In [50]:

```
# filter warnings on depreciation etc.
import warnings
warnings.filterwarnings("ignore")

import pandas as pd
import numpy as np
import re
import spacy
from collections import Counter

# adjust pandas display
pd.options.display.max_columns = 30
pd.options.display.max_rows = 100
pd.options.display.float_format = '{:.2f}'.format
pd.options.display.precision = 2
pd.options.display.max_colwidth = -1

# Import matplotlib and seaborn and adjust some defaults
%matplotlib inline
%config InlineBackend.figure_format = 'svg'

from matplotlib import pyplot as plt
plt.rcParams['figure.dpi'] = 100

# import seaborn as sns
# sns.set_style("whitegrid")
```

Import Data

In [3]:

```
df = pd.read_csv("rspct.tsv", sep='\t')
```

In [23]:

```
df_categories = pd.read_csv("subreddit_info.csv")
```

Processing math: 11%

Clean Data

In [4]:
```
def clean(s):
    s = s.replace(r'<lb>', "\n")
    s = s.replace(r'<tab>', "\i")
    s = re.sub(r'<br */*>', "\n", s)
    s = s.replace("&lt;", "<").replace("&gt;", ">").replace("&amp;",
"&")
    s = s.replace("&amp;", "&")
    # markdown urls
    s = re.sub(r'\(https*://[^\)]*\)', "", s)
    # normal urls
    s = re.sub(r'https*://[^\s]*', "", s)
    s = re.sub(r'_+', ' ', s)
    s = re.sub(r'"+', '"', s)
    return str(s)
```

In [5]:
```
df["selftext_clean"] = ''
for i, row in df.iterrows():
    df.at[i, "selftext_clean"] = clean(row.selftext)
df.head()
```

Out[5]:

	id	subreddit	title	selftext	selftext_clean
0	6d8knd	talesfromtechsupport	Remember your command line switches...	Hi there, <lb>The usual. Long time lerker, fi...	Hi there, \nThe usual. Long time lerker, firs...
1	58mbft	teenmom	So what was Matt "addicted" to?	Did he ever say what his addiction was or is h...	Did he ever say what his addiction was or is h...
2	8f73s7	Harley	No Club Colors	Funny story. I went to college in Las Vegas. T...	Funny story. I went to college in Las Vegas. T...
3	6ti6re	ringdoorbell	Not door bell, but floodlight mount height.	I know this is a sub for the 'Ring Doorbell' b...	I know this is a sub for the 'Ring Doorbell' b...
4	77sxto	intel	Worried about my 8700k small fft/data stress r...	Prime95 (regardless of version) and OCCT both,...	Prime95 (regardless of version) and OCCT both,...

NLP

In [8]:
```
nlp = spacy.load('en_core_web_sm')
```

Processing math: 11%

In [ ]:

```
for i, row in df.iterrows():
    if i % 1000 == 0:
        print(i)
    if(row["selftext_clean"] and len(str(row["selftext_clean"])) < 10000
00):
        doc = nlp(str(row["selftext_clean"]))
        adjectives = []
        nouns = []
        verbs = []
        lemmas = []

        for token in doc:
            lemmas.append(token.lemma_)
            if token.pos_ == "ADJ":
                adjectives.append(token.lemma_)
            if token.pos_ == "NOUN" or token.pos_ == "PROPN":
                nouns.append(token.lemma_)
            if token.pos_ == "VERB":
                verbs.append(token.lemma_)

        df.at[i, "selftext_lemma"] = " ".join(lemmas)
        df.at[i, "selftext_nouns"] = " ".join(nouns)
        df.at[i, "selftext_adjectives"] = " ".join(adjectives)
        df.at[i, "selftext_verbs"] = " ".join(verbs)
        df.at[i, "selftext_nav"] = " ".join(nouns+adjectives+verbs)
        df.at[i, "no_tokens"] = len(lemmas)
```

Processing math: 11%

In [11]:

```
df.head()
```

Processing math: 11%

Out[11]:

	id	subreddit	title	
0	6d8knd	talesfromtechsupport	Remember your command line switches...	Hi there, <lb>The usual. Long time lerker, first time poster, be Here's the story. I'm an independent developer w *me. < lb >< lb > Iw* PopularVersionControl.<lb><lb>We're trying to remove a branch that was c me: "dev, can you rename that branch because we're goi branches." <lb>&gt; dev: "sure, one second."<lb><lb>Five n to die!" <lb>&gt; me: "What happened?"<lb><lb>Lots of ren me: "Did you try PopularVersionControl with -u?" <lb>&gt; d cl

Processing math: 11%

	id	subreddit	title	
1	58mbft	teenmom	So what was Matt "addicted" to?	Did he ever say what his addiction was or is he still chuggin to add: As an addict myself, anyone I know whose been a and AA) drinking is considered a slip-up. Has he said what h
2	8f73s7	Harley	No Club Colors	Funny story. I went to college in Las Vegas. This was befo some college buddies would always go out on the strip to &amp; Heifers. It's worth noting the females working there c door that read 'No Club Colors'. So we lose our ties and blaze red, yellow, green etc were not allowed. So we would al years! Looking back now on how naive we were, it's just hila

Processing math: 11%

	id	subreddit	title	
3	6ti6re	ringdoorbell	Not door bell, but floodlight mount height.	I know this is a sub for the 'Ring Doorbell' but has anyo bracket for the floodlight on the back of my house, but th above the deck, 2 ft drop from the deck down to the grass id
4	77sxto	intel	Worried about my 8700k small fft/data stress results...	Prime95 (regardless of version) and OCCT both, the "small" up to 100c+/throttling even at pure stock with MCE off insta Any other stress test is lucky to spike up to 75 WITH a considered cpu heavy) is like low 60's. I don't get it.<lb><l

Processing math: 11%

EDA

In [12]:
```
# list column names and datatypes
df.dtypes
```

Out[12]:
```
id                      object
subreddit               object
title                   object
selftext                object
selftext_clean          object
selftext_lemma          object
selftext_nouns          object
selftext_adjectives     object
selftext_verbs          object
selftext_nav            object
no_tokens              float64
dtype: object
```

In [13]:
```
# select a sample of some data frame columns
df[['id', 'subreddit', 'title', 'selftext_clean']] \
  .sample(2, random_state=42)
```

