TEDx

```
In [3]: import pandas as pd
        import matplotlib.pyplot as plt
        %matplotlib inline
        import numpy as np
        import seaborn as sns; sns.set()
        from urllib.request import urlretrieve
        from IPython.display import clear_output
        import cv2
        from PIL import Image
        from sklearn.metrics.cluster import entropy as sklearn_entropy
        from skimage import io, color, img_as_ubyte
        from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer
        import string
        from textblob import TextBlob
        import traceback
        import json
        import requests
        import time
        from bs4 import BeautifulSoup
```

Let's check how the DF looks

```
In [2]: df = pd.read_excel("data/data_ted.xlsx")
        df.head()
```

Out[2]:

	Licensees.name	Events.name	Videos.id	Videos.videoid	Videos.title	
0	TEDxRíodelaPlata	CanalTEDxRiodelaPlata	72321a94-f58e-47a2-9071-40a5ae54091e	qJzRzdsGhC0	Flash Mob en TEDxRiodelaPlata 2013 - El Brindi...	ht /\
1	TEDxRíodelaPlata	TEDxRiodelaPlata2013	ea1705b1-2eb7-4782-a9d3-4f88fcc0de5a	EFdEmbuikOw	Nunca pidas permiso | Ronald Shakespear | TEDx...	ht /v
2	TEDxRíodelaPlata	TEDxJoven@RiodelaPlata 2011	54489a1b-12e8-4e5a-b9aa-bba37452309d	nZV1uefYywI	Sobre fideos y jabones: Luciano Mellera at TED...	ht
3	TEDxRíodelaPlata	TEDxRiodelaPlata2014	e5a40182-5cec-4e28-afe6-784750a83cd3	jej8qlzlAGw	Las matematicas son para siempre | Eduardo Sae...	ht
4	TEDxRíodelaPlata	TEDxRiodelaPlata2015	ea927c7b-c454-4fa4-ae54-86900daa0fff	c1iMoel2LxA	Secretos de la relación corazón-cerebro | Luci...	ht

```
In [3]: df.columns

Out[3]: Index(['Licensees.name', 'Events.name', 'Videos.id', 'Videos.videoid',
               'Videos.title', 'Videos.url', 'Videos.url_img', 'Videos.description',
               'Videos.published_at', 'Videos.channelid', 'Videos.channel_title',
               'Videos.tags', 'Videos.view_count', 'Videos.like_count',
               'Videos.dislike_count', 'Videos.comment_count', 'Videos.users_id',
               'Videos.licensees_id', 'Videos.created', 'Videos.modified'],
              dtype='object')
```

Unique values

In [4]:
```
df.nunique()
```

Out[4]:
```
Licensees.name            1
Events.name              15
Videos.id               265
Videos.videoid          265
Videos.title            265
Videos.url              265
Videos.url_img          265
Videos.description      257
Videos.published_at     259
Videos.channelid          3
Videos.channel_title      3
Videos.tags             240
Videos.view_count       265
Videos.like_count       217
Videos.dislike_count     82
Videos.comment_count     97
Videos.users_id           5
Videos.licensees_id       0
Videos.created          183
Videos.modified           7
dtype: int64
```

In [5]:
```
df = df.drop(['Licensees.name', 'Videos.licensees_id'], axis=1)
```

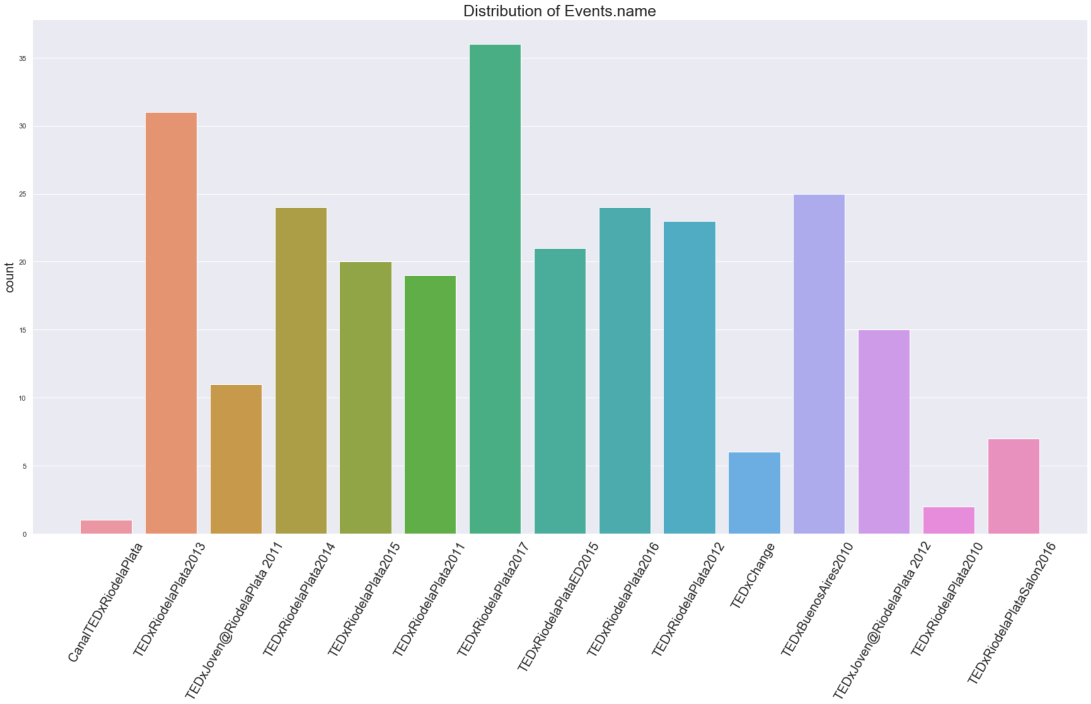
In [6]:
```
df['Events.name'].unique()
```

