In [35]:

```
import pandas as pd
import yaml
import matplotlib.pyplot as plt
from IPython.display import display, HTML
```

In [36]:

```
from modules.data import Data
from modules.search import Search
from modules.video import Video
from modules.analyze import Analyze
```

In [37]:

```
data_obj = Data()
analyze_obj = Analyze()
```

In [38]:

```
df_video_labeled = pd.read_csv("unique_id_map/videos_anonymized.csv", dtype={"au
df_comments = pd.read_csv("unique_id_map/comments_anonymized.csv", dtype={"videc
```

In [39]:

```
# Display duration in a readable format
df_video_labeled["video_duration"] = df_video_labeled["video_duration"].apply(ar
df_video_labeled.head()
# Get engagement metrics
df_video_labeled["likes_to_dislikes"] = df_video_labeled.apply(lambda row: analy
df_video_labeled["dislikes_to_likes"] = df_video_labeled.apply(lambda row: analy
df_video_labeled["engagement_score"] = df_video_labeled.apply(lambda row: analyz
# Get unique commenters for every video
df_comments_unique_commenters = df_comments.groupby("video_number")[["comment_nu
df_video_labeled = pd.merge(left=df_video_labeled, right=df_comments_unique_comm
# Factor in for videos without any comments
df_video_labeled["num_unique_commenters"].fillna(0, inplace=True)
```

In [40]:

```
dict_variables = data_obj.load_yaml("variables.yaml")
list_category = dict_variables["category"]
list_theme = dict_variables["theme"]
```

In [41]:

```
# Get dataframes per category and label
list_df_video_category, list_df_video_theme = analyze_obj.splice_by_labels(df_vi
```

In [42]:

```
display(list_df_video_category[0].head())
```

	video_title	video_description	view_count	like_count	dislike_count	favorite_count	comment_cou
31	Redwood City School District To Install Vape D...	The Redwood City School District Board of Trus...	1105372	24119	1104	0	41

	video_title	video_description	view_count	like_count	dislike_count	favorite_count	comment_cou
40	Vaping / E-Cigarette Associated Lung Injury: C...	An important update on E-Cigarette / Vaping pr...	17800	459	10	0	1(
41	Vaping / E-Cigarette Lung Failure, Illness, Di...	Please see our most recent update to vaping as...	147156	1335	422	0	8:
43	The dangers of vaping CBD oil	Dr. Cass Ingram, author of "The Hemp Oil Mirac...	39012	285	421	0	1
44	Vaping vs. Smoking	What are the effects of smoking in the lungs? ...	471	5	3	0	

Stats on views

Descriptive statistics on view count per label

In [43]:

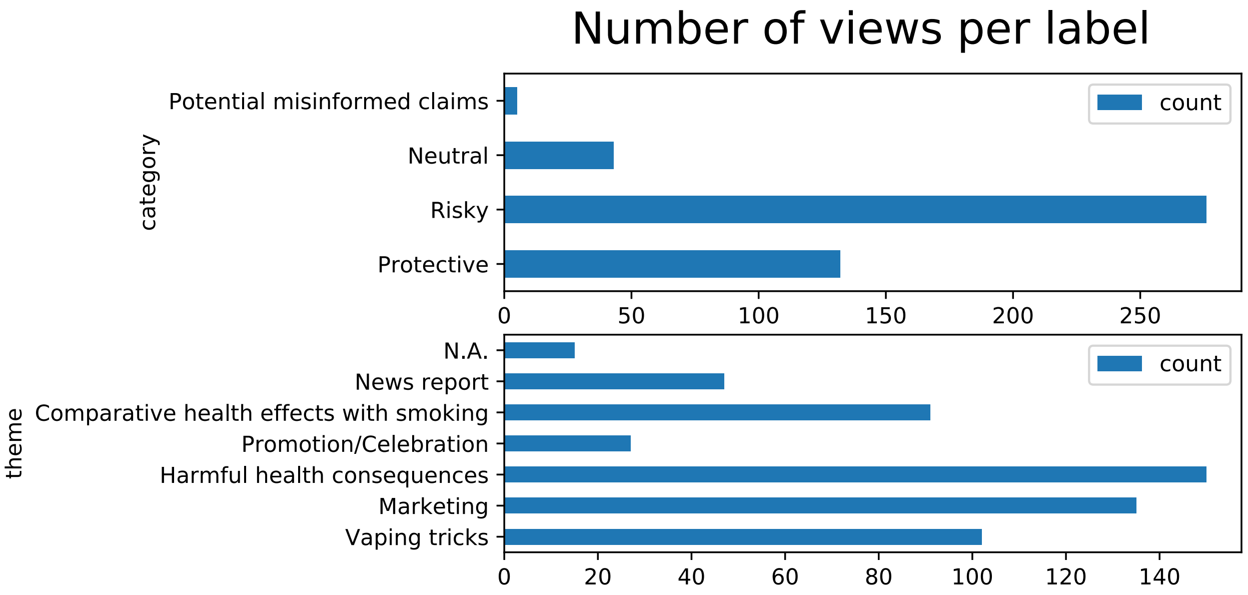
```
df_view_count_category_describe = analyze_obj.describe_df(list_df=list_df_video_
display(df_view_count_category_describe)
df_view_count_theme_describe = analyze_obj.describe_df(list_df=list_df_video_the
display(df_view_count_theme_describe)

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Number of views per label", fontsize=20)
df_view_count_category_describe.plot.barh(x="category", y="count", ax=axes[0])
df_view_count_theme_describe.plot.barh(x="theme", y="count", ax=axes[1])
```

