# Text

## Session 13

PMAP 8921: Data Visualization with R
Andrew Young School of Policy Studies
Summer 2022

# Plan for today

**Qualitative text-based data**

**Crash course in computational linguistics**

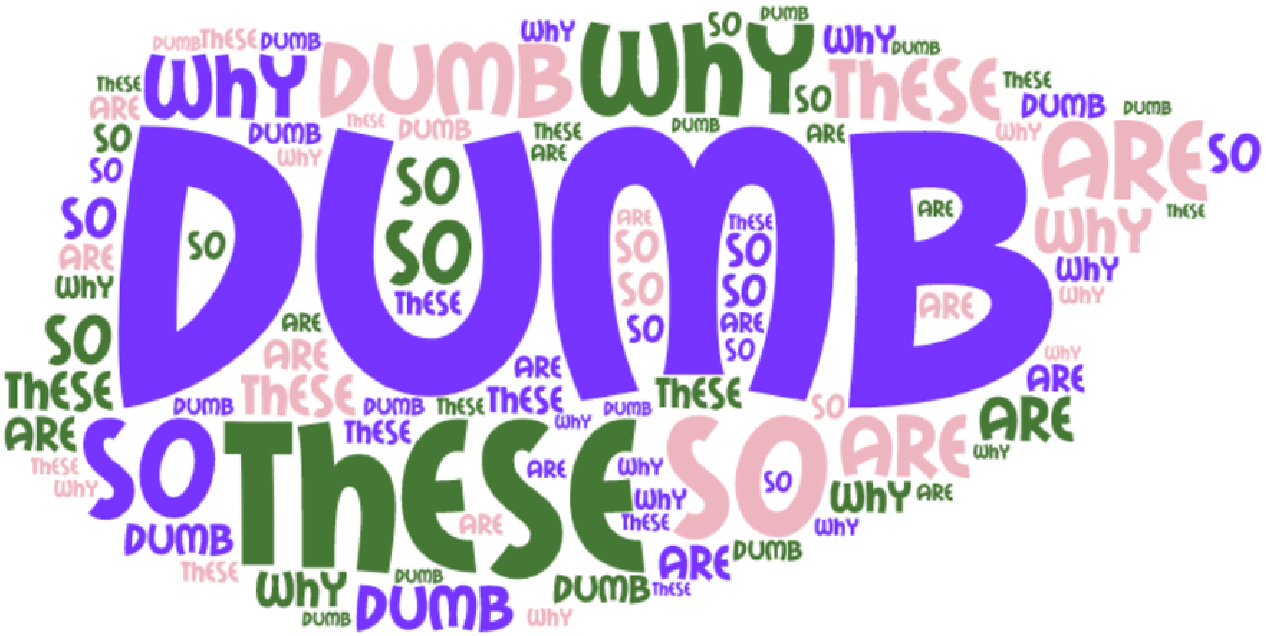
# Qualitative text-based data

# Free responses

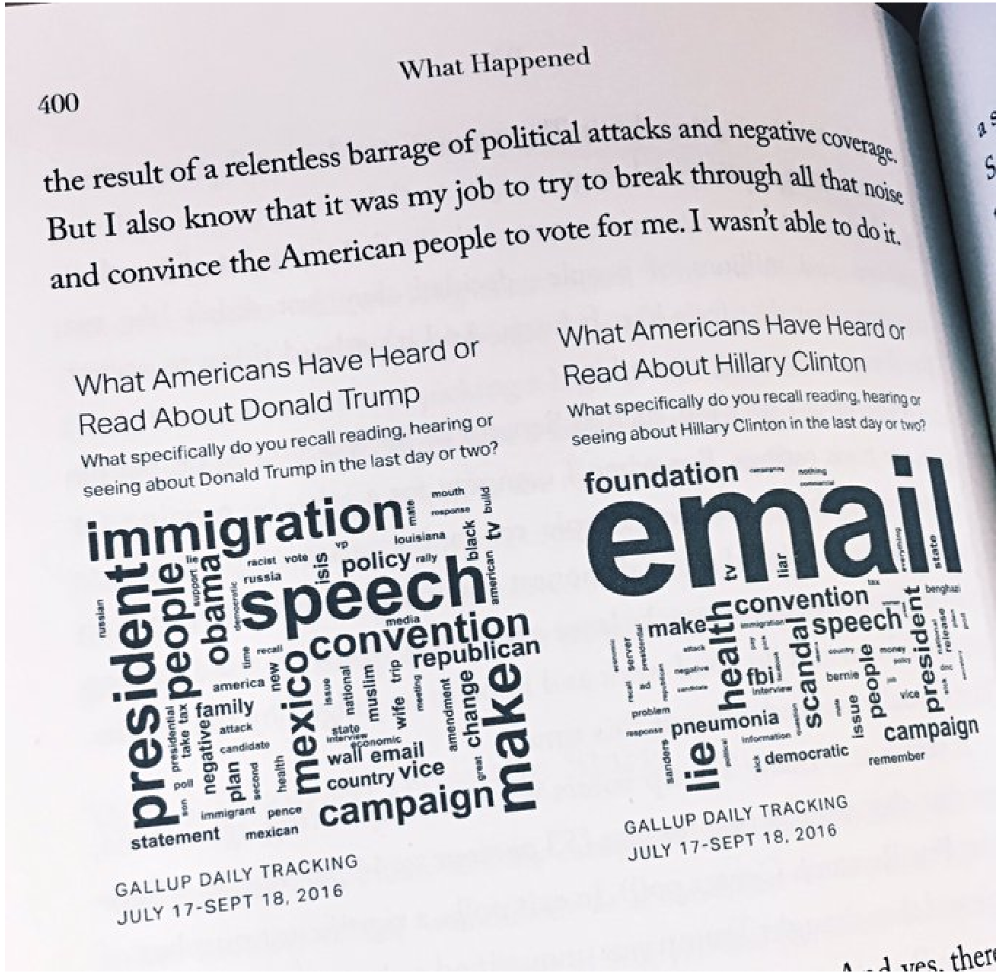
| N | O | P | |
|---|---|---|---|
| donate_likely | amount_donate | amount_keep | amount_why |
| Somewhat unlikely | 0 | 100 | I am poor |
| Somewhat unlikely | 0 | 100 | I really feel like I deserve to treat myself recently. I have been woı |
| Somewhat likely | 10 | 90 | I donate the amount that I 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 tl |
| 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?