Out[6]:
```
array(['CanalTEDxRiodelaPlata', 'TEDxRiodelaPlata2013',
       'TEDxJoven@RiodelaPlata 2011', 'TEDxRiodelaPlata2014',
       'TEDxRiodelaPlata2015', 'TEDxRiodelaPlata2011',
       'TEDxRiodelaPlata2017', 'TEDxRiodelaPlataED2015',
       'TEDxRiodelaPlata2016', 'TEDxRiodelaPlata2012', 'TEDxChange',
       'TEDxBuenosAires2010', 'TEDxJoven@RiodelaPlata 2012',
       'TEDxRiodelaPlata2010', 'TEDxRiodelaPlataSalon2016'], dtype=object)
```

In [7]:
```
def graph_categorical_dist(feature, rotation=False):
    fig, ax = plt.subplots(figsize=(30,15))
    sns.countplot(data=df, x=feature)
    plt.xlabel(feature, fontsize=20)
    plt.ylabel('count', fontsize=20)
    plt.title('Distribution of %s' % feature, fontsize=25)
    for tick in ax.xaxis.get_major_ticks():
        tick.label.set_fontsize(20)
        if rotation:
            tick.label.set_rotation(rotation)
    sns.despine()
    plt.plot();
```

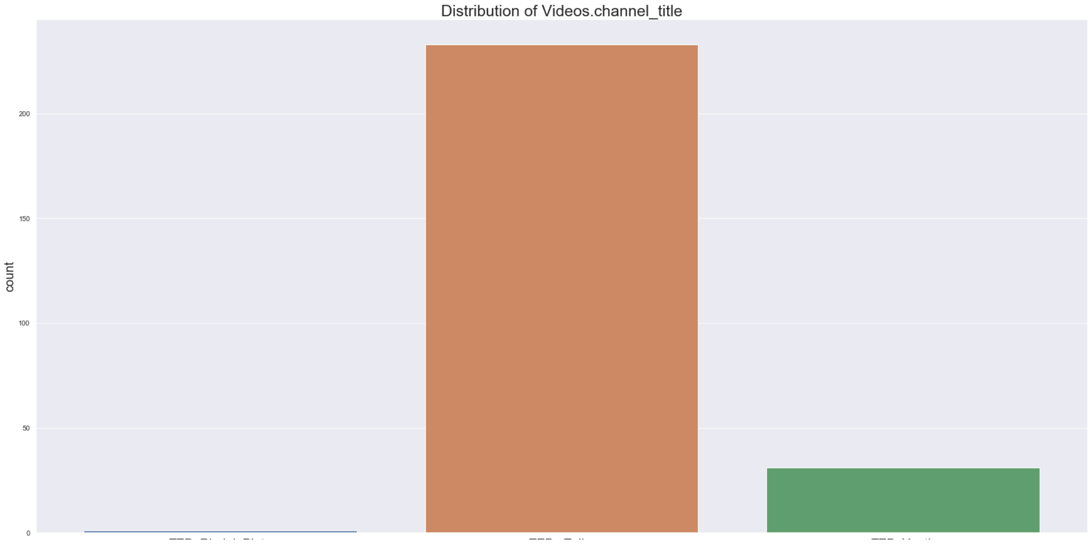
Let's check the distribution of events

In [8]:
```
graph_categorical_dist('Events.name', rotation=60)
```



Let's check distribution of channels

In [9]:
```
graph_categorical_dist('Videos.channel_title')
```



In [10]:
```
df = df.drop(['Videos.videoid','Videos.url', 'Videos.description','Videos.users_id
```

In [11]:
```
df.columns = ['event_name', 'video_id', 'title', 'url_thumb',
       'tags', 'view_count', 'like_count',
       'dislike_count', 'comment_count', 'created']
df.head()
```

Out[11]:

	event_name	video_id	title	url_thumb	
0	CanalTEDxRiodelaPlata	72321a94-f58e-47a2-9071-40a5ae54091e	Flash Mob en TEDxRiodelaPlata 2013 - El Brindi...	https://i.ytimg.com/vi/qJzRzdsGhC0/hqdefault.jpg	
1	TEDxRiodelaPlata2013	ea1705b1-2eb7-4782-a9d3-4f88fcc0de5a	Nunca pidas permiso | Ronald Shakespear | TEDx...	https://i.ytimg.com/vi/EFdEmbuikOw/hqdefault.jpg	Diseño, talks
2	TEDxJoven@RiodelaPlata 2011	54489a1b-12e8-4e5a-b9aa-bba37452309d	Sobre fideos y jabones: Luciano Mellera at TED...	https://i.ytimg.com/vi/nZV1uefYywI/hqdefault.jpg	Luciano,Meller
3	TEDxRiodelaPlata2014	e5a40182-5cec-4e28-afe6-784750a83cd3	Las matematicas son para siempre | Eduardo Sae...	https://i.ytimg.com/vi/jej8qlzlAGw/hqdefault.jpg	(hard),Cultu
4	TEDxRiodelaPlata2015	ea927c7b-c454-4fa4-ae54-86900daa0fff	Secretos de la relación corazón-cerebro | Luci...	https://i.ytimg.com/vi/c1iMoel2LxA/hqdefault.jpg	TEDxTalks,Spanish

From "Engagement and Popularity Dynamics of YouTube Videos and Sensitivity to Meta-Data": `Meta features from thumbnails: blurriness (e.g., CannyEdge, Laplace Frequency), brightness, contrast (e.g., tone), overexposure, and entropy of the thumbnail.` blurriness: `https://www.pyimagesearch.com/2015/09/07/blur-detection-with-opencv/ (https://www.pyimagesearch.com/2015/09/07/blur-detection-with-opencv/)

Saturacion, profundidad de campo, balance de blancos, r, g y b, ruido,

In [12]:
```
df['blurriness'] = 0.0
df['brightness'] = 0.0
df['contrast'] = 0.0  # HOW?!
df['overexposure'] = 0.0  # HOW?
df['entropy'] = 0.0
df['avg_color'] = np.empty((len(df), 0)).tolist()
```