	category	count	mean	std	median
0	Protective	132	8.415775e+05	3.478989e+06	46437.5
1	Risky	276	1.492521e+06	4.123480e+06	148152.5
2	Neutral	43	5.698636e+05	1.644923e+06	87154.0
3	Potential misinformed claims	5	1.631372e+05	9.440142e+04	203830.0

	theme	count	mean	std	median
0	Vaping tricks	102	2.972450e+06	6.252307e+06	652430.5
1	Marketing	135	3.542647e+05	7.795443e+05	91488.0
2	Harmful health consequences	150	7.757108e+05	3.277054e+06	47379.0
3	Promotion/Celebration	27	1.965180e+06	2.740716e+06	612535.0
4	Comparative health effects with smoking	91	1.045678e+06	4.185862e+06	33146.0
5	News report	47	6.001753e+05	1.638318e+06	56047.0

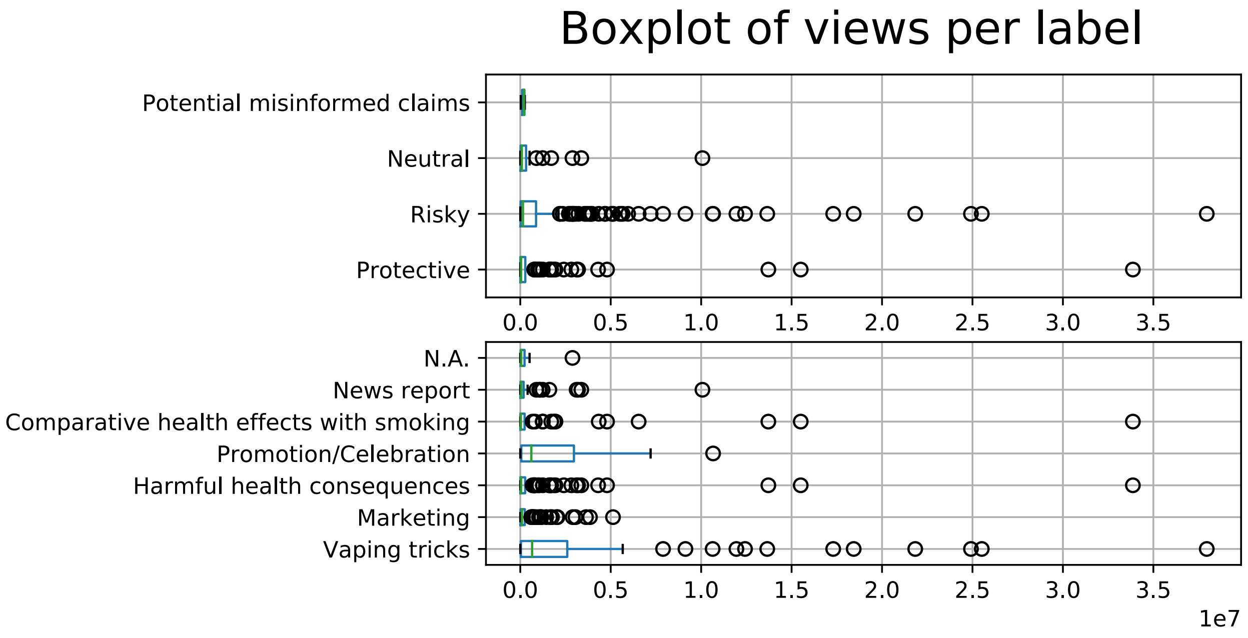
	theme	count	mean	std	median
6	N.A.	15	3.093649e+05	7.285282e+05	51524.0

