Communication statistics study

In this document we will build a model to predict audience for articles published in a company internal magazine. Raw data have been extracted in html form from the company intranet. Articles arepublished on 3 web media :

1. L'Accent, which is the official internal magazine
2. L'Accent Manager, which is a subside from the previous one, but only for the company executives
3. On Air, which is also a susbide from L'Accent but only with videos and audios

For each of these media we have the title of the articles, its teaser in a few lines, its publishing date, its theme, sometimes its sub theme and finally the numbers of views, and the number of likes which we will try to predict.

Resume: After extracting the data from raw html documents, we'll build visualizations which shows that any model using only the theme of an article to predict its audience will produce unsufficient results since the distribution of views for a given theme is widely spread. This conclusion will lead us to a model taking into account the words in the title of each articles using the bag of words technique. We'll then see if another clustering of the articles based on the bag of words could be a better predictor of its final views than the theme.

Creating a proper csv from an html document

```
Raw data have been extracted in html form from the company intranet (with the
company corporate communication approval) using Google Chromium web browser DOM
inspector.
To get rid of all the html tags in the documents we use the software "Sublime"
which allow us to catch REGEX expressions. Html tags are all written in the form
<script*>,to catch these using REGEX we use the following expression:
<[^>]*> and we replace it by ; to create a csv
^(?!.*\n\d).* to verify that each new line correspond to a new date entry

Then with a few operations to clean the document (header, footer, successive
commas, conversion to UTF-8 need to get rid of accents, Sublime allows saving with
automatic encoding to UTF-8).

Using Sublime we have now three documents in proper csv format.
```

Building a data model

We first aim at creating 3 pandas dataframe to perform analysis. These dataframe shall have the following form:

- Laccent articles : ['DATE', 'TITRE', 'RESUME', 'THEME', 'SOUS_THEME', 'LIKES', 'VUES']
- onair articles : ['DATE', 'THEME', 'SOUS_THEME', 'TITRE', 'DUREE', 'VUES']
- Laccent manager articles : ['DATE', 'TITRE', 'RESUME', 'THEME', 'SOUS_THEME', 'LIKES', 'VUES']

For that we import the proper Python libraries for dataframe creation and to attribute the proper data type to each column. We import matplotlib pyplot for Dataviz.

In [2]:

```
#Libraries import
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import datetime
```

In [3]:

```
#CSV document import
Laccent=pd.read_csv("/home/reddowan/Documents/AirFrance/Laccent_extract.csv", sep="
onair=pd.read_csv("/home/reddowan/Documents/AirFrance/onair_extract.csv", sep=";")

#We print the dataframe columns for verification
print(list(Laccent.columns.values))
print(list(onair.columns.values))
```

```
['DATE', 'TITRE', 'RESUME', 'THEME', 'SOUS_THEME', 'LIKES', 'VUES', 'U
nnamed: 7']
['DATE', 'THEME', 'SOUS_THEME', 'TITRE', 'DUREE', 'VUES', 'Unnamed:
 6']
```

In [4]:

```
#An Unnamed column has been created in both cases, there may be errors in the csv f
Laccent['Unnamed: 7'].index[Laccent['Unnamed: 7'].apply(np.isnan)]
onair['Unnamed: 6'].index[onair['Unnamed: 6'].apply(np.isnan)]
```

Out[4]:

```
Int64Index([  0,   1,   2,   3,   4,   5,   6,   7,   8,   9,
            ...
            548, 549, 550, 551, 552, 553, 554, 555, 556, 557],
           dtype='int64', length=558)
```

In [5]:

```
#They do not contain data so we get rid of these unnamed columns
Laccent=pd.DataFrame(Laccent, columns=['DATE','TITRE','RESUME','THEME','SOUS_THEME'
onair=pd.DataFrame(onair, columns=['DATE','TITRE','THEME','SOUS_THEME','DUREE','VUE
```

In [6]:

```
#Converting Laccent column DATE from string to datetime and VUES to int, in order t
for index,row in Laccent.iterrows():
    Laccent['DATE'][index]=datetime.datetime.strptime(Laccent['DATE'][index], "%d.%
    Laccent['VUES'][index]=int(Laccent['VUES'][index])
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  app.launch_new_instance()
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [7]:

```
#Converting onair column DATE from string to datetime and VUES to int and DUREE to
for index,row in onair.iterrows():
    onair['DATE'][index]=datetime.datetime.strptime(onair['DATE'][index], "%d.%m.%Y
    #print(index,onair['TITRE'][index])
    onair['VUES'][index]=int(onair['VUES'][index])
    #onair['DUREE'][index]=datetime.datetime.strptime(onair['DUREE'][index], "%M:%S
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  app.launch_new_instance()
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [8]:

```
#Let's print the 10 most read articles in the magazine Laccent for verification
Laccent.sort(['VUES'], ascending=0).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

Out[8]:

	DATE	TITRE	RESUME	THEME	SOUS_THEME	LIKES	V
241	2015-12-07	Jeu concours : faites le tour de France en 747 !	Le jeu-concours est terminé ! Voici la liste d...	TALENTS ET METIERS	FLOTTE	117	2
249	2015-12-03	AF747 : un vol en hommage au Super Jumbo	Le 14 janvier 2016 prochain, Air France organi...	FLOTTE	CLIENT	72	1
171	2016-02-03	Deux fleurons aéronautiques se donnent rendez-...	Le 27 janvier 2016, au-dessus de la Camargue, ...	TALENTS ET METIERS	FLOTTE	143	1
207	2016-01-11	Adieux au 747	Le 11 janvier 2016 à 14h, le dernier vol comme...	FLOTTE	TALENTS ET METIERS	112	9
35	2016-06-01	Profitez d'une offre wifi internationale réser...	Vous souhaitez rester connecté durant vos séjo...	COMMUNICATION	TALENTS ET METIERS	24	8
223	2015-12-17	Second vol en hommage au 747 d'Air France	Air France a reçu près de 30 000 appels en 24 ...	CLIENT	FLOTTE	29	7
165	2016-02-09	Participez à l'opération "Femmes d'Air France ...	A l'occasion de la Journée internationale des ...	TALENTS ET METIERS	NaN	49	5
57	2016-05-12	Les Cars Air France deviennent Le	A compter du 12 mai 2016, Kéolis,	PRODUITS ET SERVICES	CLIENT	0	5

		Bus Direct	actionnaire ...				
258	2015-11-24	Téléchargez la nouvelle application L'accent	Découvrez en exclusivité la toute nouvelle app...	COMMUNICATION	COMMUNICATION	21	5
178	2016-01-29	La Patrouille de France salue le 747 !	Le 27 janvier au dessus de la Camargue, douze ...	TALENTS ET METIERS	FLOTTE	112	5

In [9]:

```
#Let's print also the 10 most seen onair contents
onair.sort(['VUES'], ascending=0).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

Out[9]:

	DATE	TITRE	THEME	SOUS_THEME	DUREE	VUES
240	2015-03-16	Démonstrations de sécurité	GROUPE ET COMPAGNIE	07 - Sécurité des vols	04:40	25546
245	2015-03-04	Nouveau film publicitaire	GROUPE ET COMPAGNIE	06 - Communication	01:00	24732
75	2016-02-01	Rendez-vous de 2 fleurons aéronautiques	GROUPE ET COMPAGNIE	12 - Evénement	03:30	12658
313	2014-09-19	Message aux pilotes	GROUPE ET COMPAGNIE	01 - Stratégie	4:13	12548
150	2015-09-08	Interview de Frédéric Gagey	GROUPE ET COMPAGNIE	14 - Perform 2020	05:11	12454
191	2015-06-16	Mesures d'adaptation : ITW de F.Gagey	GROUPE ET COMPAGNIE	14 - Perform 2020	05:09	11491
315	2014-09-04	Ebola, le point de vue du CDC	GROUPE ET COMPAGNIE	01 - Stratégie	07:52	11443
365	2014-05-06	... la nouvelle suite La Première	PRODUITS ET CLIENTS	Tout savoir sur...	00:44	11423
339	2014-06-18	Making of nouvelles cabines	PRODUITS ET CLIENTS	Les making of	01:16	10490
257	2015-01-29	Tous ensemble pour retrouver notre place	GROUPE ET COMPAGNIE	14 - Perform 2020	06:21	10155