In [13]:

```
def blurriness(path):
    # compute the Laplacian of the image and then return the focus
    # measure, which is simply the variance of the Laplacian
    image = cv2.imread(path)
    gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
    return cv2.Laplacian(image, cv2.CV_64F).var()


def brightness(path):
    image = Image.open(path)
    greyscale_image = image.convert('L')
    histogram = greyscale_image.histogram()
    pixels = sum(histogram)
    brightness = scale = len(histogram)

    for index in range(0, scale):
        ratio = histogram[index] / pixels
        brightness += ratio * (-scale + index)

    return 1 if brightness == 255 else brightness / scale

def avg_color(path):
    img = Image.open(path)
    width, height = img.size

    r_total = 0
    g_total = 0
    b_total = 0

    count = 0
    for x in range(0, width):
        for y in range(0, height):
            r, g, b = img.getpixel((x,y))
            r_total += r
            g_total += g
            b_total += b
            count += 1

    return (r_total/count, g_total/count, b_total/count)

def entropy(path):
    rgbImg = io.imread(path)
    grayImg = img_as_ubyte(color.rgb2gray(rgbImg))
    return sklearn_entropy(grayImg)
```

In [14]:

```
for i, row in df.iterrows():
    name = row['url_thumb'].split('/')[-2]
    link = row['url_thumb']
    path = "data/thumbnails/%s.jpg" % name
    urlretrieve(link, path)
    clear_output(wait=True)
    print("Retrieved %s: %d" % (name, i))
    df.at[i, 'blurriness'] = blurriness(path)
    print("Computed blurriness %s: %d" % (name, i))
    df.at[i, 'brightness'] = brightness(path)
    print("Computed brightness %s: %d" % (name, i))
    df.at[i, 'avg_color'] = avg_color(path)
    print("Computed avg_color %s: %d" % (name, i))
    df.at[i, 'entropy'] = entropy(path)
    print("Computed entropy %s: %d" % (name, i))
```

```
Retrieved M-QkaJSMR9M: 264
Computed blurriness M-QkaJSMR9M: 264
Computed brightness M-QkaJSMR9M: 264
Computed avg_color M-QkaJSMR9M: 264
Computed entropy M-QkaJSMR9M: 264
```

From "Engagement and Popularity Dynamics of YouTube Videos and Sensitivity to Meta-Data": `word count, punctuation count, character count, Google hits (e.g., if the title is entered into the Google search engine how many results are found), and the Sentiment/Subjectivity of the title computed using Vader [30], and TextBlob.`

In [16]:
```
df.title.sample(10)
```

Out[16]:
```
142    Bullying -- de la culpa a la vergüenza | Paula...
219    Mis alumnos y las calles del pueblo | Miguel Á...
29     Te invito a creer: Manuel Lozano at TEDxRiodel...
254    Transformar la educación en América Latina | G...
31     La puerta equivocada | Adrián Paenza | TEDxRio...
127    Los reflejos emocionales | Hernán Laperuta | T...
50     No todo es puro verso | Cristina Domenech | TE...
131    TEDxBuenosAires - Marcelo Moguilevsky  - 04/08/10
168    ¿De qué hablan los delfines? | Marcelo Magnasc...
148    TEDxBuenosAires - Mercedes Salado Puerto - 04/...
Name: title, dtype: object
```

In [86]:
```
df['word_count'] = 0
df['punctuation_count'] = 0
df['character_count'] = 0
df['google_hits'] = 0
df['sentiment_vader'] = 0.0
df['sentiment_blob_polarity'] = 0.0
df['sentiment_blob_subjectivity'] = 0.0
```

In [92]:
```
def get_hits(searchfor):
    try:
        r = requests.get('http://www.google.com/search',
                         params={'q':'%s' % searchfor,
                                 "tbs":"li:1", # Google doesn't guess for alternat
                                "hl": 'en'}
                        )
        time.sleep(3)  # So google doesn't think we're bots. Wait, but we are...
        soup = BeautifulSoup(r.text, "lxml")
        hits_string = soup.find('div',{'id':'resultStats'}).text
        hits = int(''.join([c for c in hits_string if c.isdigit()]))
    except Exception as e:
        print(e)
        print(searchfor)
        print(hits_string)
        raise e
    if hits == -1:
        print(r)
        print(hits_string)
    return hits
```

In [94]:
```
words_series = df.title.str.strip().str.split('[\W_]+')
analyzer = SentimentIntensityAnalyzer()
count = lambda l1,l2: sum([1 for x in l1 if x in l2])
for i, row in df.iterrows():
    df.at[i, 'word_count'] = len(list(filter(None, words_series.loc[i])))
    df.at[i, 'punctuation_count'] = count(row['title'],set(string.punctuation))
    df.at[i, 'character_count'] = len(row['title'])
    if row['google_hits'] <= 0: # Sensitive, let's not recalculate in case google
        df.at[i, 'google_hits'] = get_hits(row['title'])
        df.to_csv("draft_saved_just_in_case.csv")
    df.at[i, 'sentiment_vader'] = analyzer.polarity_scores(row['title'])['compound
    df.at[i, 'sentiment_blob_polarity'] = TextBlob(row['title']).sentiment.polarit
    df.at[i, 'sentiment_blob_subjectivity'] = TextBlob(row['title']).sentiment.sub
    clear_output(wait=True)
    print(i, row['title'], df.at[i, 'google_hits'])
```