Out[13]:

	id	subreddit	title	selftext_clean
7092	5h26no	Borderlands2	Tiny Tina's Assault on Dragon Keep &amp; Other Story Missions	Hey guys, I'm just looking for a chill group that wants to run OP8 TTADK. I'm always down for other things to run to (farming OP8 raid bosses, running campaign, messin' around, or more). \n\nI'm also willing to help other people (lower levels) kill a boss, or rank up. \n\np.s. i'm looking for someone to OP power level my 2nd character, thanks.\n\nXbox One: Trisomyy XXI\n\nI will try and message you back ASAP and get a group together. Be chill when we're playing no crazy and shity mics, thanks lOl. \n\n!!!USE THIS SUBREDDIT TO FIND PLAYERS TO PLAY WITH TOO!!! (Xbox Only, sorry!)
69218	6yi7th	thelastofus	Question about weapons upgrades and new game plus plus	So I finished new game plus and was still short on upgrading all the weapons. I just started another new game plus and noticed my upgrades didn't carry over from my second play through. However the statistics page still has the count from my second play through. I'm very confused by this. Can anyone she'd some light on this for me?

In [14]:
```
# length of a dataframe
len(df)
```

Out[14]:
```
226108
```

In [15]:

```
# number of values per column
df.count()
```

Out[15]:

```
id                     226108
subreddit              226108
title                  226108
selftext               226108
selftext_clean         226108
selftext_lemma         226108
selftext_nouns         226108
selftext_adjectives    226108
selftext_verbs         226108
selftext_nav           226108
no_tokens              226108
dtype: int64
```

In [16]:

```
# size info, including memory consumption
df.info(memory_usage='deep')
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 226108 entries, 0 to 226107
Data columns (total 11 columns):
 #   Column               Non-Null Count   Dtype  
---  ------               --------------   -----  
 0   id                   226108 non-null  object 
 1   subreddit            226108 non-null  object 
 2   title                226108 non-null  object 
 3   selftext             226108 non-null  object 
 4   selftext_clean       226108 non-null  object 
 5   selftext_lemma       226108 non-null  object 
 6   selftext_nouns       226108 non-null  object 
 7   selftext_adjectives  226108 non-null  object 
 8   selftext_verbs       226108 non-null  object 
 9   selftext_nav         226108 non-null  object 
 10  no_tokens            226108 non-null  float64
dtypes: float64(1), object(10)
memory usage: 882.5 MB
```

Summary for categorical features

In [24]:

```
df_categories.head()
```

Out[24]:

	subreddit	category_1	category_2	category_3	in_data	reason_for_exclusion
0	whatsthatbook	advice/question	book	NaN	True	NaN
1	CasualConversation	advice/question	broad	NaN	False	too_broad
2	Clairvoyantreadings	advice/question	broad	NaN	False	too_broad
3	DecidingToBeBetter	advice/question	broad	NaN	False	too_broad
4	HelpMeFind	advice/question	broad	NaN	False	too_broad

Processing math: 11%

In [27]:
```
df_merged = df.merge(df_categories, how='left', on='subreddit')
```

In [28]:
```
df = df_merged
```

In [30]:
```
df.columns = df.columns.str.replace('category_1', 'category')
df.columns = df.columns.str.replace('category_2', 'subcategory')
```

In [31]:
```
columns = [col for col in df.columns if not col.startswith('self')]
columns
```

Out[31]:
```
['id',
 'subreddit',
 'title',
 'no_tokens',
 'category',
 'subcategory',
 'category_3',
 'in_data',
 'reason_for_exclusion']
```

In [33]:
```
# describe categorical columns of type np.object
df[['category', 'subcategory', 'subreddit']] \
  .describe(include=object) \
  .transpose()
```

Out[33]:

	count	unique	top	freq
category	226108	39	video_game	22430
subcategory	226108	1013	chronic fatigue syndrome	261
subreddit	226108	1013	cfs	261

In [34]:
```
df['subreddit'].value_counts()[:10]
```

Out[34]:
```
cfs                  261
chemistry            261
premiere             257
Charity              257
flexibility          256
fragrance            256
vinyl                255
androiddev           254
theydidthemath       253
GuitarAmps           253
Name: subreddit, dtype: int64
```

Processing math: 11%

Summary for numerical features

In [35]:

```
# describe numerical columns
df.describe().transpose()
```

Out[35]:

	count	mean	std	min	25%	50%	75%	max
no_tokens	226108.00	168.09	134.84	1.00	82.00	120.00	199.00	1340.00

Explore text categories

In [36]:

```
# number of unique values = count distinct
df['category'].nunique()
```

Out[36]:

```
39
```

In [38]:

```
# group by category, count distinct subreddits and posts
cat_df = df.groupby('category') \
            .agg({'subreddit': pd.Series.nunique,
                  'id': pd.Series.count}) \
            .rename(columns={'subreddit': 'num_subreddits',
                             'id': 'num_posts'}) \
            .sort_values('num_subreddits', ascending=False)

# show top 5 records
cat_df.head(5)
```

Out[38]:

	num_subreddits	num_posts
category		
video_game	100	22430
tv_show	68	15236
health	58	12870
profession	56	12560
software	52	11493

Processing math: 11%

In [39]:

```
cat_df.describe()
```

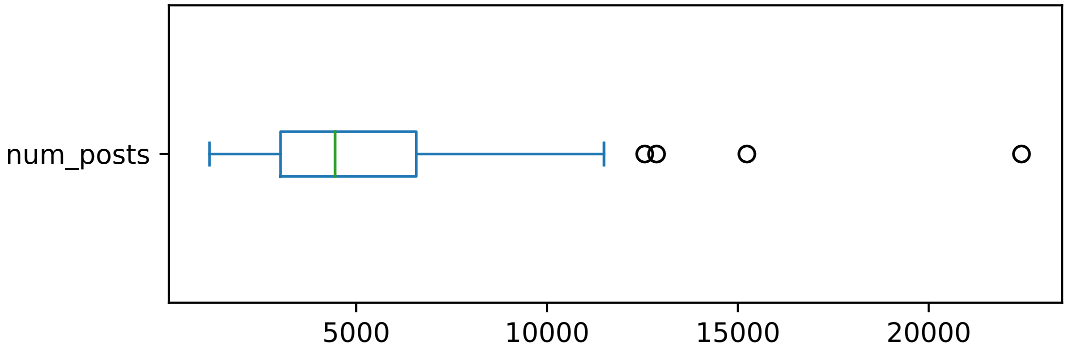
Out[39]:

	num_subreddits	num_posts
count	39.00	39.00
mean	25.97	5797.64
std	19.76	4422.38
min	5.00	1159.00
25%	13.50	3019.00
50%	20.00	4449.00
75%	29.50	6575.50
max	100.00	22430.00