Creating our first dataviz

Our aim is to identify clear visible pattern in the data (if there is any). So to start we would like to see the following viz :

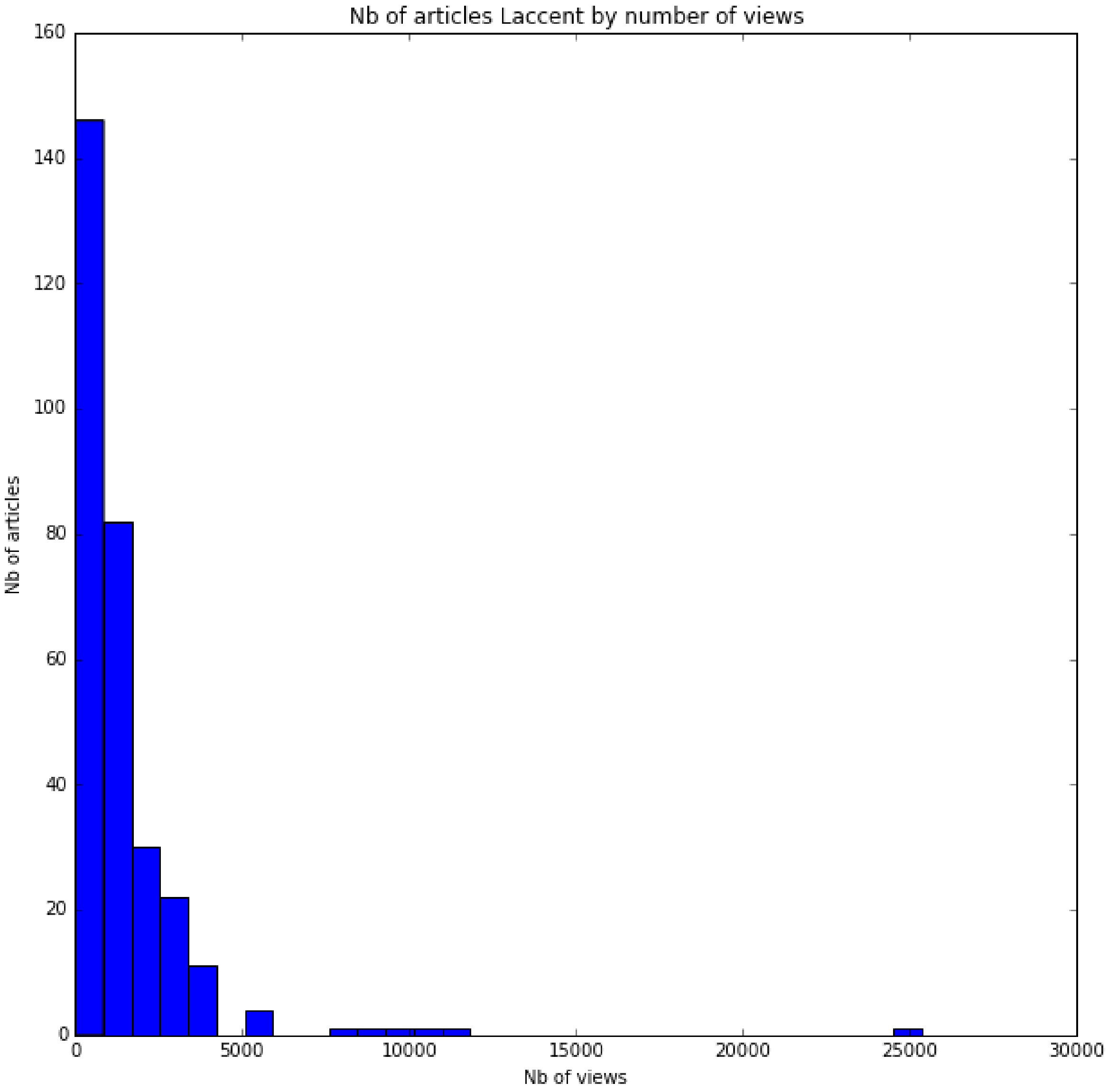
1. Article number of views distribution (what's the typical number of views for an article? what range?)
2. Number of views per article per publishing date (is the number of views per article globally rising? declining? does the date of the article have an influence on its audience?)
3. What are the most read article theme by the audience?
4. Finaly,is there a clear correlation the theme and the distribution of the number of views?

These quetions are essential as they aim at finding what truly interest our readers and if the content is appropriate to what the audience is seeking. Finding the answer to these questions is also key to building our audience predictor, if the theme has no clear influence on views it means that the reader is clicking (or not) on the article basing its judgment of interest on something else which is probably the words of the article title.

In [10]:

```
%matplotlib inline

print("La moyenne de vue par article Laccent est de", np.mean(Laccent['VUES']),
      "\nla mediane de vue des articles Laccent est de",np.median(Laccent['VUES']),
      "\net la deviation standard des articles Laccent est de",np.std(Laccent['VUES
plt.figure(figsize=(10,10))
plt.title('Nb of articles Laccent by number of views')
plt.xlabel('Nb of views')
plt.ylabel('Nb of articles')
plt.hist(Laccent['VUES'],bins=30)
plt.show()
```

```
La moyenne de vue par article Laccent est de 1376.1528239202657
la mediane de vue des articles Laccent est de 868.0
et la deviation standard des articles Laccent est de 2047.064840618069
6
```