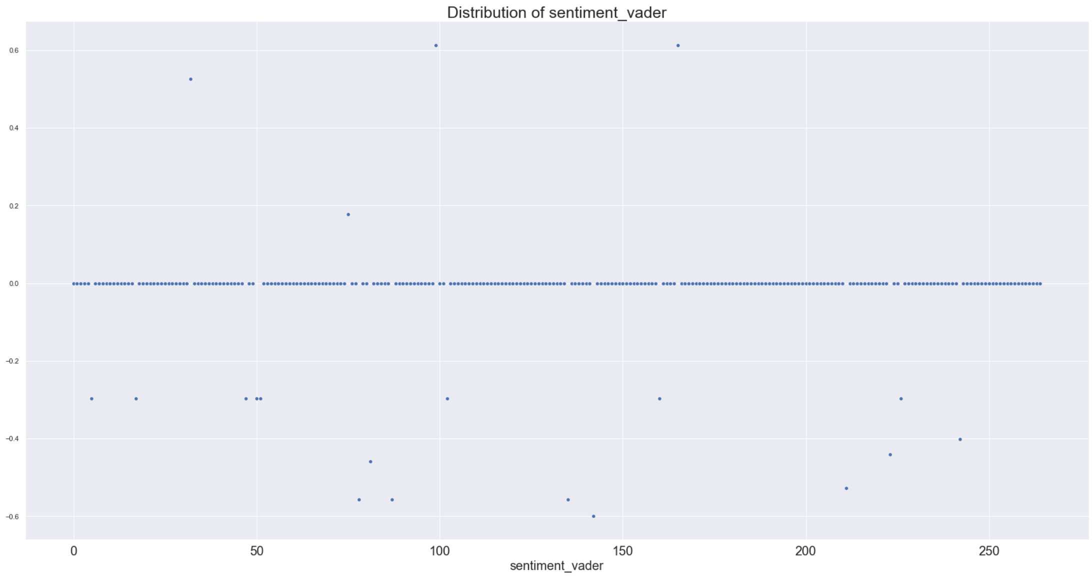
```
264 Performance | Saxaje | TEDxRiodelaPlataED 8230000000
```

In [98]:
```
# df.to_csv('data/processed_v1.csv')
```

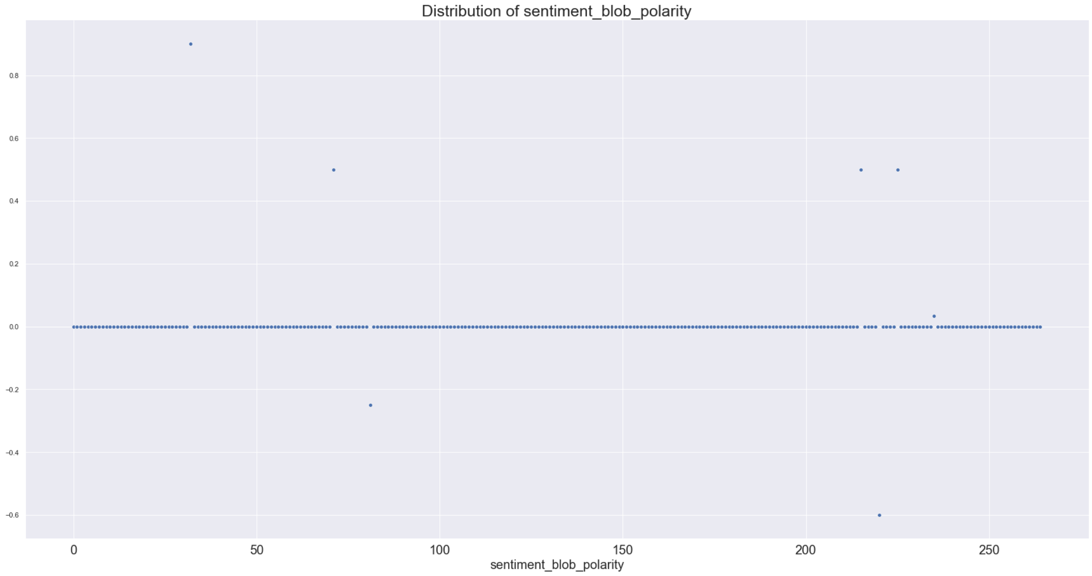
In [102]:
```
# df = pd.read_csv("data/processed_v1.csv", index_col=[0])
```

Let's check distribution for the sentiment analysis.

In [200]:
```
fig, ax = plt.subplots(figsize=(30,15))
ax = sns.scatterplot(data=df.sentiment_vader)
plt.xlabel('sentiment_vader', fontsize=20)
plt.title('Distribution of sentiment_vader', fontsize=25)
for tick in ax.xaxis.get_major_ticks():
    tick.label.set_fontsize(20)
sns.despine()
plt.plot();
```

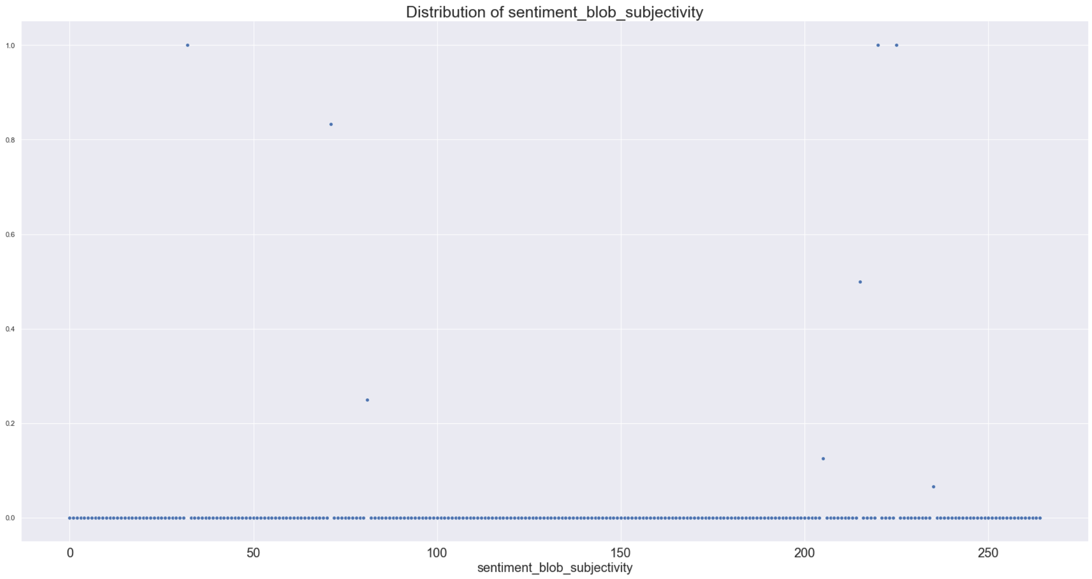


In [202]:
```
fig, ax = plt.subplots(figsize=(30,15))
ax = sns.scatterplot(data=df.sentiment_blob_polarity)
plt.xlabel('sentiment_blob_polarity', fontsize=20)
plt.title('Distribution of sentiment_blob_polarity', fontsize=25)
for tick in ax.xaxis.get_major_ticks():
    tick.label.set_fontsize(20)
sns.despine()
plt.plot();
```