Visualizing frequency distributions

In [40]:

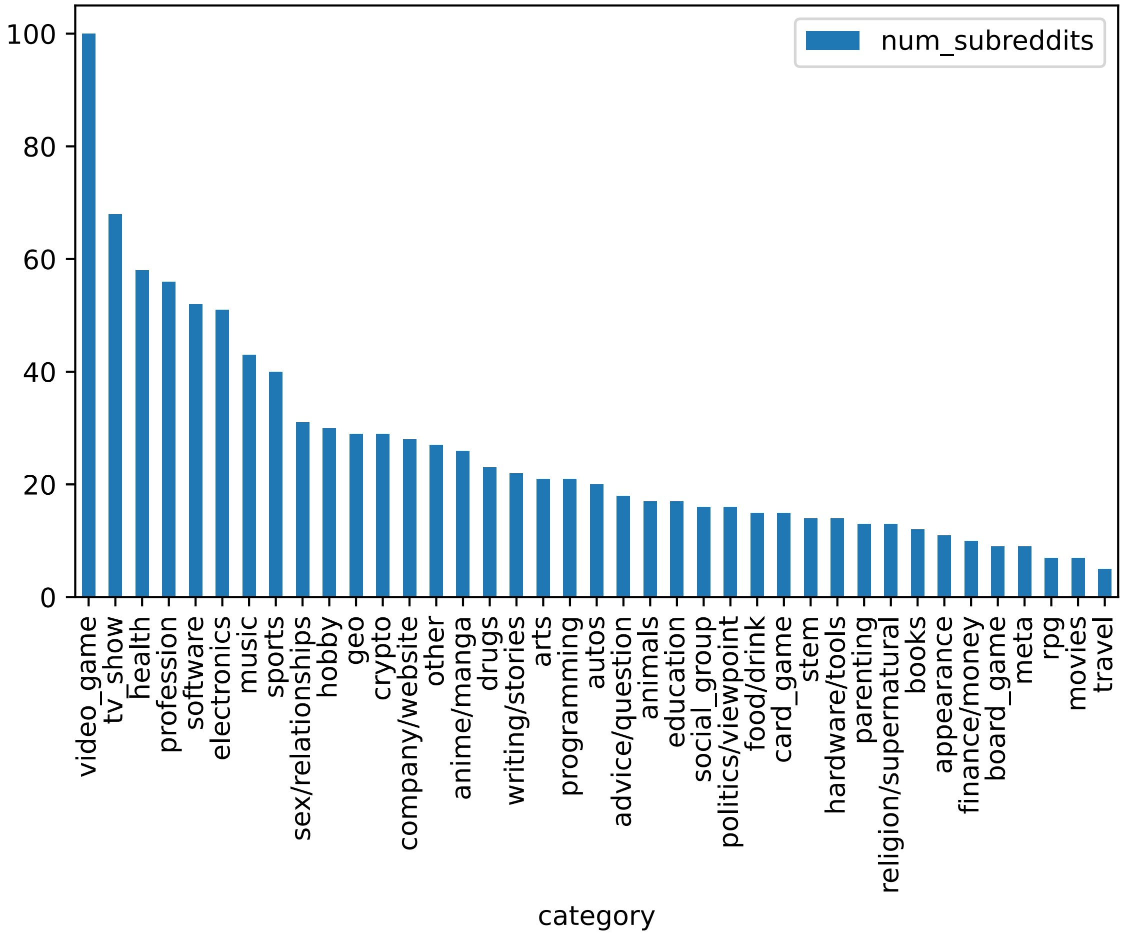
```
# horizontal boxplot of a dataframe column
cat_df[['num_posts']].plot(kind='box', vert=False, figsize=(6, 2));
```



Processing math: 11%

In [41]:

```
# bar chart of a dataframe column
cat_df[['num_subreddits']].plot(kind='bar', figsize=(7,4));
```



Explore word frequencies

In [42]:

```
# create a data frame slice
sub_df = df[df['subreddit']=='TheSimpsons']

# sample cleaned text and tokens tagged as nouns
sub_df[['selftext_clean', 'selftext_nouns']].sample(2)
```

Out[42]:

	selftext_clean	selftext_nouns
65540	Hey guys,\n\nI'm looking for the clip described above. I have no idea what episode or season, but I remember it from quite a few years ago so obviously not anything super recent. But basically Marge is looking for Homer on a workday morning and she goes to find him at Moe's.\n\nAnyone know where it's from?\n\nThanks	guy clip idea episode season year Marge Homer workday morning Moe thank
123482	Hello r/TheSimpsons, I was trying to explain a scene to a friend the other day and couldn't find the gif anywhere online. Is anyone able to make me a gif of principal Skinner, from the episode Principal Charming. The scene after he and Patty break up, and it just shows a silhouette of him rising, and saying "tomorrow is another school day"?\n\nThanks if you can :D	r thesimpson scene friend day gif online gif Skinner episode Principal Charming scene Patty silhouette tomorrow school day thank

