.500000	4602.923214
std	5504.024452	4363.468471
min	0.000000	1.000000
25%	4766.250000	109.000000
50%	9532.500000	3667.500000
75%	14298.750000	8431.750000
max	19065.000000	13198.000000

In [4]:

```
event.head()
```

Out[4]:

	user_id	occurred_at	event_type	event_name	location	device	user_type
0	10522.0	2014-05-02 11:02:39	engagement	login	Japan	dell inspiron notebook	3.0
1	10522.0	2014-05-02 11:02:53	engagement	home_page	Japan	dell inspiron notebook	3.0
2	10522.0	2014-05-02 11:03:28	engagement	like_message	Japan	dell inspiron notebook	3.0

	user_id	occurred_at	event_type	event_name	location	device	user_type
3	10522.0	2014-05-02 11:04:09	engagement	view_inbox	Japan	dell inspiron notebook	3.0
4	10522.0	2014-05-02 11:03:16	engagement	search_run	Japan	dell inspiron notebook	3.0

In [5]:

```
event.describe()
```

Out[5]:

	user_id	user_type
count	340832.000000	325255.000000
mean	9983.835758	1.512238
std	5369.955949	0.754780
min	4.000000	1.000000
25%	5224.000000	1.000000
50%	11069.000000	1.000000
75%	14412.000000	2.000000
max	19065.000000	3.000000

In [6]:

```
email.head()
```

Out[6]:

	user_id	occurred_at	action	user_type
0	0.0	2014-05-06 09:30:00	sent_weekly_digest	1.0
1	0.0	2014-05-13 09:30:00	sent_weekly_digest	1.0
2	0.0	2014-05-20 09:30:00	sent_weekly_digest	1.0
3	0.0	2014-05-27 09:30:00	sent_weekly_digest	1.0
4	0.0	2014-06-03 09:30:00	sent_weekly_digest	1.0

In [7]:

```
email.describe()
```

Out[7]:

	user_id	user_type
count	90389.000000	90389.000000
mean	8635.558187	2.097988
std	4957.734547	0.848892
min	0.000000	1.000000
25%	4426.000000	1.000000
50%	8631.000000	2.000000
75%	12670.000000	3.000000
max	19001.000000	3.000000

In [8]:

```
period.head()
```

Out[8]:

	period_id	time_id	pst_start	pst_end	utc_start	utc_end
0	1.0	2013-01-01 00:00:00	2013-01-01 00:00:00	2013-01-02 00:00:00	2013-01-01 08:00:00	2013-01-02 08:00:00
1	1.0	2013-01-02 00:00:00	2013-01-02 00:00:00	2013-01-03 00:00:00	2013-01-02 08:00:00	2013-01-03 08:00:00
2	1.0	2013-01-03 00:00:00	2013-01-03 00:00:00	2013-01-04 00:00:00	2013-01-03 08:00:00	2013-01-04 08:00:00
3	1.0	2013-01-04 00:00:00	2013-01-04 00:00:00	2013-01-05 00:00:00	2013-01-04 08:00:00	2013-01-05 08:00:00
4	1.0	2013-01-05 00:00:00	2013-01-05 00:00:00	2013-01-06 00:00:00	2013-01-05 08:00:00	2013-01-06 08:00:00

In [9]:

```
period.describe()
```

Out[9]:

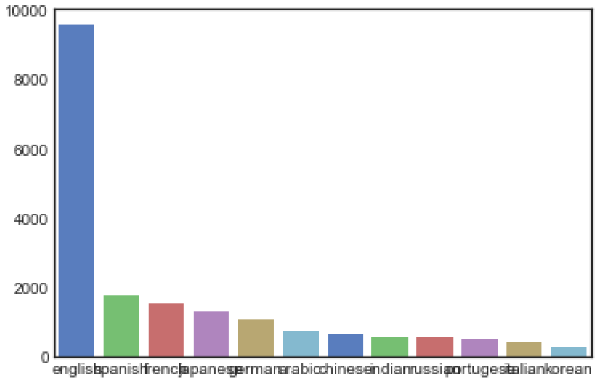
	period_id
count	56002.000000
mean	1920.645227
std	347.572356
min	1.000000
25%	2001.000000
50%	2001.000000
75%	2007.000000
max	2007.000000