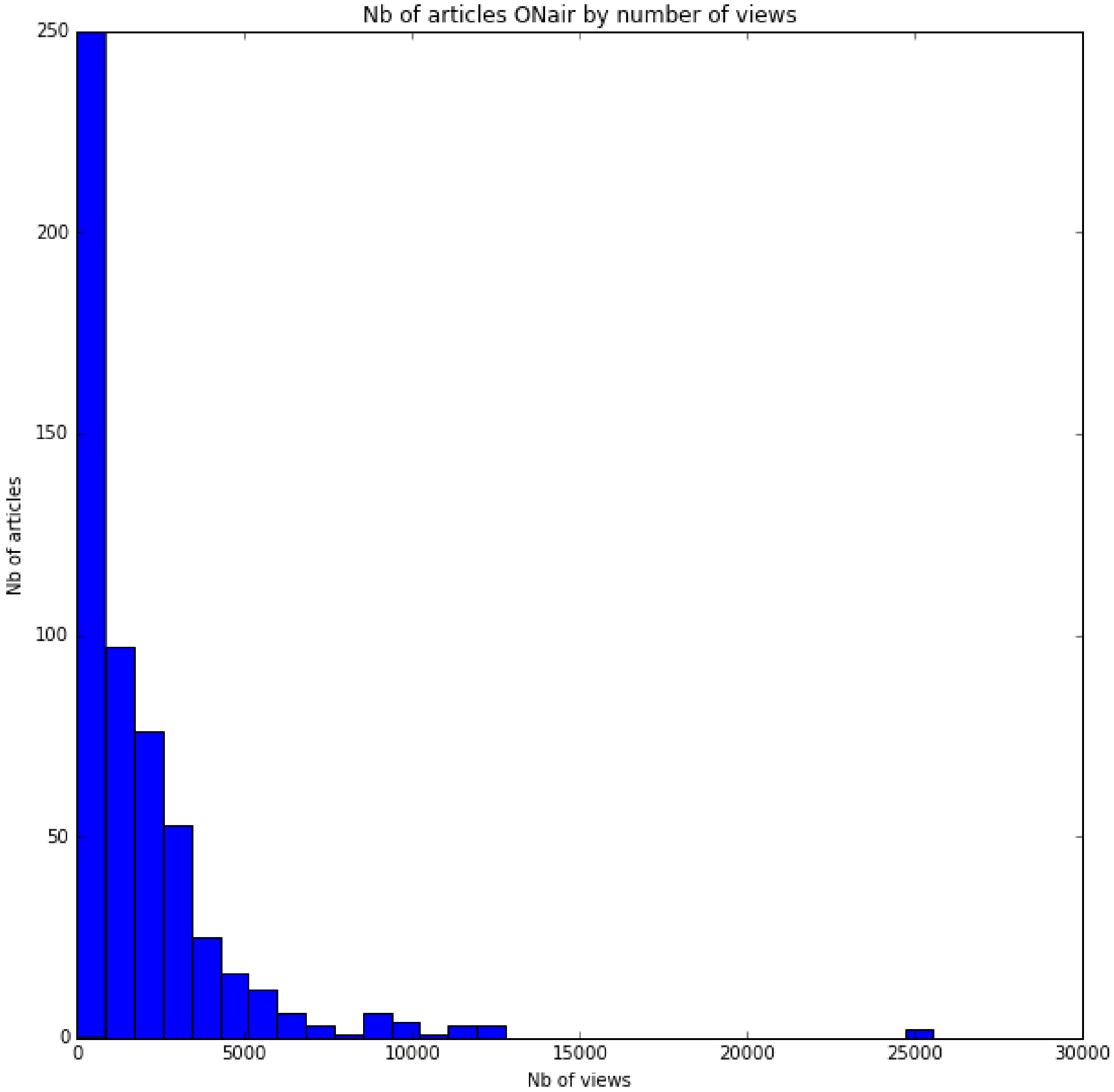


The result here are interesting because we realize that halfthe articles does not pass 868 number of views which is quite low for a potential audience of 47k people inside the company. We can also see that a few articles have outstanding number of views surpassing 5x to 10x the average.

In [11]:

```
print("La moyenne de vue par article onair est de", np.mean(onair['VUES']),
      "\nla mediane des articles onair est de",(onair['VUES'].median()),
      "\net la deviation standard des articles onair est de",np.std(onair['VUES']))
plt.figure(figsize=(10,10))
plt.title('Nb of articles ONair by number of views')
plt.xlabel('Nb of views')
plt.ylabel('Nb of articles')
plt.hist(onair['VUES'],bins=30)
#plt.hist(onair['VUES'])
plt.show()
```

```
La moyenne de vue par article onair est de 1871.7293906810037
la mediane des articles onair est de 1148.0
et la deviation standard des articles onair est de 2585.476741787897
```



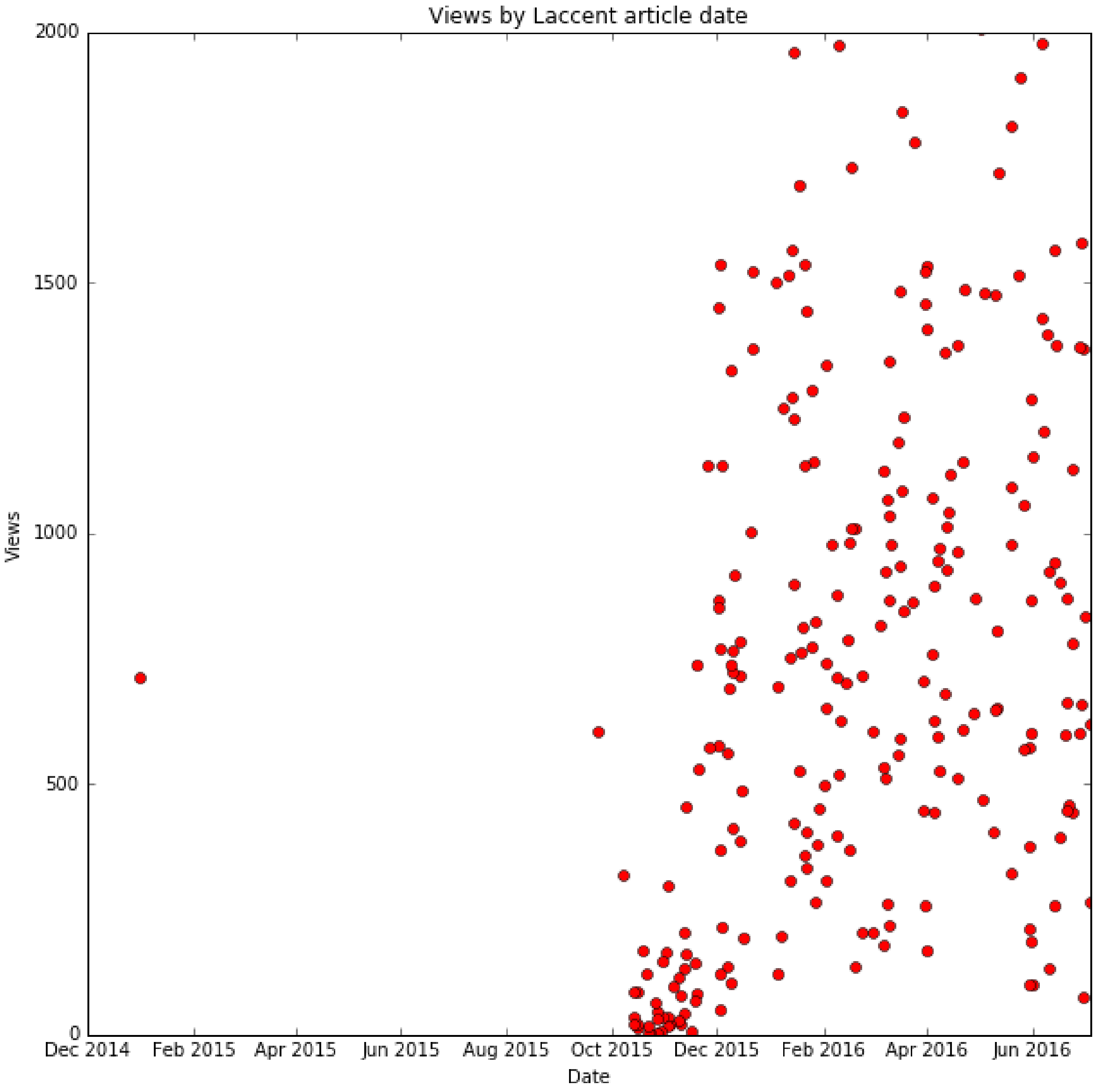
The same observation are true for onair contents.

In [12]:

```
#list_titre=pd.concat([Laccent['TITRE'],onair['TITRE']],ignore_index=True)
#print(list_titre)
```

In [13]:

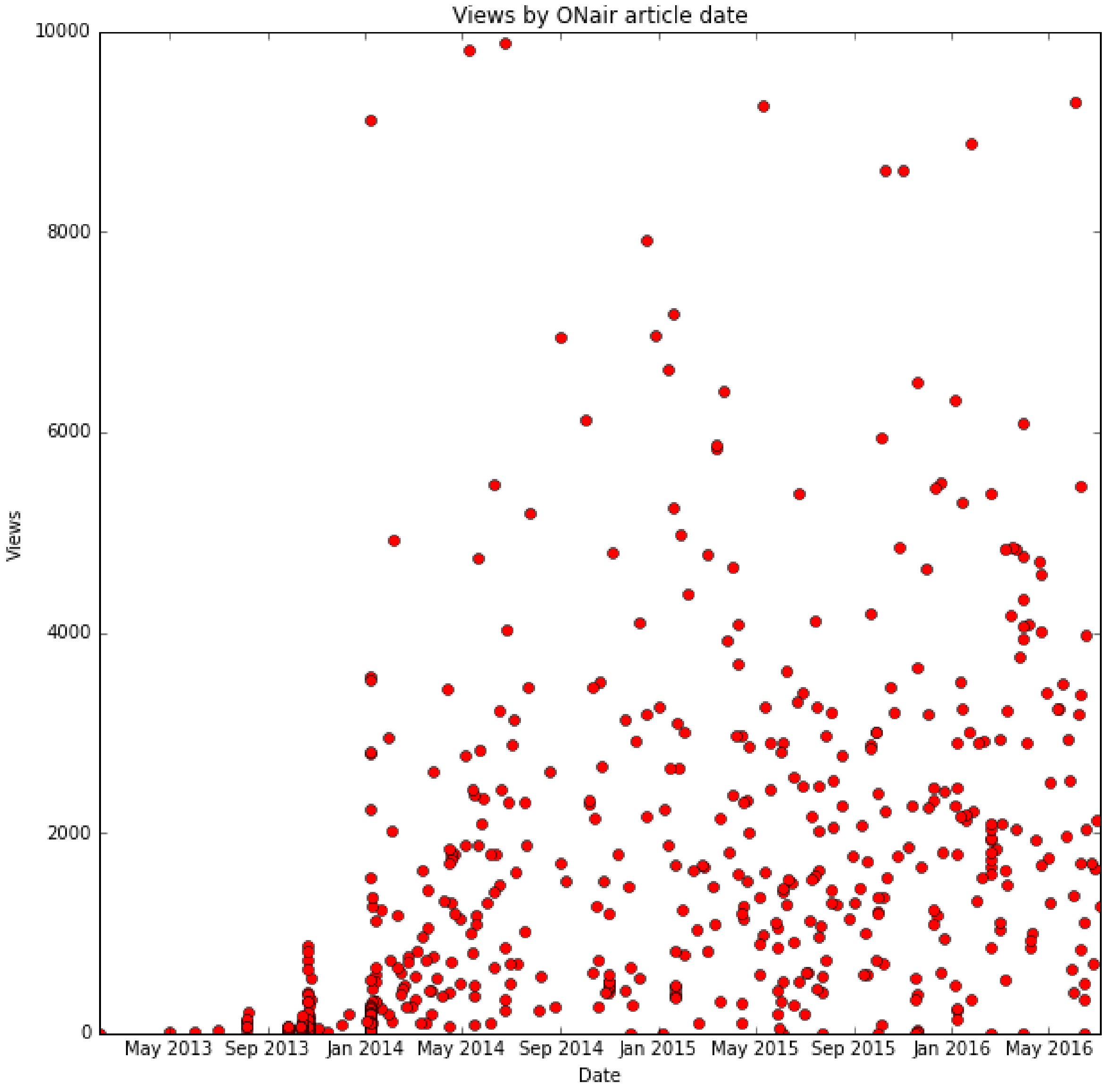
```
x=Laccent['DATE']
y=Laccent['VUES']
plt.figure(figsize=(10,10))
plt.title('Views by Laccent article date')
plt.xlim(xmin=datetime.datetime.strptime("01.12.2014", "%d.%m.%Y").date(),xmax=date
plt.ylim(ymin=0,ymax=2000)
plt.xlabel('Date')
plt.ylabel('Views')
plt.plot(x,y,'ro')
plt.show()
```



This viz is also very interesting, we can see that there must be something missing in the data for the year 2015 for Laccent articles. The web magazine has been put online in the beginning of 2015 and apparently data has been lost. The articles published at the end of 2015 also all have a very low number of views which can only be explained by missing data. Data in 2016 seem complete and there is no clear pattern of a evolution in the global number of views.

In [14]:

```
x=onair['DATE']
y=onair['VUES']
plt.figure(figsize=(10,10))
plt.title('Views by ONair article date')
plt.ylim(ymin=0,ymax=10000)
plt.xlabel('Date')
plt.ylabel('Views')
plt.plot(x,y,'ro')
plt.show()
```



ONair data seem more complete over the time period 2014-2016 as no missing data pattern is apparent on this visualization. We can see that the missing data are probably over the 2013 period where the audience and the number of articles seem oddly low.

In [15]:

```
#We list the different themes that we have in the dataframe Laccent in an array to
list_theme_Laccent=pd.concat([Laccent['THEME'],Laccent['SOUS_THEME']],ignore_index=
```

In [16]:

```
#We list the different theme the same way for ONair but the structure is not the sa
print(onair['THEME'].unique())
list_theme_onair=pd.concat([onair['THEME'],onair['SOUS_THEME']],ignore_index=True).
```

```
['GROUPE ET COMPAGNIE' 'PRODUITS ET CLIENTS' 'MANAGER']
```

In [17]:

```
#Let's analyse some statistics for Laccent by theme likethe total number of article
resume_Laccent=pd.DataFrame({'THEME':np.zeros(34),'SUM':np.zeros(34),'COUNT':np.zer

for index,row in resume_Laccent.iterrows():
    resume_Laccent['THEME'][index]=list_theme_Laccent[index]
    resume_Laccent['SUM'][index]=Laccent[Laccent.THEME==list_theme_Laccent[index]][
    resume_Laccent['COUNT'][index]=Laccent[Laccent.THEME==list_theme_Laccent[index]
    resume_Laccent['MEAN'][index]=resume_Laccent['SUM'][index]/resume_Laccent['COUN
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [18]:

```
#Same thing for ONair
resume_onair=pd.DataFrame({'THEME':np.zeros(34),'SUM':np.zeros(34),'COUNT':np.zeros

for index,row in resume_onair.iterrows():
    resume_onair['THEME'][index]=list_theme_onair[index]
    resume_onair['SUM'][index]=onair[onair.THEME==list_theme_onair[index]]['VUES'].
    resume_onair['COUNT'][index]=onair[onair.THEME==list_theme_onair[index]]['VUES'
    resume_onair['MEAN'][index]=resume_onair['SUM'][index]/resume_onair['COUNT'][in
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [19]:

```
#Let's see the 10 most viewed theme on L'accent (filter on theme with more than 5 a
resume_Laccent[resume_Laccent.COUNT>5].sort(['MEAN'], ascending=0).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

Out[19]:

	COUNT	MEAN	SUM	THEME
14	27.0	3464.333333	93537.0	FLOTTE
1	77.0	1784.350649	137395.0	TALENTS ET METIERS
20	9.0	1502.333333	13521.0	TRANSAVIA
8	14.0	1483.714286	20772.0	PRODUITS ET SERVICES
0	102.0	1369.117647	139650.0	CLIENT
3	86.0	1364.953488	117386.0	STRATEGIE
10	30.0	1349.733333	40492.0	COMMUNICATION
13	38.0	1209.710526	45969.0	PASSAGE
6	12.0	1056.250000	12675.0	PRIX ET RECOMPENSES
15	11.0	1029.636364	11326.0	HOP! AIR FRANCE

In [20]:

```
#Let's see the 10 less viewed theme on L'accent (filter on theme with more than 5 a
resume_Laccent[resume_Laccent.COUNT>5].sort(['MEAN'], ascending=1).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

Out[20]:

	COUNT	MEAN	SUM	THEME
21	8.0	370.250000	2962.0	FONDATION AIR FRANCE
9	12.0	670.083333	8041.0	DEVELOPPEMENT DURABLE
4	6.0	772.166667	4633.0	SECURITE DES VOLS
5	10.0	813.600000	8136.0	PARTENARIATS
30	6.0	934.000000	5604.0	RESSOURCES HUMAINES
7	13.0	947.307692	12315.0	PERFORM 2020
17	11.0	1010.090909	11111.0	BEST AND BEYOND
11	18.0	1011.611111	18209.0	GROUPE
15	11.0	1029.636364	11326.0	HOP! AIR FRANCE
6	12.0	1056.250000	12675.0	PRIX ET RECOMPENSES

```
In [21]:
```

```
#Let's see the 10 most viewed theme on ONair (filter on theme with more than 5 arti
resume_onair[resume_onair.COUNT>5].sort(['MEAN'], ascending=0).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