Create a list of tokens from a list of documents

```
In [43]: def my_tokenizer(text):
             return text.split() if text != None else []
```

```
In [44]: # transform list of documents into a single list of tokens
         tokens = sub_df.selftext_nouns.map(my_tokenizer).sum()
```

```
In [45]: print(tokens[:200])
```

```
['episode', 'time', 'other', 'instance', 'proposal', 'Putlocker', 'wee
k', 'tv', 'Bart', 'Thanksgiving', 'episode', 'other', 'show', 'girlfrie
nd', 'kid', 'point', 'go', 'show', 'movie', 'thing', 'reference', 'cont
inuity', 'quality', 'reference', 'back', 'movie', 'season', 'Mr.', 'Bur
ns', 'joke', 'consequence', 'callback', 'order', 'problem', 'quality',
'matching', 'movie', 'lot', 'episode', 'show', 'point', 'season', 'di
p', 'movie', 'end', 'cap', 'movie', 'cartooniness', 'vibe', 'show', 'ho
ur', 'episode', 'head', 'while', 'guy', 'hope', 'year', 'Lisa', 'boy',
'school', 'parent', 'stuff', 'episode', 'treehouse', 'horror', 'idea',
'idea', 'episode', 'Elijah', 'Wood', 'guest', 'show', '¯\\', 'ツ', 'pos
t', 'time', 'episode', 'episode', 'Homer', 'City', 'New', 'York', 'seas
on', 'episode', 'Youtube', 'min', 'clip', 'Homer', 'car', 'garage', 'Ma
rge', 'homer', 'chore', 'paper', 'car', 'episode', 'name', 'episode',
'Homer', 'bully', 'Kearney', 'joke', 'Homer', 'line', 'guy', 'thank',
'episode', 'Simpsons', 'episode', 'Lisa', 'Gaga', 'braindead', 'STUPI
D', 'paddling', 'episode', 'scene', 'Homer', 'Gill', 'car', 'dog', 'wa
y', 'show', 'minute', 'episode', 'court', 'minute', 'court', 'thing',
'Homer', 'dog', 'Springfield', 'dog', 'treehouse', 'horror', 'dog', 'co
ntrol', 'city', 'town', 'Gill', 'dog', 'Marge', 'Chihuahua', 'Deus', 'E
x', 'Machina', 'Marge', 'Chihuahua', 'death', 'moronic', 'angry.](/spoi
ler', 'joke', 'episode', 'reference', 'Turbo', 'WHY', 'REALLY', 'ASK',
'fucking', 'episode', 'turbo', 'joke', 'month', 'production', 'time',
'hell', 'Turbo', 'month', 'turbo', 'episode', 'Treehouse', 'Horror', 'b
reakneck', 'pace', 'Treehouse', 'Horror', 'heart', 'episode', 'GOD', 'e
pisode', 'season', 'episode', 'season', 'opinion', 'series', 'Button|',
'Poll', 'Vote', 'Count|', '|:-----------:|:------------:|:------------
|', '|**[vote]**|619\\i1\\i"the', 'Serfsons"|**0', '*', 'vote', '|**[Vo
te]**|620\\i2\\i"Springfield', 'Splendor"|**0', '*', '*', 'vote', '|**
[vote]**|621\\i3\\i"whistler', 'Father"|**0']
```

Processing math: 11%

Count frequencies with a counter

In [51]:
```
counter = Counter(tokens)
counter.most_common(20)
```

Out[51]:
```
[('episode', 301),
 ('season', 152),
 ('Homer', 139),
 ('Simpsons', 113),
 ('Bart', 71),
 ('show', 70),
 ('year', 66),
 ('time', 48),
 ('scene', 48),
 ('Lisa', 45),
 ('Marge', 42),
 ('joke', 40),
 ('character', 36),
 ('*', 33),
 ('one', 33),
 ('simpson', 32),
 ('people', 32),
 ('thing', 30),
 ('guy', 28),
 ('movie', 26)]
```

In [52]:
```
df.category.unique()
```

Out[52]:
```
array(['writing/stories', 'tv_show', 'autos', 'hardware/tools',
       'electronics', 'video_game', 'crypto', 'sports', 'hobby',
       'appearance', 'card_game', 'drugs', 'advice/question',
       'social_group', 'anime/manga', 'sex/relationships', 'software',
       'health', 'other', 'animals', 'arts', 'programming', 'rpg',
       'books', 'parenting', 'education', 'company/website', 'professio
n',
       'music', 'politics/viewpoint', 'stem', 'travel', 'geo',
       'religion/supernatural', 'board_game', 'movies', 'food/drink',
       'finance/money', 'meta'], dtype=object)
```