In [203]:

```
fig, ax = plt.subplots(figsize=(30,15))
ax = sns.scatterplot(data=df.sentiment_blob_subjectivity)
plt.xlabel('sentiment_blob_subjectivity', fontsize=20)
plt.title('Distribution of sentiment_blob_subjectivity', fontsize=25)
for tick in ax.xaxis.get_major_ticks():
    tick.label.set_fontsize(20)
sns.despine()
plt.plot();
```



Not very useful... let's leave it at that for the moment

From "Engagement and Popularity Dynamics of YouTube Videos and Sensitivity to Meta-Data":

```
 For the Keywords, seven meta-level features are computed which include: the
number of keywords, and keyword length
```

In [185]:

```
df['tags'] = df['tags'].apply(str).apply(lambda x: '' if x=='nan' else x)
```

In [191]:

```
df['n_keywords'] = 0
df['keyword_length'] = 0.0
```

In [192]:

```
for i, row in df.iterrows():
    if row['tags']:
        tags = row['tags'].split(',')
        df.at[i, 'n_keywords'] = len(tags)
        df.at[i, 'keyword_length'] = sum( map(len, tags) ) / len(tags)
        clear_output(wait=True)
        print(i, row['title'], sum( map(len, tags) ) / len(tags))
```

```
264 Performance | Saxaje | TEDxRiodelaPlataED 9.4
```

From "Engagement and Popularity Dynamics of YouTube Videos and Sensitivity to Meta-Data":

```
 In addition, to the above 49 meta-level features, we also include auxiliary user
meta-level features including: the number of subscribers, resolution of the
thumbnail used, category of the video, the length of the video, and the first
day view count of the video.
```

In [195]:
```
df.columns
```

Out[195]:
```
Index(['event_name', 'video_id', 'title', 'url_thumb', 'tags', 'view_count',
       'like_count', 'dislike_count', 'comment_count', 'created', 'blurriness',
       'brightness', 'contrast', 'overexposure', 'entropy', 'avg_color',
       'word_count', 'punctuation_count', 'character_count', 'google_hits',
       'sentiment_vader', 'sentiment_blob_polarity',
       'sentiment_blob_subjectivity', 'n_keywords', 'keyword_length'],
      dtype='object')
```

In [18]:
```
df['created'] = pd.to_datetime(df['created'])
df['created_day'] = [d.day for d in df['created']]
df['created_month'] = [d.month for d in df['created']]
df['created_year'] = [d.year for d in df['created']]
df['created_hour'] = [d.hour for d in df['created']]
df['created_minute'] = [d.minute for d in df['created']]
df['created_second'] = [d.second for d in df['created']]
```

In [20]:
```
#df.to_csv('data/processed_v2.csv')
```

In [204]:
```
# df = pd.read_csv("data/processed_v2.csv", index_col=[0])
```

Let's start analyzing and doing stuff. Add features later.

In [205]:
```
df = df.drop(['video_id', 'title', 'url_thumb', 'tags', 'created'], axis=1)
```

Split color

In [206]:
```
df[['avg_color_r', 'avg_color_g', 'avg_color_b']] = df['avg_color'].apply(eval).ap
```

In [207]:
```
df = df.drop(['avg_color'], axis=1)
```

One hot encode event

In [208]:
```
df.event_name.unique()
```

Out[208]:
```
array(['CanalTEDxRiodelaPlata', 'TEDxRiodelaPlata2013',
       'TEDxJoven@RiodelaPlata 2011', 'TEDxRiodelaPlata2014',
       'TEDxRiodelaPlata2015', 'TEDxRiodelaPlata2011',
       'TEDxRiodelaPlata2017', 'TEDxRiodelaPlataED2015',
       'TEDxRiodelaPlata2016', 'TEDxRiodelaPlata2012', 'TEDxChange',
       'TEDxBuenosAires2010', 'TEDxJoven@RiodelaPlata 2012',
       'TEDxRiodelaPlata2010', 'TEDxRiodelaPlataSalon2016'], dtype=object)
```

In [209]:
```
df = pd.get_dummies(df, prefix=['event'], columns=['event_name'])
```

```
In [210]: df.columns = ['view_count', 'like_count', 'dislike_count', 'comment_count',
                 'blurriness', 'brightness', 'contrast', 'overexposure', 'entropy',
                 'word_count', 'punctuation_count', 'character_count', 'google_hits',
                 'sentiment_vader', 'sentiment_blob_polarity',
                 'sentiment_blob_subjectivity', 'n_keywords', 'keyword_length',
                 'created_day', 'created_month', 'created_year', 'created_hour',
                 'created_minute', 'created_second', 'avg_color_r', 'avg_color_g',
                 'avg_color_b', 'event_CanalTEDxRiodelaPlata',
                 'event_TEDxBuenosAires2010', 'event_TEDxChange',
                 'event_TEDxJoven@RiodelaPlata2011',
                 'event_TEDxJoven@RiodelaPlata2012', 'event_TEDxRiodelaPlata2010',
                 'event_TEDxRiodelaPlata2011', 'event_TEDxRiodelaPlata2012',
                 'event_TEDxRiodelaPlata2013', 'event_TEDxRiodelaPlata2014',
                 'event_TEDxRiodelaPlata2015', 'event_TEDxRiodelaPlata2016',
                 'event_TEDxRiodelaPlata2017', 'event_TEDxRiodelaPlataED2015',
                 'event_TEDxRiodelaPlataSalon2016']
```

```
In [211]: y = df.view_count
          X = df[df.columns[1:]]
```