Out[43]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4572549f10>
```



In [44]:
```
list_view_count_category = [list_df_video_category[index]["view_count"] for inde
df_view_count_category_boxplot = pd.concat(list_view_count_category, axis=1, key

list_view_count_theme = [list_df_video_theme[index]["view_count"] for index, _ i
df_view_count_theme_boxplot = pd.concat(list_view_count_theme, axis=1, keys=list

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of views per label", fontsize=20)
df_view_count_category_boxplot.boxplot(column=list_category, ax=axes[0], vert=Fa
df_view_count_theme_boxplot.boxplot(column=list_theme, ax=axes[1], vert=False)
```

Out[44]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4573ba7760>
```



Stats on duration

Descriptive statistics on video duration per label

In [45]:

```
df_video_duration_category_describe = analyze_obj.describe_df(list_df=list_df_vi
display(df_video_duration_category_describe)
df_video_duration_theme_describe = analyze_obj.describe_df(list_df=list_df_video
display(df_video_duration_theme_describe)
```

	category	mean	std	median
0	Protective	568.469697	818.485433	283.5
1	Risky	387.420290	256.083333	325.0
2	Neutral	423.232558	407.279057	303.0
3	Potential misinformed claims	584.400000	344.558123	644.0

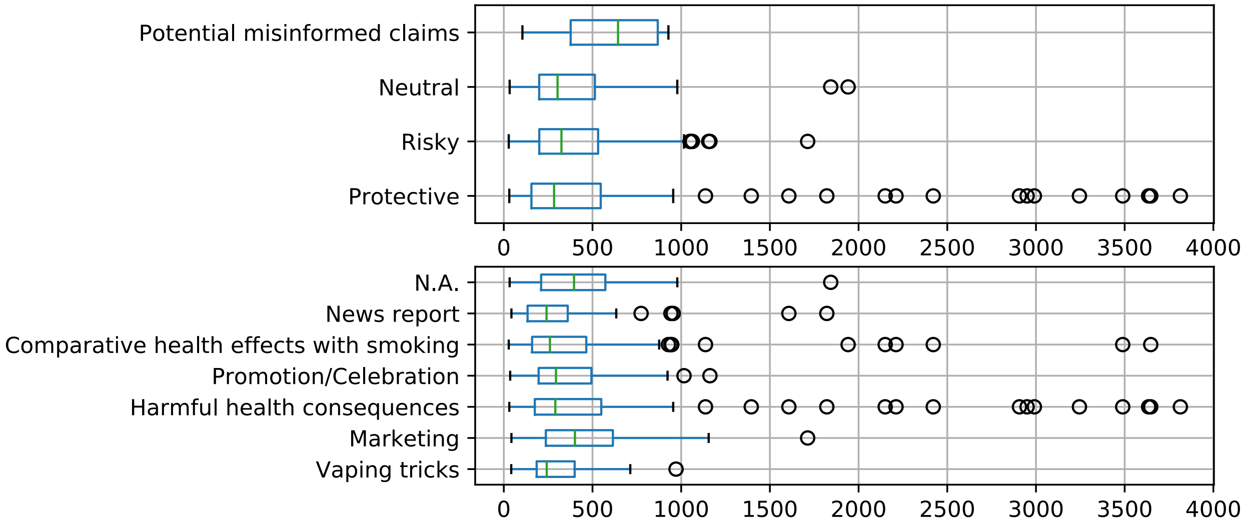
	theme	mean	std	median
0	Vaping tricks	307.990196	178.662384	242.0
1	Marketing	452.829630	278.239603	401.0
2	Harmful health consequences	552.100000	775.215828	290.5
3	Promotion/Celebration	375.962963	282.919325	294.0
4	Comparative health effects with smoking	481.582418	649.459691	260.0
5	News report	341.553191	361.091028	241.0
6	N.A.	465.600000	459.109511	396.0

In [46]:

```
list_video_duration_category = [list_df_video_category[index]["video_duration"]
df_video_duration_category = pd.concat(list_video_duration_category, axis=1, key

list_video_duration_theme = [list_df_video_theme[index]["video_duration"] for in
df_video_duration_theme = pd.concat(list_video_duration_theme, axis=1, keys=list

fig, axes = plt.subplots(nrows=2, ncols=1)
df_video_duration_category.boxplot(column=list_category, ax=axes[0], vert=False)
df_video_duration_theme.boxplot(column=list_theme, ax=axes[1], vert=False)
```