Processing math: 11%

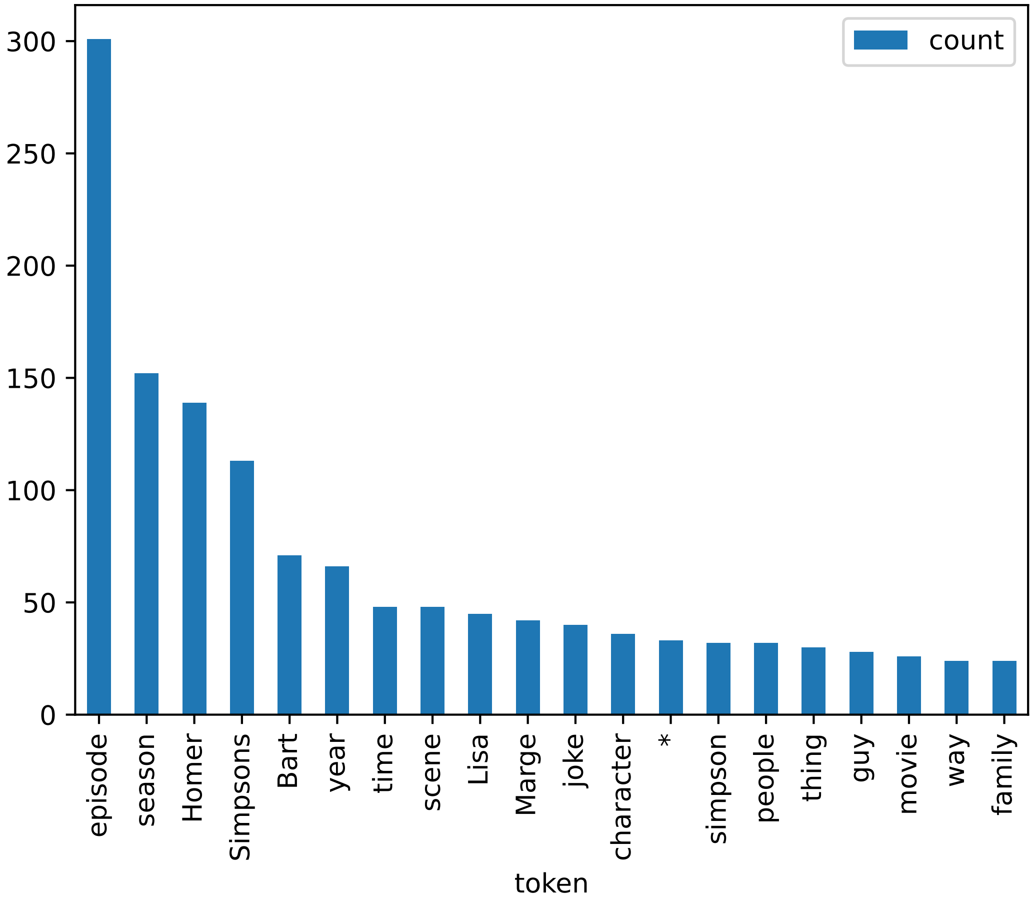
In [53]:
```
print([t[0] for t in counter.most_common(200)])
```

```
['episode', 'season', 'Homer', 'Simpsons', 'Bart', 'show', 'year', 'tim
e', 'scene', 'Lisa', 'Marge', 'joke', 'character', '*', 'one', 'simpso
n', 'people', 'thing', 'guy', 'movie', 'way', 'family', 'thank', 'lot',
'Simpson', 'idea', 'day', 'car', 'line', 'series', 'game', 'a', 'home
r', 'b', 'point', 'c', 'reference', 'end', 'place', 'Burns', 'clip', 'S
pringfield', 'kid', 'Krusty', 'Season', 'Canyonero', 'tv', 'post', 'hel
p', 'bit', 'Ned', 'quote', 'opinion', 'version', 'age', 'memory', 'plo
t', 'call', 'story', 'name', 'Horror', 'vote', 'Flanders', 'event', 'jo
b', 'voice', 'question', 'fan', 'Apu', 'd', 'Mr.', 'problem', 'head',
'moment', 'Wiggum', 'wife', 'mind', 'example', 'friend', 'gif', 'Moe',
'Scratchy', 'other', 'quality', 'dog', 'Treehouse', 'life', 'video', 'R
alph', 'service', 'sense', '-', 'list', 'aspect', 'roll', 'Itchy', 'Sum
mer', 'school', 'gag', 'title', 'reason', 'today', 'part', 'money', 'ef
fect', 'film', 'DVD', 'writer', 'hand', 'Bob', 'canon', 'advance', 'wee
k', 'minute', 'man', 'future', 'store', 'dvd', 'home', 'Milhouse', 'fac
e', 'Christmas', 'moe', 'number', 'speech', 'case', 'thought', 'HD', 'e
nding', 'bunch', 'segment', 'majority', 'stereotype', 'hour', 'New', 'm
onth', 'heart', 'commentary', 'course', 'shirt', 'Futurama', 'woman',
'plant', 'r', 'marge', 'Abe', 'Dick', 'answer', 'person', 'comedy', 'co
ntext', 'actor', 'Future', 'Kamp', 'book', 'food', 'King', 'entry', 'is
sue', 'ton', 'song', 'HORROR', 'Family', 'Bush', 'room', 'recollectio
n', 'eye', 'Dr.', 'D', 'Lenny', 'Thanksgiving', 'order', 'while', 'stuf
f', 'horror', 'City', 'hell', 'Mayor', ':*', 'couple', 'sub', 'timelin
e', 'brother', 'hole', 'thesimpson', 'Frinkiac', 'shit', 'night', 'flas
hback', 'research', 'project', 'link', 'box', 'streaming', 'Fox', 'mem
e', 'appearance', 'accent', 'country', 'start']
```

In [54]:
```
from spacy.lang.en.stop_words import STOP_WORDS

def remove_stopwords(tokens):
    """Remove stopwords from a list of tokens."""
    return [t for t in tokens if t not in STOP_WORDS]

# rebuild counter
counter = Counter(remove_stopwords(tokens))
```

Processing math: 11%

```
In [55]: # convert list of tuples into data frame
         freq_df = pd.DataFrame.from_records(counter.most_common(20),
                                             columns=['token', 'count'])

         # create bar plot
         freq_df.plot(kind='bar', x='token');
```



Use word clouds

```
In [56]: %matplotlib inline
         import matplotlib.pyplot as plt
```

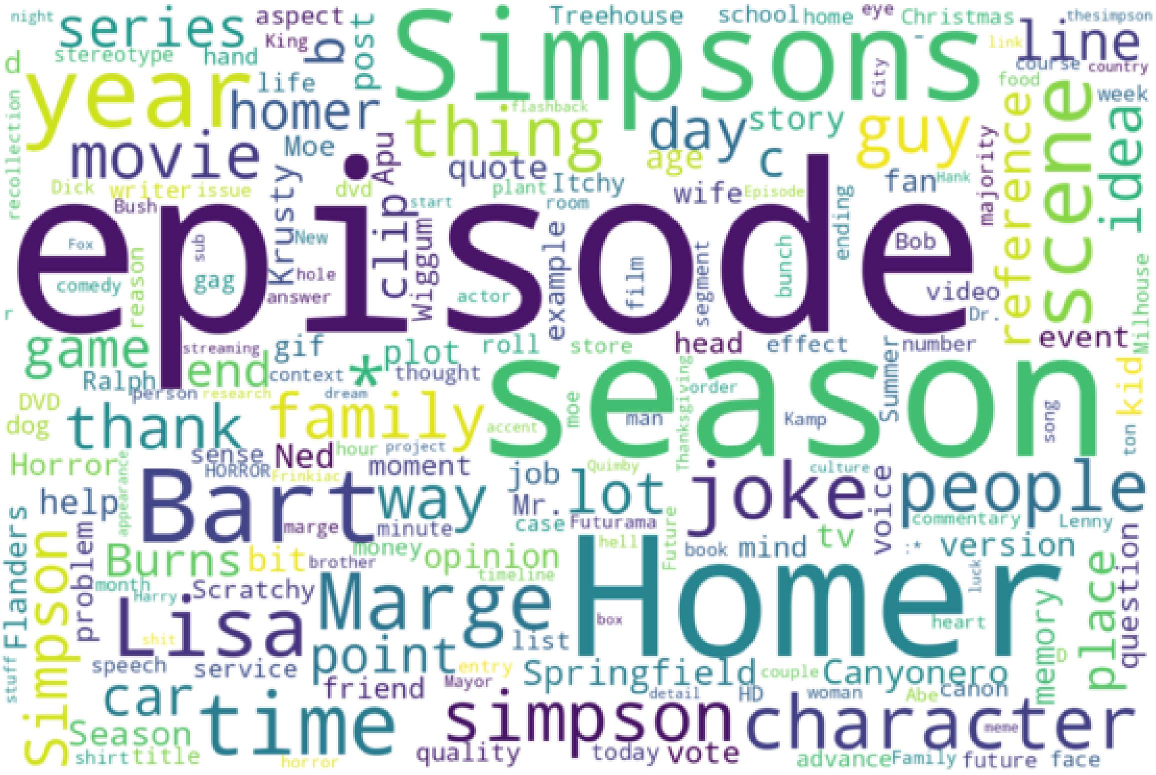
Processing math: 11%

In [58]:

```
from wordcloud import WordCloud

def wordcloud(counter):
    """A small wordloud wrapper"""
    wc = WordCloud(width=1200, height=800,
                   background_color="white",
                   max_words=200)
    wc.generate_from_frequencies(counter)

    # Plot
    fig=plt.figure(figsize=(6, 4))
    plt.imshow(wc, interpolation='bilinear')
    plt.axis("off")
    plt.tight_layout(pad=0)
    plt.show()
```

