Text

Session 13

PMAP 8921: Data Visualization with R
Andrew Young School of Policy Studies
Fall 2023

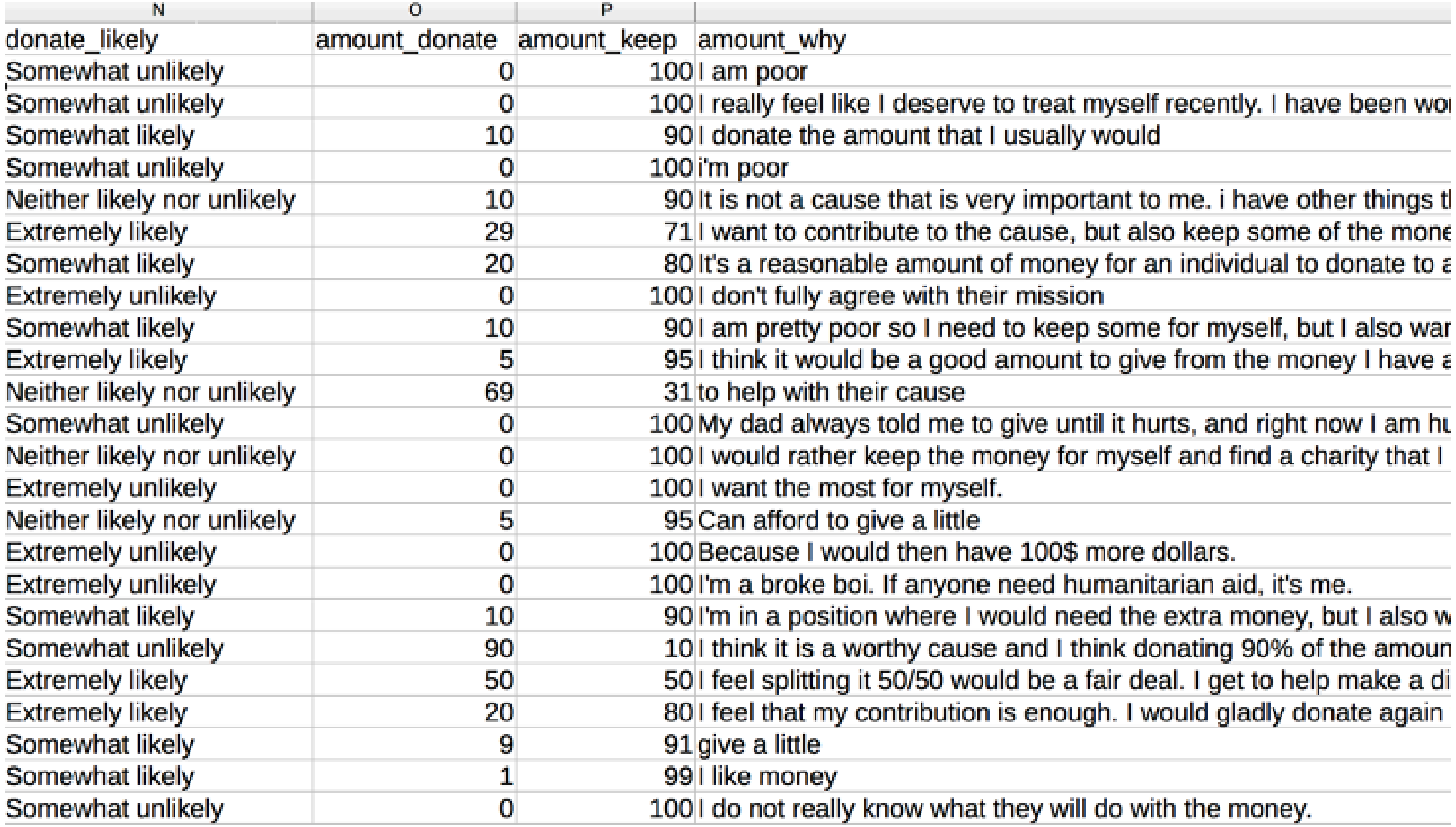
Plan for today

Qualitative text-based data

Crash course in computational linguistics

Qualitative text-based data

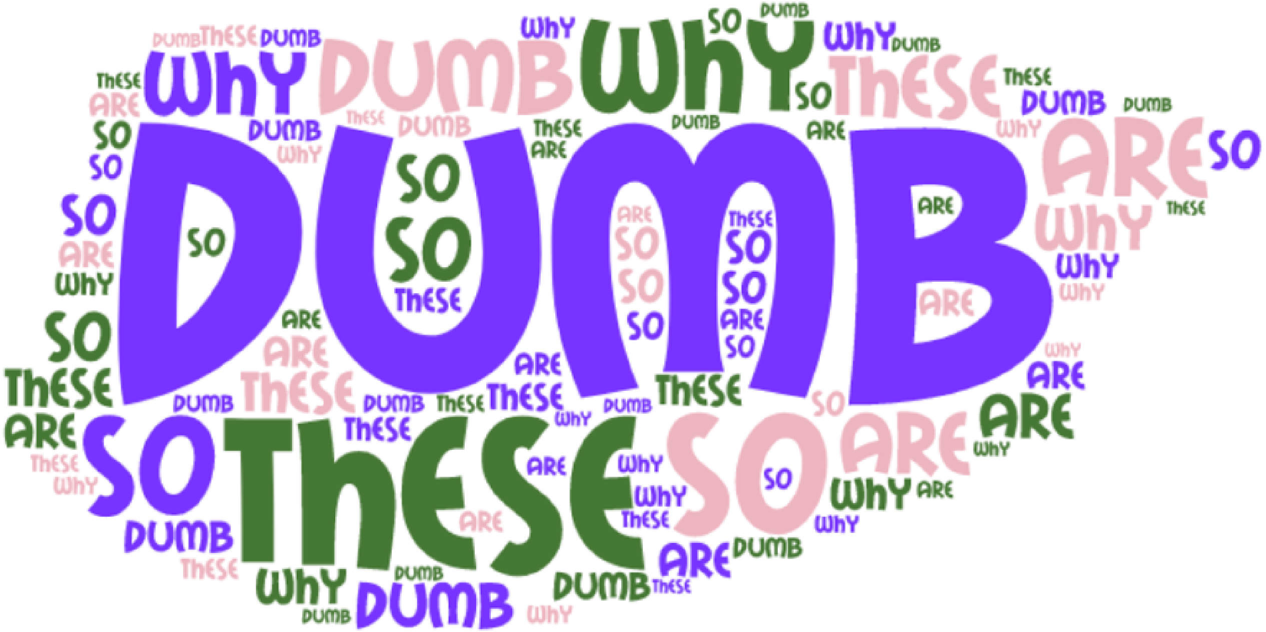
Free responses



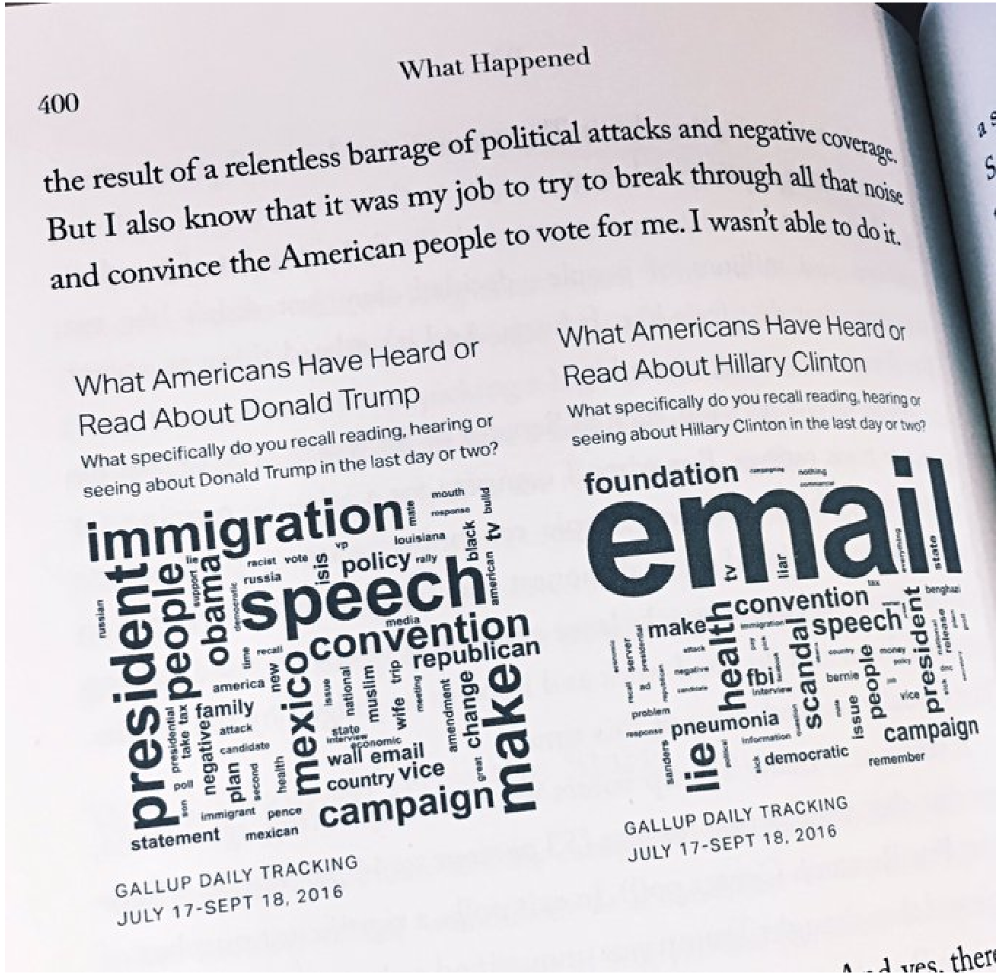
N	O	P	
donate_likely	amount_donate	amount_keep	amount_why
Somewhat unlikely	0	100	I am poor
Somewhat unlikely	0	100	I really feel like I deserve to treat myself recently. I have been wor
Somewhat likely	10	90	I donate the amount that I usually would
Somewhat unlikely	0	100	i'm poor
Neither likely nor unlikely	10	90	It is not a cause that is very important to me. i have other things t
Extremely likely	29	71	I want to contribute to the cause, but also keep some of the mone
Somewhat likely	20	80	It's a reasonable amount of money for an individual to donate to a
Extremely unlikely	0	100	I don't fully agree with their mission
Somewhat likely	10	90	I am pretty poor so I need to keep some for myself, but I also war
Extremely likely	5	95	I think it would be a good amount to give from the money I have a
Neither likely nor unlikely	69	31	to help with their cause
Somewhat unlikely	0	100	My dad always told me to give until it hurts, and right now I am hu
Neither likely nor unlikely	0	100	I would rather keep the money for myself and find a charity that I
Extremely unlikely	0	100	I want the most for myself.
Neither likely nor unlikely	5	95	Can afford to give a little
Extremely unlikely	0	100	Because I would then have 100$ more dollars.
Extremely unlikely	0	100	I'm a broke boi. If anyone need humanitarian aid, it's me.
Somewhat likely	10	90	I'm in a position where I would need the extra money, but I also w
Somewhat unlikely	90	10	I think it is a worthy cause and I think donating 90% of the amoun
Extremely likely	50	50	I feel splitting it 50/50 would be a fair deal. I get to help make a di
Extremely likely	20	80	I feel that my contribution is enough. I would gladly donate again
Somewhat likely	9	91	give a little
Somewhat likely	1	99	I like money
Somewhat unlikely	0	100	I do not really know what they will do with the money.

Typical free responses from a survey

y tho?



Some cases are okay



the result of a relentless barrage of political attacks and negative coverage. But I also know that it was my job to try to break through all that noise and convince the American people to vote for me. I wasn't able to do it.

What Americans Have Heard or Read About Donald Trump

What specifically do you recall reading, hearing or seeing about Donald Trump in the last day or two?

GALLUP DAILY TRACKING
JULY 17–SEPT 18, 2016

What Americans Have Heard or Read About Hillary Clinton

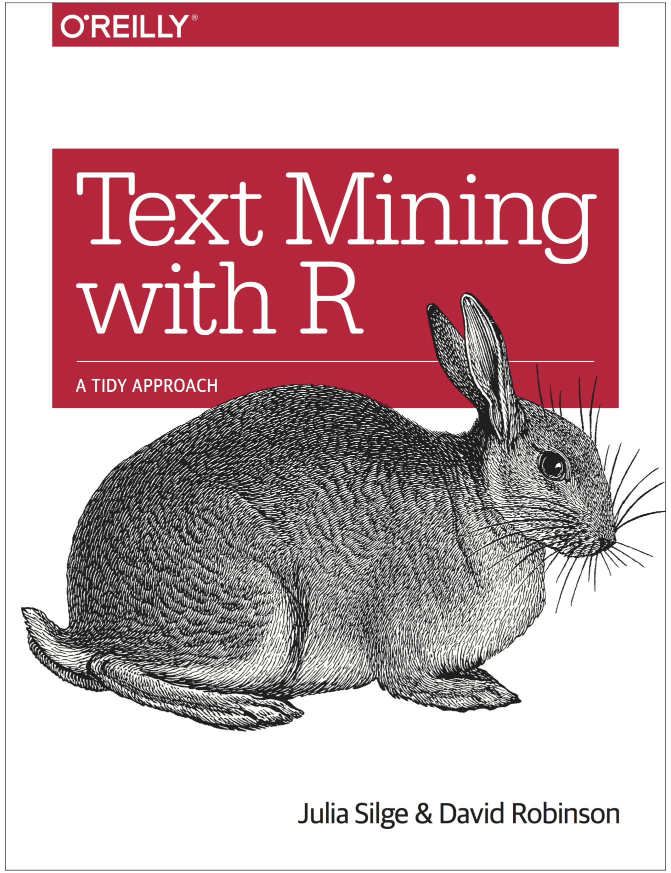
What specifically do you recall reading, hearing or seeing about Hillary Clinton in the last day or two?

GALLUP DAILY TRACKING
JULY 17–SEPT 18, 2016

And yes, there

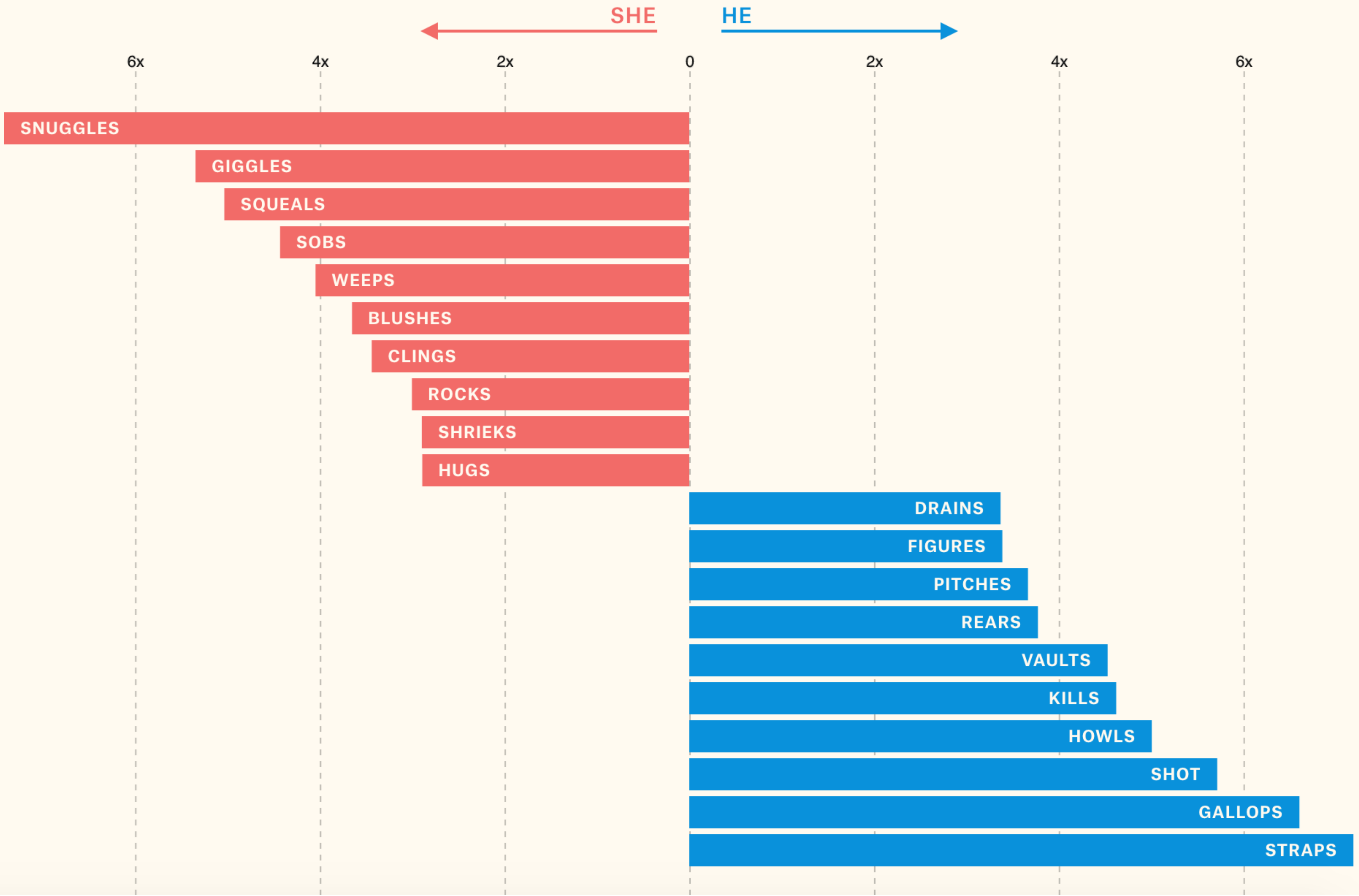
Word clouds for grownups

Count words, but in fancier ways

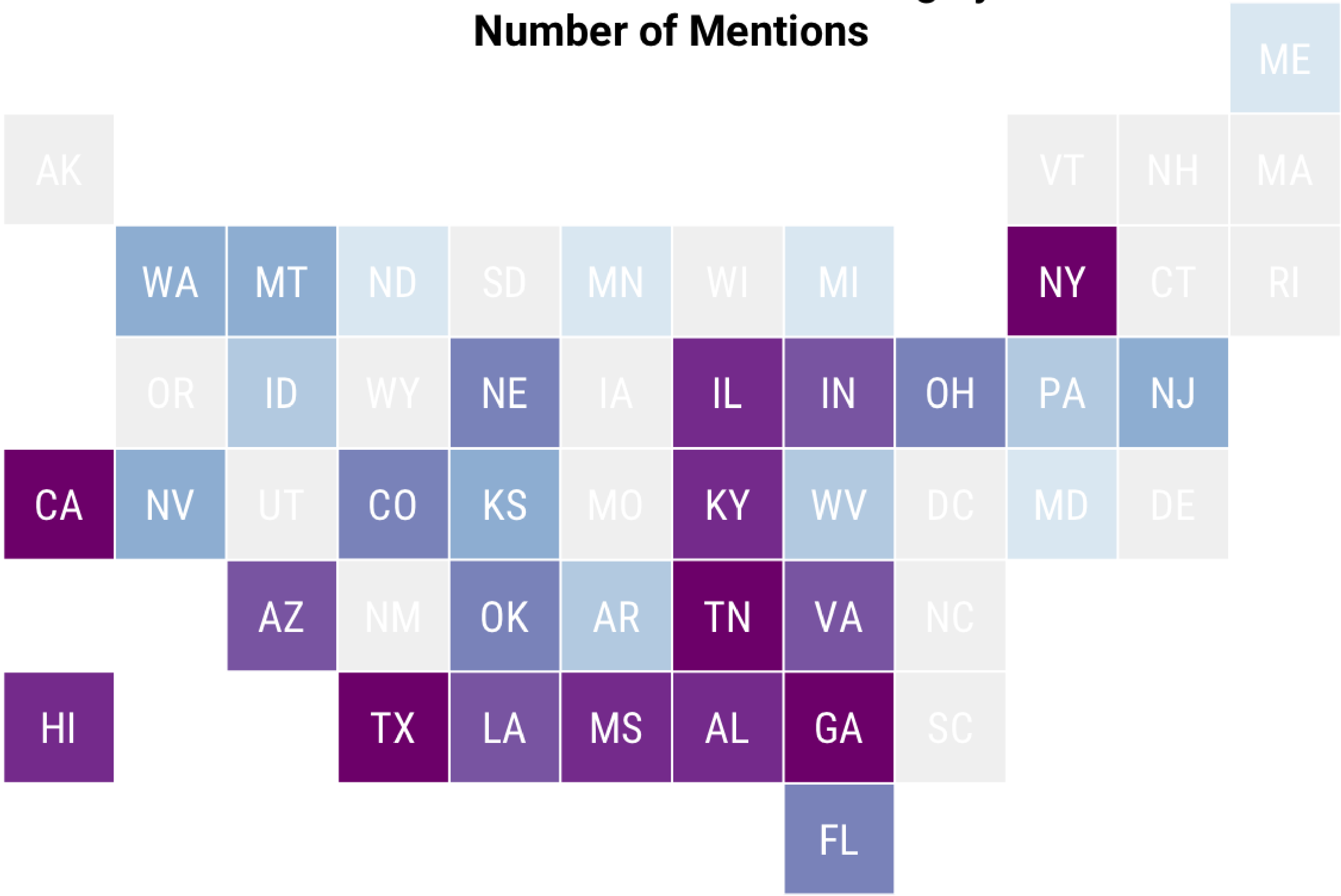


The most used words for women vs. men

Likelihood that certain words appear after “she” vs. “he” in screen direction.



What States Are Mentioned in Song Lyrics?
Number of Mentions



Crash course in computational linguistics

Core concepts and techniques

Tokens, lemmas, and parts of speech

Sentiment analysis

tf-idf

Topics and LDA

Fingerprinting

Regular text

```
THE BOY WHO LIVED   Mr. and Mrs. Dursley, of number four, Privet Drive, were proud to
say that they were perfectly normal, thank you very much. They were the last people you'd
expect to be involved in anything strange or mysterious, because they just didn't hold
with such nonsense.   Mr. Dursley was the director of a firm called Grunnings, which made
drills. He was a big, beefy man with hardly any neck, although he did have a very large
mustache. Mrs. Dursley was thin and blonde and had nearly twice the usual amount of neck,
which came in very useful as she spent so much of her time craning over garden fences,
spying on the neighbors. The Dursleys had a small son called Dudley and in their opinion
there was no finer boy anywhere.   The Dursleys had everything they wanted, but they also
had a secret, and their greatest fear was that somebody would discover it. They didn't
think they could bear it if anyone found out about the Potters. Mrs. Potter was Mrs.
Dursley's sister, but they hadn't met for several years; in fact, Mrs. Dursley pretended
she didn't have a sister, because her sister and her good-for-nothing husband were as
unDursleyish as it was possible to be. The Dursleys shuddered to think what the neighbors
would say if the Potters a...
```

Tidy text

One row for each text element

Can be chapter, page, verse, etc.

```
# A tibble: 6 × 3
  chapter book                                  text
    <int> <chr>                                 <chr>
1       1 Harry Potter and the Philosopher's Stone "THE BOY WHO LIVED   Mr. and Mrs. Dur…
2       2 Harry Potter and the Philosopher's Stone "THE VANISHING GLASS   Nearly ten yea…
3       3 Harry Potter and the Philosopher's Stone "THE LETTERS FROM NO ONE   The escape…
4       4 Harry Potter and the Philosopher's Stone "THE KEEPER OF THE KEYS   BOOM. They …
5       5 Harry Potter and the Philosopher's Stone "DIAGON ALLEY   Harry woke early the …
6       6 Harry Potter and the Philosopher's Stone "THE JOURNEY FROM PLATFORM NINE AND TH…
```

Tokens

Split the text into even smaller parts

Paragraph, line, verse, sentence, n-gram, word, letter, etc.

```
# A tibble: 6 × 3
  word  chapter book
  <chr>   <int> <chr>
1 the         1 Harry Potter...
2 boy         1 Harry Potter...
3 who         1 Harry Potter...
4 lived       1 Harry Potter...
5 mr          1 Harry Potter...
6 and         1 Harry Potter...
```

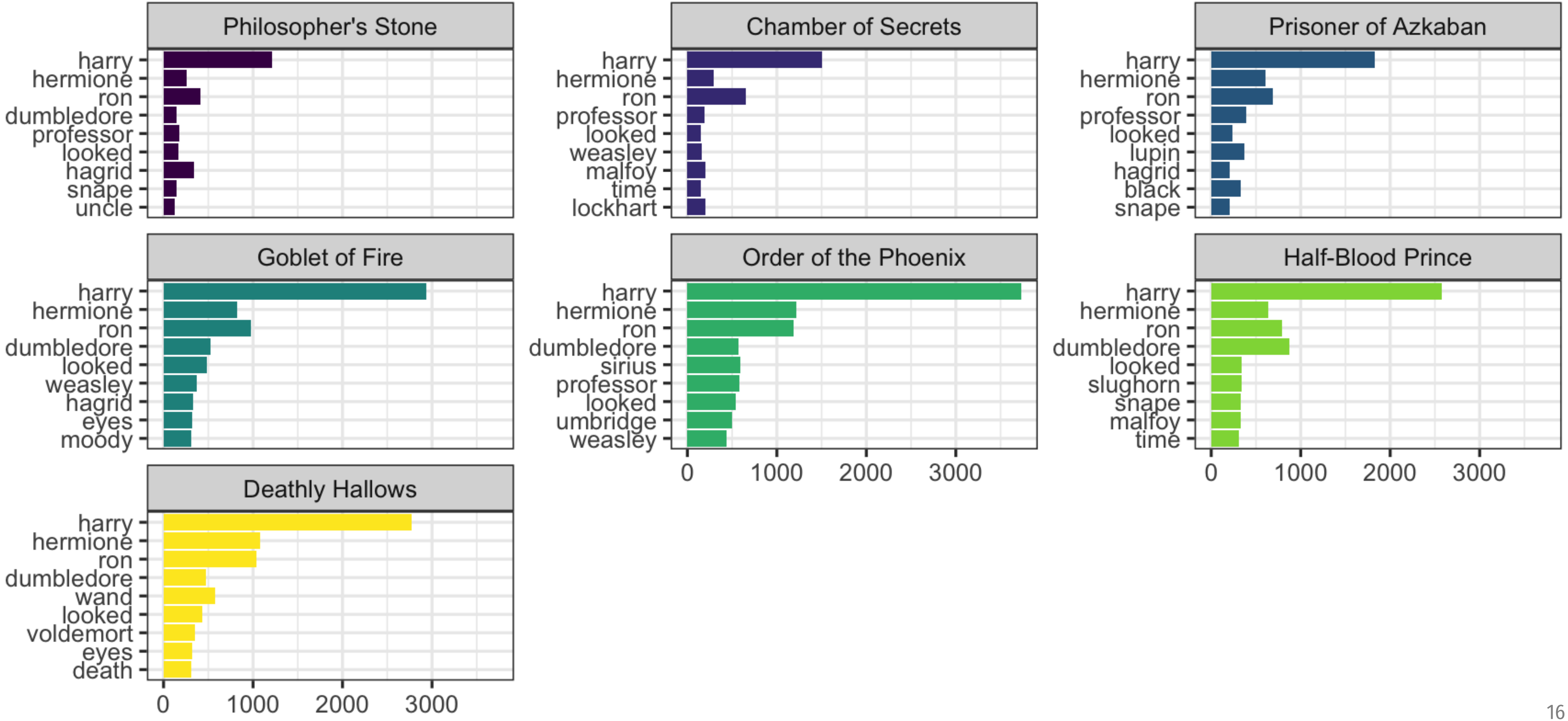
```
# A tibble: 6 × 3
  bigram    chapter book
  <chr>       <int> <chr>
1 the boy         1 Harry Potter...
2 boy who         1 Harry Potter...
3 who lived       1 Harry Potter...
4 lived mr        1 Harry Potter...
5 mr and          1 Harry Potter...
6 and mrs         1 Harry Potter...
```

Stop words

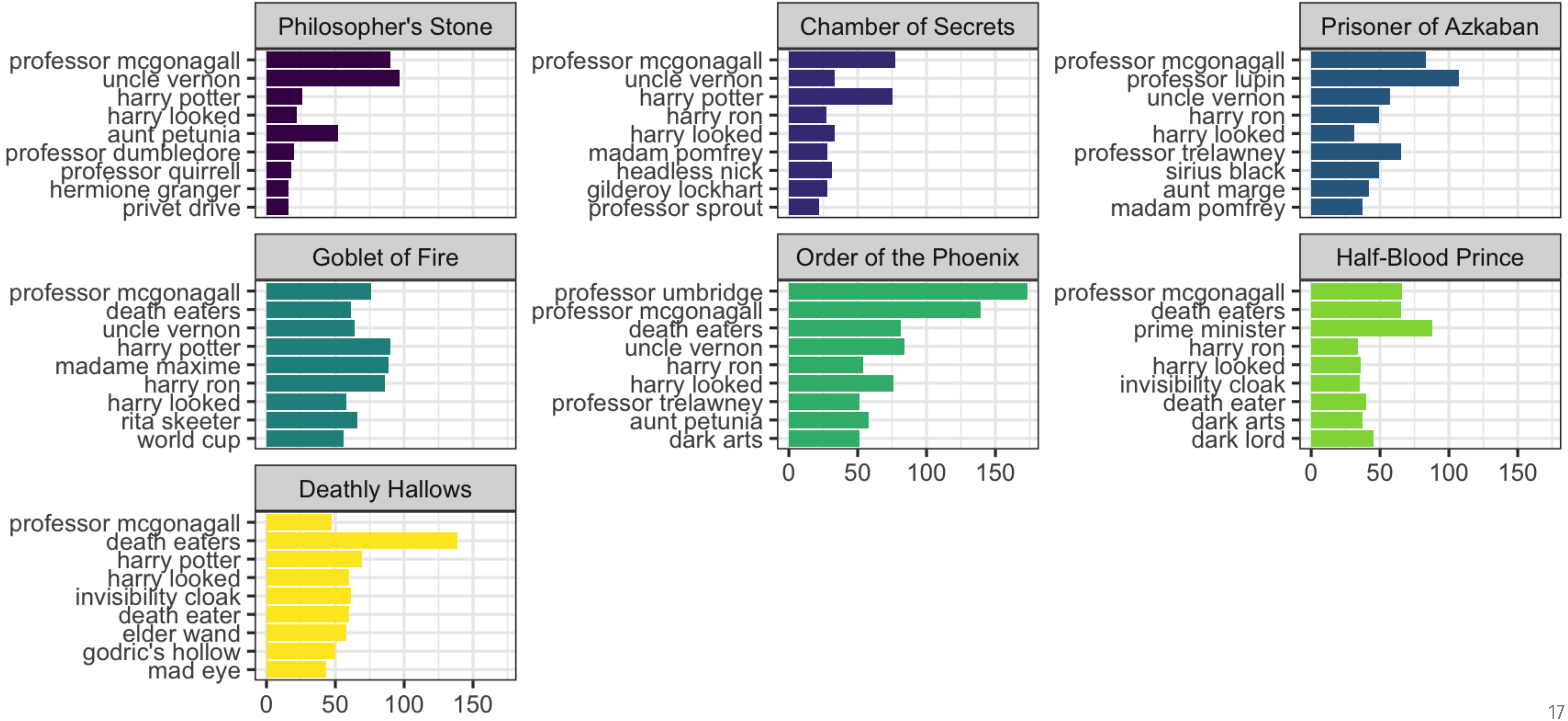
Common words that we can generally ignore

```
# A tibble: 1,149 × 2
   word        lexicon
   <chr>       <chr>  
 1 a           SMART  
 2 a's         SMART  
 3 able        SMART  
 4 about       SMART  
 5 above       SMART  
 6 according   SMART  
 7 accordingly SMART  
 8 across      SMART  
 9 actually    SMART  
10 after       SMART  
 # ℹ 1,139 more rows
```

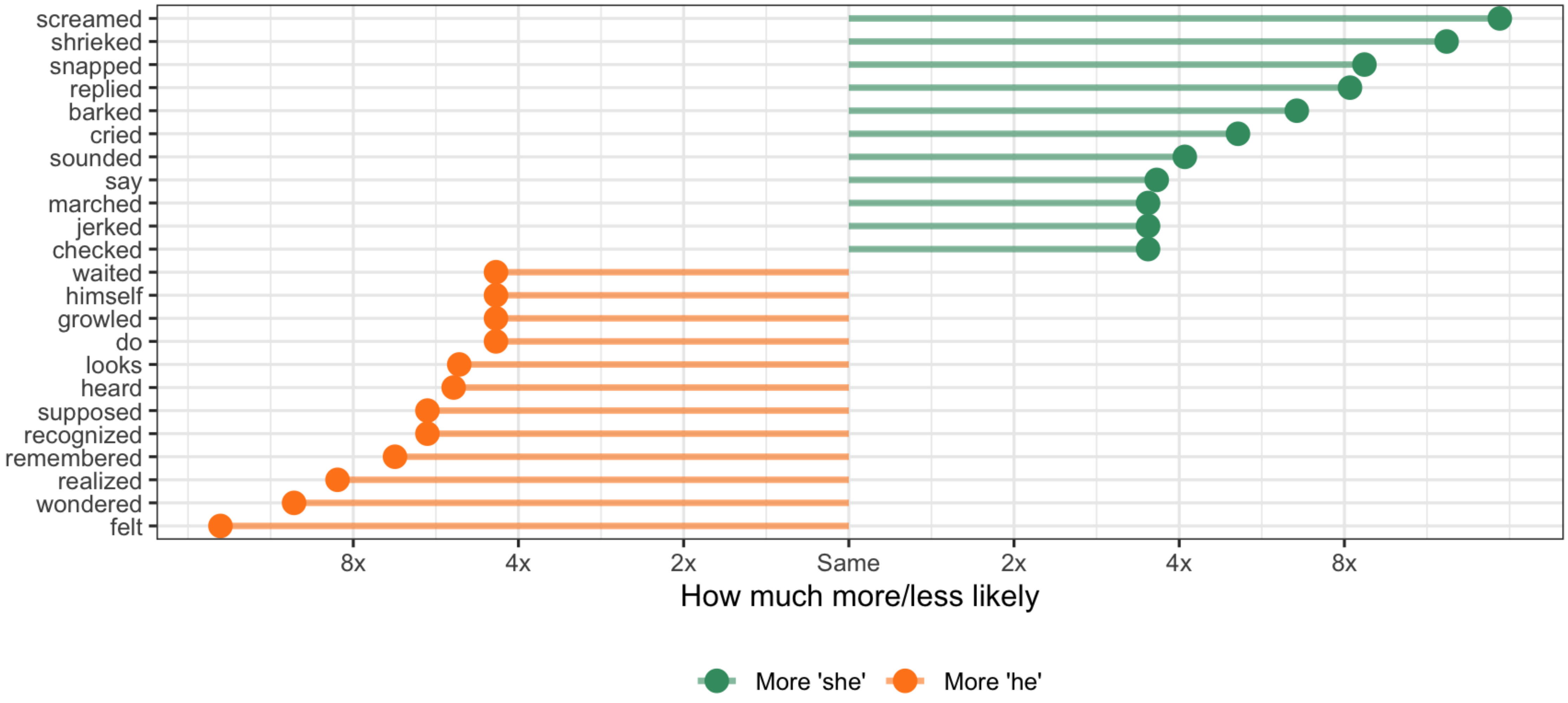
Token frequency: words



Token frequency: n-grams



Token frequency: n-gram ratios



Parts of speech

```
# A tibble: 50 × 11
   doc_id   sid   tid token    token_with_ws lemma    upos  xpos  feats    tid_source relation
    <dbl> <dbl> <dbl> <chr>    <chr>         <chr>    <chr> <chr> <chr>         <dbl> <chr>
 1      1     1     1 THE      THE           the      DET   DT    Defin…            2 det
 2      1     1     2 BOY      BOY           Boy      NOUN  NN    Numbe…           18 nsubj
 3      1     1     3 WHO      WHO           who      PRON  WP    PronT…            4 nsubj
 4      1     1     4 LIVED    LIVED         live     VERB  VBD   Mood=…            2 acl:rel…
 5      1     1     5 Mr.      Mr.           Mr.      PROPN NNP   Numbe…            4 xcomp
 6      1     1     6 and      and           and      CCONJ CC    <NA>              7 cc
 7      1     1     7 Mrs.     Mrs.          Mrs.     PROPN NNP   Numbe…            5 conj
 8      1     1     8 Dursley  Dursley       Dursley  PROPN NNP   Numbe…            7 flat
 9      1     1     9 ,        ,             ,        PUNCT ,     <NA>              5 punct
10      1     1    10 of       of            of       ADP   IN    <NA>             11 case
# ℹ 40 more rows
```

These use the **Penn part of speech tags**

Parts of speech frequency

Verbs

```
# A tibble: 1,557 × 2
   lemma     n
   <chr> <dbl>
 1 say     920
 2 get     440
 3 have    417
 4 go      384
 5 look    380
 6 be      310
 7 know    310
 8 see     303
 9 think   230
10 do      227
# ℹ 1,547 more rows
```

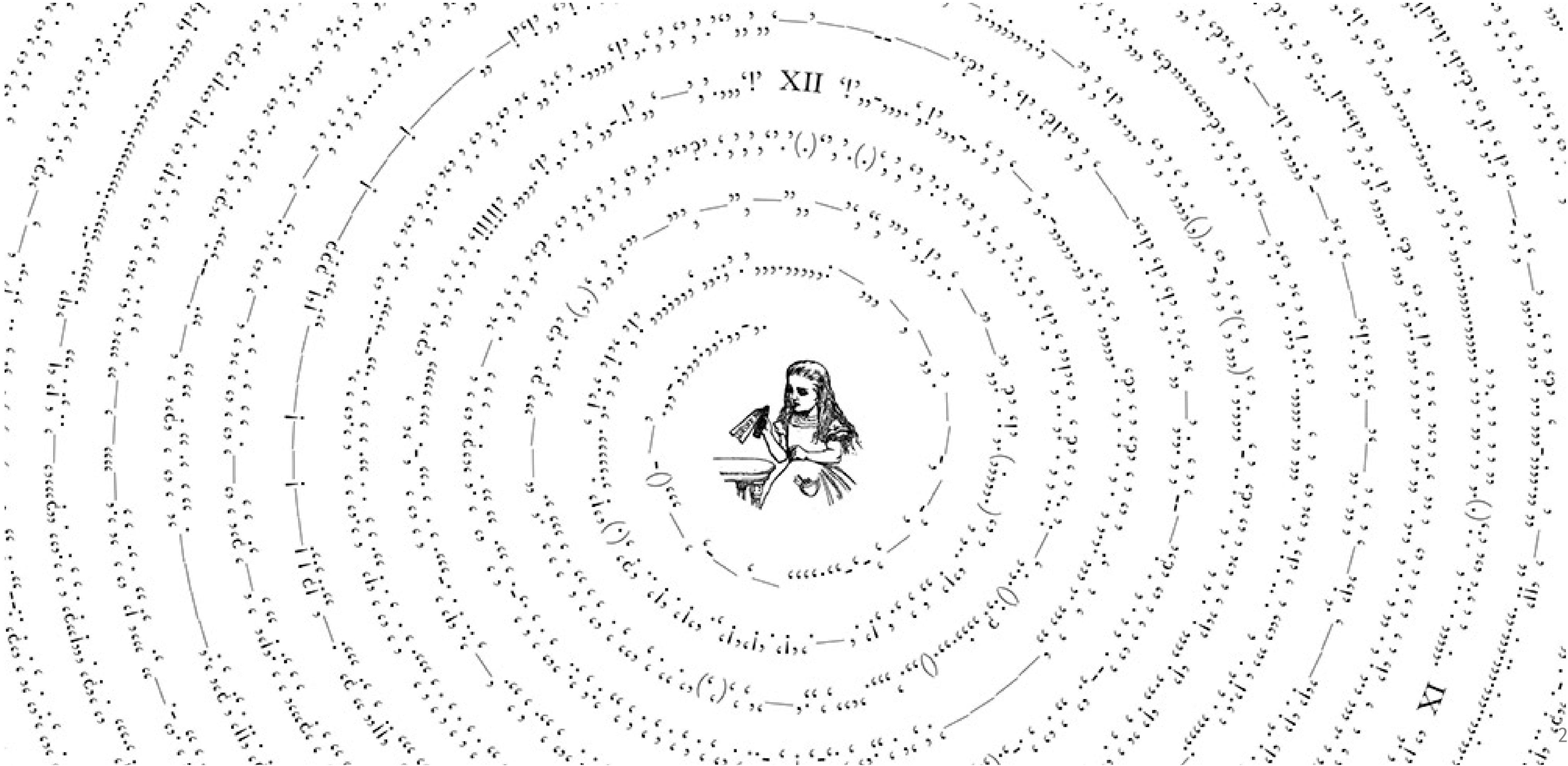
Nouns

```
# A tibble: 2,852 × 2
   lemma          n
   <chr>      <dbl>
 1 Harry       1315
 2 Ron          423
 3 Hagrid       258
 4 Professor    167
 5 Snape        154
 6 Hermione     153
 7 Dumbledore   144
 8 time         138
 9 Dudley       136
10 uncle        122
# ℹ 2,842 more rows
```

Adjectives & adverbs

```
# A tibble: 1,240 × 2
   lemma     n
   <chr> <dbl>
 1 back    223
 2 so      215
 3 just    180
 4 when    178
 5 very    171
 6 now     166
 7 then    165
 8 all     147
 9 how     136
10 there   123
# ℹ 1,230 more rows
```

Artsy stuff



Sentiment analysis

```r
get_sentiments("bing")
```

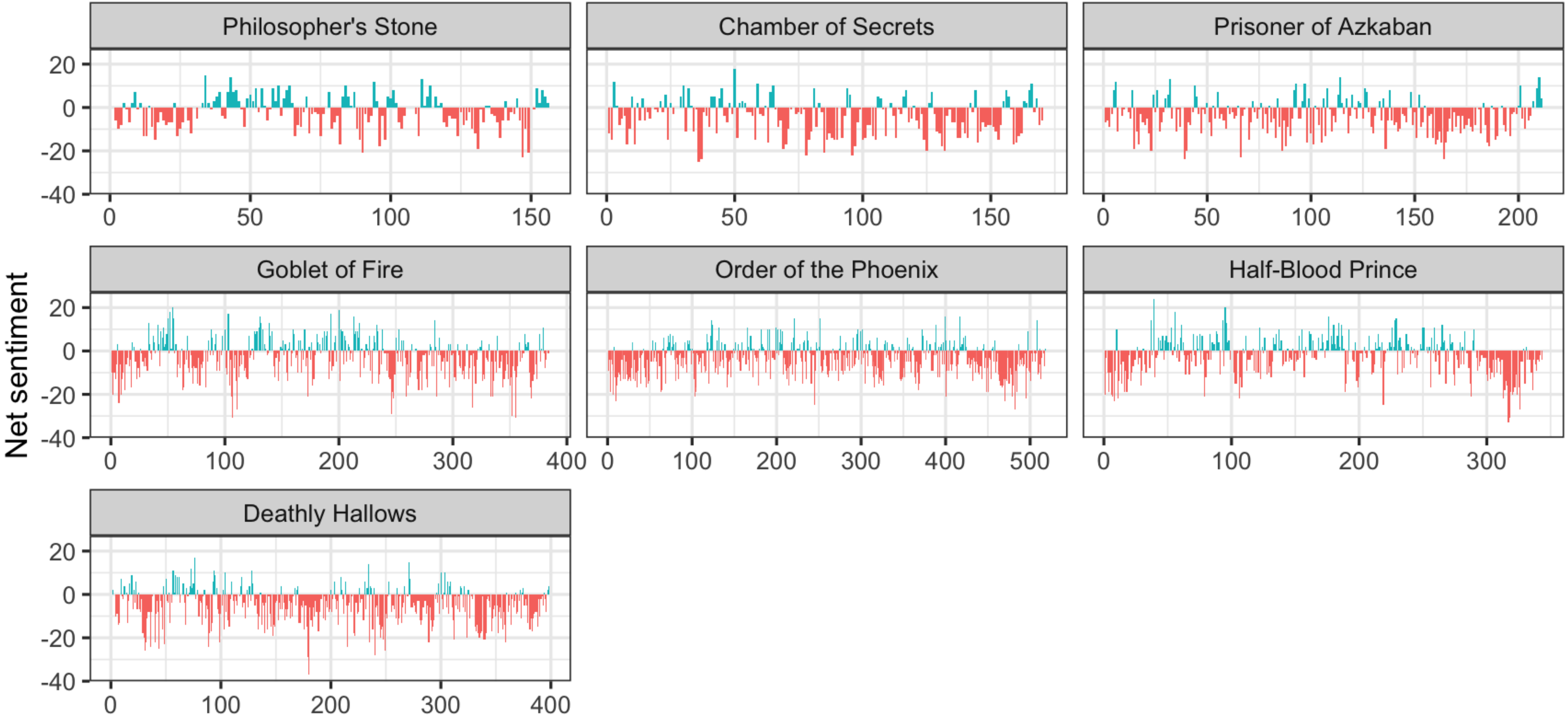
```
# A tibble: 6,786 × 2
   word        sentiment
   <chr>       <chr>    
 1 2-faces     negative 
 2 abnormal    negative 
 3 abolish     negative 
 4 abominable  negative 
 5 abominably  negative 
 6 abominate   negative 
 7 abomination negative 
 8 abort       negative 
 9 aborted     negative 
10 aborts      negative 
# ℹ 6,776 more rows
```

```r
get_sentiments("afinn")
```

```
# A tibble: 2,477 × 2
   word       value
   <chr>      <dbl>
 1 abandon       -2
 2 abandoned     -2
 3 abandons      -2
 4 abducted      -2
 5 abduction     -2
 6 abductions    -2
 7 abhor         -3
 8 abhorred      -3
 9 abhorrent     -3
10 abhors        -3
# ℹ 2,467 more rows
```

```r
get_sentiments("nrc")
```

```
# A tibble: 13,872 × 2
   word        sentiment
   <chr>       <chr>    
 1 abacus      trust    
 2 abandon     fear     
 3 abandon     negative 
 4 abandon     sadness  
 5 abandoned   anger    
 6 abandoned   fear     
 7 abandoned   negative 
 8 abandoned   sadness  
 9 abandonment anger    
10 abandonment fear     
# ℹ 13,862 more rows
```


Philosopher's Stone
Chamber of Secrets
Prisoner of Azkaban
Goblet of Fire
Order of the Phoenix
Half-Blood Prince
Deathly Hallows
Net sentiment
20
0
-20
-40
0
50
100
150
200
300
400
500

tf-idf

Term frequency-inverse document frequency

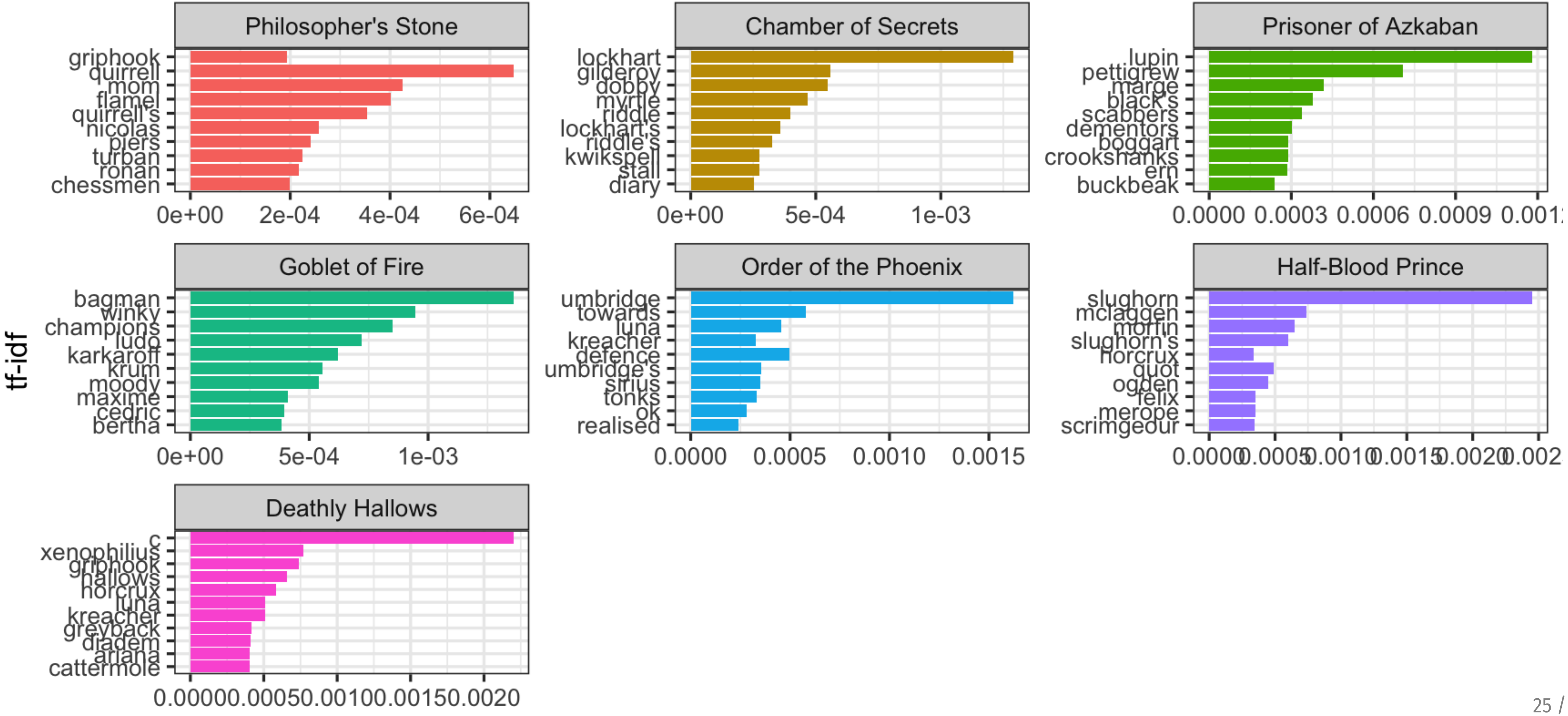
How important a term is compared to the rest of the documents

$$tf = \frac{n_{\text{term}}}{n_{\text{terms in document}}}$$

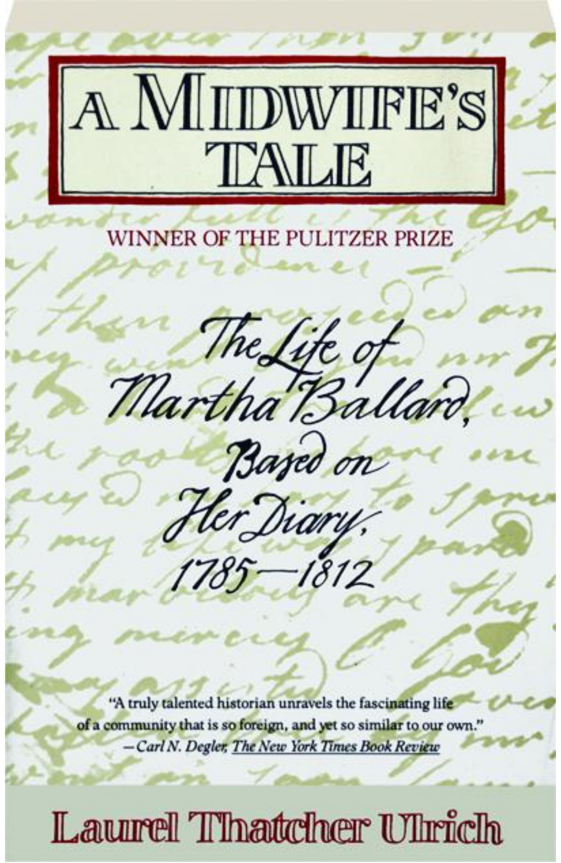
$$idf(\text{term}) = \ln\left(\frac{n_{\text{documents}}}{n_{\text{documents containing term}}}\right)$$

$$tf\text{-}idf(\text{term}) = tf(\text{term}) \times idf(\text{term})$$

tf-idf


tf-idf
Philosopher's Stone
griphook
quirrell
mom
flamel
quirrell's
nicolas
piers
turban
ronan
chessmen
0e+00
2e-04
4e-04
6e-04
Chamber of Secrets
lockhart
gilderoy
dobby
myrtle
riddle
lockhart's
riddle's
kwikspell
stall
diary
0e+00
5e-04
1e-03
Prisoner of Azkaban
lupin
pettigrew
marge
black's
scabbers
dementors
boggart
crookshanks
ern
buckbeak
0.0000
0.0003
0.0006
0.0009
0.001
Goblet of Fire
bagman
winky
champions
ludo
karkaroff
krum
moody
maxime
cedric
bertha
0e+00
5e-04
1e-03
Order of the Phoenix
umbridge
towards
luna
kreacher
defence
umbridge's
sirius
tonks
ok
realised
0.0000
0.0005
0.0010
0.0015
Half-Blood Prince
slughorn
mclaggen
morfin
slughorn's
horcrux
quot
ogden
felix
merope
scrimgeour
0.0000
0.0005
0.0010
0.0015
0.0020
0.002
Deathly Hallows
c
xenophilius
griphook
hallows
horcrux
luna
kreacher
greyback
diadem
ariana
cattermole
0.0000
0.0005
0.0010
0.0015
0.0020

Topic modeling



A MIDWIFE'S TALE

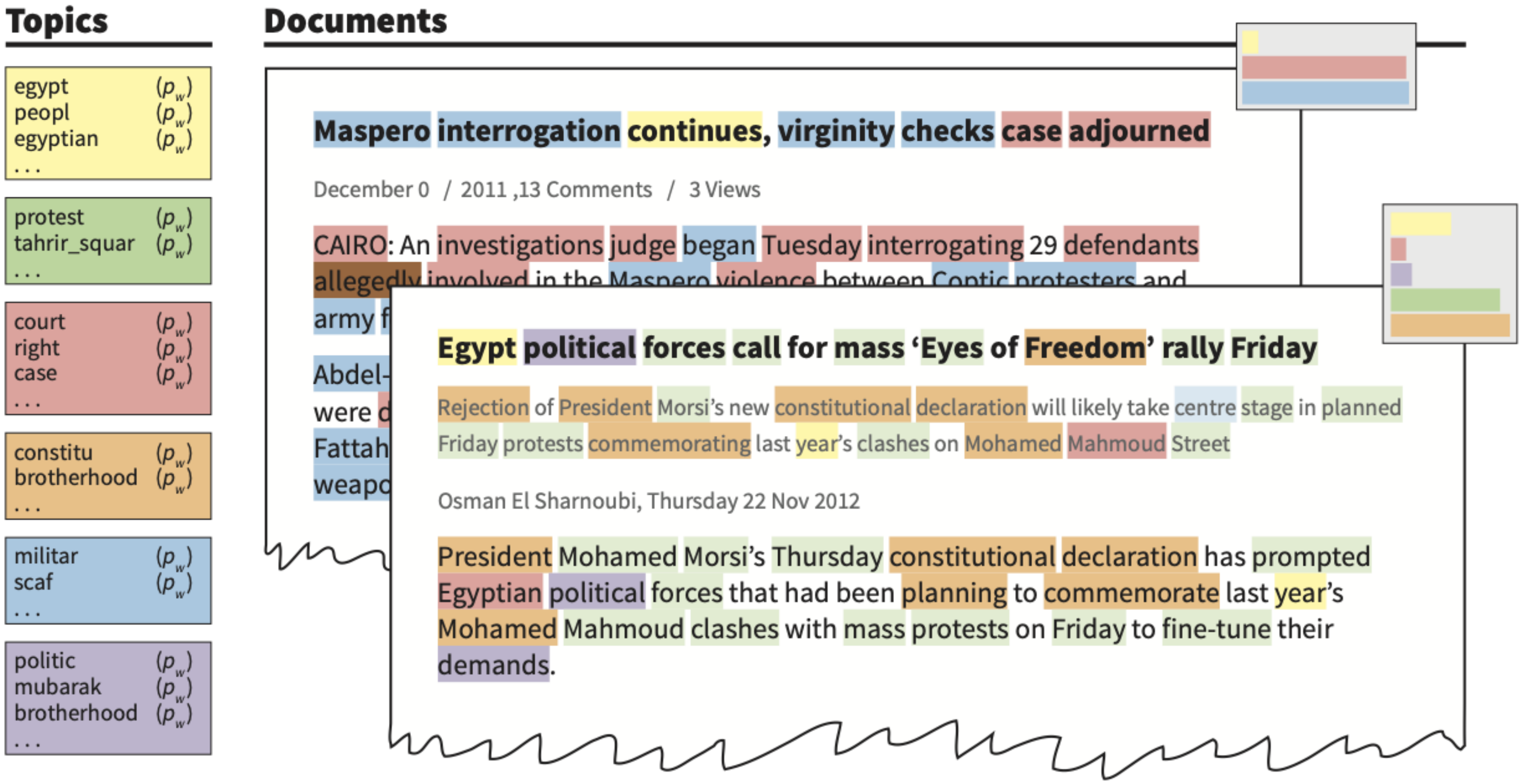
WINNER OF THE PULITZER PRIZE

The Life of Martha Ballard, Based on Her Diary, 1785–1812

"A truly talented historian unravels the fascinating life of a community that is so foreign, and yet so similar to our own."
—*Carl N. Degler, The New York Times Book Review*

Laurel Thatcher Ulrich

Latent Dirichlet Allocation (LDA)



Topics

egypt	(p_w)
peopl	(p_w)
egyptian	(p_w)
. . .	
protest	(p_w)
tahrir_squar	(p_w)
. . .	
court	(p_w)
right	(p_w)
case	(p_w)
. . .	
constitu	(p_w)
brotherhood	(p_w)
. . .	
militar	(p_w)
scaf	(p_w)
. . .	
politic	(p_w)
mubarak	(p_w)
brotherhood	(p_w)
. . .	

Documents

Maspero interrogation continues, virginity checks case adjourned

December 0 / 2011 ,13 Comments / 3 Views

CAIRO: An investigations judge began Tuesday interrogating 29 defendants allegedly involved in the Maspero violence between Coptic protesters and army f

Abdel-
were d
Fattah
weapo

Egypt political forces call for mass 'Eyes of Freedom' rally Friday

Rejection of President Morsi's new constitutional declaration will likely take centre stage in planned Friday protests commemorating last year's clashes on Mohamed Mahmoud Street

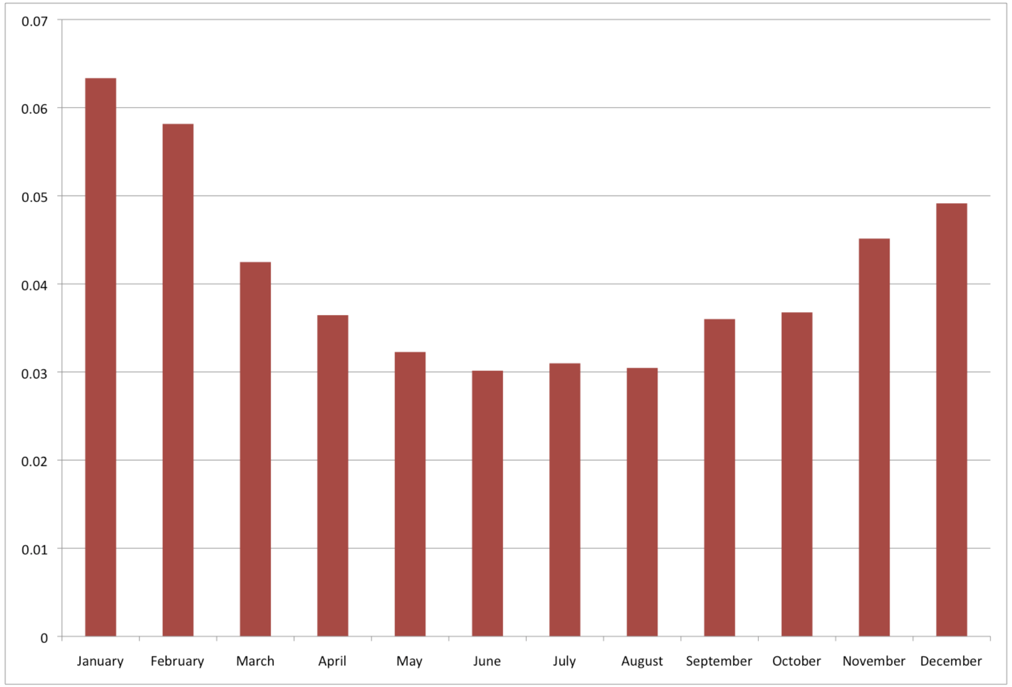
Osman El Sharnoubi, Thursday 22 Nov 2012

President Mohamed Morsi's Thursday constitutional declaration has prompted Egyptian political forces that had been planning to commemorate last year's Mohamed Mahmoud clashes with mass protests on Friday to fine-tune their demands.

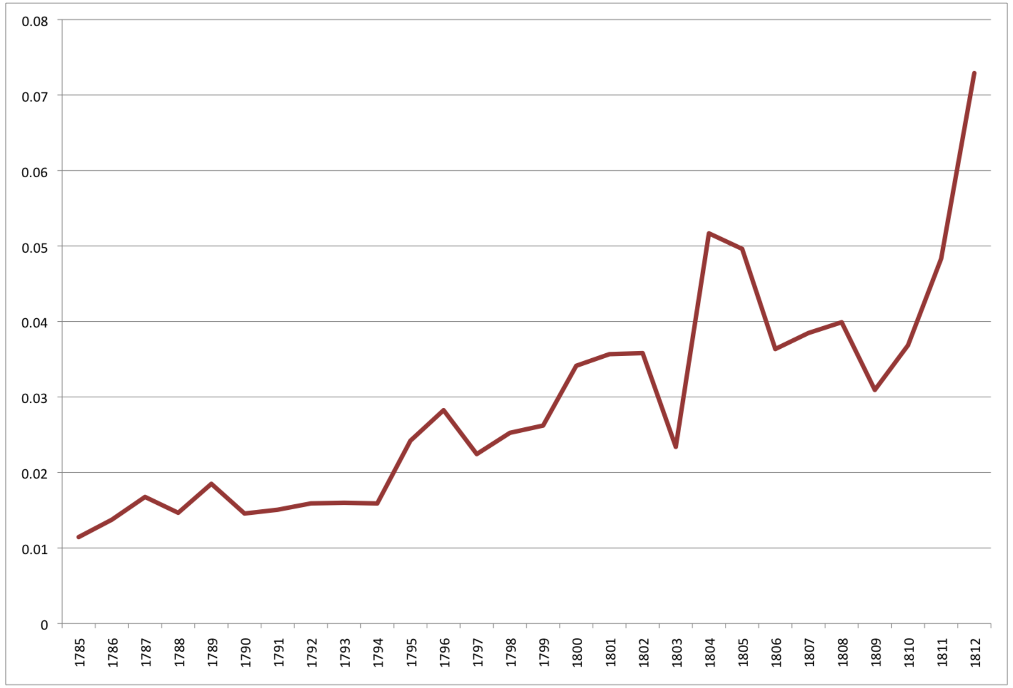
Clusters of related words

Topic label	Topic words
Midwifery	birth safe morn receivd calld left cleverly pm labour ...
Church	meeting attended afternoon reverend worship ...
Death	day yesterday informd morn years death expired ...
Gardening	gardin sett worked clear beens corn warm planted ...
Shopping	lb made brot bot tea butter sugar carried ...
Illness	unwell sick gave dr rainy easier care head neighbor ...

Track topics over time

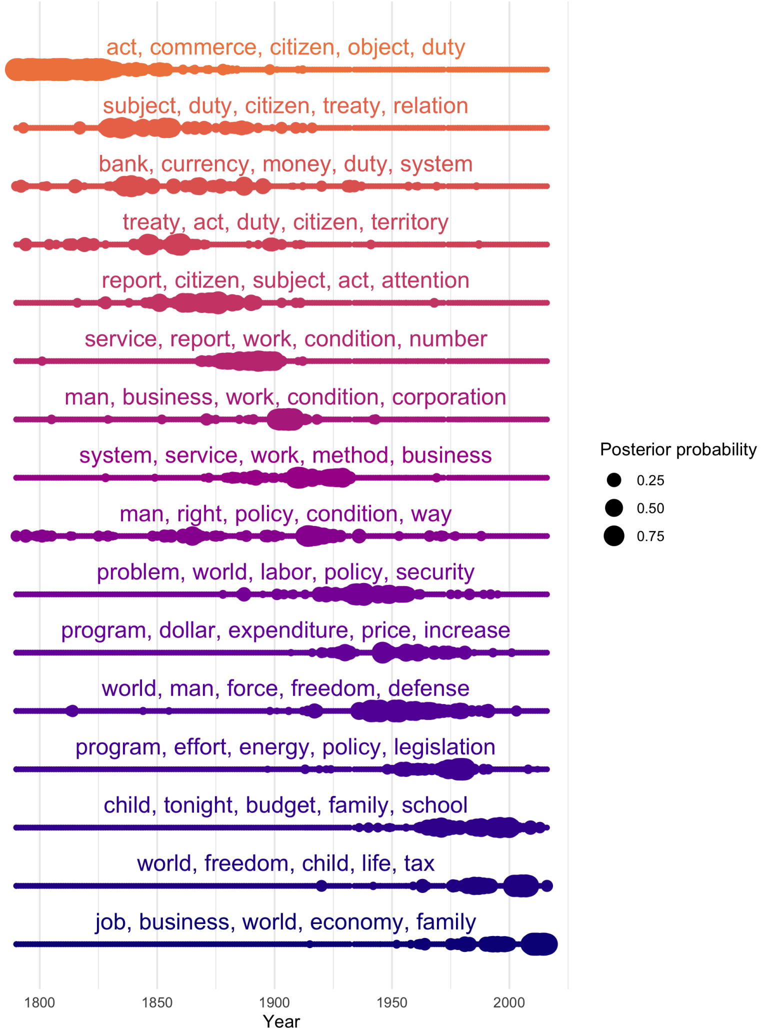


Cold weather topic by month



Emotion topic over time

State of the Union addresses



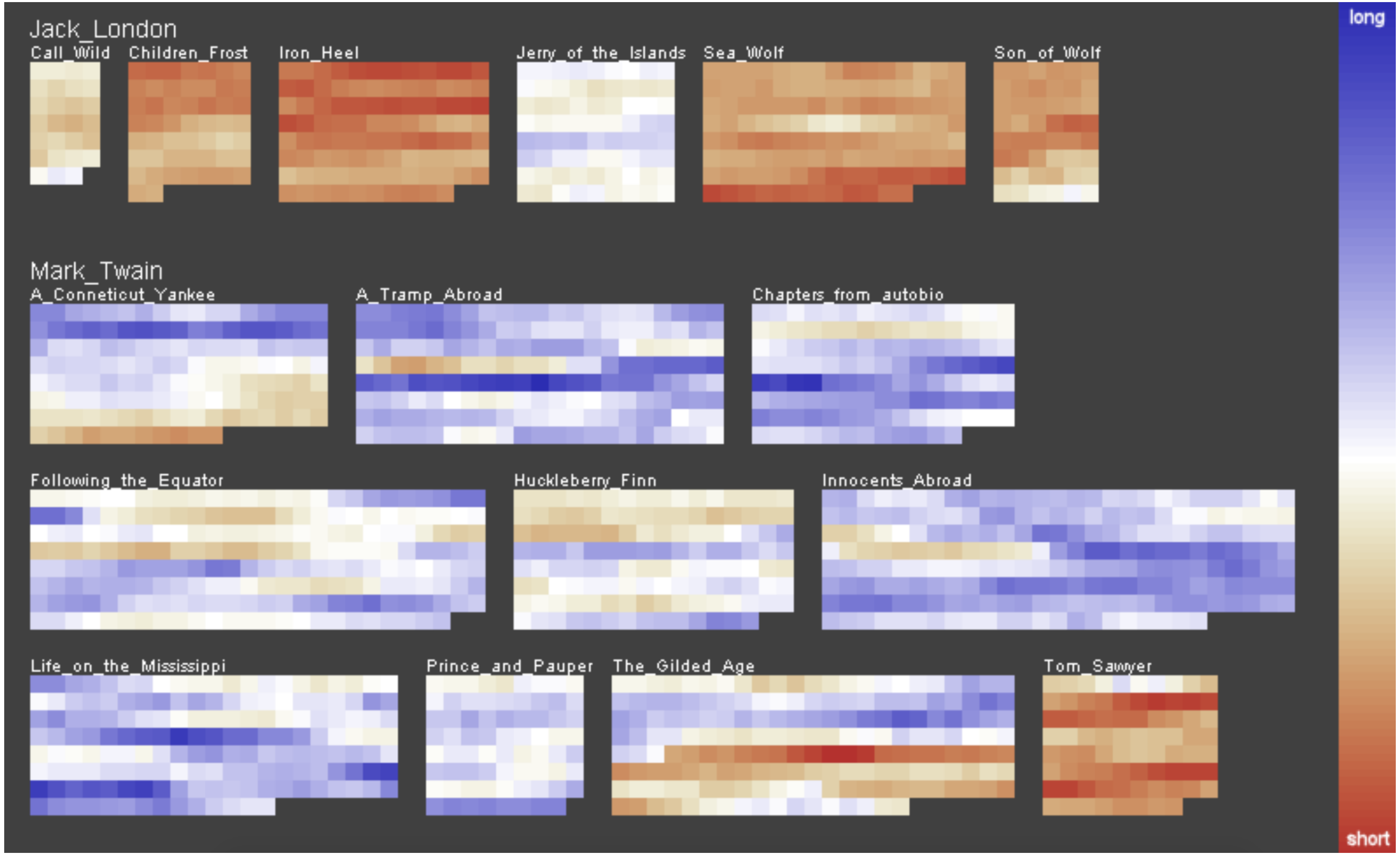
Fingerprinting

Analyze richness or uniqueness of a document

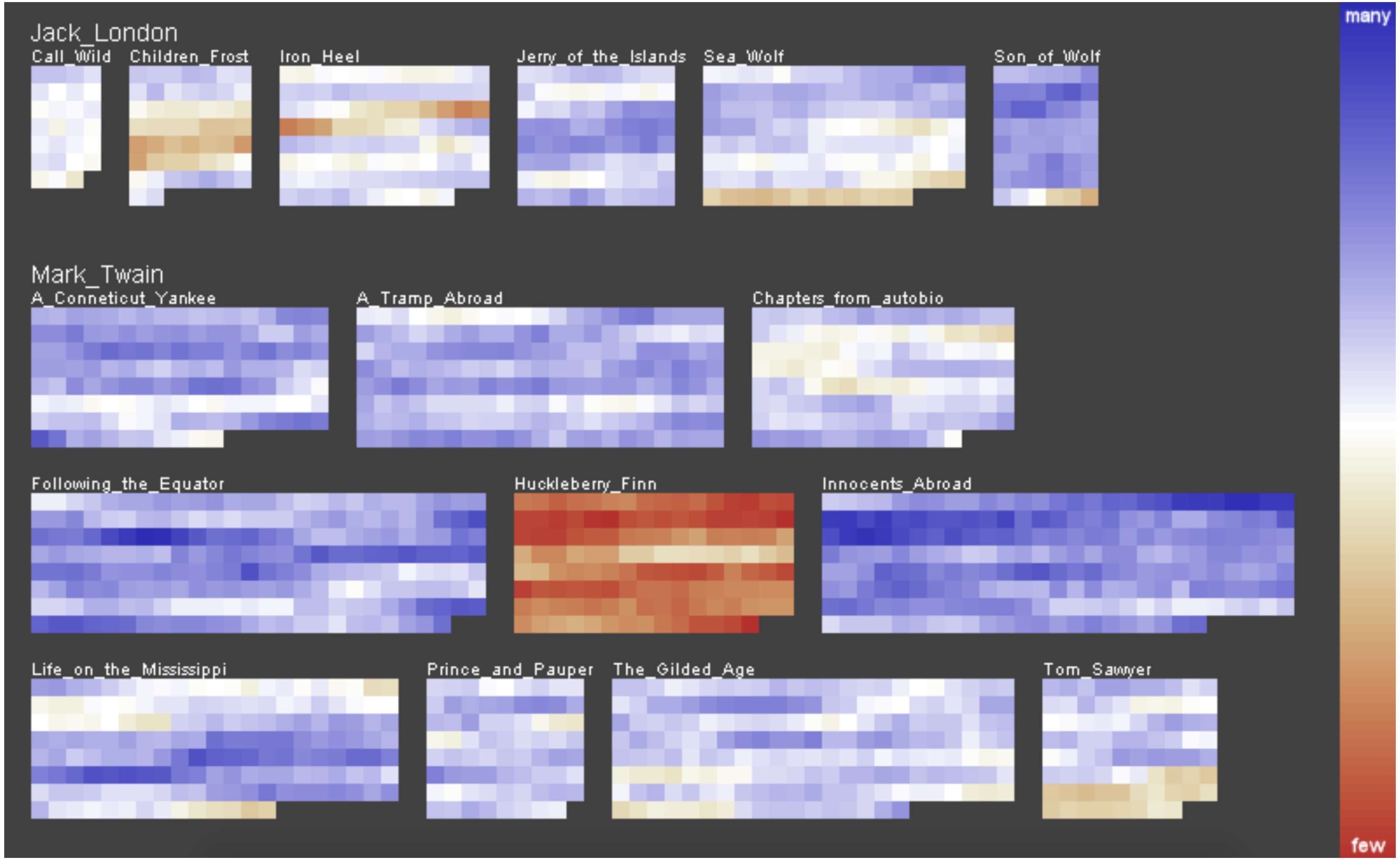
Punctuation patterns, vocabulary choices, sentence length

Hapax legomenon

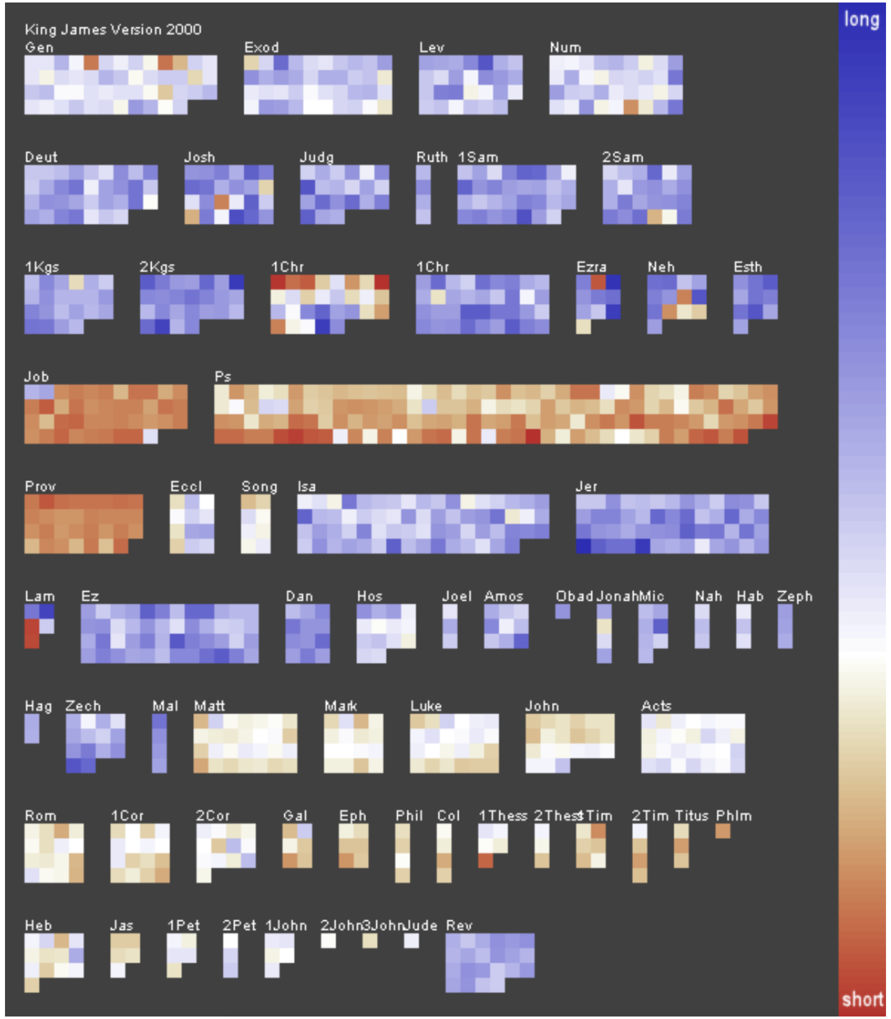
Sentence length



Hapax legomena



Verse length


King James Version 2000
Gen
Exod
Lev
Num
Deut
Josh
Judg
Ruth
1Sam
2Sam
1Kgs
2Kgs
1Chr
1Chr
Ezra
Neh
Esth
Job
Ps
Prov
Eccl
Song
Isa
Jer
Lam
Ez
Dan
Hos
Joel
Amos
Obad
Jonah
Mic
Nah
Hab
Zeph
Hag
Zech
Mal
Matt
Mark
Luke
John
Acts
Rom
1Cor
2Cor
Gal
Eph
Phil
Col
1Thess
2Thess
1Tim
2Tim
Titus
Phlm
Heb
Jas
1Pet
2Pet
1John
2John
3John
Jude
Rev
long
short