Out[46]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4574d939a0>
```



Stats on engagement

There are three metrics on display here:

1. Likes to dislikes ratio: likes/dislikes * 1000
2. Dislikes to likes ratio: dislikes/likes * 1000
3. Engagement score: (likes + dislikes + comment_count)/view_count * 1000

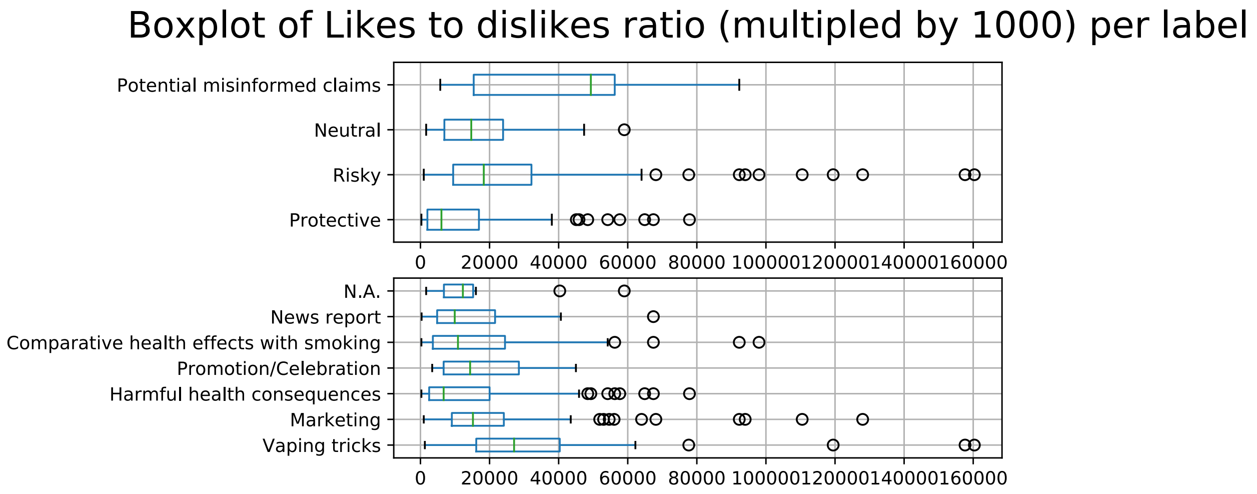
In [47]:

```
list_df_video_category_likes_dislikes = [
    list_df_video_category[index][
        (list_df_video_category[index]["comment_count"] > 0) &
        (list_df_video_category[index]["like_count"] > 0)
    ]
    for index in range(len(list_category))
]
list_df_video_theme_likes_dislikes = [
    list_df_video_theme[index][
        (list_df_video_theme[index]["comment_count"] > 0) &
        (list_df_video_theme[index]["like_count"] > 0)
    ]
    for index in range(len(list_theme))
]

# Likes to dislikes
print("Likes to dislikes")
list_likes_to_dislikes_category = [list_df_video_category_likes_dislikes[index][
df_likes_to_dislikes_category = pd.concat(list_likes_to_dislikes_category, axis=

list_likes_to_dislikes_theme = [list_df_video_theme_likes_dislikes[index]["likes
df_likes_to_dislikes_theme = pd.concat(list_likes_to_dislikes_theme, axis=1, key

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of Likes to dislikes ratio (multipled by 1000) per label",
df_likes_to_dislikes_category.boxplot(column=list_category, ax=axes[0], vert=Fal
df_likes_to_dislikes_theme.boxplot(column=list_theme, ax=axes[1], vert=False)

# Dislikes to likes
print("Dislikes to likes")
```

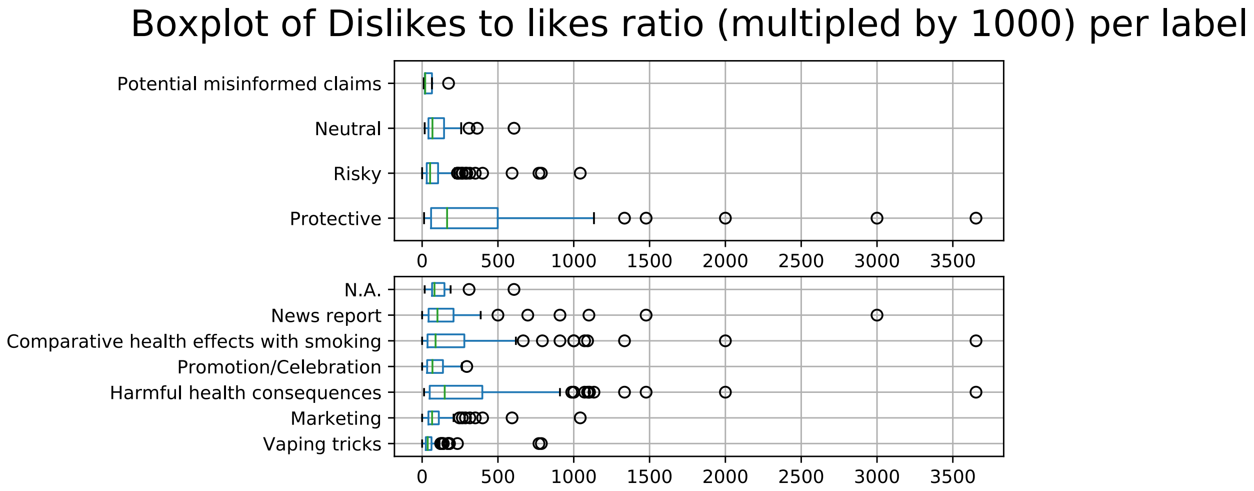
```
list_dislikes_to_likes_category = [list_df_video_category_likes_dislikes[index][
df_dislikes_to_likes_category = pd.concat(list_dislikes_to_likes_category, axis=