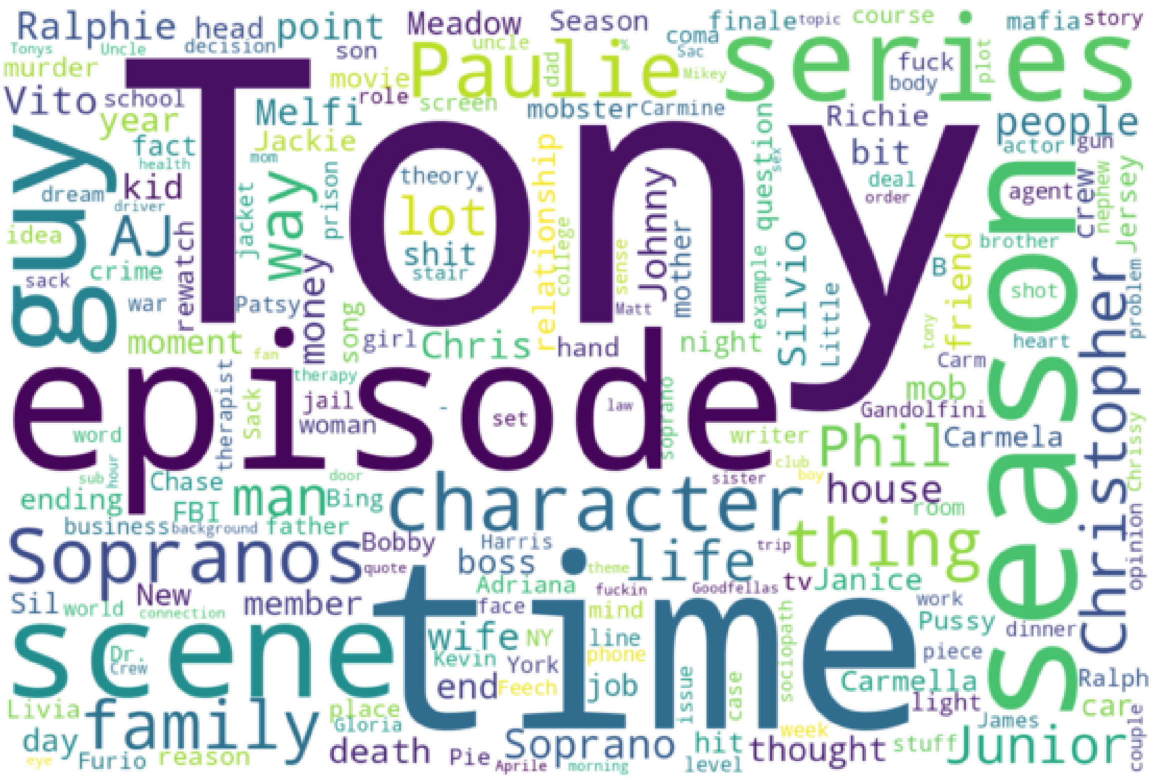
In [59]:

```
# create wordcloud
wordcloud(counter)
```



Processing math: 11%

```
In [60]: # compare to Sopranos
         tokens2 = df[df['subreddit']=='thesopranos'].selftext_nouns \
                   .map(my_tokenizer).sum()

         counter2 = Counter(remove_stopwords(tokens2))
         wordcloud(counter2)
```



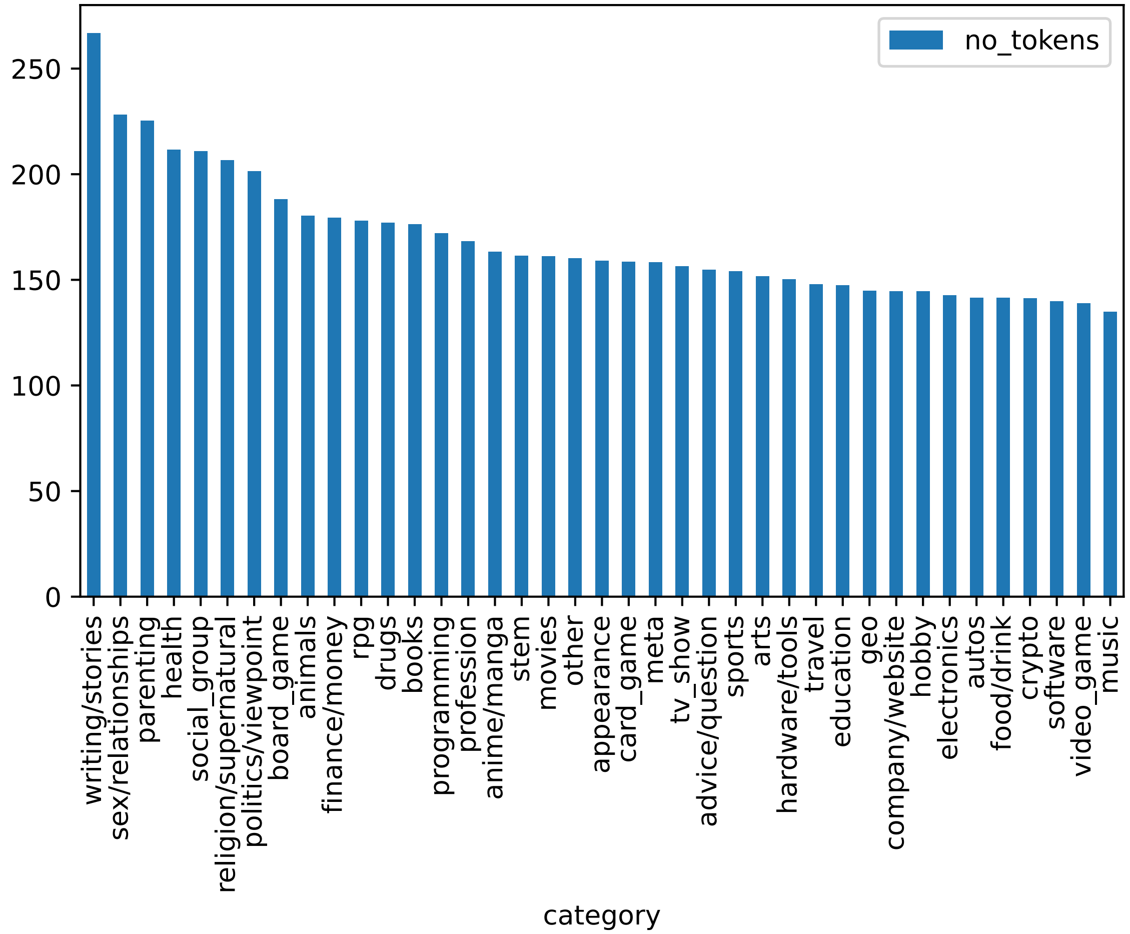
Explore text complexity

```
In [61]: df['no_tokens'] = df.selftext_lemma\
           .map(lambda l: 0 if l==None else len(l.split()))
```