```
Out[21]:
```

	COUNT	MEAN	SUM	THEME
25	6.0	10142.833333	60857.0	14 - Perform 2020
17	9.0	3400.444444	30604.0	03 - Les décodeurs
29	7.0	3362.000000	23534.0	Les making of
12	69.0	3055.173913	210807.0	06 - Communication
7	15.0	3029.866667	45448.0	07 - Sécurité des vols
3	40.0	2831.975000	113279.0	01 - Stratégie
23	9.0	2788.666667	25098.0	04 - La boîte à questions
16	53.0	2759.716981	146265.0	12 - Evénement
0	318.0	2386.201258	758812.0	GROUPE ET COMPAGNIE
24	20.0	1922.700000	38454.0	Tout savoir sur...

In [22]:

```
#Let's see the 10 less viewed theme on ONair (filter on theme with more than 5 arti
resume_onair[resume_onair.COUNT>5].sort(['MEAN'], ascending=1).head(10)
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:2: FutureWarning: sort(columns=....) is deprecated, use sort_valu
es(by=.....)
  from ipykernel import kernelapp as app
```

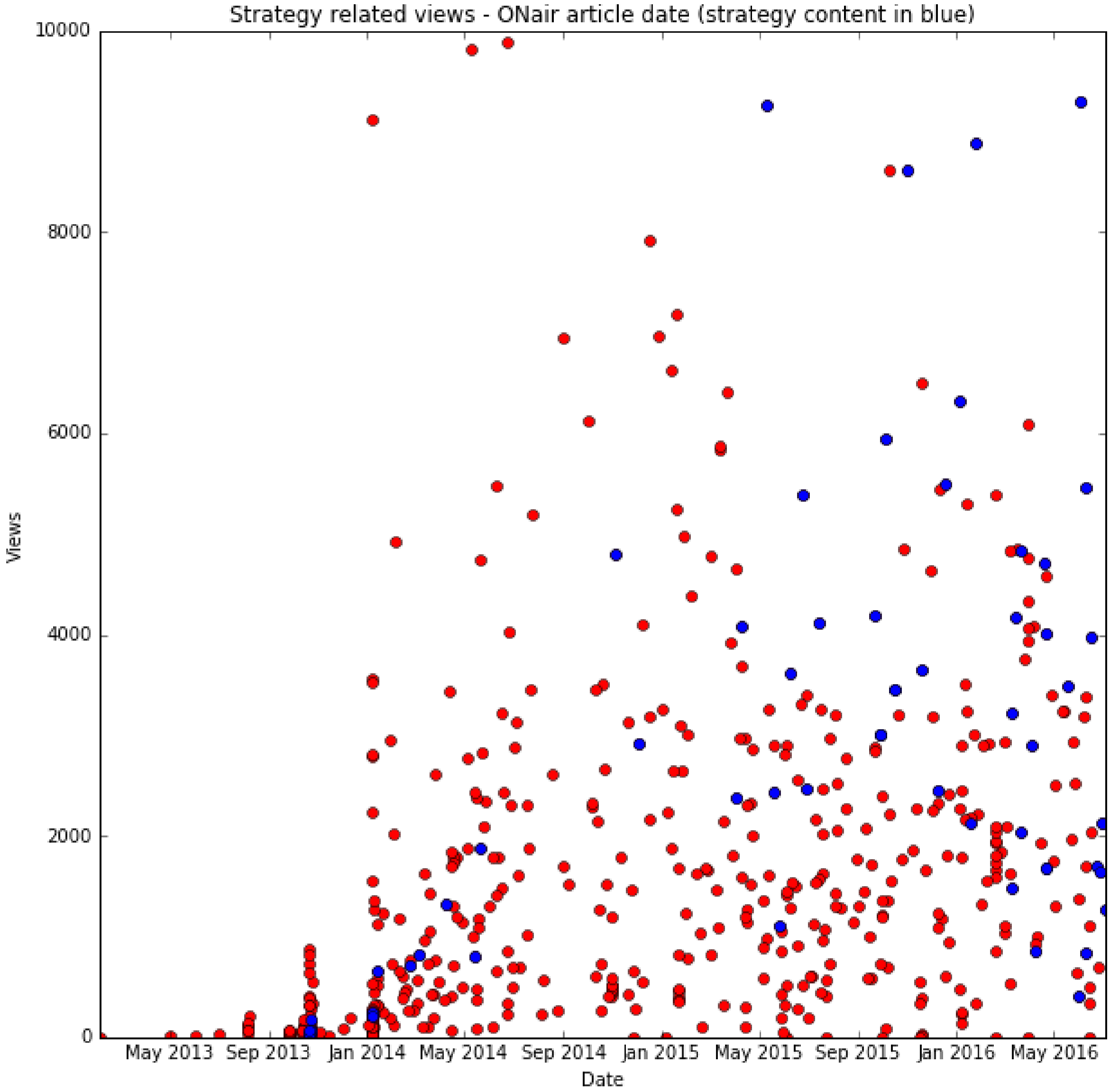
Out[22]:

	COUNT	MEAN	SUM	THEME
32	13.0	243.307692	3163.0	Offre Industrie
10	12.0	552.083333	6625.0	Au sol
20	11.0	759.454545	8354.0	A table
33	20.0	780.650000	15613.0	02 - La Radio
27	9.0	815.111111	7336.0	05 - Zoom sur...
31	7.0	885.714286	6200.0	Offre Cargo
18	34.0	910.970588	30973.0	11 - La Saga
30	17.0	917.411765	15596.0	06 - Parlons-En !
11	19.0	925.315789	17581.0	10 - Engagement
9	15.0	973.333333	14600.0	01 - Enjeux et stratégie

These results are very interesting because they show different topics being mostly viewed by the public which has an explanation because the two medias have been used for different purposes. On L'accent, the most viewed theme corredpond to the arrival of new aircrafts, new products and services, customer and strategy arrives close. On ONair strategy is all over the winning places with Perform videos, the decodeurs which are pedagogic videos on strategy and again strategy. One might think that this has to be put in perspective of the relative number of content published. The following viz shows that compared to other content published at the samedate, strategy/economy related contents are clearly preferred by the viewers.

In [23]:

```
x1=onair['DATE']
y1=onair['VUES']

x2=onair[onair.SOUS_THEME=='14 - Perform 2020']['DATE']
y2=onair[onair.SOUS_THEME=='14 - Perform 2020']['VUES']

x3=onair[onair.SOUS_THEME=='03 - Les décodeurs']['DATE']
y3=onair[onair.SOUS_THEME=='03 - Les décodeurs']['VUES']

x4=onair[onair.SOUS_THEME=='01 - Stratégie']['DATE']
y4=onair[onair.SOUS_THEME=='01 - Stratégie']['VUES']

x5=onair[onair.SOUS_THEME=='15 - Les décodeurs']['DATE']
y5=onair[onair.SOUS_THEME=='15 - Les décodeurs']['VUES']

x6=onair[onair.SOUS_THEME=='15 - Les décodeurs']['DATE']
y6=onair[onair.SOUS_THEME=='15 - Les décodeurs']['VUES']

x7=onair[onair.SOUS_THEME=="02 - L'éco sur un plateau"]['DATE']
y7=onair[onair.SOUS_THEME=="02 - L'éco sur un plateau"]['VUES']

x8=onair[onair.SOUS_THEME=="17- L'éco sur un plateau"]['DATE']
y8=onair[onair.SOUS_THEME=="17- L'éco sur un plateau"]['VUES']

plt.figure(figsize=(10,10))
plt.title('Strategy related views - ONair article date (strategy content in blue)')
plt.ylim(ymin=0,ymax=10000)
plt.xlabel('Date')
plt.ylabel('Views')
plt.plot(x1,y1,'ro')
plt.plot(x2,y2,'ro',color='blue')
plt.plot(x3,y3,'ro',color='blue')
plt.plot(x4,y4,'ro',color='blue')
plt.plot(x5,y5,'ro',color='blue')
plt.plot(x6,y6,'ro',color='blue')
plt.plot(x7,y7,'ro',color='blue')
plt.plot(x8,y8,'ro',color='blue')