list_dislikes_to_likes_theme = [list_df_video_theme_likes_dislikes[index]["disli
df_dislikes_to_likes_theme = pd.concat(list_dislikes_to_likes_theme, axis=1, key

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of Dislikes to likes ratio (multipled by 1000) per label",
df_dislikes_to_likes_category.boxplot(column=list_category, ax=axes[0], vert=Fal
df_dislikes_to_likes_theme.boxplot(column=list_theme, ax=axes[1], vert=False)

# Engagement score
print("Engagement score")

list_engagement_score_category = [list_df_video_category_likes_dislikes[index]["
df_engagement_score_category = pd.concat(list_engagement_score_category, axis=1,

list_engagement_score_theme = [list_df_video_theme_likes_dislikes[index]["engage
df_engagement_score_theme = pd.concat(list_engagement_score_theme, axis=1, keys=

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of Engagement score (multipled by 1000) per label", fontsi
df_engagement_score_category.boxplot(column=list_category, ax=axes[0], vert=Fals
df_engagement_score_theme.boxplot(column=list_theme, ax=axes[1], vert=False)
```

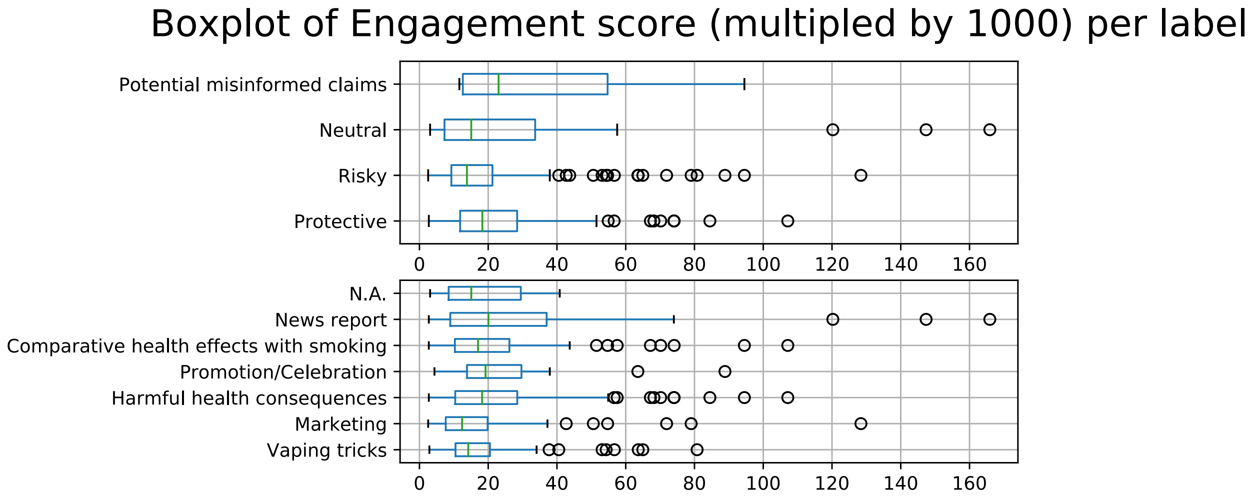
```
Likes to dislikes
Dislikes to likes
Engagement score
```

```
Out[47]: <matplotlib.axes._subplots.AxesSubplot at 0x7f4570f23880>
```



Boxplot of Likes to dislikes ratio (multipled by 1000) per label





Stats on comments

Descriptive statistics on comments per label

In [48]:

```
list_df_video_category_comments = [
    list_df_video_category[index][
        list_df_video_category[index]["comment_count"] > 0
    ]
    for index in range(len(list_category))
]
list_df_video_theme_comments = [
    list_df_video_theme[index][
        list_df_video_theme[index]["comment_count"] > 0
    ]
    for index in range(len(list_theme))
]

print("Stats on comment_count")

df_comment_count_category_describe = analyze_obj.describe_df(list_df=list_df_vic
display(df_comment_count_category_describe)
df_comment_count_theme_describe = analyze_obj.describe_df(list_df=list_df_video_
display(df_comment_count_theme_describe)

