Text analysis

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Examples of questions that require text analysis

1. Did J.K. Rowling write The Cuckoo's Calling under the pen name Robert Galbraith?
2. What themes are common in 19th century literature?
3. Can we tell the difference between tweets that come from Trump himself or a staffer?
4. Is Hillary the most poisoned name in US History?

Today's example question: How has pop music changed in the last five years?

Goal: Understand the basics of sentiment analysis and TF-IDF

What data would we need to answer this question?

How has pop music changed in the last five years?

Data: Lyrics to the most popular songs from each year

The data : Top songs from Feb music charts 2017-2021

2017: 152 songs

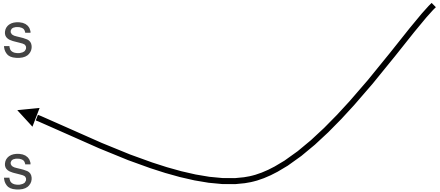
2018: 139 songs

2019: 127 songs

2020: 137 songs

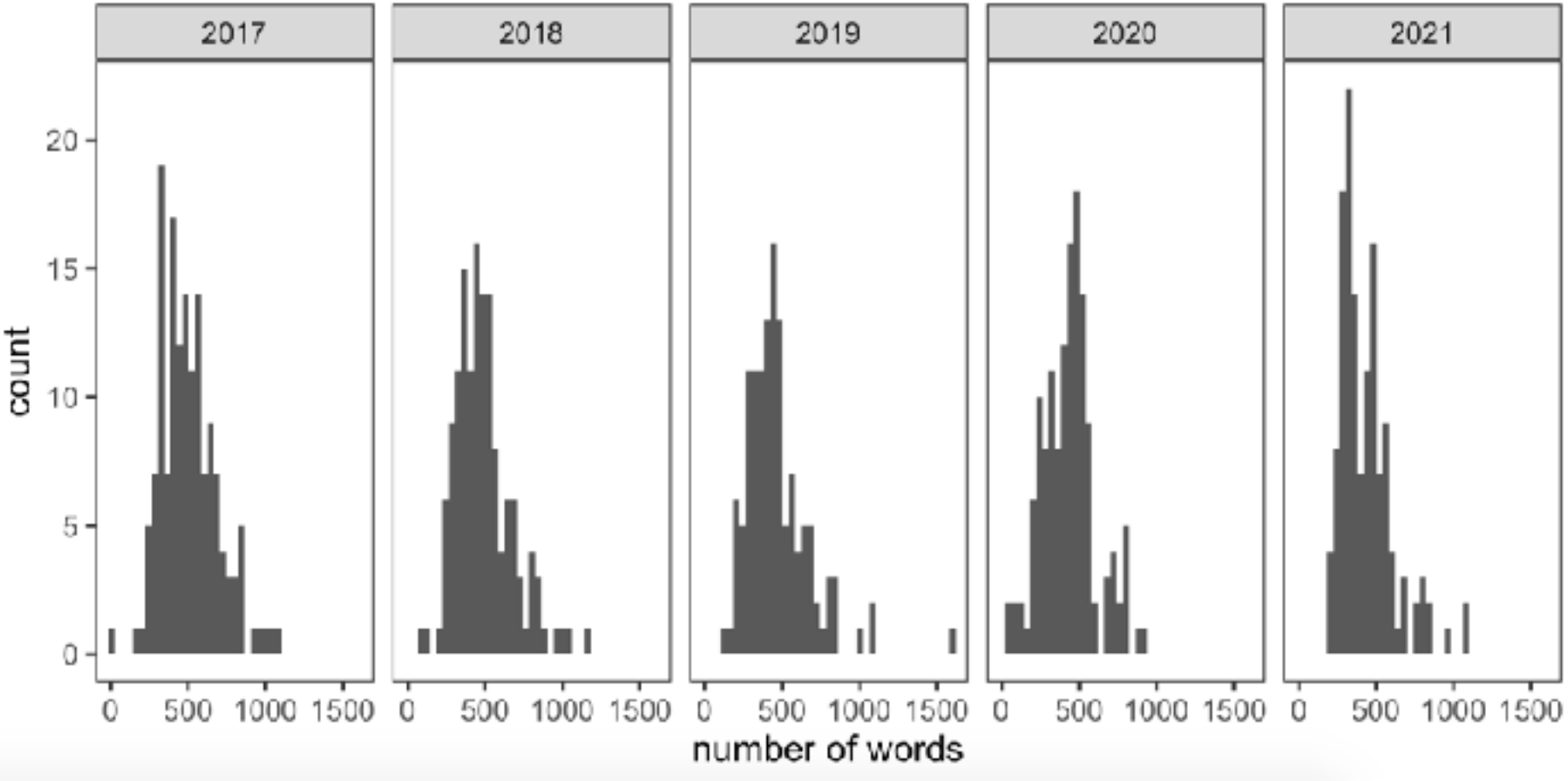
2021: 134 songs

Song data from **Spotify**.
Lyrics from **genius.com**

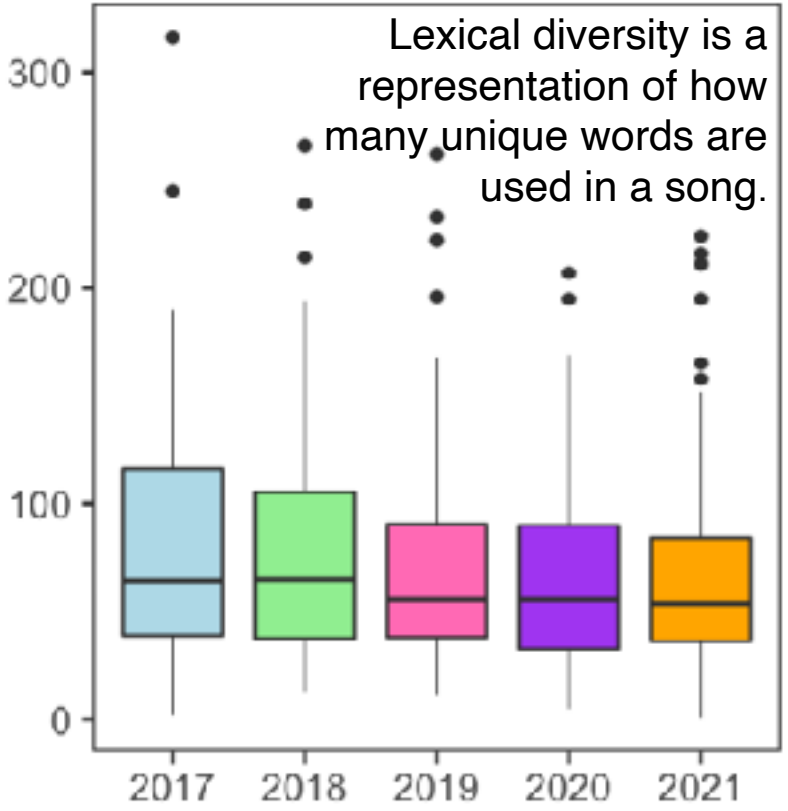


Questions we can ask...

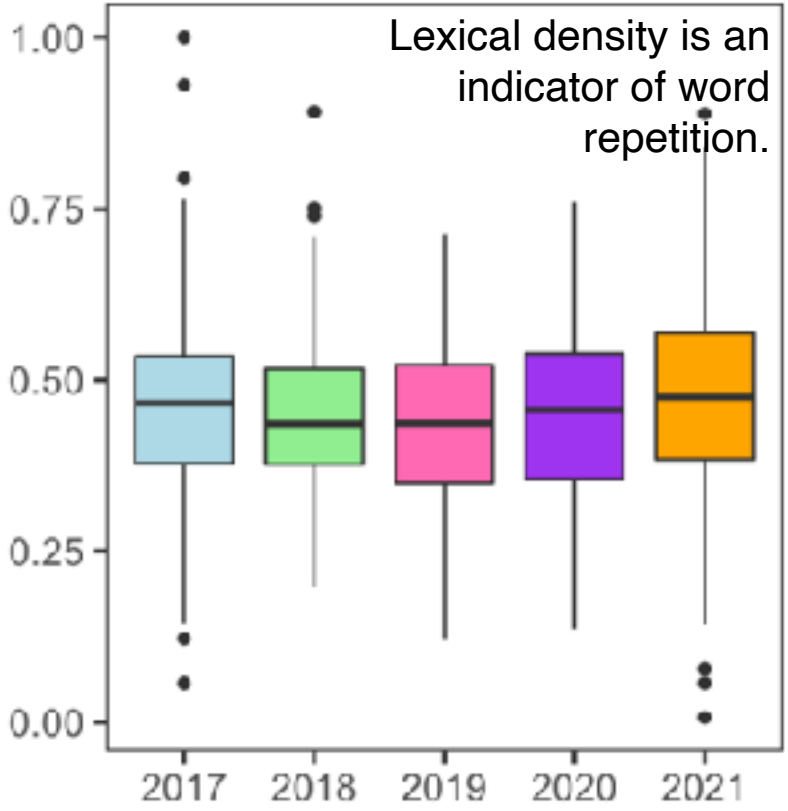
1. Does the total number of words change over time?
2. Does uniqueness change over time?
3. Does the diversity or density change?
4. What words are most common?
5. What words are most unique to each year?
6. What sentiment do songs convey most frequently?
7. Has sentiment changed over time?
8. What are the sentiment of the #1 songs?
9. What words contribute to the sentiment of these #1 songs?
10. ...what about bigrams? N-grams?


2017
2018
2019
2020
2021
count
0
5
10
15
20
0
500
1000
1500
number of words

Lexical Diversity



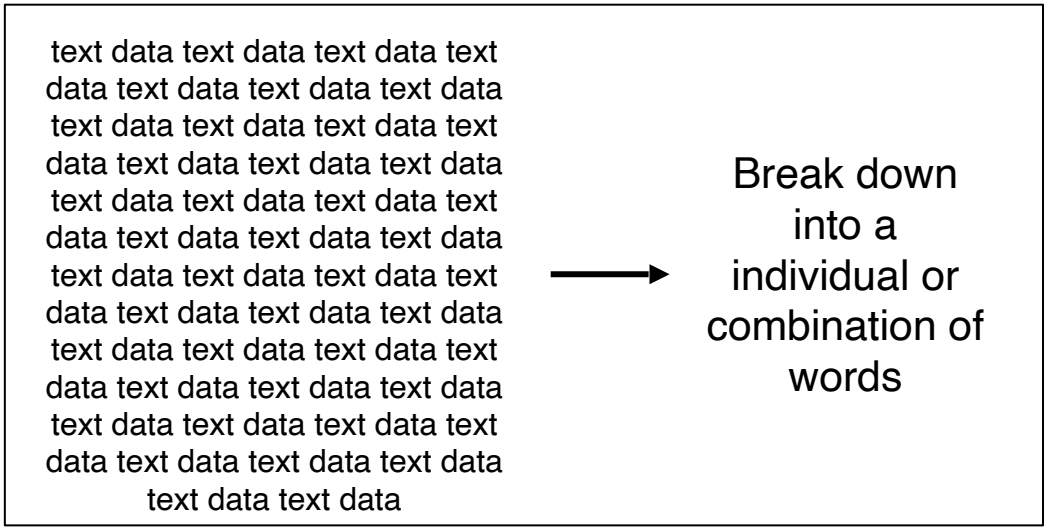
Lexical Density



Sentiment Analysis

Sentiment Analysis

Programmatically infer emotional content of text



Part of the "NRC" sentiment **lexicon**:

word	sentiment	lexicon
<chr>	<chr>	<chr>
abacus	trust	nrc
abandon	fear	nrc
abandon	negative	nrc
abandon	sadness	nrc
abandoned	anger	nrc
abandoned	fear	nrc
abandoned	negative	nrc
abandoned	sadness	nrc
abandonment	anger	nrc
abandonment	fear	nrc

... with 27,304 more rows

http://varianceexplained.org/r/trump-tweets/

When doing sentiment analysis...

token - a meaningful unit of text

- what you use for analysis
- *tokenization* takes corpus of text and splits it into tokens (words, bigrams, etc.)

stop words - words not helpful for analysis

- extremely common words such as “the”, “of”, “to”
- are typically removed from analysis

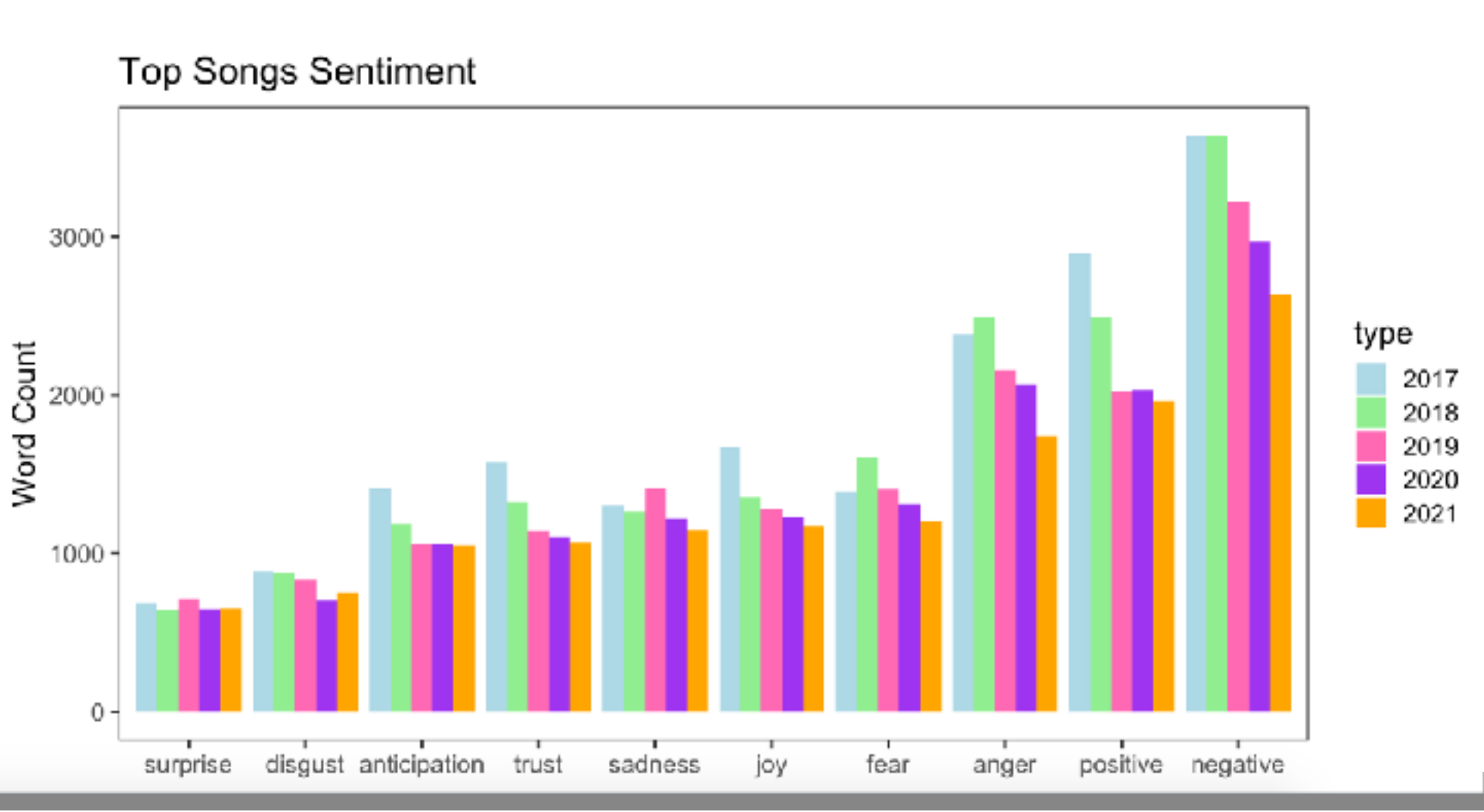
When doing sentiment analysis...

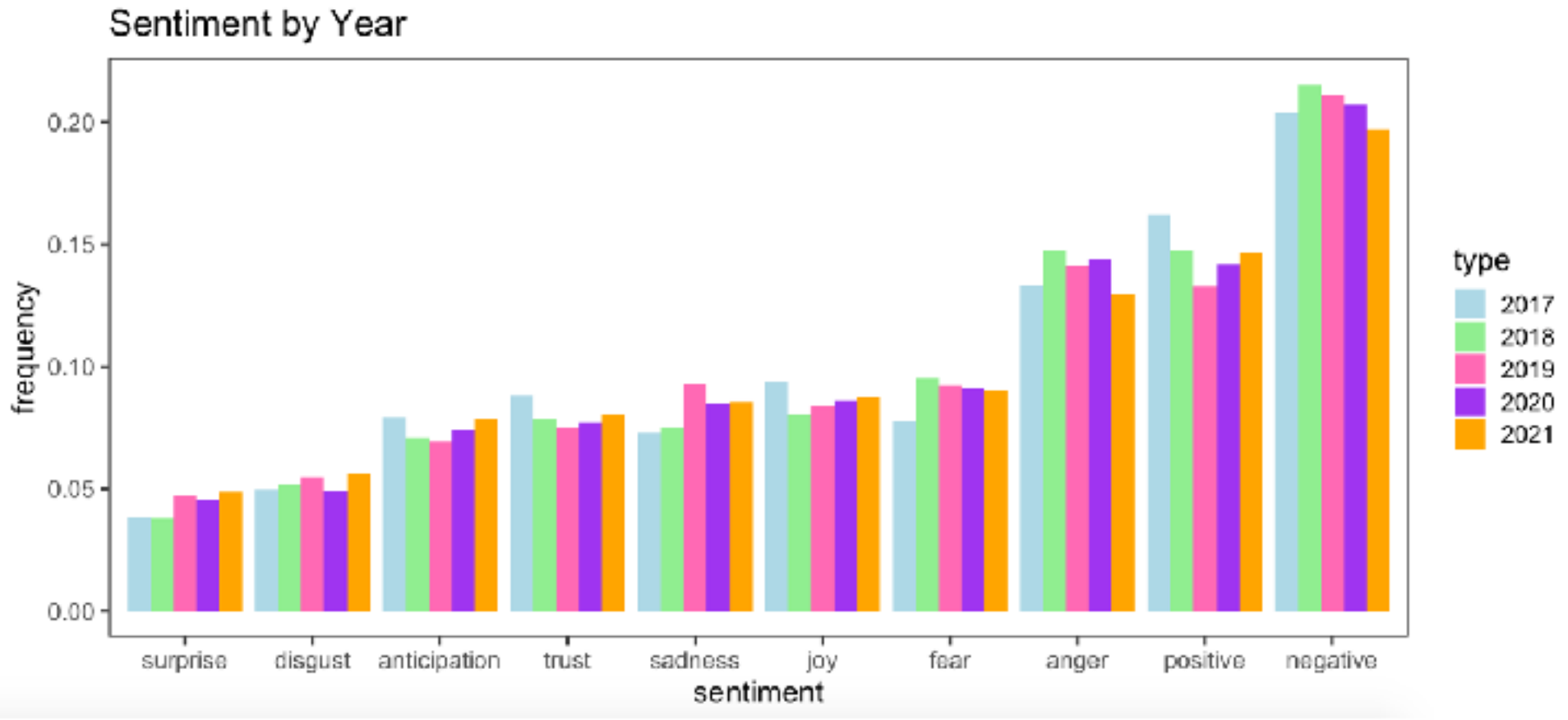
stemming - lexicon normalization

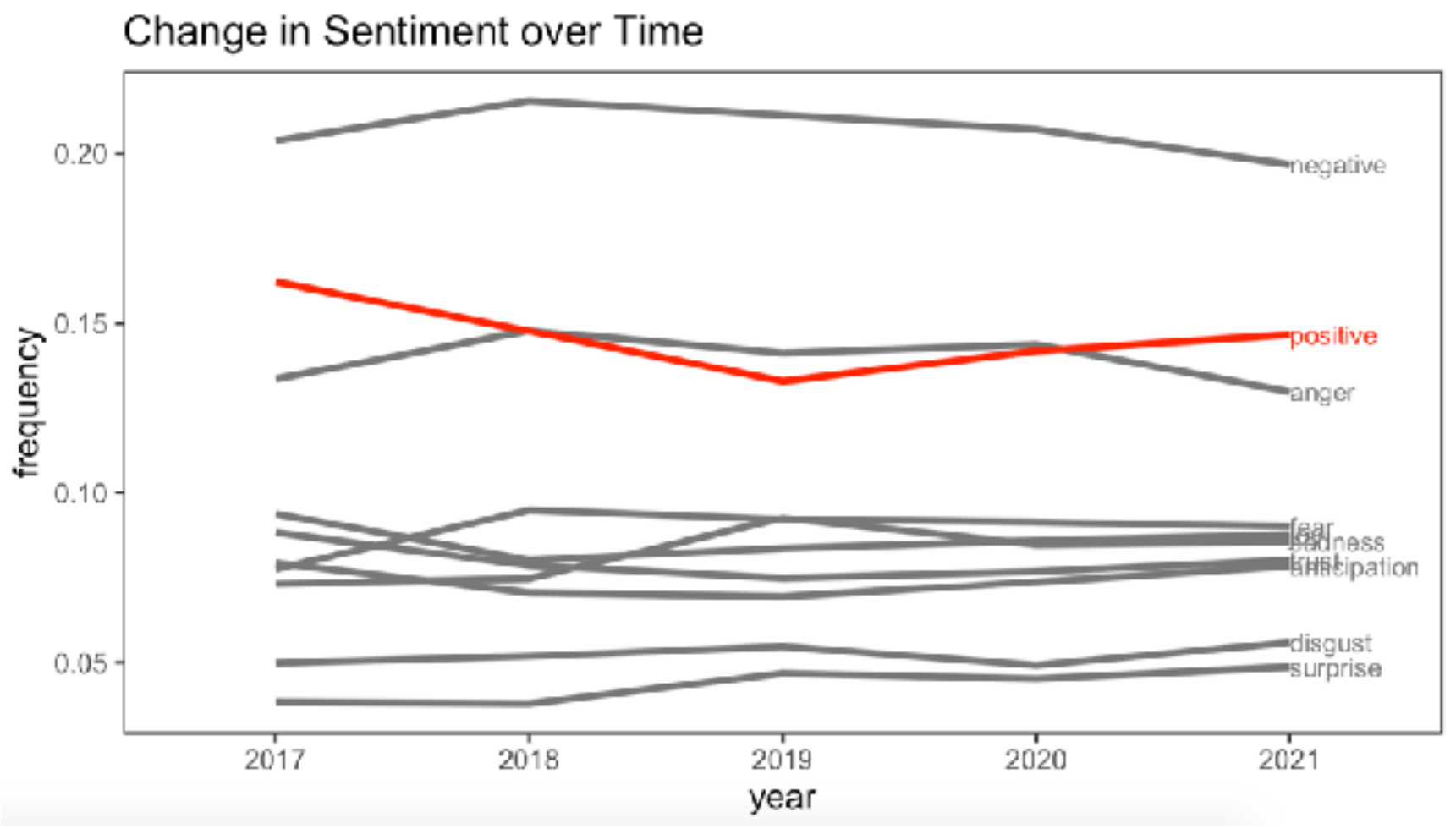
- Identifying the root for each token
- Jumping, jumped, jumps, jump all have the same root ‘jump’
- Where things get tricky: jumper???

In text analysis, your choices matter:

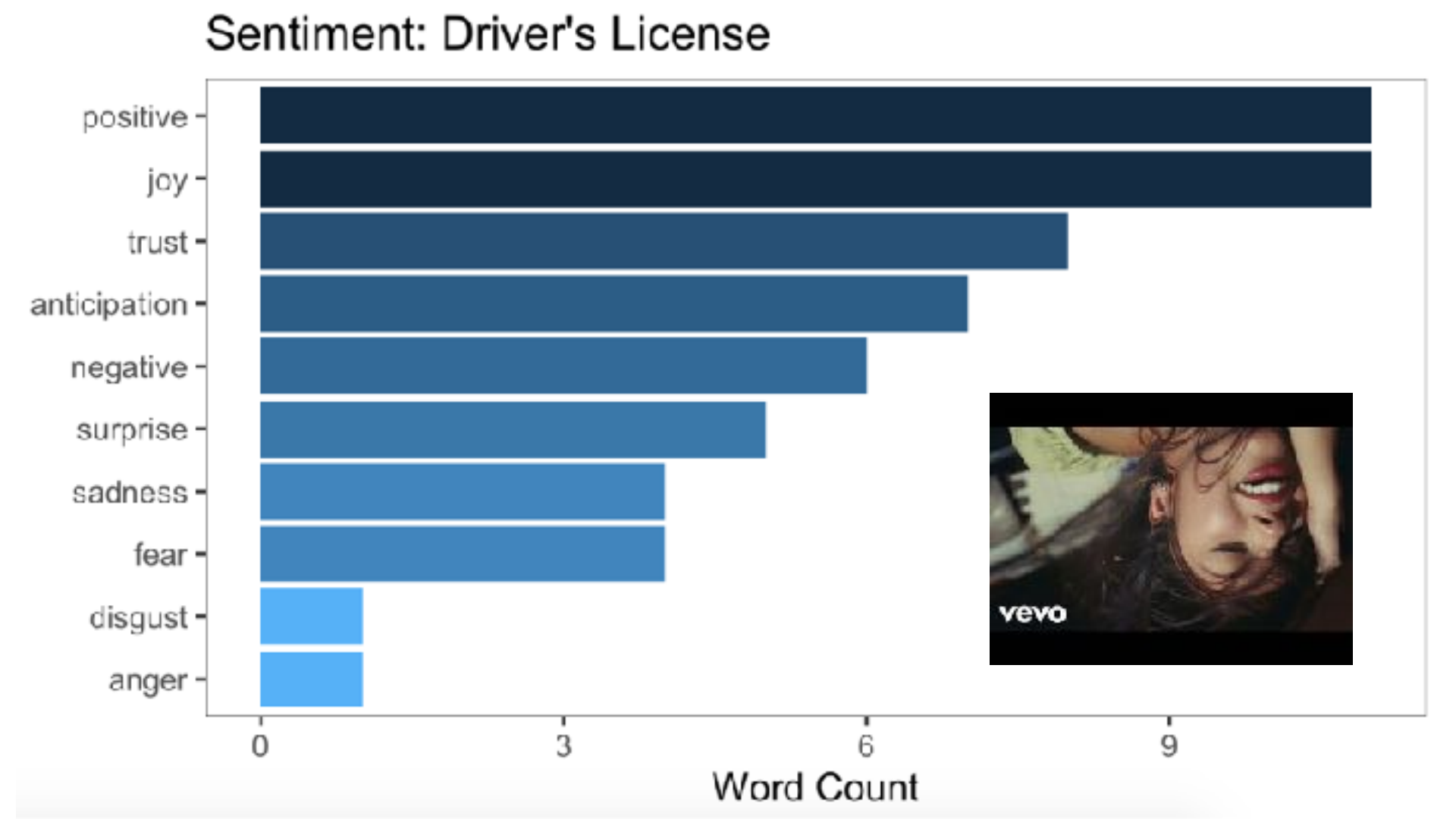
1. How to tokenize?
2. What lexicon to use?
3. Remove stop words? Remove common words?
4. Use stemming?


Top Songs Sentiment
Word Count
3000
2000
1000
0
surprise
disgust
anticipation
trust
sadness
joy
fear
anger
positive
negative
type
2017
2018
2019
2020
2021


Sentiment by Year
0.20
0.15
0.10
0.05
0.00
frequency
surprise
disgust
anticipation
trust
sadness
joy
fear
anger
positive
negative
sentiment
type
2017
2018
2019
2020
2021

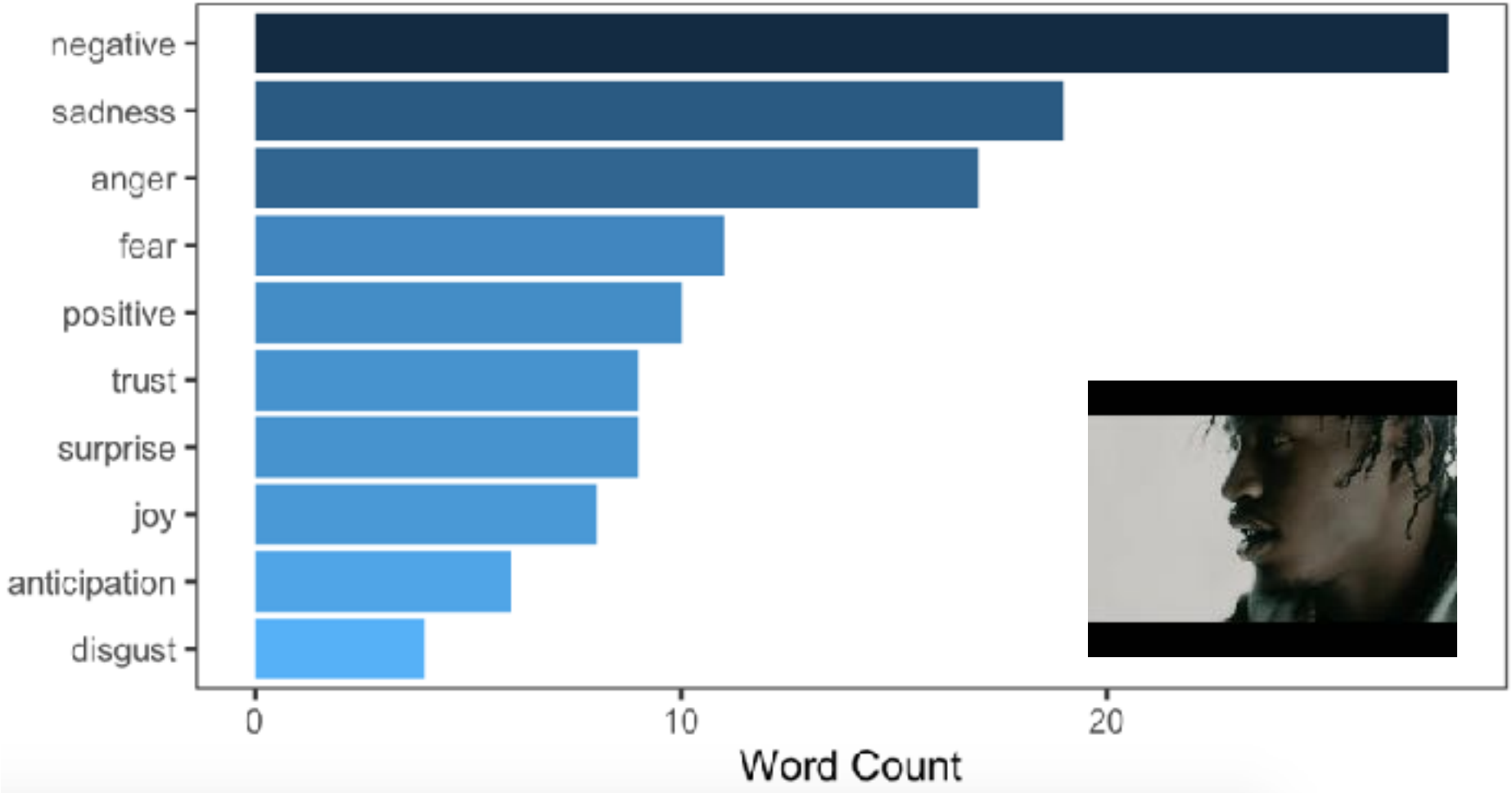

Change in Sentiment over Time
0.20
0.15
0.10
0.05
frequency
negative
positive
anger
fear
sadness
anticipation
disgust
surprise
2017
2018
2019
2020
2021
year

Sentiment: Driver's License



I got my driver's license last week
Just like we always talked about
'Cause you were so excited for me
To finally drive up to your house
But today I drove through the suburbs
Crying 'cause you weren't around
And you're probably with that blonde girl
Who always made me doubt
She's so much older than me
She's everything I'm insecure about
Yeah, today I drove through the suburbs
'Cause how could I ever love someone else?
And I know we weren't perfect but I've never felt this way for no one
And I just can't imagine how you could be so okay now that I'm gone
Guess you didn't mean what you wrote in that song about me
'Cause you said forever, now I drive alone past your street
And all my friends are tired
Of hearing how much I miss you, but
I kinda feel sorry for them
'Cause they'll never know you the way that I do, yeah
Today I drove through the suburbs
And pictured I was driving home to you

Sentiment: Calling My Name

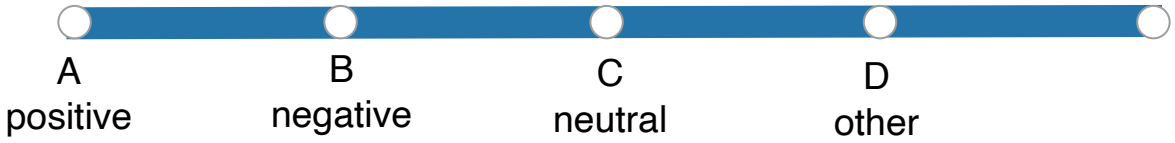


I ain't tryna play these game no more
I don't wanna be textin' your name no more
I ain't tryna feel this pain no more
And I'm sorry but my feelings ain't the same no more (no)
Used to be my homie, you ain't gang no more (no)
I am not a nigga you could claim you no more (no)
Traumatized, hoping it don't rain no more
You done put me through some things that done changed my aura
Now all around the world, I explore, no Dora
New bitch, I might drip out and Dior her
Ass fat, shawty straight heat, no Florida
Bad and she know it, for herself, I applaud her
No needs, yeah, I'm talkin' my boo
So please, leave 'lone, I'm through
And it's all 'cause of what you started
I been told you I won't lose (mmh)
Steady callin' my phone (brrt)
I done told you before that it's over, leave me 'lone
Know it's hurtin' you to see me gone
Dark clouds, you gon' see me storm
I won't go back (go back)
But trust me, you're gon' hold that
Hold that (mmh, mmh)

Sentiment Limitations

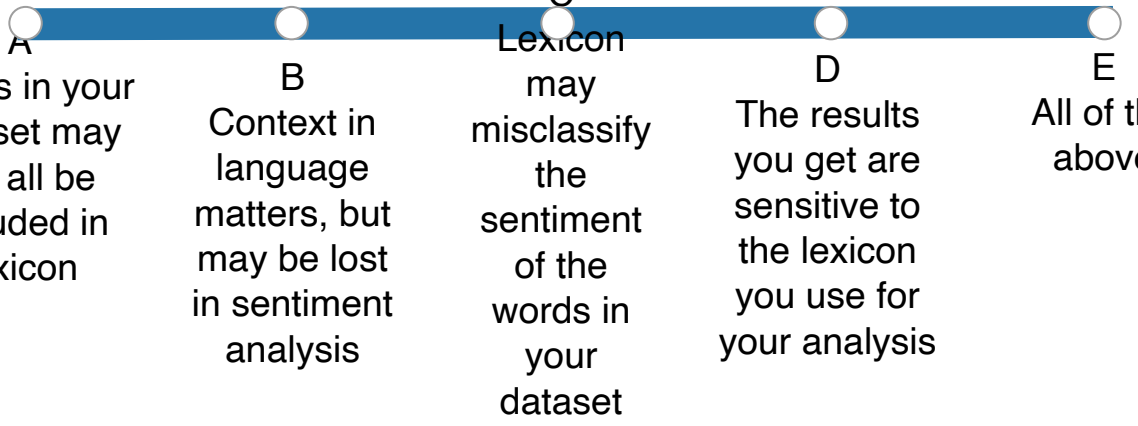
How would you classify the sentiment of the following sentence?

“The idea behind the movie was great, but it could have been better”



Sentiment Limitations

What is a limitation of sentiment analysis?



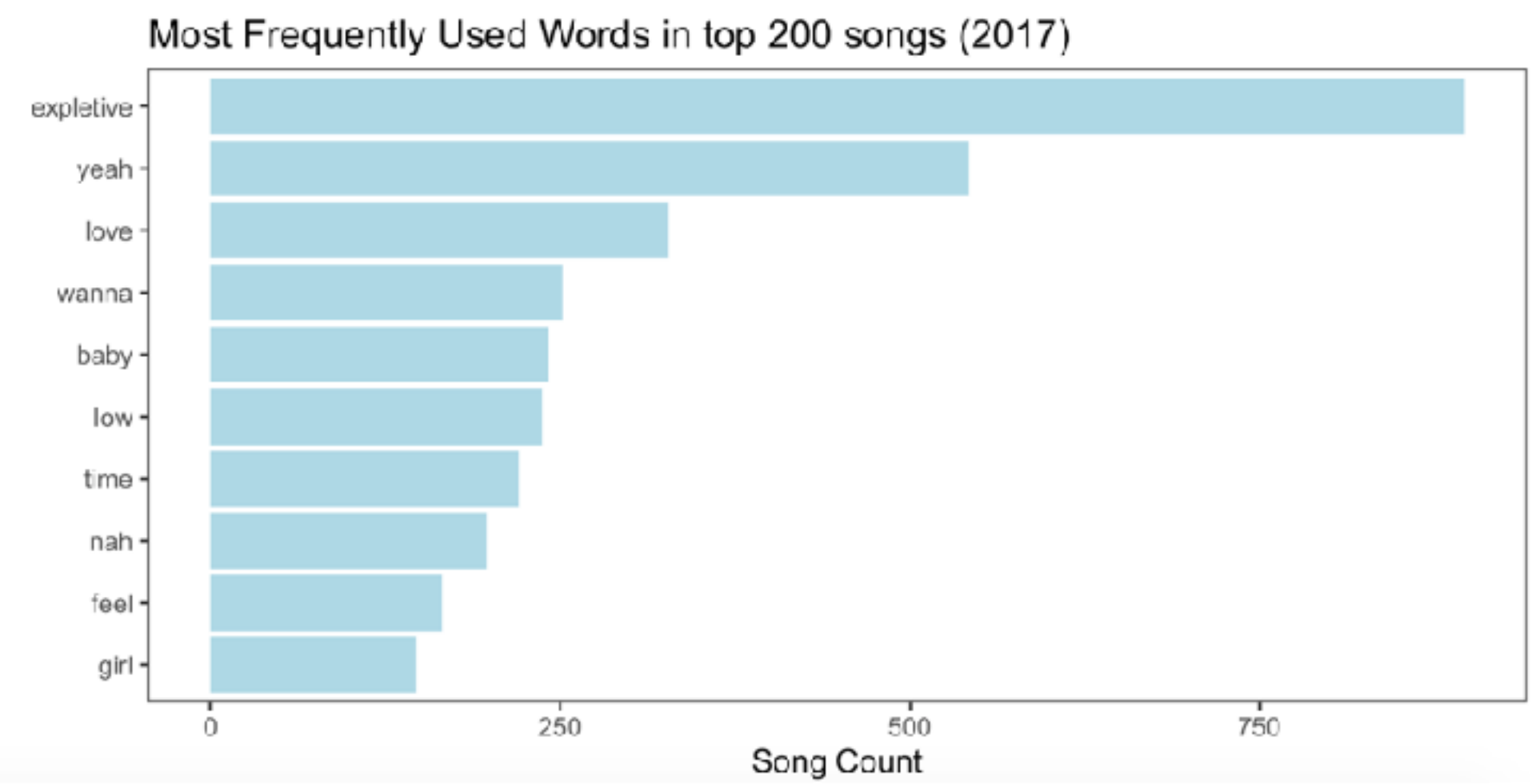
TF-IDF

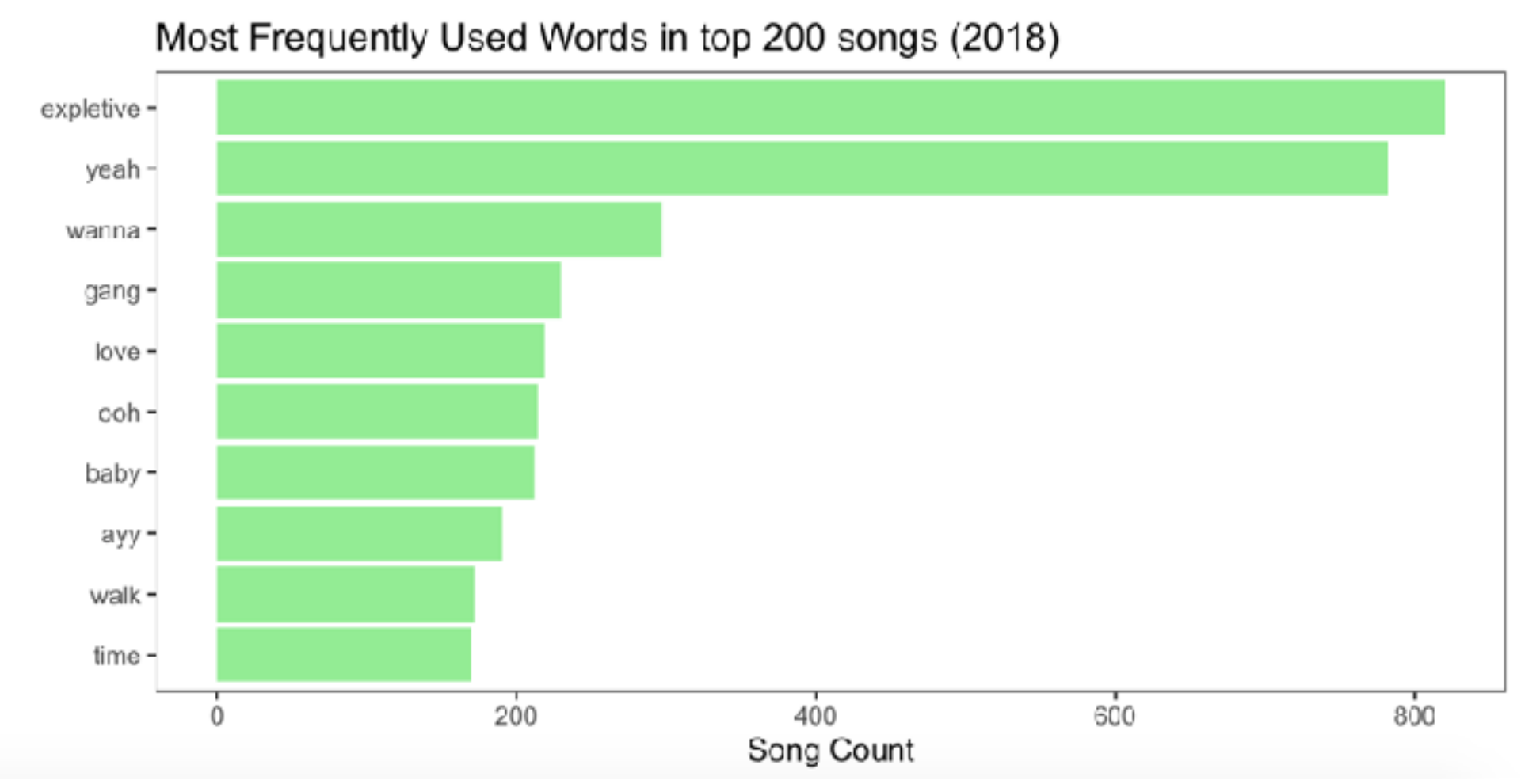
Term Frequency - Inverse Document Frequency

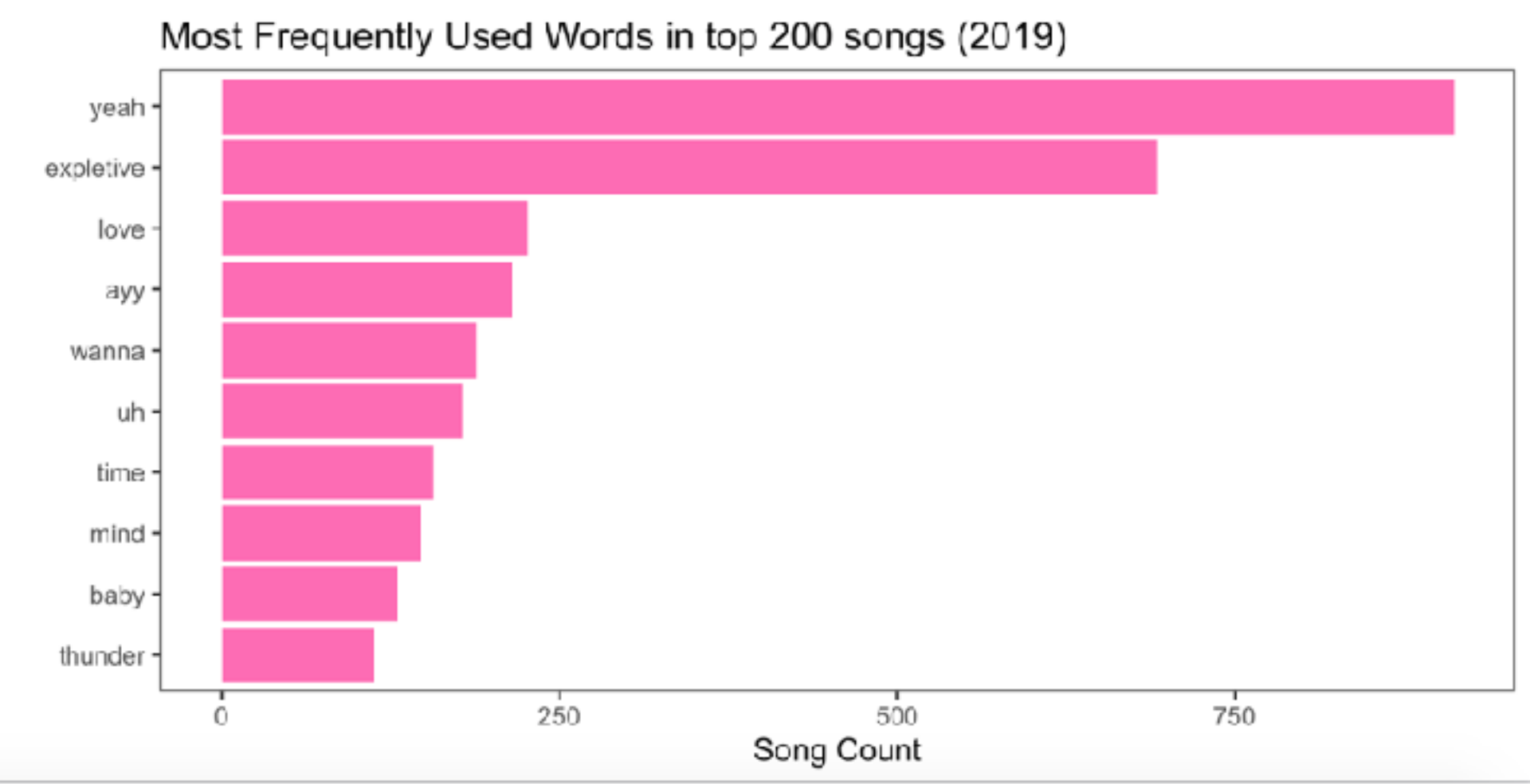
What words are the most unique to the lyrics of each year's top hits?

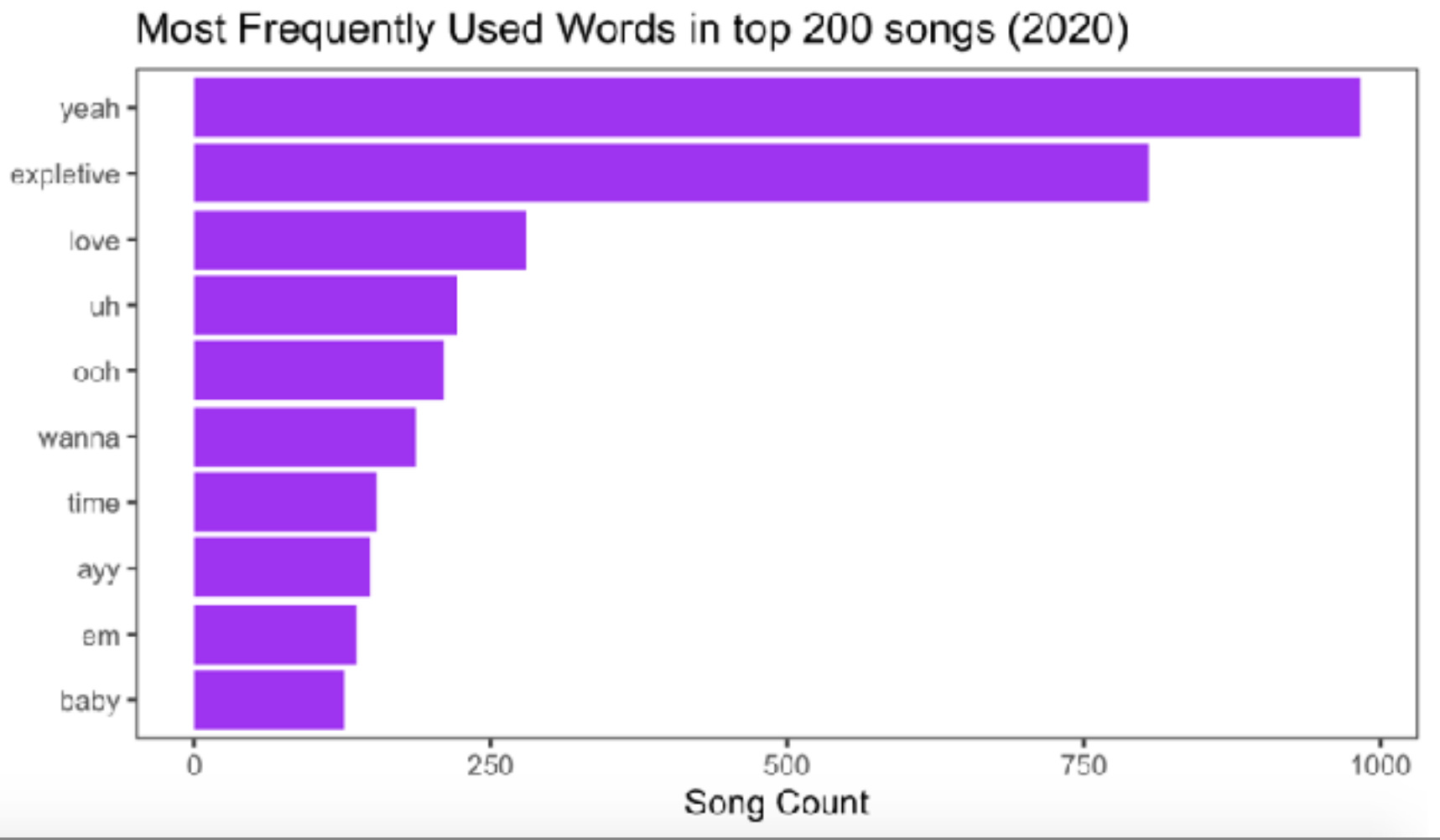
Goal: to use TF-IDF to *find the important words* for the content of each document by decreasing the weight for commonly used words and increasing the weight for words that are not used very much in a collection or corpus of documents

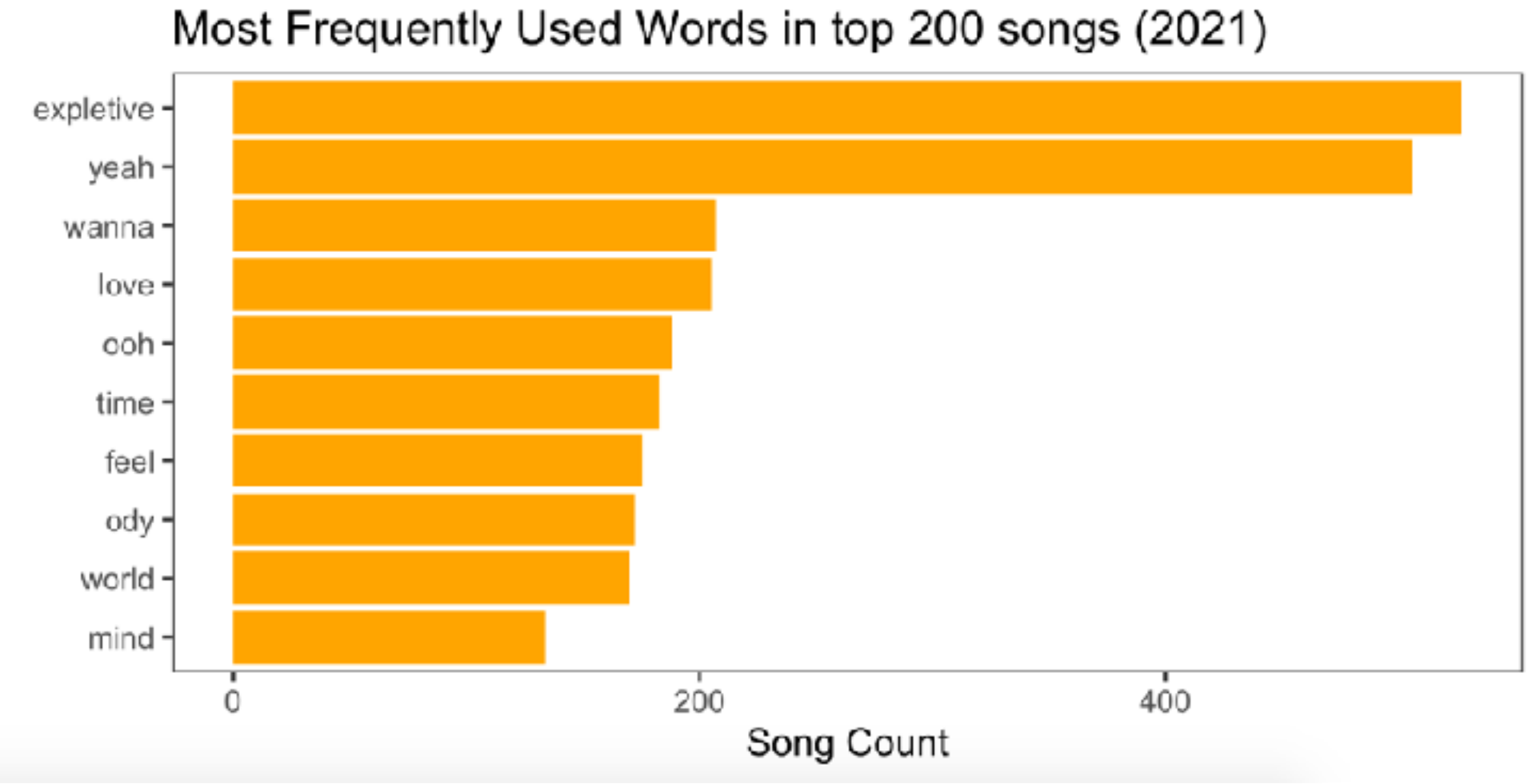
Calculating TF-IDF attempts to find the words that are important (i.e., common) in a text, but not *too* common


Most Frequently Used Words in top 200 songs (2017)
expletive
yeah
love
wanna
baby
low
time
nah
feel
girl
0
250
500
750
Song Count


Most Frequently Used Words in top 200 songs (2018)
expletive
yeah
wanna
gang
love
coh
baby
ayy
walk
time
0
200
400
600
800
Song Count


Most Frequently Used Words in top 200 songs (2019)
yeah
expletive
love
ayy
wanna
uh
time
mind
baby
thunder
0
250
500
750
Song Count


Most Frequently Used Words in top 200 songs (2020)
yeah
expletive
love
uh
ooh
wanna
time
ayy
em
baby
0
250
500
750
1000
Song Count


Most Frequently Used Words in top 200 songs (2021)
expletive
yeah
wanna
love
ooh
time
feel
ody
world
mind
0
200
400
Song Count

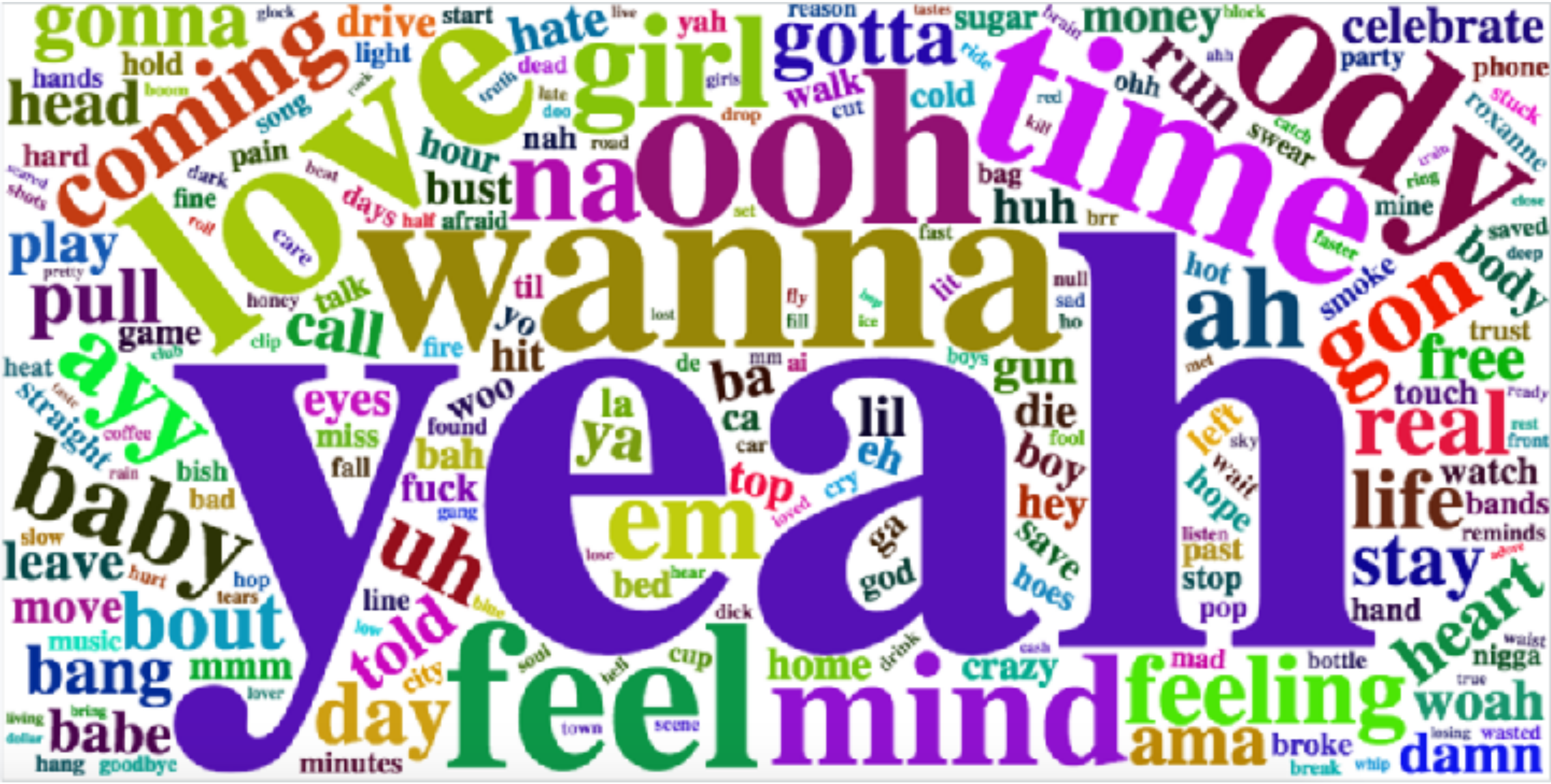
Term Frequency can only tell us so much….

2017

2018

2019

2020


yeah
wanna
ooh
time
love
girl
gotta
body
coming
gonna
na
feel
mind
feeling
ah
gon
baby
pull
ayy
bout
bang
babe
day
em
uh
told
real
life
stay
heart
woah
damn
ama
home
crazy
hate
money
celebrate
run
drive
start
sugar
head
hold
hands
play
hard
call
game
bust
hour
pain
eyes
miss
lil
ba
gun
die
boy
hey
hope
save
free
touch
trust
watch
bands
reminds
hand
nigga
bottle
broke
minutes
goodbye
hang
music
move
leave
heat
straight
fuck
bah
hit
la
ya
god
bed
top
eh
ca
stop
past
pop
left
wait
mine
saved
smoke
hot
cold
walk
light
party
phone
roxanne
swear
huh
bag
afraid
fine
talk
fire
found
woo
line
mmm
cup
fall
bish
bad
mad
boys
ohh
nah
yah
reason
dead
song
cut
drop
days
half

2021

TF-IDF:
Term Frequency - Inverse Document Frequency

Term Frequency (TF) : how frequently a word occurs in a document

Inverse document frequency (IDF) : intended to measure how important a word is to a document

decreases the weight for commonly used words and increases the weight for words that are not used very much in a collection of documents

$$idf(\text{term}) = \ln\left(\frac{n_{\text{documents}}}{n_{\text{documents containing term}}}\right)$$

TF-IDF:

Term Frequency - Inverse Document Frequency

the frequency of a term adjusted for how rarely it is used

$$w_{x,y} = tf_{x,y} \times \log\left(\frac{N}{df_x}\right)$$

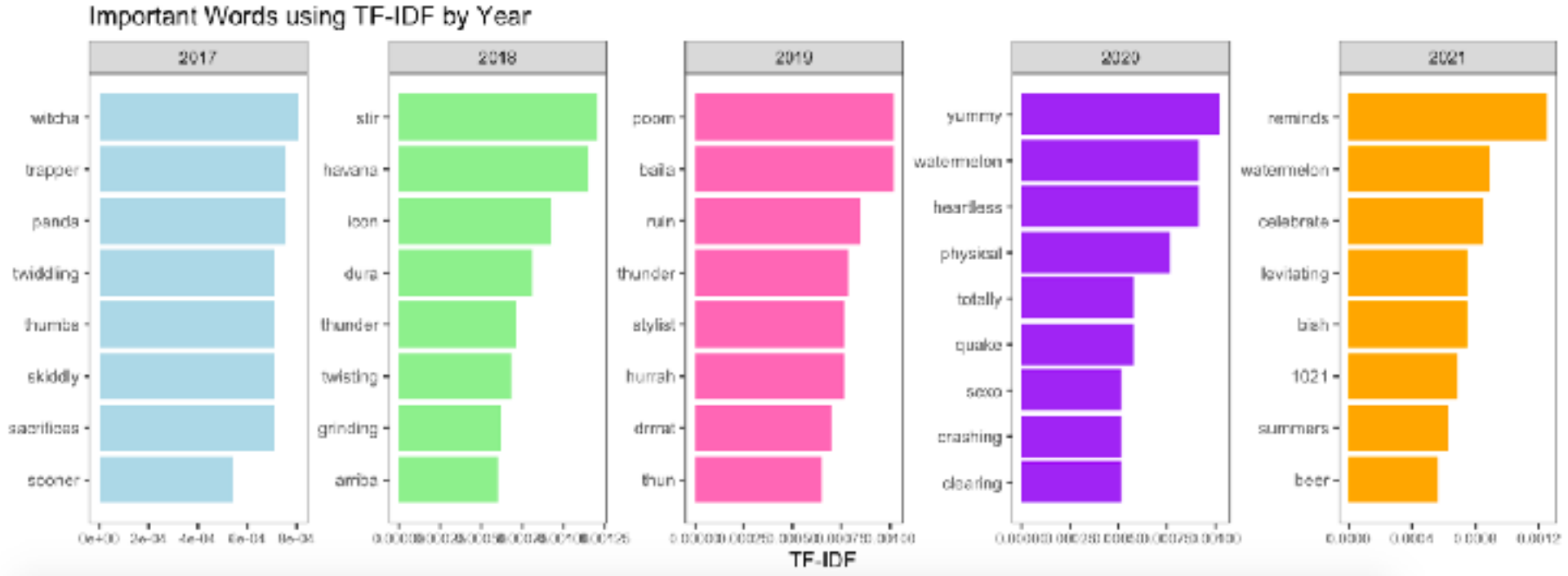
TF-IDF

Term x within document y

$tf_{x,y}$ = frequency of x in y

df_x = number of documents containing x

N = total number of documents


Important Words using TF-IDF by Year
2017
witcha
trapper
panda
twiddling
humbe
skiddly
sacrificss
sconer
2018
stir
havana
loon
dura
thunder
twisting
grinding
amba
2019
poom
baila
ruin
thunder
stylist
hurrah
drmst
thun
2020
yummy
watermelon
heartless
physical
totally
quake
seco
crashing
clearing
2021
reminds
watermelon
celebrate
levitating
bish
1021
summers
beer
TF-IDF

Father and Son
Flight of the Conchords

Live in London
2019

Just you and I
Driving round in the car
I even let you drive
Eating dinner from a can
dad's **yummy** can delight

I'm Me
Chai

Punk
2019

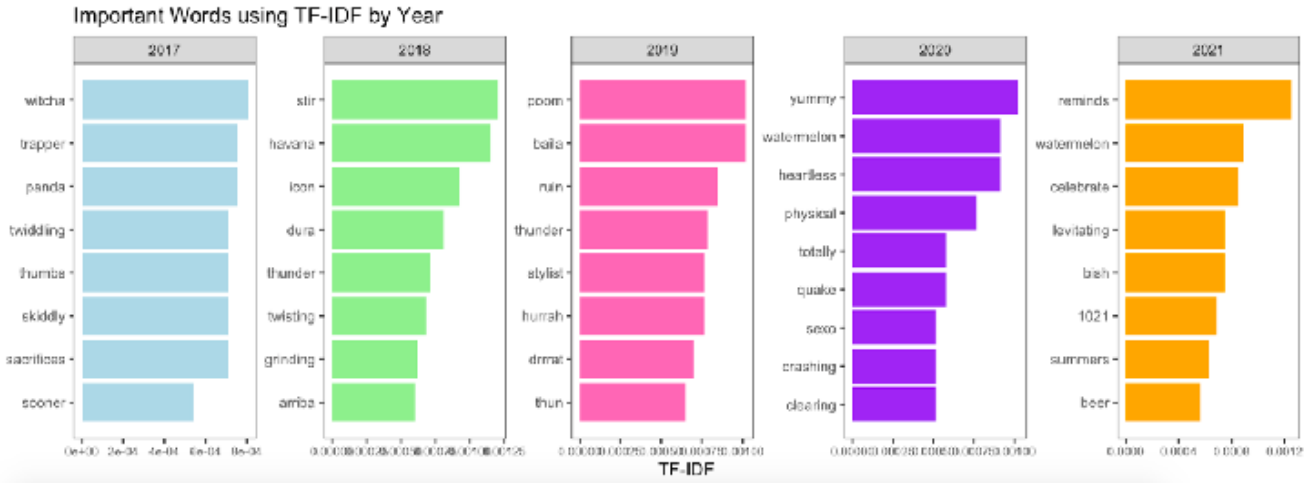
ビーフ アンド チャオズ フィッシュ オレンジ
Everything **yummy** foods!

Sex Talk
Megan Thee Stallion

Sex Talk
2019

He eat from the back to the front
Bitch I got green like I'm Buttercup (ah)
He say I got that lil **yummy** yum (ah ah)

What can you conclude from this TF-IDF plot?



A No words overlap across the years in these data

B ‘reminds’ and ‘watermelon’ are the most unique words to the 2021 data

C ‘watermelon’ is the most common word in this dataset

D A-C (all of the above)

E None of the above

Questions we can ask...

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2. Does uniqueness change over time?
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EDA

TF-IDF

Sentiment Analysis