In [10]:

```
#plot number of users by language
from matplotlib import pyplot
sns.set_style("white")
sns.barplot(x = user['language'].value_counts().index,
            y = user['language'].value_counts().values,
            palette='muted', errcolor='dimgray')
```

Out[10]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x213dabb51d0>
```



Top five languages spoken by Yammer users are English, Spanish, French, Japanese, and German (in a descending order). Number of English speakers is far higher than that of any other language speakers.

In [11]:

```
event.event_type.unique()
```

Out[11]:

```
array(['engagement', 'signup_flow'], dtype=object)
```

In [12]:

```
#drop 'signup_flow' from event dataframe
engagement=event[event['event_type']=='engagement']
```

In [13]:

```
#count number of engagement events by country
engagement.groupby(['location']).size()
```

Out[13]:

```
location
Argentina                1607
Australia                7098
Austria                  2399
Belgium                  2665
Brazil                  10607
Canada                   8555
Chile                    1034
Colombia                 1831
Denmark                  2067
Egypt                    2180
Finland                  1832
France                  16469
Germany                 22304
Greece                    899
Hong Kong                1434
India                    9036
Indonesia                5919
Iran                     2974
Iraq                     1321
Ireland                   997
Israel                   2016
Italy                   11051
Japan                   24584
Korea                    6756
Malaysia                 2407
Mexico                   8648
Netherlands              4187
Nigeria                  1507
Norway                   1877
Pakistan                  966
Philippines              1239
Poland                   3628
Portugal                 1245
Russia                  11561
Saudi Arabia             3864
Singapore                1396
South Africa             2201
Spain                    5443
Sweden                   3690
Switzerland              3548
Taiwan                   3457
Thailand                 1864
Turkey                   2184
United Arab Emirates     2231
United Kingdom          15590
United States           89379
Venezuela                1828
dtype: int64
```

In [14]:

```
engagement.head(50)
engagement.dtypes
```

Out[14]:

```
user_id          float64
```

```
occurred_at     object
event_type      object
event_name      object
location        object
device          object
user_type      float64
dtype: object
```

In [15]:

```
engagement[['occurred_at']]=engagement[['occurred_at']].apply(pd.to_datetime)
engagement.dtypes
```

```
C:\Users\jinwe\Anaconda3\lib\site-packages\pandas\core\frame.py:2540: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  self[k1] = value[k2]
```

Out[15]:

```
user_id               float64
occurred_at    datetime64[ns]
event_type             object
event_name             object
location               object
device                 object
user_type             float64
dtype: object
```

In [23]:

```
#define two-week predrop period:July 18 to August 1, 2014
pre_engagement=engagement[engagement['occurred_at']>'2014-7-18 00:00:00']
pre_engagement=pre_engagement[pre_engagement['occurred_at']<'2014-8-2 00:00:00']
len(pre_engagement)
```

Out[23]:

```
46333
```

In [28]:

```
#define two-week postdrop period:August 2 to August 16, 2014
post_engagement=engagement[engagement['occurred_at']>'2014-8-2 00:00:00']
post_engagement=post_engagement[post_engagement['occurred_at']<'2014-8-17 00:00:00']
len(post_engagement)
```

Out[28]:

```
36850
```

In [29]:

```
#Drop in number of dengagement events
len(pre_engagement)-len(post_engagement)
```

Out[29]:

```
9483
```

Hypothesis #1: Five western countries (US, UK, Germany, Italy, France) contributed to most drop in number of dengagement events (likely due to people taking vacation)

In [37]:

```
west_pre_engagement=pre_engagement.query('location == "Italy" or location == "Germany" or location
== "France" or location == "United Kingdom"or location == "United States"')
```

```
len(west_pre_engagement)
```

Out[37]:

```
23675
```

In [38]:

```
west_post_engagement=post_engagement.query('location == "Italy" or location == "Germany" or locati
on == "France" or location == "United Kingdom"or location == "United States"')
len(west_post_engagement)
```

Out[38]:

```
17889
```

In [39]:

```
#Drop in number of dengagement events in the fieve western countries
len(west_pre_engagement)-len(west_post_engagement)
```

Out[39]:

```
5786
```

In [40]:

```
5786/9483
```

Out[40]:

```
0.6101444690498787
```

In [46]:

```
jp_pre_engagement=pre_engagement.query('location == "Japan"')
len(jp_pre_engagement)
```

Out[46]:

```
3364
```

In [47]:

```
jp_post_engagement=post_engagement.query('location == "Japan"')
len(jp_post_engagement)
```

Out[47]:

```
2986
```

In [48]:

```
len(jp_pre_engagement)-len(jp_post_engagement)
```

Out[48]:

```
378
```

In [50]:

```
us_pre_engagement=pre_engagement.query('location == "United States"')
us_post_engagement=post_engagement.query('location == "United States"')
US=(len(us_pre_engagement)-len(us_post_engagement))/9483
print(US)
```

```
0.30781398291679846
```

In [51]:

```
uk_pre_engagement=pre_engagement.query('location == "United Kingdom"')
uk_post_engagement=post_engagement.query('location == "United Kingdom"')
UK=(len(uk_pre_engagement)-len(uk_post_engagement))/9483
print(UK)
```

```
0.06422018348623854
```

In [52]:

```
ITALY_pre_engagement=pre_engagement.query('location == "Italy"')
ITALY_post_engagement=post_engagement.query('location == "Italy"')
ITALY=(len(ITALY_pre_engagement)-len(ITALY_post_engagement))/9483
print(ITALY)
```

```
0.045871559633027525
```

In [53]:

```
Germany_pre_engagement=pre_engagement.query('location == "Germany"')
Germany_post_engagement=post_engagement.query('location == "Germany"')
Germany=(len(Germany_pre_engagement)-len(Germany_post_engagement))/9483
print(Germany)
```

```
0.10692818728250554
```

In [54]:

```
France_pre_engagement=pre_engagement.query('location == "France"')
France_post_engagement=post_engagement.query('location == "France"')
France=(len(France_pre_engagement)-len(France_post_engagement))/9483
print(France)
```

```
0.08531055573130866
```

In [55]:

```
d={'country':["US", "Germany", "France", "UK","Italy"], 'percentage of total drop in engagement
events':[US, Germany, France, UK, ITALY]}
drop_percent=pd.DataFrame(data=d)
drop_percent
```

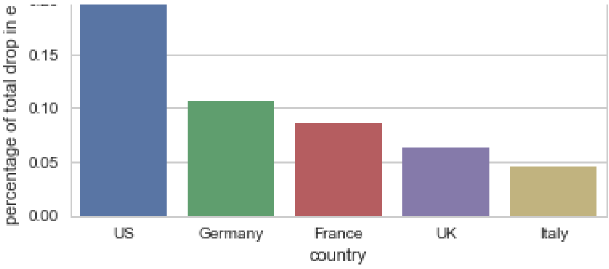
Out[55]:

	country	percentage of total drop in engagement events
0	US	0.307814
1	Germany	0.106928
2	France	0.085311
3	UK	0.064220
4	Italy	0.045872

In [56]:

```
import seaborn as sns
sns.set(style="whitegrid")
ax = sns.barplot(x="country", y="percentage of total drop in engagement events", data=drop_percent)
```

ngagement events
0.30
0.25
0.20



The US contributes to the largest percent drop (more than 30%) in engagement events between the predrop and postdrop periods, followed by Germany, France, UK, and Italy.

In [59]:

```
pre_engagement.head()
```

Out[59]:

	user_id	occurred_at	event_type	event_name	location	device	user_type
11092	13317.0	2014-07-20 12:18:05	engagement	login	Italy	lenovo thinkpad	2.0
11093	13317.0	2014-07-20 12:18:13	engagement	home_page	Italy	lenovo thinkpad	2.0
11094	13317.0	2014-07-20 12:18:42	engagement	like_message	Italy	lenovo thinkpad	2.0
11095	13317.0	2014-07-20 12:19:11	engagement	home_page	Italy	lenovo thinkpad	2.0
11096	13317.0	2014-07-20 12:19:34	engagement	send_message	Italy	lenovo thinkpad	2.0

In [63]:

```
pre_engagement.event_name.unique()
```

Out[63]:

```
array(['login', 'home_page', 'like_message', 'send_message', 'search_run',
       'view_inbox', 'search_click_result_2', 'search_click_result_5',
       'search_click_result_6', 'search_click_result_10',
       'search_click_result_4', 'search_click_result_1',
       'search_click_result_3', 'search_click_result_9',
       'search_autocomplete', 'search_click_result_7',
       'search_click_result_8'], dtype=object)
```

In [61]:

```
post_engagement.event_name.unique()
```

Out[61]:

```
array(['login', 'home_page', 'view_inbox', 'send_message', 'like_message',
       'search_autocomplete', 'search_run', 'search_click_result_2',
       'search_click_result_5', 'search_click_result_8',
       'search_click_result_4', 'search_click_result_6',
       'search_click_result_1', 'search_click_result_9',
       'search_click_result_10', 'search_click_result_3',
       'search_click_result_7'], dtype=object)
```

Now that we have examined drop of engagement events by country. Not it is time to consider what types of engagement events, e.g., login, contributed more to the total engagement events.

In [72]:

```
count_a=pre_engagement.groupby(['event_name']).size()
```

In [73]:

```
count_b=post_engagement.groupby(['event_name']).size()
```

In [93]:

```
c=count_b-count_a
print(c)
```

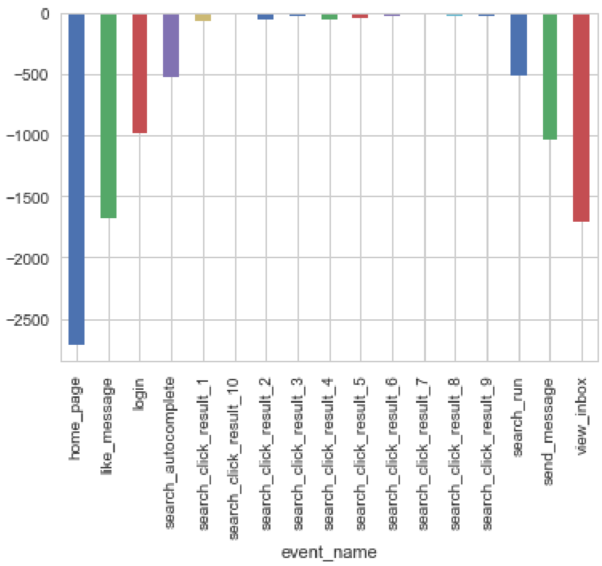
```
event_name
home_page                 -2716
like_message              -1684
login                      -984
search_autocomplete        -519
search_click_result_1       -64
search_click_result_10      -15
search_click_result_2       -52
search_click_result_3       -24
search_click_result_4       -49
search_click_result_5       -36
search_click_result_6       -22
search_click_result_7       -14
search_click_result_8       -26
search_click_result_9       -28
search_run                 -510
send_message              -1036
view_inbox                -1704
dtype: int64
```

In [90]:

```
c.plot.bar()
```

Out[90]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x213dddfa3c8>
```



This figure shows that "home page" event drops the most, followed by "view inbox" and "like message".

We have examined change in engagement events. Now let's focus on people.

In [99]:

```
pre_engagement.head()
```

Out[99]:

	user_id	occurred_at	event_type	event_name	location	device	user_type
11092	13317.0	2014-07-20 12:18:05	engagement	login	Italy	lenovo thinkpad	2.0
11093	13317.0	2014-07-20 12:18:13	engagement	home_page	Italy	lenovo thinkpad	2.0
11094	13317.0	2014-07-20 12:18:42	engagement	like_message	Italy	lenovo thinkpad	2.0

	user_id	occurred_at	event_type	event_name	location	device	user_type
11094	13317.0	2014-07-20 12:18:42	engagement	like_message	Italy	lenovo thinkpad	2.0
11095	13317.0	2014-07-20 12:19:11	engagement	home_page	Italy	lenovo thinkpad	2.0
11096	13317.0	2014-07-20 12:19:34	engagement	send_message	Italy	lenovo thinkpad	2.0

In [104]:

```
pre_engagement['pre_people']=pre_engagement.groupby('user_id').cumcount() == 0
pre_people=pre_engagement[pre_engagement['pre_people']==True]
len(pre_people)
```