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Average number of comments per label", fontsize=20)
```

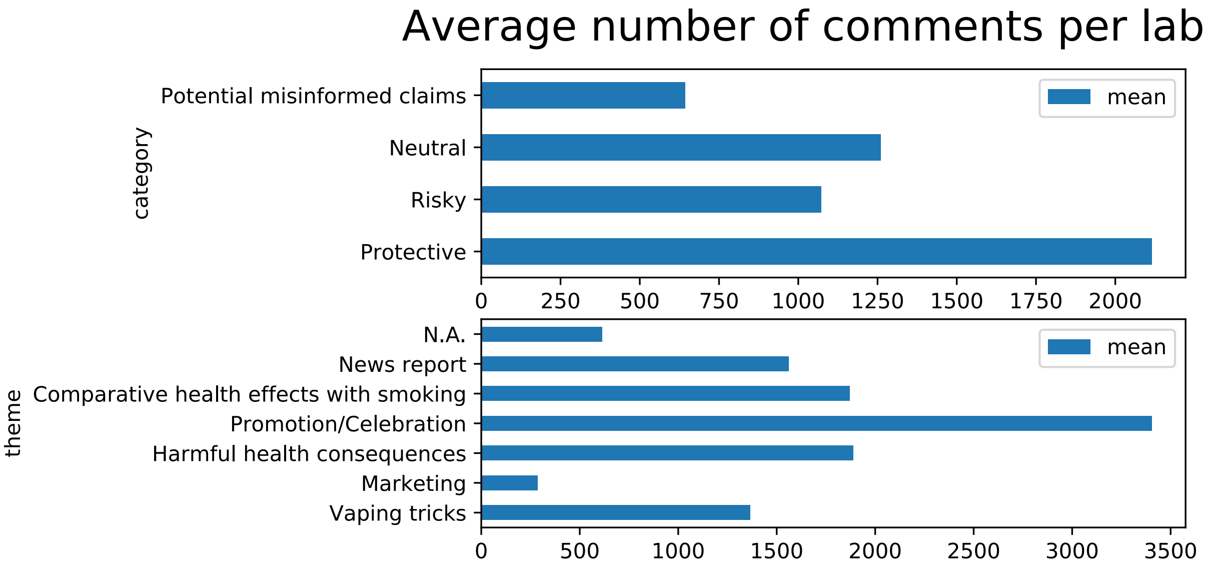
```
df_comment_count_category_describe.plot.barh(x="category", y="mean", ax=axes[0])
df_comment_count_theme_describe.plot.barh(x="theme", y="mean", ax=axes[1])

list_comment_count_category = [list_df_video_category_comments[index]["comment_c
df_comment_count_category_boxplot = pd.concat(list_comment_count_category, axis=

list_comment_count_theme = [list_df_video_theme_comments[index]["comment_count"]
df_comment_count_theme_boxplot = pd.concat(list_comment_count_theme, axis=1, key