plt.show()
```

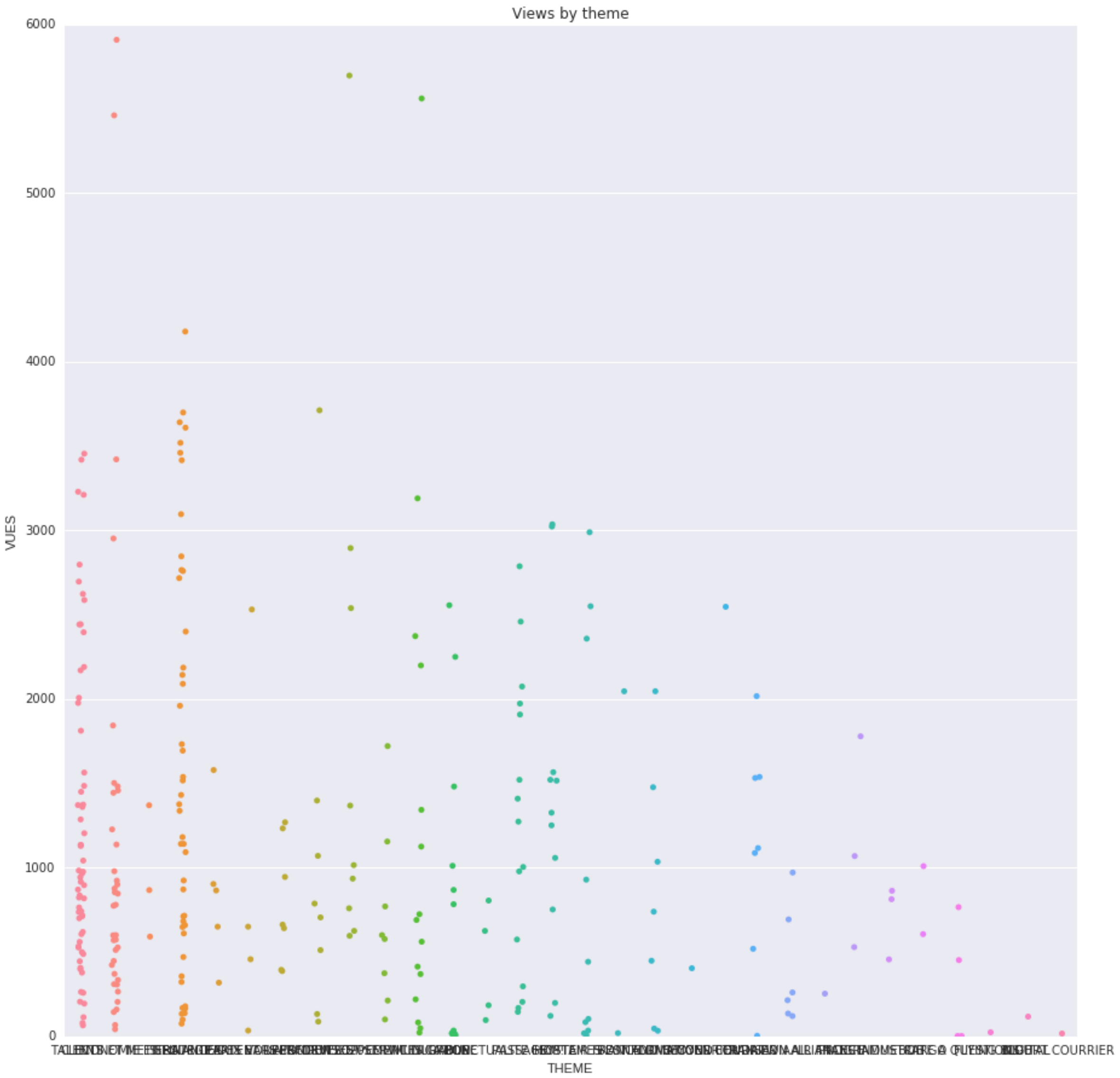


In [24]:

```
#The seaborn python librarie will allow us to better visualize the distribution of
import seaborn as sns
```

In [25]:

```
#Lets visualize Laccent number of views by the main theme to see if there is a clea
plt.figure(figsize=(15,15))
plt.ylim(ymin=0,ymax=6000)
plt.title('Views by theme')
sns.stripplot(x=Laccent['THEME'], y=Laccent['VUES'], data=Laccent, jitter=True);
```



Visualizing a clear trend in Laccent article is a more difficult. It is less obvious to see if a few good articles are responsible for the good statistics or if they rely on a clear public preference.

In [26]:

```
#We will visualize the influence of the day and the week on the total numbers of vi
onair.insert(loc=1,column='WEEK',value=0)
onair.insert(loc=1,column='SUNDAY',value=0)
onair.insert(loc=1,column='SATURDAY',value=0)
onair.insert(loc=1,column='FRIDAY',value=0)
onair.insert(loc=1,column='THURSDAY',value=0)
onair.insert(loc=1,column='WEDNESDAY',value=0)
onair.insert(loc=1,column='TUESDAY',value=0)
onair.insert(loc=1,column='MONDAY',value=0)
```

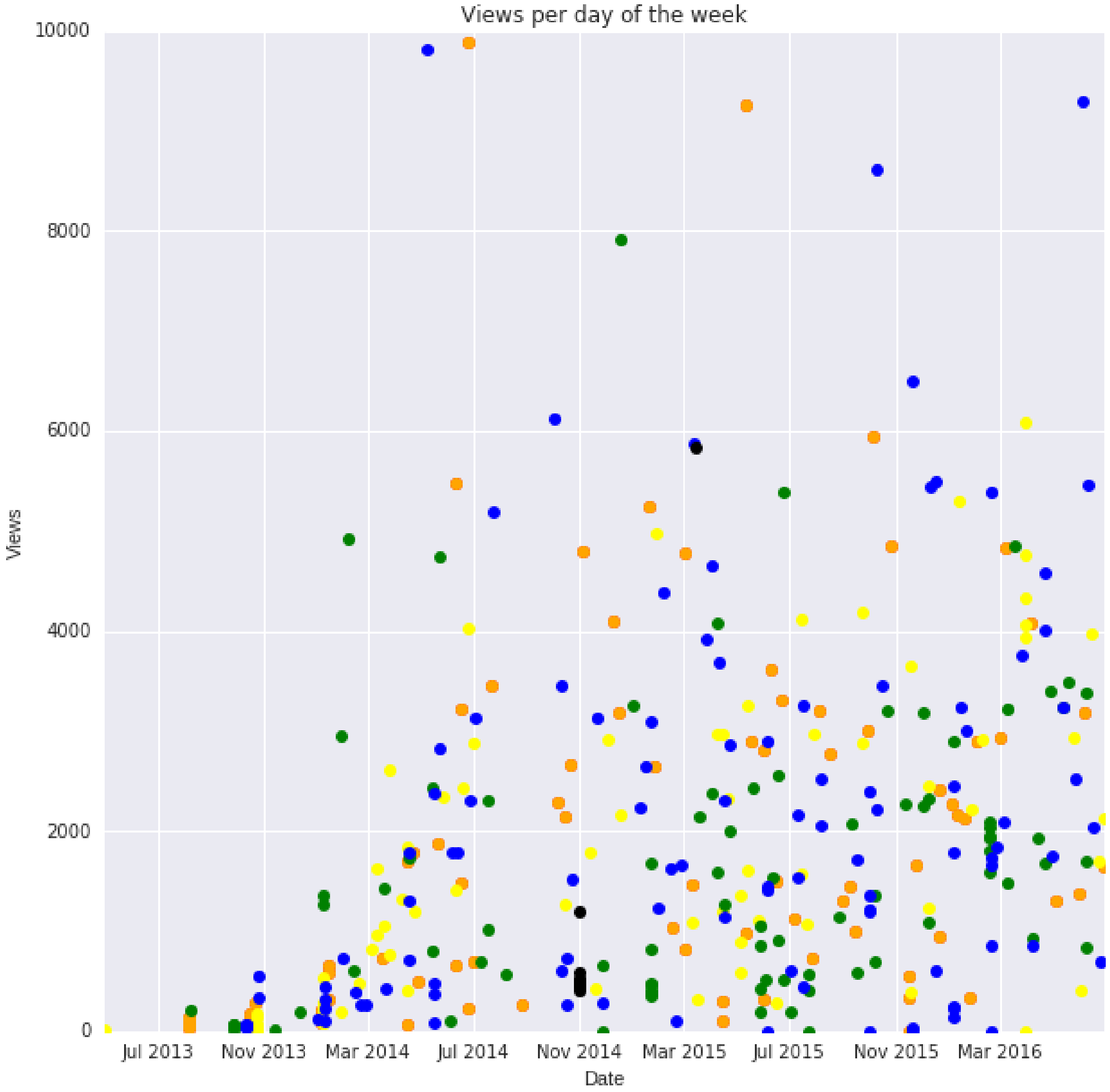
In [27]:

```
#We fill the columns with the number of the week and to what day in the week it is
for index,row in onair.iterrows():
    onair['WEEK'][index]=onair['DATE'][index].toordinal()//7
    jour=onair['DATE'][index].isoweekday()
    if jour==1:
        onair['MONDAY'][index]=1
    elif jour==2:
        onair['TUESDAY'][index]=1
    elif jour==3:
        onair['WEDNESDAY'][index]=1
    elif jour==4:
        onair['THURSDAY'][index]=1
    elif jour==5:
        onair['FRIDAY'][index]=1
    elif jour==6:
        onair['SATURDAY'][index]=1
    elif jour==7:
        onair['SUNDAY'][index]=1
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  app.launch_new_instance()
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:14: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:12: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:18: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:16: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [28]:

```
#Visualize the data per week et per day of the week
x1=onair[onair.MONDAY==1]['DATE']
y1=onair[onair.MONDAY==1]['VUES']

x2=onair[onair.TUESDAY==1]['DATE']
y2=onair[onair.TUESDAY==1]['VUES']

x3=onair[onair.WEDNESDAY==1]['DATE']
y3=onair[onair.WEDNESDAY==1]['VUES']

x4=onair[onair.THURSDAY==1]['DATE']
y4=onair[onair.THURSDAY==1]['VUES']

x5=onair[onair.FRIDAY==1]['DATE']
y5=onair[onair.FRIDAY==1]['VUES']

x6=onair[onair.SATURDAY==1]['DATE']
y6=onair[onair.SATURDAY==1]['VUES']

x7=onair[onair.SUNDAY==1]['DATE']
y7=onair[onair.SUNDAY==1]['VUES']


plt.figure(figsize=(10,10))
plt.title('Views per day of the week')
plt.ylim(ymin=0,ymax=10000)
plt.xlabel('Date')
plt.ylabel('Views')
plt.plot(x2,y2,'ro',color='red')
plt.plot(x2,y2,'ro',color='orange')
plt.plot(x3,y3,'ro',color='yellow')
plt.plot(x4,y4,'ro',color='green')
plt.plot(x5,y5,'ro',color='blue')
plt.plot(x6,y6,'ro',color='black')
plt.plot(x7,y7,'ro',color='black')

plt.show()
```



```
In [29]:
```

```
#Getting a few statistics per day of the week
print("la mediane de vue des articles onair vus le lundi est",y1.median(),"pour",y1
print("la mediane de vue des articles onair vus le mardi est",y2.median(),"pour",y2
print("la mediane de vue des articles onair vus le mercredi est",y3.median(),"pour"
print("la mediane de vue des articles onair vus le jeudi est",y4.median(),"pour",y4
print("la mediane de vue des articles onair vus le vendredi est",y5.median(),"pour"
print("la mediane de vue des articles onair vus le samedi est",y6.median(),"pour",y
print("la mediane de vue des articles onair vus le dimanche est",y7.median(),"pour"
```

```
la mediane de vue des articles onair vus le lundi est 831.5 pour 164 a
rticles
la mediane de vue des articles onair vus le mardi est 1007.0 pour 101
 articles
la mediane de vue des articles onair vus le mercredi est 1201.0 pour 8
7 articles
la mediane de vue des articles onair vus le jeudi est 1361.0 pour 91 a
rticles
la mediane de vue des articles onair vus le vendredi est 1720.0 pour 1
05 articles
la mediane de vue des articles onair vus le samedi est 509.0 pour 9 ar
ticles
la mediane de vue des articles onair vus le dimanche est 5832.0 pour 1
 articles
```

Challenge the theme classification using the bag of words clustering

We've seen that the theme classification wasn't a clear discriminant for the audience in Laccent views analysis. On the ONair video/audio content it seems clearer. But what the users see when he reaches the welcome page on thecompany intranet is not the category of any given article, its his title and sometimes its teaser, that is what leads the viewer to click or not on the article. Acknowledging this fact we will try another view on the articles using a bag of words clustering to determine if certain words are responsible for maximizing the views and to what topic or related articles they are linked.

In [30]:

```
#Importing librairies to stem resume and titles of articles
import re
from nltk.stem.snowball import FrenchStemmer
stemmer=FrenchStemmer()
for index in range(len(Laccent['RESUME'])):
    article=""
    titre=""
    for word in re.split("\W+",Laccent['RESUME'][index]):
        article=article+stemmer.stem(word)+" "
    for word in re.split("\W+",Laccent['TITRE'][index]):
        titre=titre+stemmer.stem(word)+" "
    Laccent['TITRE'][index]=titre
```

```
/home/reddowan/anaconda3/lib/python3.5/site-packages/ipykernel/__main_
_.py:12: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy (http://pandas.pyd
ata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [31]:

```
#Importing stopwords for french language
from stop_words import get_stop_words

stop_words = get_stop_words('fr')
#importing vectorizer to create a sparse matrix of all words token in Laccent.First
from sklearn.feature_extraction.text import CountVectorizer
count_vect = CountVectorizer(stop_words=stop_words)
Resume_token = count_vect.fit_transform(Laccent['RESUME']+" "+Laccent['TITRE'])
Resume_token.shape
```

Out[31]:

```
(301, 3063)
```

In [32]:

```
#Verifying that the stopwordshave been removed
print(count_vect.vocabulary_.get(u'est'))
```

```
None
```

In [33]:

```
#Transform the matrix to tfidf to reduce the impact of frequent words for later clu
from sklearn.feature_extraction.text import TfidfTransformer
transformer=TfidfTransformer()
tfidf=transformer.fit_transform(Resume_token)
```

In [34]:

```
#Import KMeans algorithm, create a list of cluster attribution for each article, ad
from sklearn.cluster import KMeans
from scipy.sparse import csc_matrix, hstack

tfidf_vues=hstack([tfidf,csc_matrix(Laccent['VUES']/8000).T])
y_pred = KMeans(n_clusters=5).fit_predict(tfidf_vues)
#y_pred = KMeans(n_clusters=5).fit_predict(tfidf_vues)
Laccent['CLUSTER']=y_pred
Laccent.head(5)
```

Out[34]:

	DATE	TITRE	RESUME	THEME	SOUS_THEME	LIKES	VUES	CLUSTER
0	2016-07-04	découvr oran nouvel destin d air franc	Dès le 27 juillet, Air France proposera à ses ...	CLIENT	PASSAGE	8	619	0
1	2016-07-04	le tech caf ouvr se port à cdg	Dans le cadre du plan de transformation digita...	TALENTS ET METIERS	SYSTEMES D'INFORMATION	7	265	1
2	2016-07-01	cap ver cub avec air franc et msc croisi	Le 1er juillet 2016, Air France et MSC Croisiè...	CLIENT	PARTENARIATS	4	835	0
3	2016-06-30	l eco sur un plateau ep 2 la maîtris de nos dé...	Pourquoi la maîtrise de nos dépenses est-elle ...	ECONOMIE ET FINANCES	STRATEGIE	10	1370	0
4	2016-06-30	la simplif au servic de la ponctual	Depuis le 28 avril, sur les vols long-courrier...	STRATEGIE	PERFORM 2020	66	2186	2

In [35]:

```
Laccent[Laccent.CLUSTER==0]['VUES'].median()
print("la mediane de vue des articles Laccent du cluster 0 est",Laccent[Laccent.CLU
print("la mediane de vue des articles Laccent du cluster 1 est",Laccent[Laccent.CLU
print("la mediane de vue des articles Laccent du cluster 2 est",Laccent[Laccent.CLU
print("la mediane de vue des articles Laccent du cluster 3 est",Laccent[Laccent.CLU
print("la mediane de vue des articles Laccent du cluster 4 est",Laccent[Laccent.CLU
#print("la mediane de vue des articles Laccent du cluster 5 est",Laccent[Laccent.CL
#print("la mediane de vue des articles Laccent du cluster 6 est",Laccent[Laccent.CL
#print("la mediane de vue des articles Laccent du cluster 7 est",Laccent[Laccent.CL
#print("la mediane de vue des articles Laccent du cluster 8 est",Laccent[Laccent.CL
#print("la mediane de vue des articles Laccent du cluster 9 est",Laccent[Laccent.CL
```

```
la mediane de vue des articles Laccent du cluster 0 est 641.0 pour 163
 articles
la mediane de vue des articles Laccent du cluster 1 est 654.5 pour 64
 articles
la mediane de vue des articles Laccent du cluster 2 est 2550.0 pour 66
 articles
la mediane de vue des articles Laccent du cluster 3 est 8466.0 pour 7
 articles
la mediane de vue des articles Laccent du cluster 4 est 25340.0 pour 1
 articles
```

In [36]:

```
#Lets compare our clustrering based on the bag of words approach to the THEME clust
print("les themes du cluster 0 dont la médiane de vue est la plus faible (641) sont
print("les themes du cluster 1 dont la médiane de vue est également faible (654) so
print("les themes du cluster 2 dont la médiane de vue est de 2550 vues sont",np.uni
print("les themes du cluster 3 dont la médiane de vue est 8466 vues sont",np.unique
print("les themes du cluster 4 qui ne contient qu'un article (pas représentatif) so
#print("les themes du cluster 5 sont",np.unique(Laccent[Laccent.CLUSTER==5]['THEME'
#print("les themes du cluster 6 sont",np.unique(Laccent[Laccent.CLUSTER==6]['THEME'
#print("les themes du cluster 7 sont",np.unique(Laccent[Laccent.CLUSTER==7]['THEME'
#print("les themes du cluster 8 sont",np.unique(Laccent[Laccent.CLUSTER==8]['THEME'
#print("les themes du cluster 9 sont",np.unique(Laccent[Laccent.CLUSTER==9]['THEME'
```

```
les themes du cluster 0 dont la médiane de vue est la plus faible (64
1) sont ['ALLIANCES' 'BEST AND BEYOND' 'BOITE A QUESTIONS' 'CARGO' 'CL
IENT'
 'COMMUNICATION' 'COURT COURRIER' 'DEVELOPPEMENT DURABLE' 'DIGITAL'
 'ECONOMIE ET FINANCES' 'FLOTTE' 'FLYING BLUE' 'FONDATION AIR FRANCE'
 'GROUPE' 'HOP! AIR FRANCE' 'INDUSTRIE' 'LONG COURRIER' 'PARTENARIATS'
 'PASSAGE' 'PERFORM 2020' 'PONCTUALITE' 'PRIX ET RECOMPENSES'
 'PRODUITS ET SERVICES' 'PROGRAMME' 'SECURITE DES VOLS' 'STRATEGIE'
 'TALENTS ET METIERS' 'TRANSAVIA']

les themes du cluster 1 dont la médiane de vue est également faible (6
54) sont ['BOITE A QUESTIONS' 'CLIENT' 'COMMUNICATION' 'DEVELOPPEMENT
 DURABLE'
 'ECONOMIE ET FINANCES' 'FONDATION AIR FRANCE' 'HOP! AIR FRANCE'
 'INDUSTRIE' 'PARTENARIATS' 'PASSAGE' 'PERFORM 2020' 'PONCTUALITE'
 'PRIX ET RECOMPENSES' 'SECURITE DES VOLS' 'STRATEGIE'
 "SYSTEMES D'INFORMATION" 'TALENTS ET METIERS' 'TRANSAVIA']

les themes du cluster 2 dont la médiane de vue est de 2550 vues sont
 ['BEST AND BEYOND' 'CLIENT' 'COMMUNICATION' 'FLOTTE' 'GROUPE'
 'HOP! AIR FRANCE' 'MOYEN COURRIER' 'PARTENARIATS' 'PASSAGE' 'PERFORM
 2020'
 'PRIX ET RECOMPENSES' 'PRODUITS ET SERVICES' 'PROGRAMME' 'STRATEGIE'
 "SYSTEMES D'INFORMATION" 'TALENTS ET METIERS' 'TRANSAVIA']

les themes du cluster 3 dont la médiane de vue est 8466 vues sont ['CL
IENT' 'COMMUNICATION' 'FLOTTE' 'TALENTS ET METIERS']

les themes du cluster 4 qui ne contient qu'un article (pas représentat
if) sont ['TALENTS ET METIERS']
```

In [37]:

```
#Isolating the winning words
kmeans=KMeans(n_clusters=5).fit(tfidf_vues)
kmeans.cluster_centers_
```

Out[37]:

```
array([[  3.61668731e-03,   0.00000000e+00,   7.94248045e-03, ...,
          3.72702830e-03,   2.82493251e-03,   7.01482143e-02],
       [  0.00000000e+00,   4.00773557e-03,   6.11901197e-03, ...,
          3.30567932e-03,   0.00000000e+00,   3.64085000e-01],
       [  2.06485463e-03,   0.00000000e+00,   1.36690406e-03, ...,
          1.97858074e-03,   0.00000000e+00,   1.41013554e-01],
       [  0.00000000e+00,   0.00000000e+00,   9.97204222e-03, ...,
          0.00000000e+00,   0.00000000e+00,   1.35352273e-01],
       [  2.94145674e-02,   0.00000000e+00,   0.00000000e+00, ...,
          0.00000000e+00,   0.00000000e+00,   1.51181250e+00]])
```

In [81]:

```
#Biggest winning words
#getter=tuple(np.array(np.nonzero(kmeans.cluster_centers_[1][0].argmax())))
getter=kmeans.cluster_centers_[4][0:3062].argmax()

print(getter)
from operator import itemgetter
itemgetter(getter)(count_vect.get_feature_names())
```

```
120
```

Out[81]:

```
'747'
```

## Conclusion

In this document,we've seen in the first part how the data can be played with to build a first data model which use the dimensions of the data:

- what are the general statistics of the article numbers of views, and the hitory
- how the date can be transformed to a one hot encoder model to see the influence on views
- how the human classification of theme influence the views (poorly)

In the second part we've challenged this theme classification because people do not see theme they see words, so we used the bag of words transformation with the tf-idf to correct the importance of each token relatively to their frequence in all documents. We've created a new data model on which we created clusters using the Kmeans algorithm.

The result is quite probing, because we have now 5 clusters of words corresponding to very different "audience acclaim", this first result shows that there may not be 20+ theme in the audience head but 5 "bag of words" which will determine if a viewer will read the article or not.

The next step is to build a predictor of the number of views using this new data model with the bag of words representation, the cluster attibution and the date of publication.

## Building a predictor

Using the data model we have now developed we will build a predictor of the number of views per articles.