Processing math: 11%

In [62]:

```
# mean number of tokens by category
df.groupby(['category']) \
  .agg({'no_tokens':'mean'}) \
  .sort_values(by='no_tokens', ascending=False) \
  .plot(kind='bar', figsize=(7,4));
```



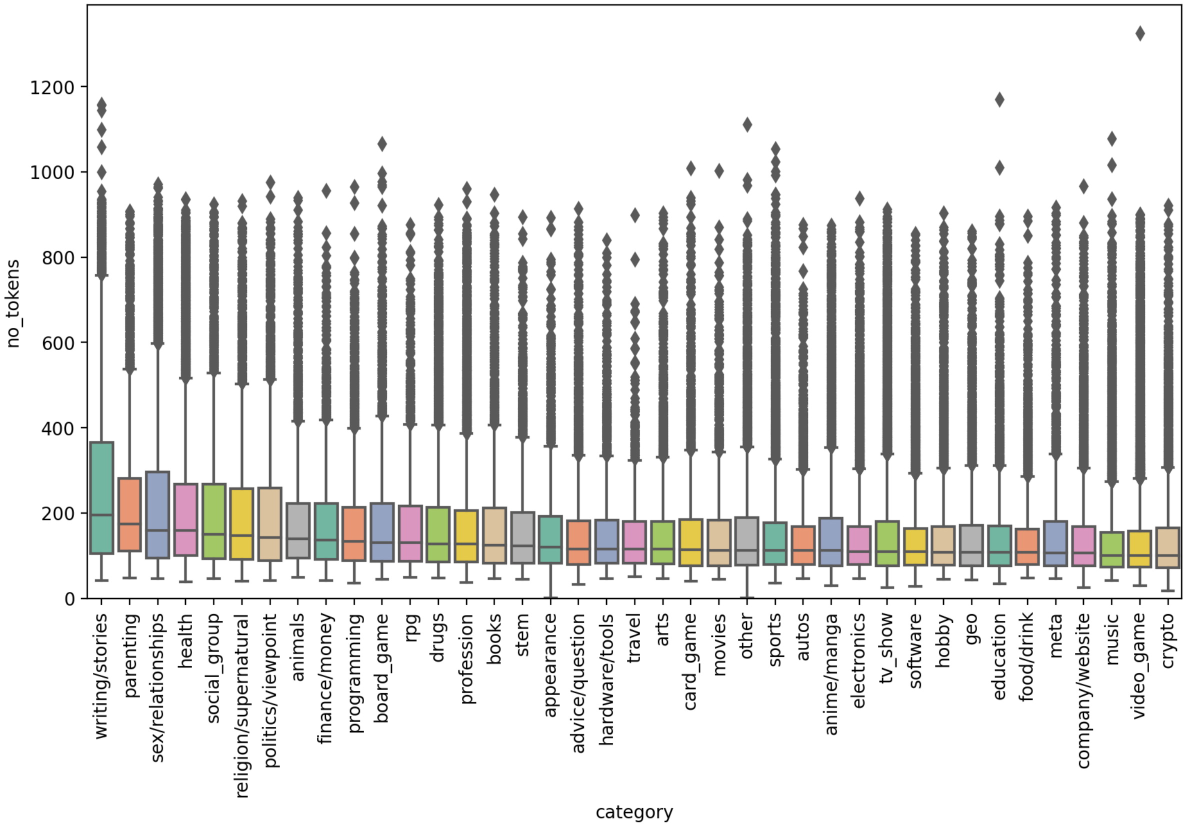
Processing math: 11%

In [64]:

```
# render plots as retina or png, because svg is very slow
%config InlineBackend.figure_format = 'retina'

import seaborn as sns

def multi_boxplot(data, x, y, ylim = None):
    '''Wrapper for sns boxplot with cut-off functionality'''
    # plt.figure(figsize=(30, 5))
    fig, ax = plt.subplots()
    plt.xticks(rotation=90)

    # order boxplots by median
    ordered_values = data.groupby(x)[[y]] \
                         .median() \
                         .sort_values(y, ascending=False) \
                         .index

    sns.boxplot(x=x, y=y, data=data, palette='Set2',
                order=ordered_values)

    fig.set_size_inches(11, 6)

    # cut-off y-axis at value ylim
    ax.set_ylim(0, ylim)
```

In [65]:

```
multi_boxplot(df, 'category', 'no_tokens');
```



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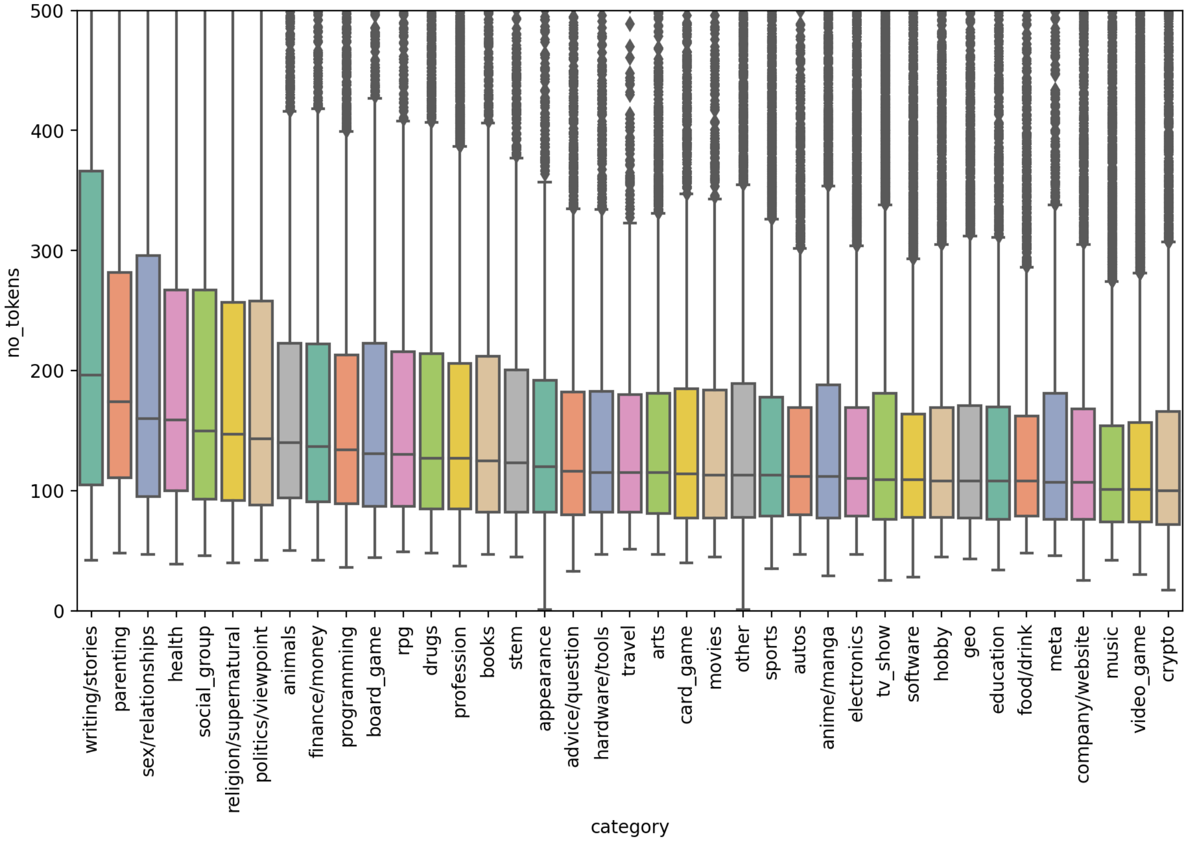
```
In [66]: # print text of outliers
         df['selftext_lemma'][df.no_tokens > 1500]
```

```
Out[66]: Series([], Name: selftext_lemma, dtype: object)
```

```
In [67]: # cut-off diagram at y=500
         multi_boxplot(df, 'category', 'no_tokens', ylim=500)
```



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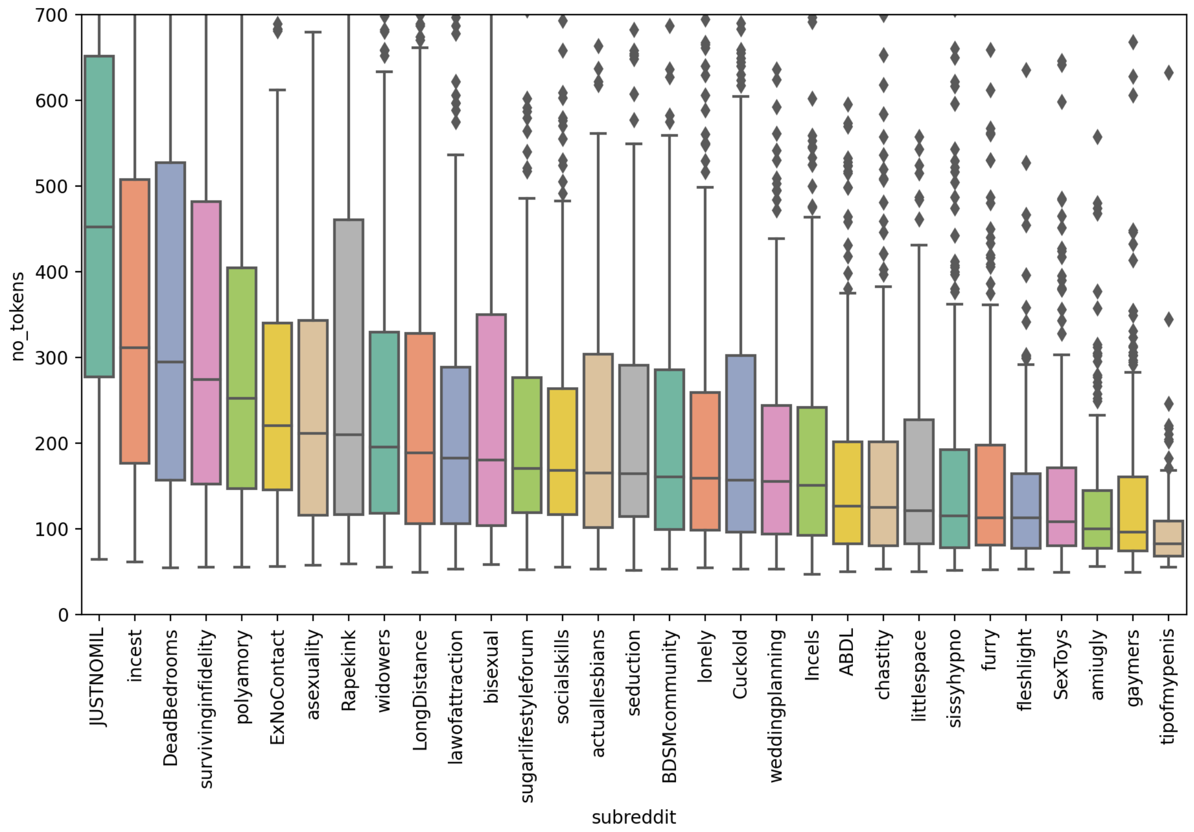
In [68]:

```
# comparing subreddits within a single category
multi_boxplot(df[df.category=='sex/relationships'],
              'subreddit', 'no_tokens', ylim=700)
```



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