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of comments per label", fontsize=20)
df_comment_count_category_boxplot.boxplot(column=list_category, ax=axes[0], vert
df_comment_count_theme_boxplot.boxplot(column=list_theme, ax=axes[1], vert=False
```

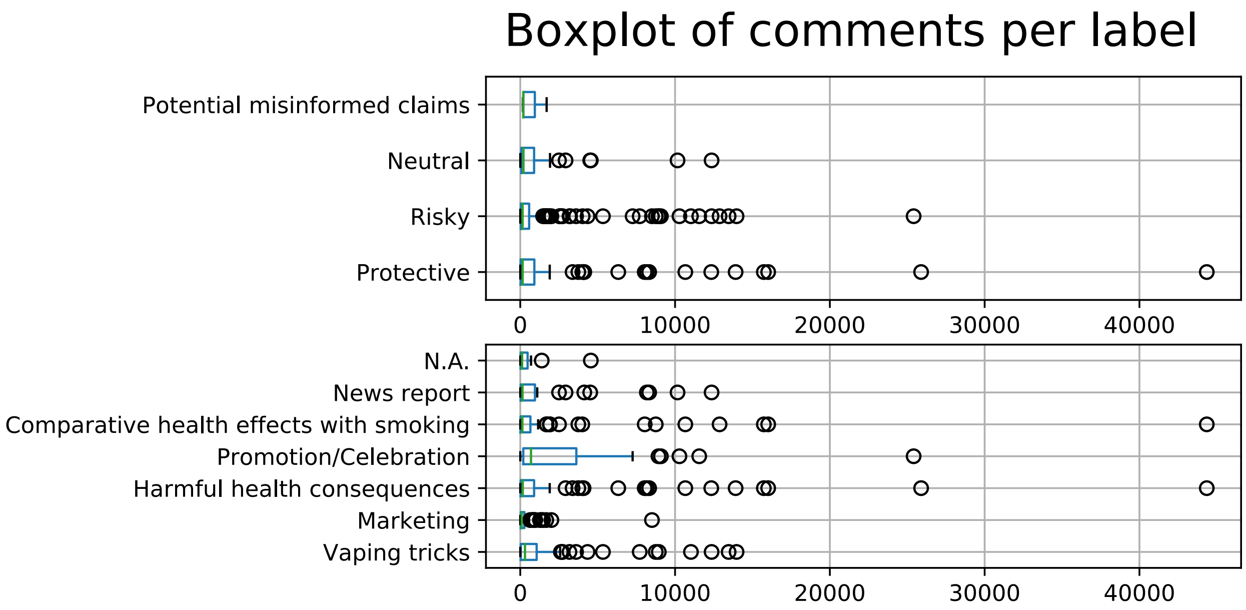
```
Stats on comment_count
```

	category	count	mean	std	median
0	Protective	102	2115.970588	5875.416703	154.0
1	Risky	262	1072.805344	2841.606047	150.5
2	Neutral	38	1260.105263	2659.967718	206.5
3	Potential misinformed claims	5	643.000000	676.753279	198.0

	theme	count	mean	std	median
0	Vaping tricks	100	1364.920000	2868.253700	304.5
1	Marketing	125	286.656000	816.601238	96.0
2	Harmful health consequences	117	1887.094017	5511.675762	162.0
3	Promotion/Celebration	27	3405.629630	5657.203387	694.0
4	Comparative health effects with smoking	79	1871.544304	5853.748862	138.0
5	News report	38	1559.763158	3101.954732	145.0
6	N.A.	13	613.076923	1248.652504	120.0

```
Out[48]: <matplotlib.axes._subplots.AxesSubplot at 0x7f4574f92be0>
```





In [49]:

```
print("Stats on unique commenters")

df_num_unique_commenters_category_describe = analyze_obj.describe_df(list_df=lis
display(df_num_unique_commenters_category_describe)
df_num_unique_commenters_theme_describe = analyze_obj.describe_df(list_df=list_d
display(df_num_unique_commenters_theme_describe)

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Average number of unique commenters per label", fontsize=20)
df_num_unique_commenters_category_describe.plot.barh(x="category", y="mean", ax=
df_num_unique_commenters_theme_describe.plot.barh(x="theme", y="mean", ax=axes[1

list_num_unique_commenters_category = [list_df_video_category_comments[index]["n
df_num_unique_commenters_category_boxplot = pd.concat(list_num_unique_commenters

list_num_unique_commenters_theme = [list_df_video_theme_comments[index]["num_uni
df_num_unique_commenters_theme_boxplot = pd.concat(list_num_unique_commenters_th

fig, axes = plt.subplots(nrows=2, ncols=1)
fig.suptitle("Boxplot of unique commenters per label", fontsize=20)
df_num_unique_commenters_category_boxplot.boxplot(column=list_category, ax=axes[
df_num_unique_commenters_theme_boxplot.boxplot(column=list_theme, ax=axes[1], ve
```

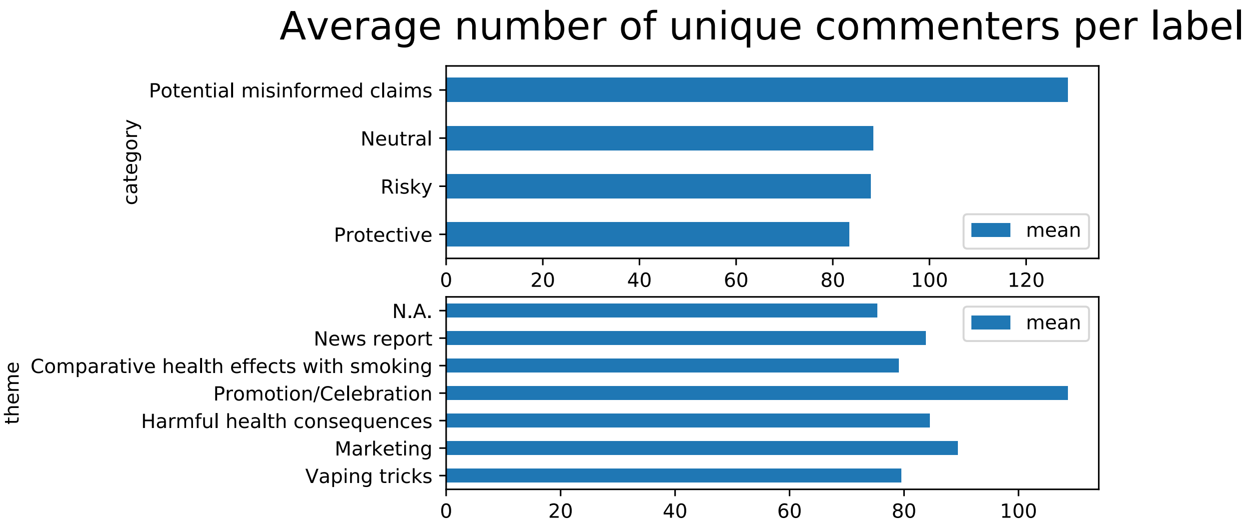
```
Stats on unique commenters
```

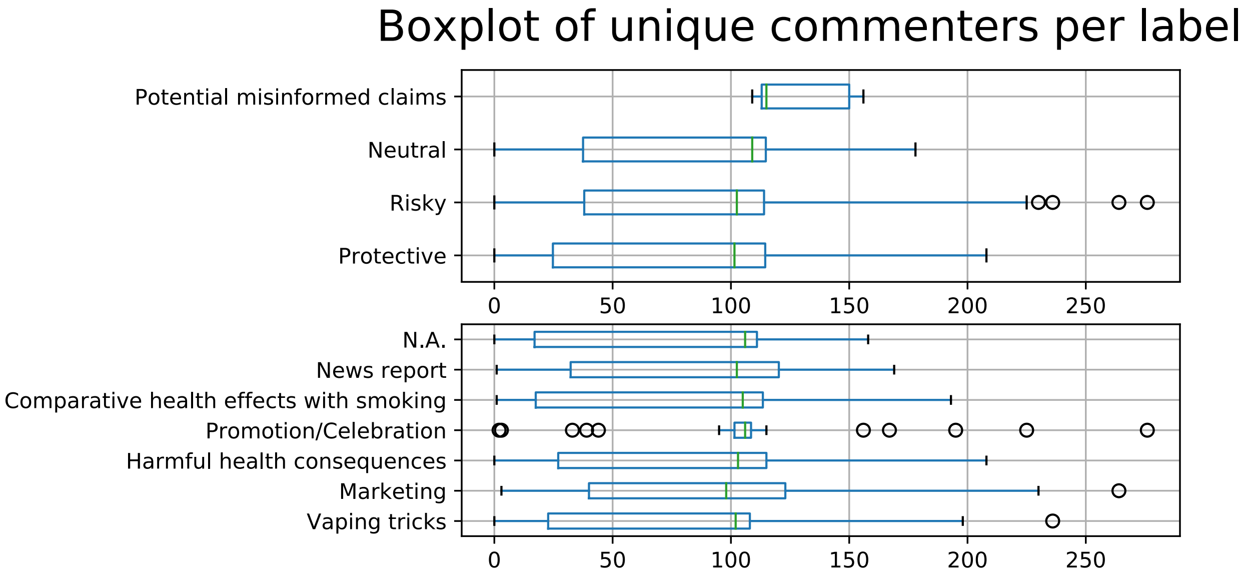
	category	count	mean	std	median
0	Protective	102	83.333333	53.711981	101.5
1	Risky	262	87.797710	55.178786	102.5
2	Neutral	38	88.368421	52.083831	109.0
3	Potential misinformed claims	5	128.600000	22.478879	115.0

	theme	count	mean	std	median
0	Vaping tricks	100	79.460000	49.823207	102.0
1	Marketing	125	89.400000	57.286631	98.0
2	Harmful health consequences	117	84.461538	53.243348	103.0

	theme	count	mean	std	median
3	Promotion/Celebration	27	108.592593	59.609150	106.0
4	Comparative health effects with smoking	79	79.025316	53.275764	105.0
5	News report	38	83.789474	51.929348	102.5
6	N.A.	13	75.307692	56.426035	106.0

```
Out[49]: <matplotlib.axes._subplots.AxesSubplot at 0x7f4573fd5850>
```





Stats on videos

Descriptive statistics on videos What could be added:

> Time taken for a comment to be posted after a video is uploaded.

```
In [55]: # list_df_video_category_comments_merged = [
         #     pd.merge(left=list_df_video_category_comments[index], right=df_comments, c
         #     for index in range(len(list_category))
         # ]
         # list_df_video_theme_comments_merged = [
         #     pd.merge(left=list_df_video_theme_comments[index], right=df_comments, on='
         #     for index in range(len(list_theme))
         # ]
         # print("Time taken to start commenting")
         # list_df_video_category_comments_merged[0].head()
```