From "Engagement and Popularity Dynamics of YouTube Videos and Sensitivity to Meta-Data":

```
 Models: he machine learning methods we utilize include: the Extreme Learning
Machine(ELM), Feed-Forward   Neural   Network (FFNN), Stacked  Auto-Encoder
Deep  Neural-Network , Elasticnet, Lasso, Relaxed Lasso , Quantile Regression
with Lasso, Conditional Inference Random Forest (CIRF), Boosted Generalized
Additive Model, Bagged MARS using gCV Pruning, Generalized Linear Model with
Stepwise Feature Selection using Akaike information criterion, and Spike and
Slab Regression.
```

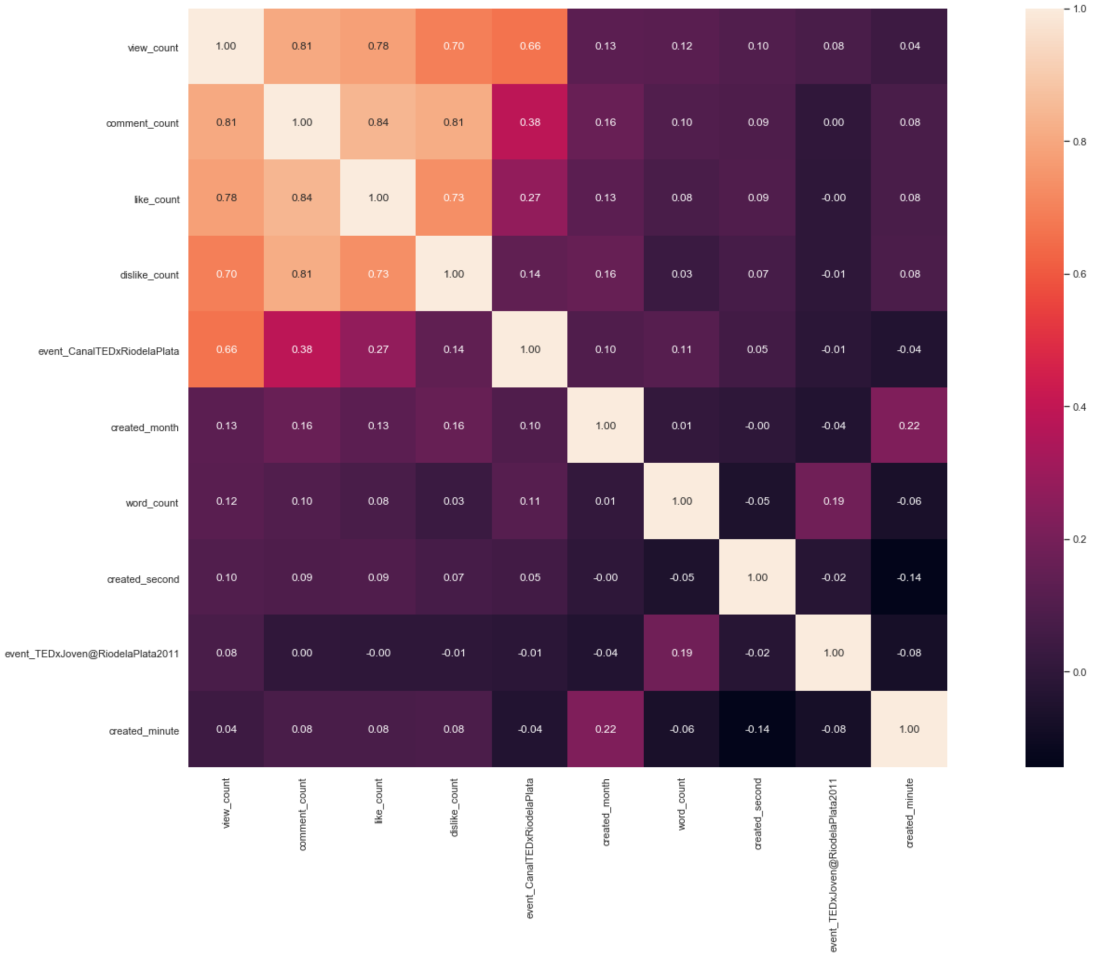
```
In [212]: from sklearn_extensions.extreme_learning_machines.elm import ELMRegressor
          from sklearn.linear_model import ElasticNet, Lasso, LinearRegression
          from sklearn.ensemble import GradientBoostingRegressor
          from pygam import LinearGAM
          from sklearn.ensemble import AdaBoostRegressor
          from xgboost import XGBRegressor
          from sklearn.tree import DecisionTreeRegressor
          from sklearn.neighbors import KNeighborsRegressor

          from sklearn.model_selection import train_test_split, KFold, cross_val_score
```

```
In [213]: correlation = df.corr(method='pearson')
          columns = correlation.nlargest(10, 'view_count').index
          columns
```