Out[104]:

```
2130
```

In [107]:

```
pre_count=pre_people.groupby(['location']).size()
print(pre_count)
```

```
location
Argentina                10
Australia                49
Austria                  13
Belgium                  22
Brazil                   74
Canada                   60
Chile                    13
Colombia                 13
Denmark                  13
Egypt                    11
Finland                  12
France                  105
Germany                 142
Greece                   12
Hong Kong                 8
India                    59
Indonesia                32
Iran                     17
Iraq                     11
Ireland                   6
Israel                   15
Italy                    80
Japan                   165
Korea                    43
Malaysia                 10
Mexico                   46
Netherlands              35
Nigeria                  13
Norway                   11
Pakistan                  5
Philippines              11
Poland                   14
Portugal                  5
Russia                   74
Saudi Arabia             30
Singapore                12
South Africa             17
Spain                    33
Sweden                   21
Switzerland              22
Taiwan                   11
Thailand                 16
Turkey                   20
United Arab Emirates     11
United Kingdom          102
United States           606
Venezuela                20
dtype: int64
```

In [109]:

```
post_engagement['post_people']=post_engagement.groupby('user_id').cumcount() == 0
```

```
post_people=post_engagement[post_engagement['post_people']==True]
len(post_people)
```

Out[109]:

```
1828
```

In [115]:

```
post_count=post_people.groupby(['location']).size()
print(post_count)
```

```
location
Argentina                12
Australia                41
Austria                  14
Belgium                   9
Brazil                   66
Canada                   41
Chile                     7
Colombia                 13
Denmark                  16
Egypt                     9
Finland                   9
France                   85
Germany                 116
Greece                    7
Hong Kong                 8
India                    57
Indonesia                27
Iran                     17
Iraq                      9
Ireland                   8
Israel                   10
Italy                    70
Japan                   142
Korea                    40
Malaysia                 15
Mexico                   43
Netherlands              30
Nigeria                  12
Norway                   12
Pakistan                  7
Philippines              10
Poland                   18
Portugal                 10
Russia                   61
Saudi Arabia             19
Singapore                 8
South Africa             13
Spain                    28
Sweden                   20
Switzerland              21
Taiwan                   11
Thailand                 13
Turkey                   20
United Arab Emirates     11
United Kingdom           82
United States           518
Venezuela                13
dtype: int64
```

In [110]:

```
len(pre_people)-len(post_people)
```

Out[110]:

```
302
```

In [116]:

```
diff=post_count-pre_count
```

```
diff
```

Out[116]:

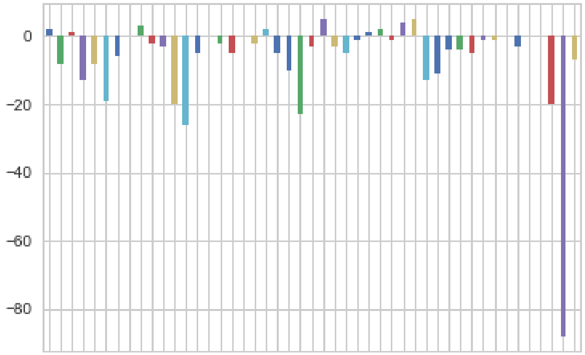
```
location
Argentina                2
Australia               -8
Austria                  1
Belgium                -13
Brazil                  -8
Canada                 -19
Chile                   -6
Colombia                 0
Denmark                  3
Egypt                   -2
Finland                 -3
France                 -20
Germany                -26
Greece                  -5
Hong Kong                0
India                   -2
Indonesia               -5
Iran                     0
Iraq                    -2
Ireland                  2
Israel                  -5
Italy                  -10
Japan                  -23
Korea                   -3
Malaysia                 5
Mexico                  -3
Netherlands             -5
Nigeria                 -1
Norway                   1
Pakistan                 2
Philippines             -1
Poland                   4
Portugal                 5
Russia                 -13
Saudi Arabia           -11
Singapore               -4
South Africa            -4
Spain                   -5
Sweden                  -1
Switzerland             -1
Taiwan                   0
Thailand                -3
Turkey                   0
United Arab Emirates     0
United Kingdom         -20
United States          -88
Venezuela               -7
dtype: int64
```

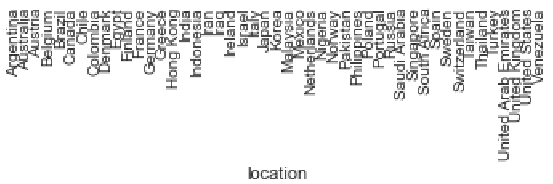
In [117]:

```
diff.plot.bar()
```

Out[117]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x213ddda79b0>
```





This figure shows that the US sees the largest drop in number of active users, followed by Germany, Japan, UK, France, and Canada. All six countries are developed countries primarily located in northern temperate region.