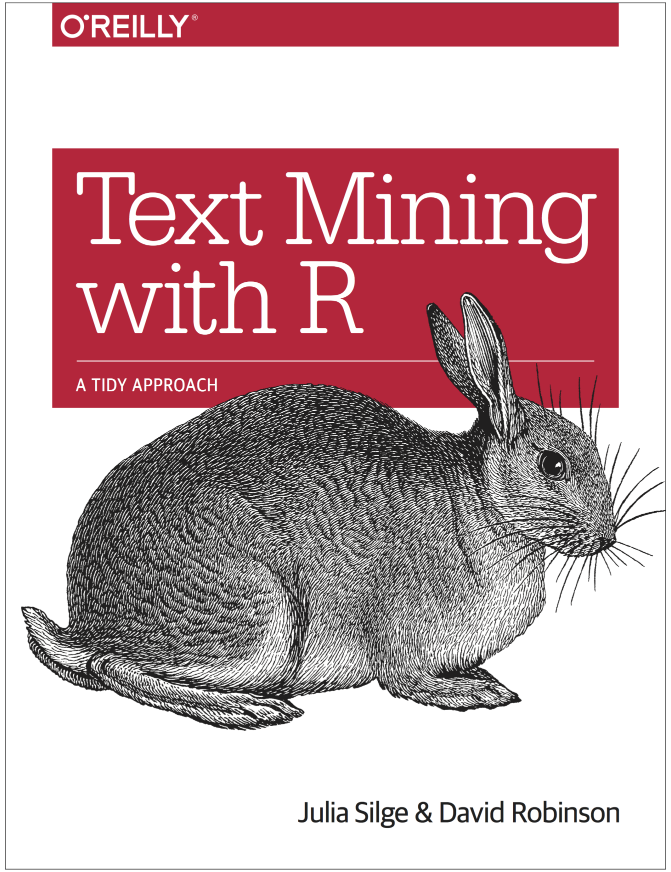


# Some cases are okay



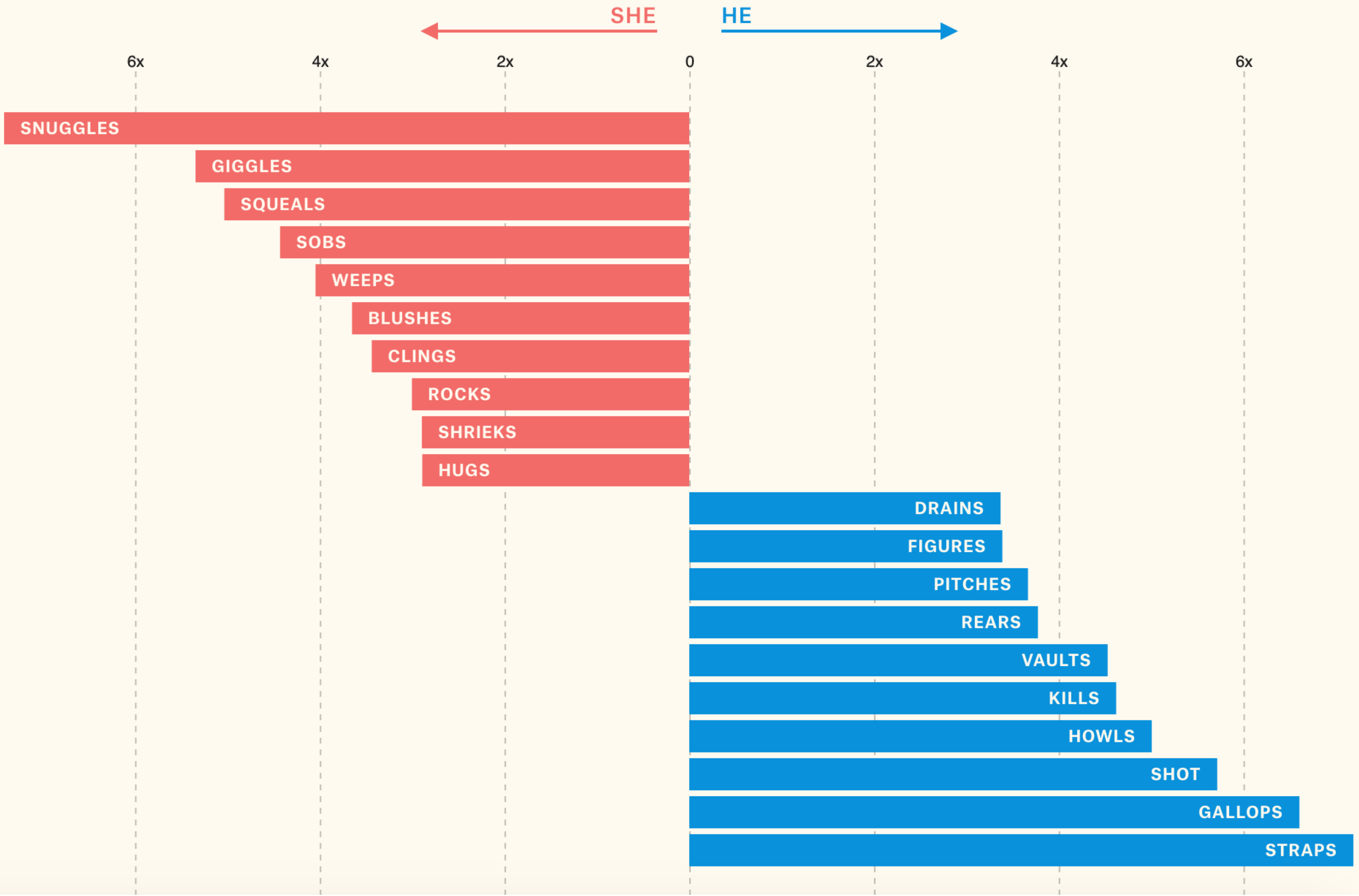
# Word clouds for grownups

## Count words, but in fancier ways

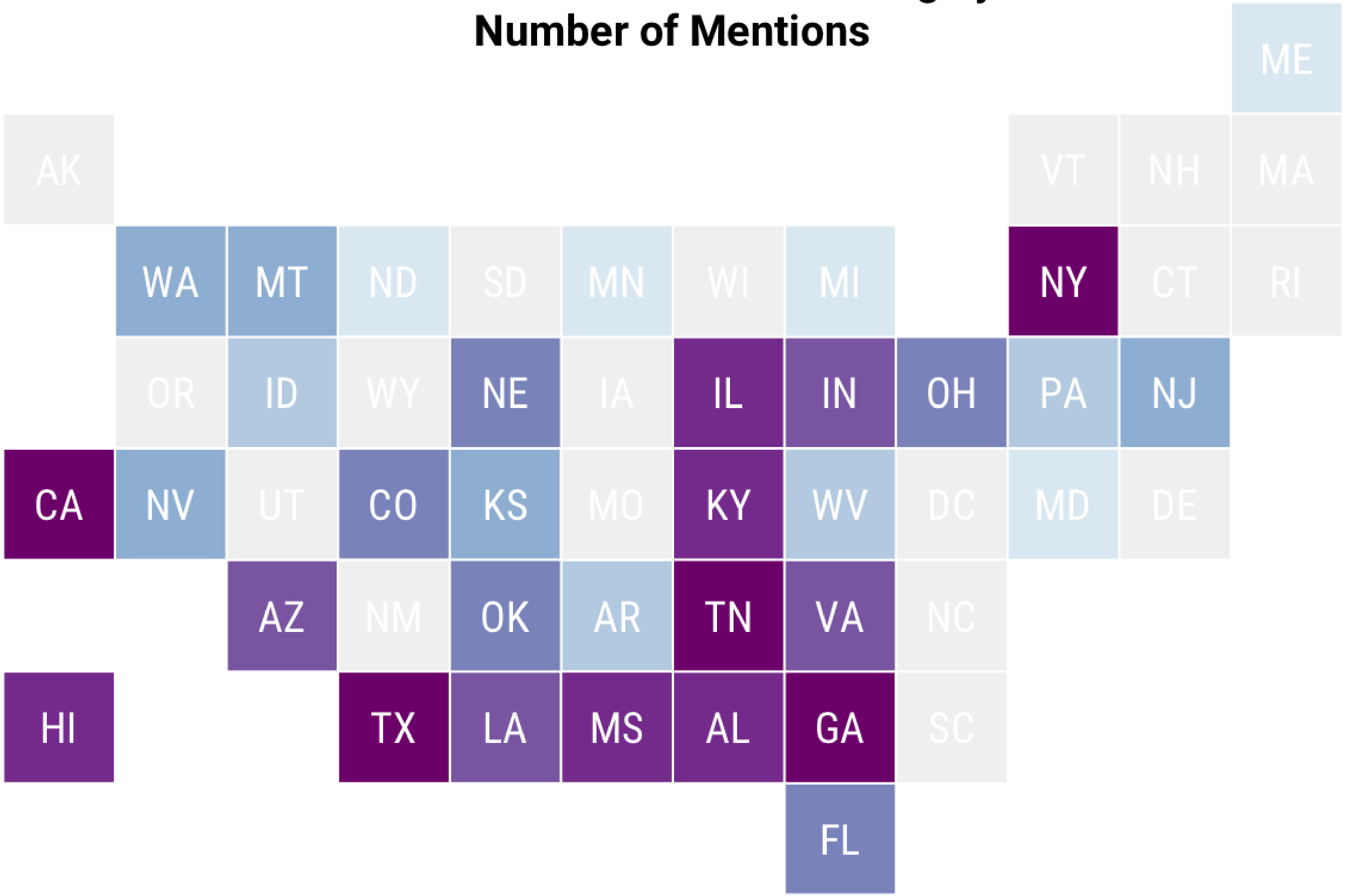


# The most used words for women vs. men

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...
```

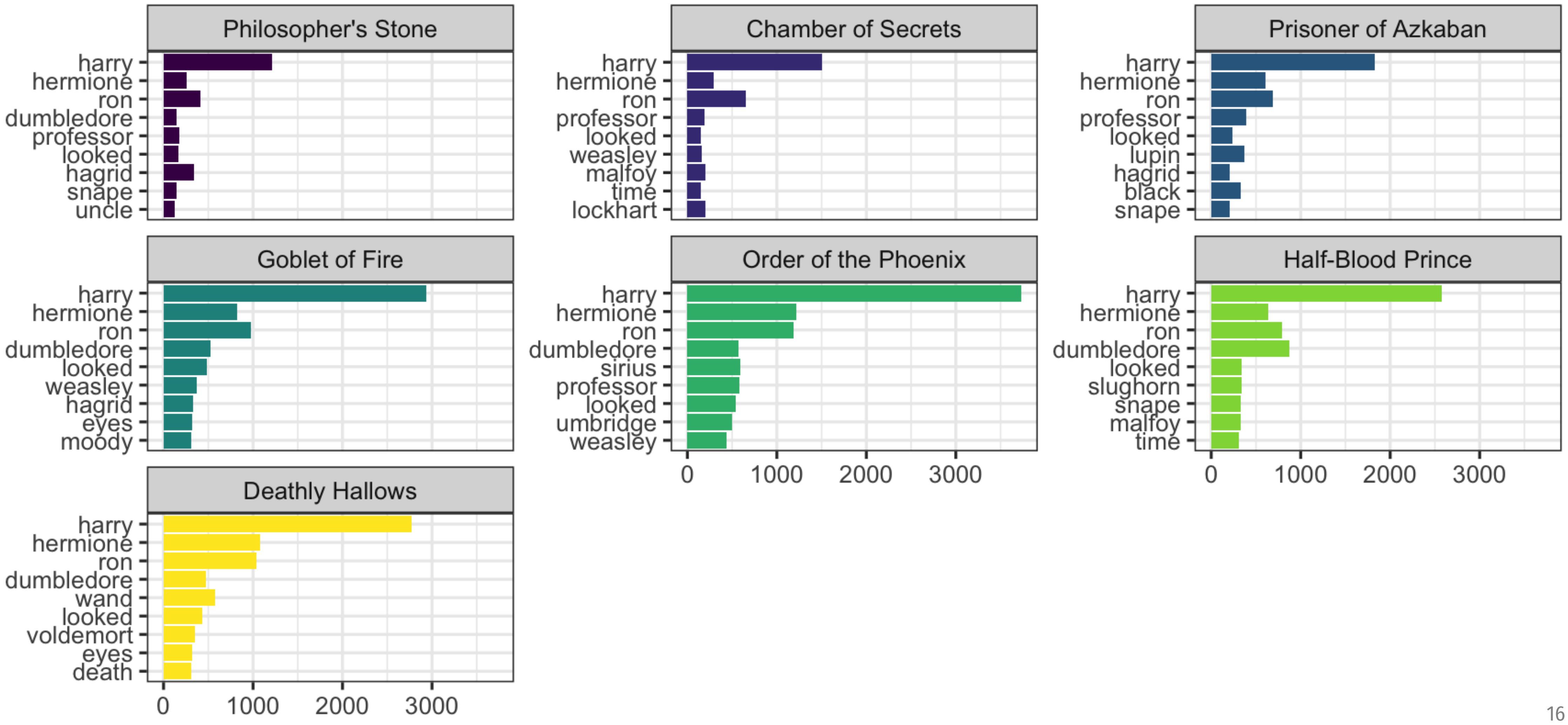
```
# A tibble: 6 × 3
  bigram    chapter book
  <chr>       <int> <chr>
1 the boy         1 Harry Potter...
2 boy who         1 Harry Potter...
3 who lived       1 Harry Potter...
4 lived mr        1 Harry Potter...
5 mr and          1 Harry Potter...
6 and mrs         1 Harry Potter...
```

# Stop words

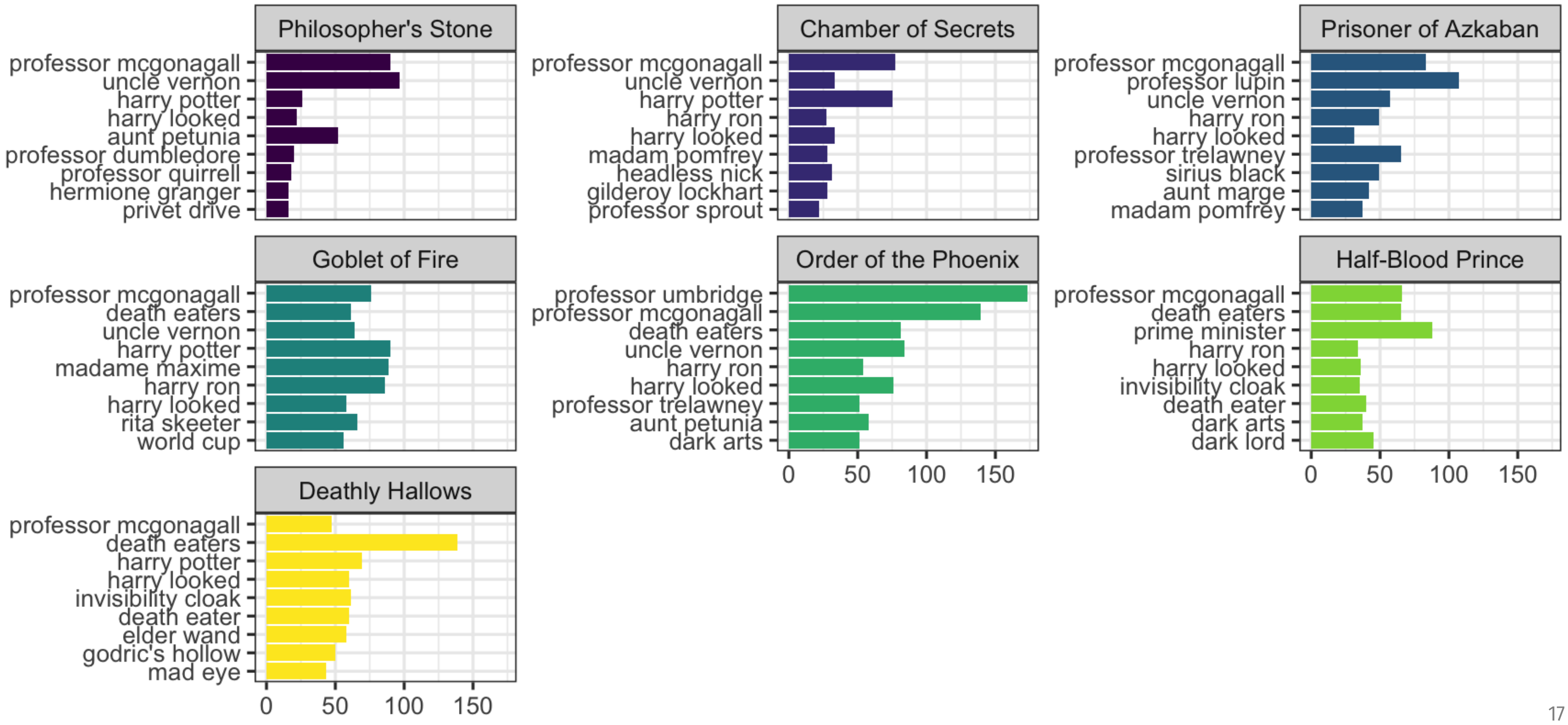
## Common words that we can generally ignore

```
# 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
# … with 1,139 more rows
```

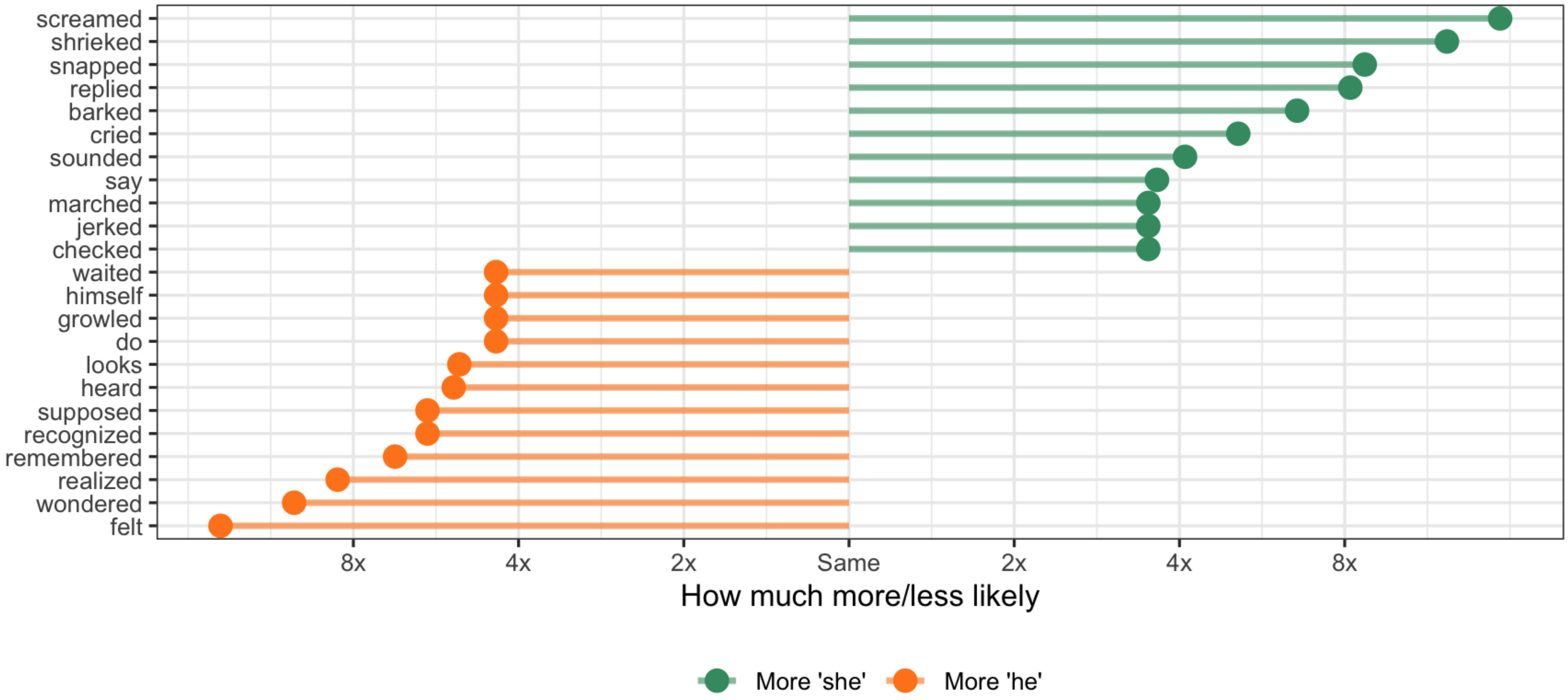
# Token frequency: words



# 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
# … with 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
# … with 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
# … with 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
# … with 1,230 more rows
```

# Artsy stuff

# Sentiment analysis

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

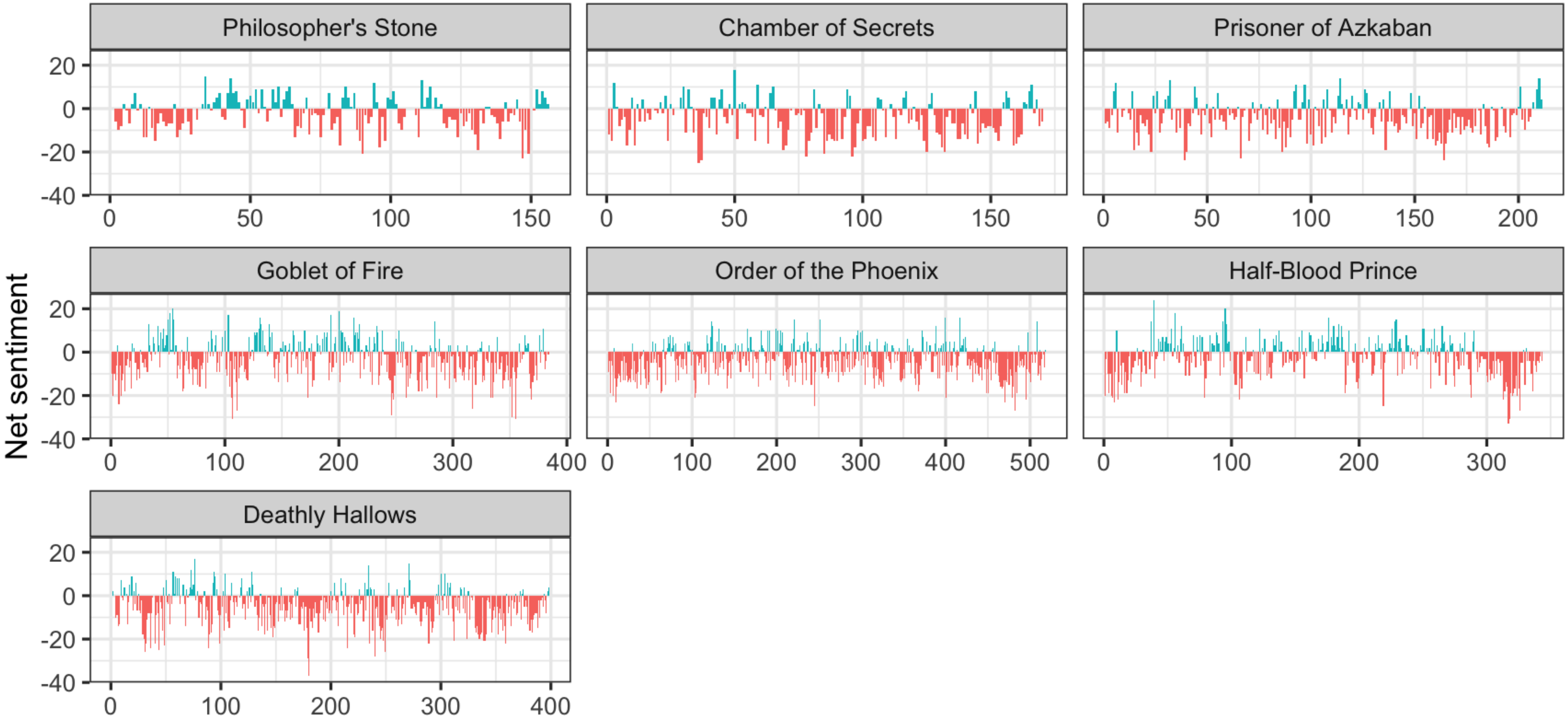
```
# A tibble: 6,786 × 2
   word        sentiment
   <chr>       <chr>
 1 2-faces     negative
 2 abnormal    negative
 3 abolish     negative
 4 abominable  negative
 5 abominably  negative
 6 abominate   negative
 7 abomination negative
 8 abort       negative
 9 aborted     negative
10 aborts   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

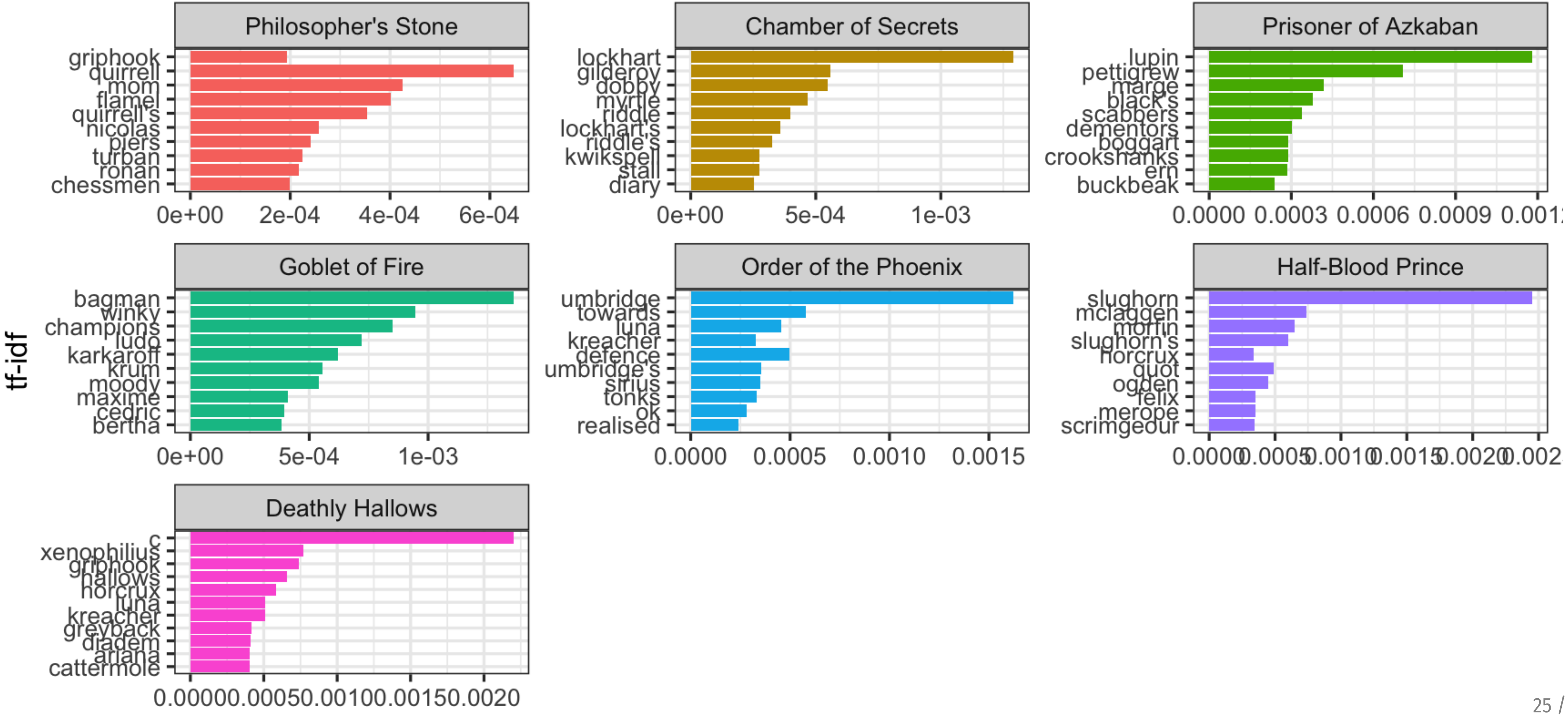
**How important a term is compared to the rest of the documents**

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

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

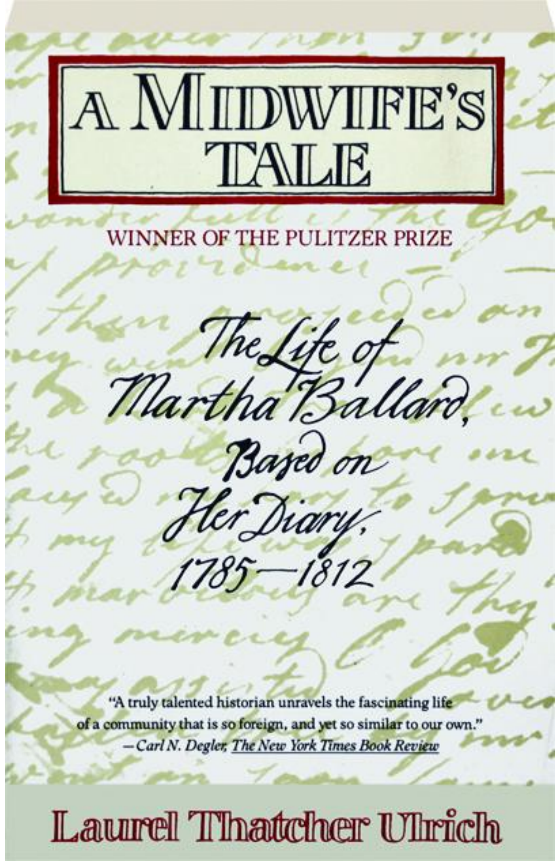
$$tf\text{-}idf(\text{term}) = tf(\text{term}) \times idf(\text{term})$$

# tf-idf

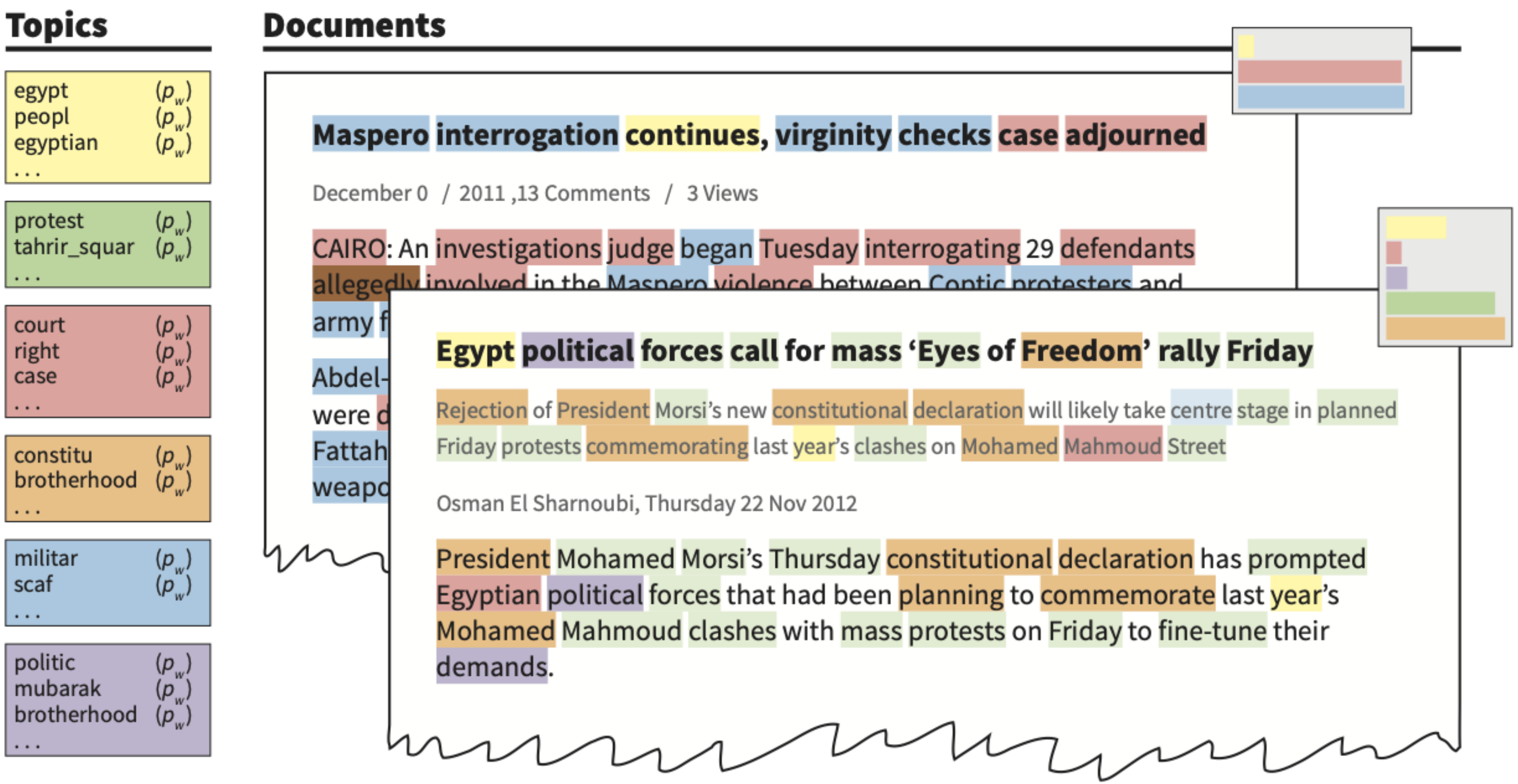


Philosopher's Stone
griphook
quirrell
mom
flamel
quirrell's
nicolas
piers
turban
ronan
chessmen
0e+00 2e-04 4e-04 6e-04
Chamber of Secrets
lockhart
gilderoy
dobby
myrtle
riddle
lockhart's
riddle's
kwikspell
stall
diary
0e+00 5e-04 1e-03
Prisoner of Azkaban
lupin
pettigrew
marge
black's
scabbers
dementors
boggart
crookshanks
ern
buckbeak
0.0000 0.0003 0.0006 0.0009
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
Deathly Hallows
c
xenophilius
griphook
hallows
horcrux
luna
kreacher
greyback
diadem
ariana
cattermole
tf-idf

# Topic modeling



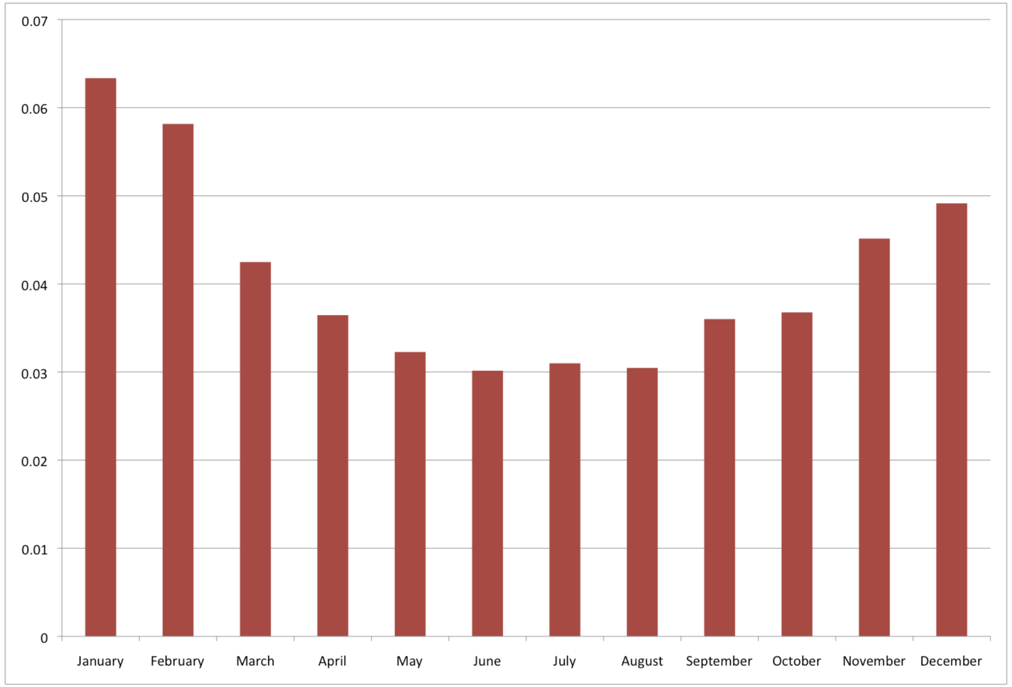
# Latent Dirichlet Allocation (LDA)



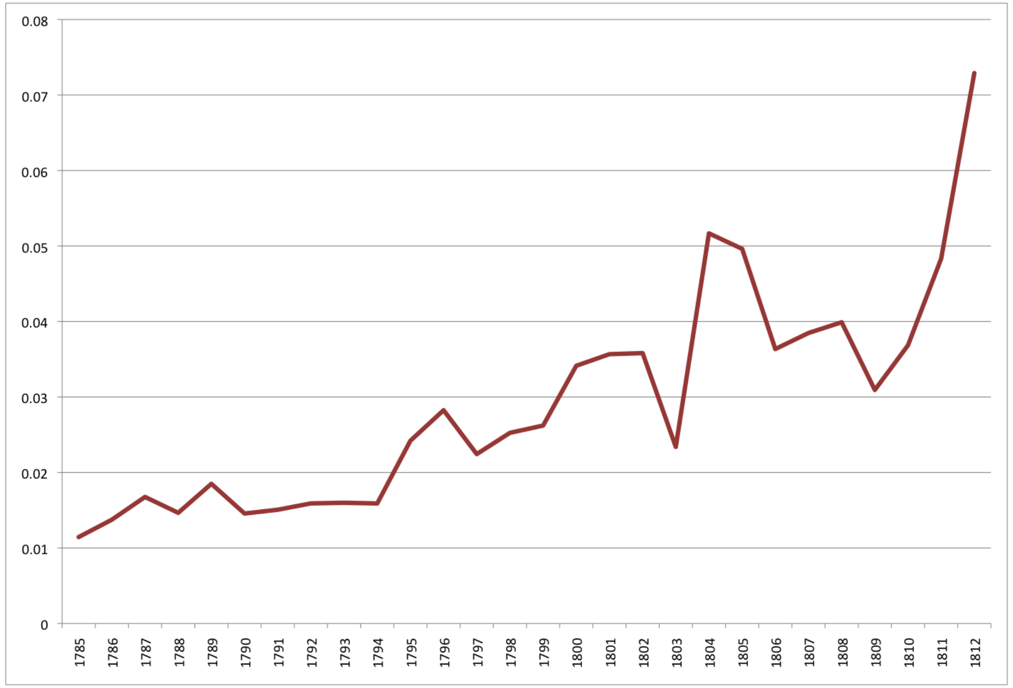
# Clusters of related words

| 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

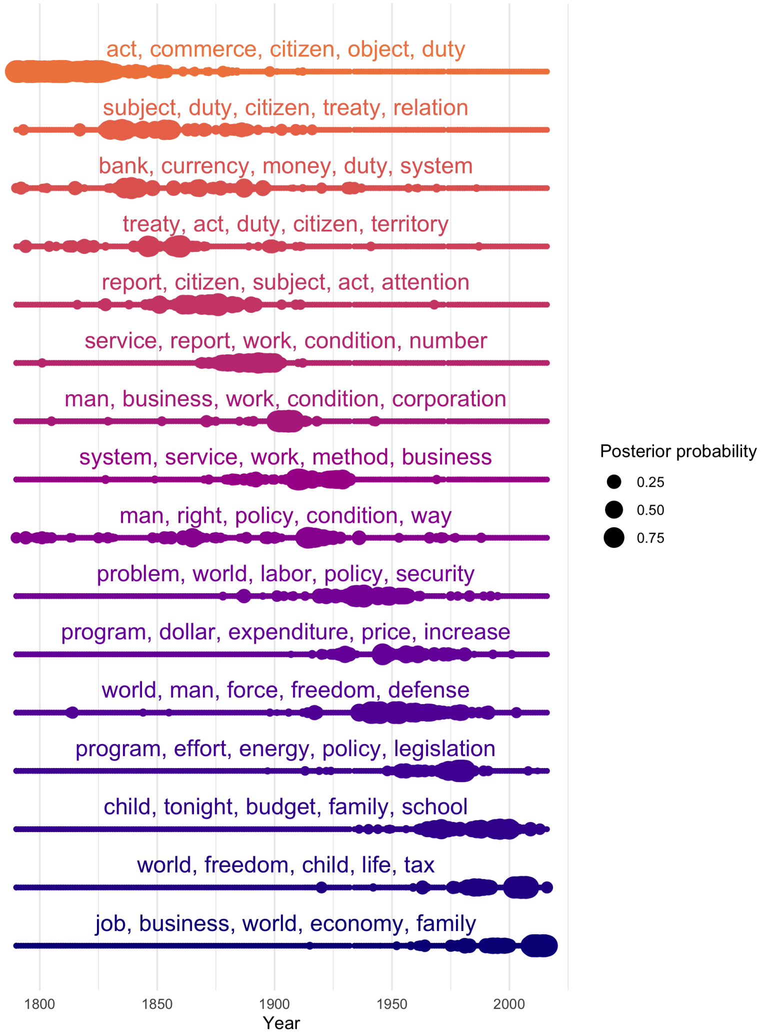



Cold weather topic by month




Emotion topic over time

# State of the Union addresses



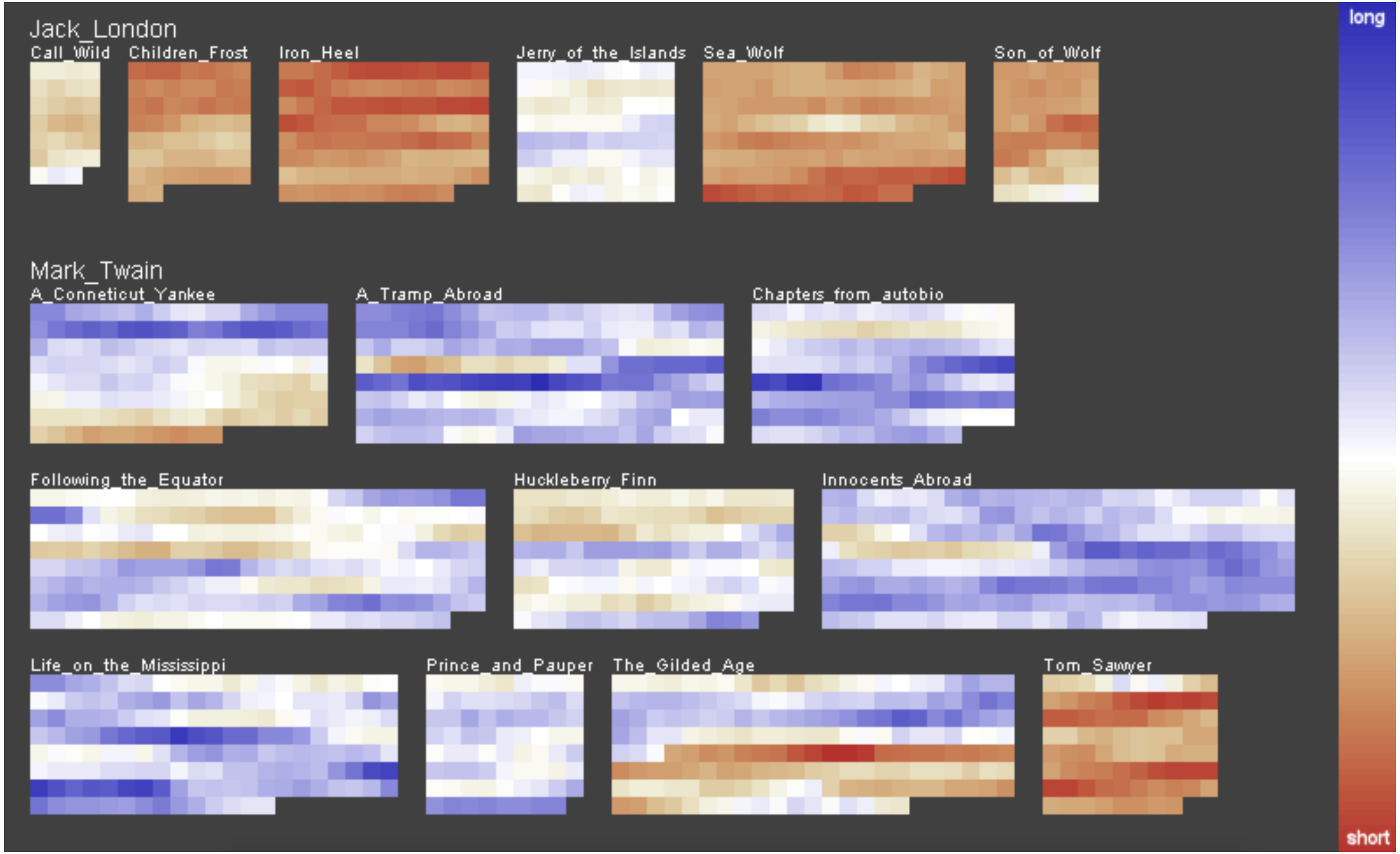
# Fingerprinting

Analyze richness or uniqueness of a document

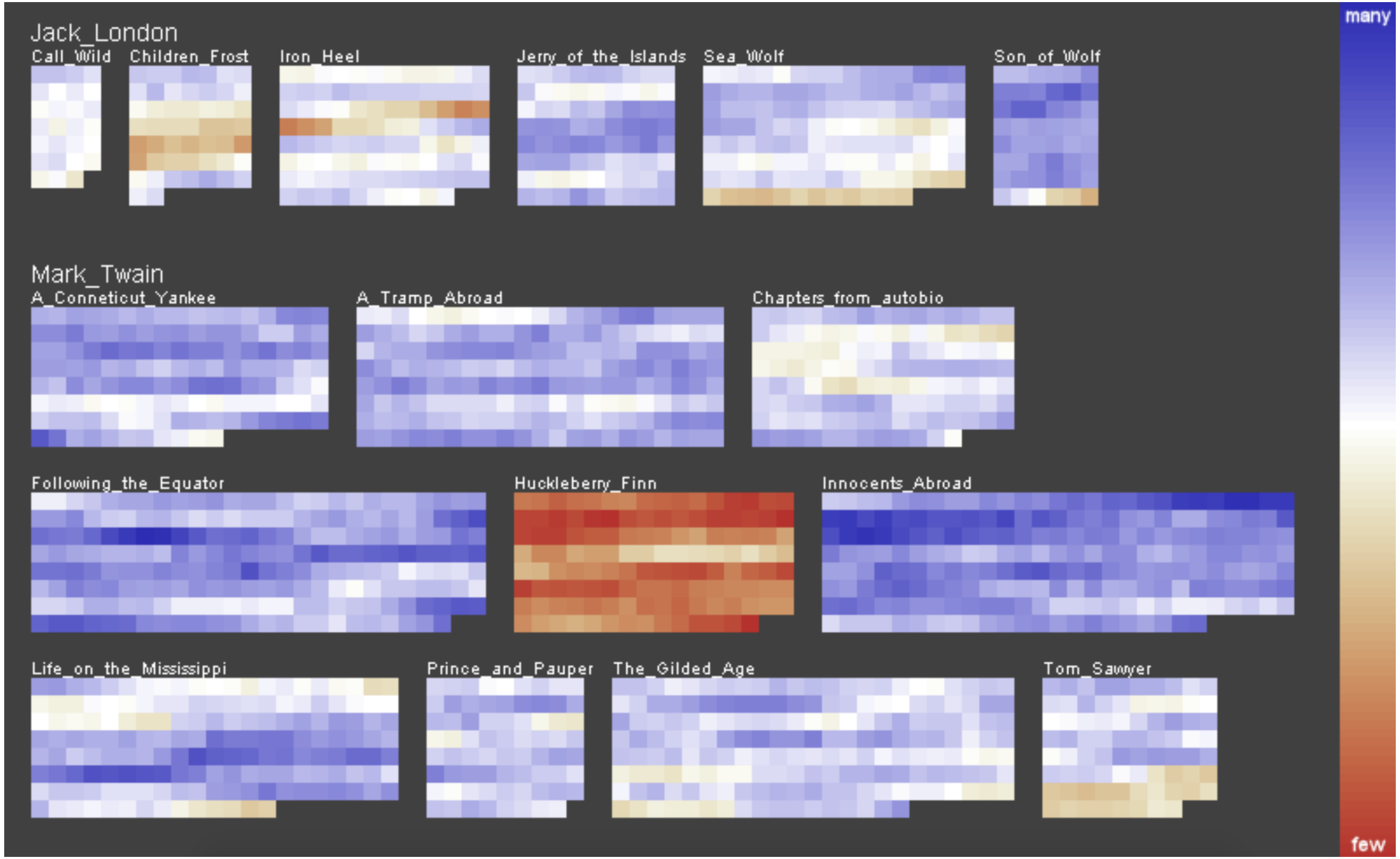
Punctuation patterns, vocabulary choices, sentence length

Hapax legomenon

# Sentence length



# Hapax legomena



# Verse length