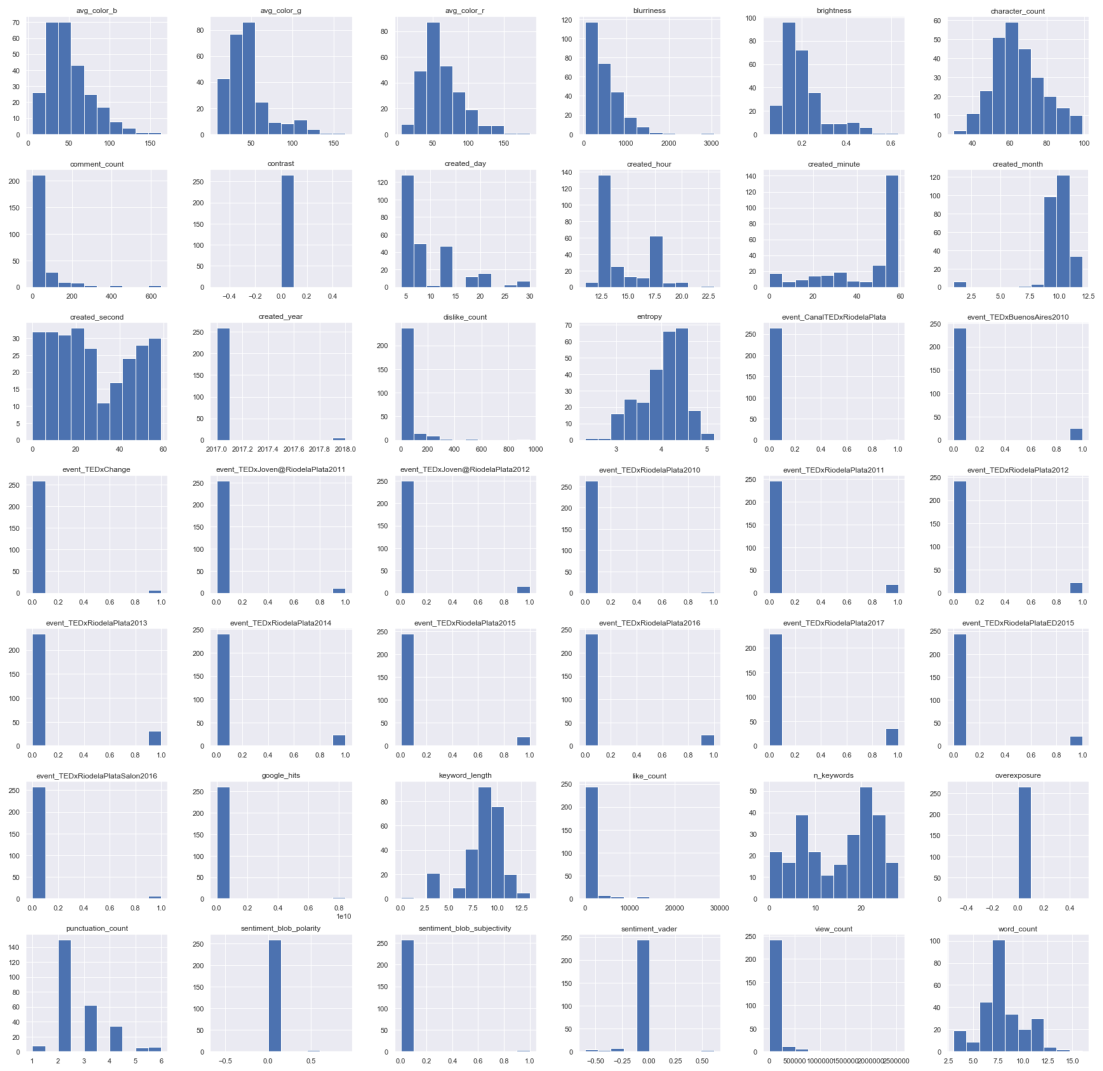
```
Out[213]: Index(['view_count', 'comment_count', 'like_count', 'dislike_count',
                 'event_CanalTEDxRiodelaPlata', 'created_month', 'word_count',
                 'created_second', 'event_TEDxJoven@RiodelaPlata2011', 'created_minute'],
                dtype='object')
```

In [214]:
```
correlation_map = np.corrcoef(df[columns].values.T)
fig, ax = plt.subplots(figsize=(30,15))
sns.set(font_scale=1.0)
heatmap = sns.heatmap(correlation_map, cbar=True, annot=True, square=True, fmt='.2
plt.show()
```



We don't have a lot of correlated features

In [215]:
```
df.hist(figsize=(30,30));
```



In [216]:
```
X_train, X_test, y_train, y_test = train_test_split (X, y, test_size = 0.20, rando
```

In [218]:
```
from sklearn.preprocessing import StandardScaler
scalerX = StandardScaler()
scalery = StandardScaler()
X_train = scalerX.fit_transform(X_train)
y_train = scalery.fit_transform(y_train.reshape(-1, 1))
X_test = scalerX.fit_transform(X_test)
y_test = scalery.fit_transform(y_test.reshape(-1, 1))
```

Let's check performance of the different models

In [220]:

```
models = [
    ("ELMRegressor", ELMRegressor()), ("ElasticNet", ElasticNet()), ("Lasso", Lass
    ("LinearRegression", LinearRegression()), ("GradientBoostingRegressor", Gradie
    ("GradientBoostingRegressor w/quantile loss", GradientBoostingRegressor(loss='
    ("LinearGAM", LinearGAM()), ("AdaBoostRegressor", AdaBoostRegressor()), ("XGBR
    ("DecisionTreeRegressor", DecisionTreeRegressor()), ("KNeighborsRegressor", KN
]

import warnings
warnings.filterwarnings('ignore')

results = []
names = []
for name, model in models:
    kfold = KFold(n_splits=10, random_state=21)
    cv_results = cross_val_score(model, X_train, y_train, cv=kfold, scoring='neg_m
    results.append(cv_results.mean())
    names.append(name)
    msg = "%s: %f (%f)" % (name, cv_results.mean(), cv_results.std())
    print(msg)
print("Best model: %s" % str(sorted(list(zip(results, names)), key=lambda tup: tup
```

```
ELMRegressor: -0.889908 (1.012574)
ElasticNet: -0.809974 (1.318992)
Lasso: -1.010317 (1.393977)
LinearRegression: -0.454327 (0.810584)
GradientBoostingRegressor: -0.308878 (0.634281)
GradientBoostingRegressor w/quantile loss: -0.353544 (0.509432)
LinearGAM: -0.760800 (1.079107)
AdaBoostRegressor: -0.420131 (0.634911)
XGBRegressor: -0.312693 (0.680793)
DecisionTreeRegressor: -0.929138 (1.286812)
KNeighborsRegressor: -0.684558 (1.000135)
Best model: (-0.30887841110299236, 'GradientBoostingRegressor')
```

Grid search for hyperparameters:

In [222]:
```
from sklearn.model_selection import GridSearchCV


param_grid = dict(n_estimators=np.array([50,100,200,300,400]),
                  loss=['ls', 'lad', 'huber', 'quantile'],
                  learning_rate=np.array([0.1, 0.05, 0.01]),
                  max_depth=np.array([3,5,10]))
model = GradientBoostingRegressor(random_state=21)
kfold = KFold(n_splits=10, random_state=21)
grid = GridSearchCV(estimator=model, param_grid=param_grid, scoring='neg_mean_squa
grid_result = grid.fit(X_train, y_train)

means = grid_result.cv_results_['mean_test_score']
stds = grid_result.cv_results_['std_test_score']
params = grid_result.cv_results_['params']
for mean, stdev, param in zip(means, stds, params):
    print("%f (%f) with: %r" % (mean, stdev, param))

print("Best: %f using %s" % (grid_result.best_score_, grid_result.best_params_))
```

```
-0.291833 (0.633911) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 3,
'n_estimators': 50}
-0.289982 (0.632731) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 3,
'n_estimators': 100}
-0.289588 (0.632717) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 3,
'n_estimators': 200}
-0.289528 (0.632892) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 3,
'n_estimators': 300}
-0.289590 (0.633003) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 3,
'n_estimators': 400}
-0.603071 (1.126002) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 5,
'n_estimators': 50}
-0.603566 (1.125133) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 5,
'n_estimators': 100}
-0.603530 (1.125008) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 5,
'n_estimators': 200}
-0.603528 (1.125006) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 5,
'n_estimators': 300}
-0.603528 (1.125006) with: {'learning_rate': 0.1, 'loss': 'ls', 'max_depth': 5,
'n_estimators': 400}
```

So

In [223]:
```
model = GradientBoostingRegressor(**grid_result.best_params_)
```

In [224]:
```
model.fit(X_train, y_train)
```

Out[224]:
```
GradientBoostingRegressor(alpha=0.9, criterion='friedman_mse', init=None,
             learning_rate=0.1, loss='ls', max_depth=3, max_features=None,
             max_leaf_nodes=None, min_impurity_decrease=0.0,
             min_impurity_split=None, min_samples_leaf=1,
             min_samples_split=2, min_weight_fraction_leaf=0.0,
             n_estimators=300, presort='auto', random_state=None,
             subsample=1.0, verbose=0, warm_start=False)
```

In [225]:
```
from sklearn.metrics import mean_squared_error
y_pred = model.predict(X_test)
print(mean_squared_error(y_test, y_pred))
```

```
0.36232661107619896
```

In [226]:
```
compare = pd.DataFrame({'Prediction': y_pred, 'Test Data' : y_test.flatten()})
compare.head(10)
```

Out[226]:

	Prediction	Test Data
0	-0.349741	-0.529010
1	-0.338426	-0.419116
2	-0.153162	-0.363055
3	2.322078	0.984878
4	1.885398	3.303815
5	-0.370476	-0.475171
6	-0.377834	-0.585905
7	-0.046461	0.097545
8	-0.349484	-0.536913
9	-0.326438	-0.444637

Let's descale

In [230]:
```
actual_y_test = scalery.inverse_transform(y_test).flatten()
actual_predicted = scalery.inverse_transform(y_pred)
diff = abs(actual_y_test - actual_predicted)

compare_actual = pd.DataFrame({'Test Data': actual_y_test, 'Predicted views' : act

compare_actual = compare_actual.astype(int)
compare_actual[['Test Data', 'Predicted views', 'Difference']].head(10)
```

Out[230]:

	Test Data	Predicted views	Difference
0	9978	37085	27107
1	26595	38796	12201
2	35072	66809	31737
3	238892	441089	202197
4	589537	375059	214477
5	18119	33949	15830
6	1375	32837	31462
7	104719	82943	21775
8	8783	37124	28341
9	22736	40608	17872

In [228]:

```
np.set_printoptions(formatter={'float_kind':'{:f}'.format})
important_features_dict = {}
for x,i in zip(X.columns, model.feature_importances_):
    important_features_dict[x]=i


important_features_list = sorted(important_features_dict,
                                 key=important_features_dict.get,
                                 reverse=True)

for feature in important_features_list:
    print("%s: %f" % (feature, important_features_dict[feature]))
```

```
like_count: 0.157566
comment_count: 0.083433
dislike_count: 0.068754
entropy: 0.067336
blurriness: 0.060509
n_keywords: 0.054015
keyword_length: 0.049715
avg_color_r: 0.049344
avg_color_b: 0.048850
avg_color_g: 0.048818
character_count: 0.046719
google_hits: 0.042824
created_second: 0.040307
created_minute: 0.034012
brightness: 0.028513
created_hour: 0.019080
punctuation_count: 0.014174
sentiment_vader: 0.013227
word_count: 0.011739
created_day: 0.008017
created_month: 0.007740
event_TEDxRiodelaPlata2017: 0.006784
event_TEDxRiodelaPlata2012: 0.006389
event_TEDxRiodelaPlata2016: 0.005892
event_TEDxRiodelaPlata2013: 0.004568
event_TEDxBuenosAires2010: 0.003785
event_TEDxRiodelaPlataED2015: 0.003708
sentiment_blob_polarity: 0.003611
event_TEDxJoven@RiodelaPlata2012: 0.002403
event_TEDxJoven@RiodelaPlata2011: 0.002388
event_TEDxRiodelaPlata2011: 0.002077
sentiment_blob_subjectivity: 0.001431
event_TEDxRiodelaPlata2015: 0.000678
event_TEDxChange: 0.000671
event_TEDxRiodelaPlata2014: 0.000612
event_CanalTEDxRiodelaPlata: 0.000313
contrast: 0.000000
overexposure: 0.000000
created_year: 0.000000
event_TEDxRiodelaPlata2010: 0.000000
event_TEDxRiodelaPlataSalon2016: 0.000000
```

Some heavy reengineering in the features need to be done.

In [ ]: