Test Mining with R

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Following the article

```
ids <- 1:5
works_sample <- gutenberg_download(gutenberg_id = ids)
glimpse(works_sample)
names(gutenberg_metadata)
works_sample <- gutenberg_download(gutenberg_id = ids, meta_fields = c("title",
    "author"))
glimpse(works_sample)
ids <- filter(gutenberg_subjects, subject_type == "lcc", subject == "PR")
glimpse(ids)
ids_has_text <- filter(gutenberg_metadata, gutenberg_id %in% ids$gutenberg_id,
    has_text == TRUE)
glimpse(ids_has_text)

set.seed(123)
ids_sample <- sample_n(ids_has_text, 10)
glimpse(ids_sample)
works_pr <- gutenberg_download(gutenberg_id = ids_sample$gutenberg_id, meta_fields = c("author",
    "title"))
glimpse(works_pr)
```

Getting Started

```
## [1] "Because I could not stop for Death -"
## [2] "He kindly stopped for me -"
## [3] "The Carriage held but just Ourselves -"
## [4] "and Immortality"
```

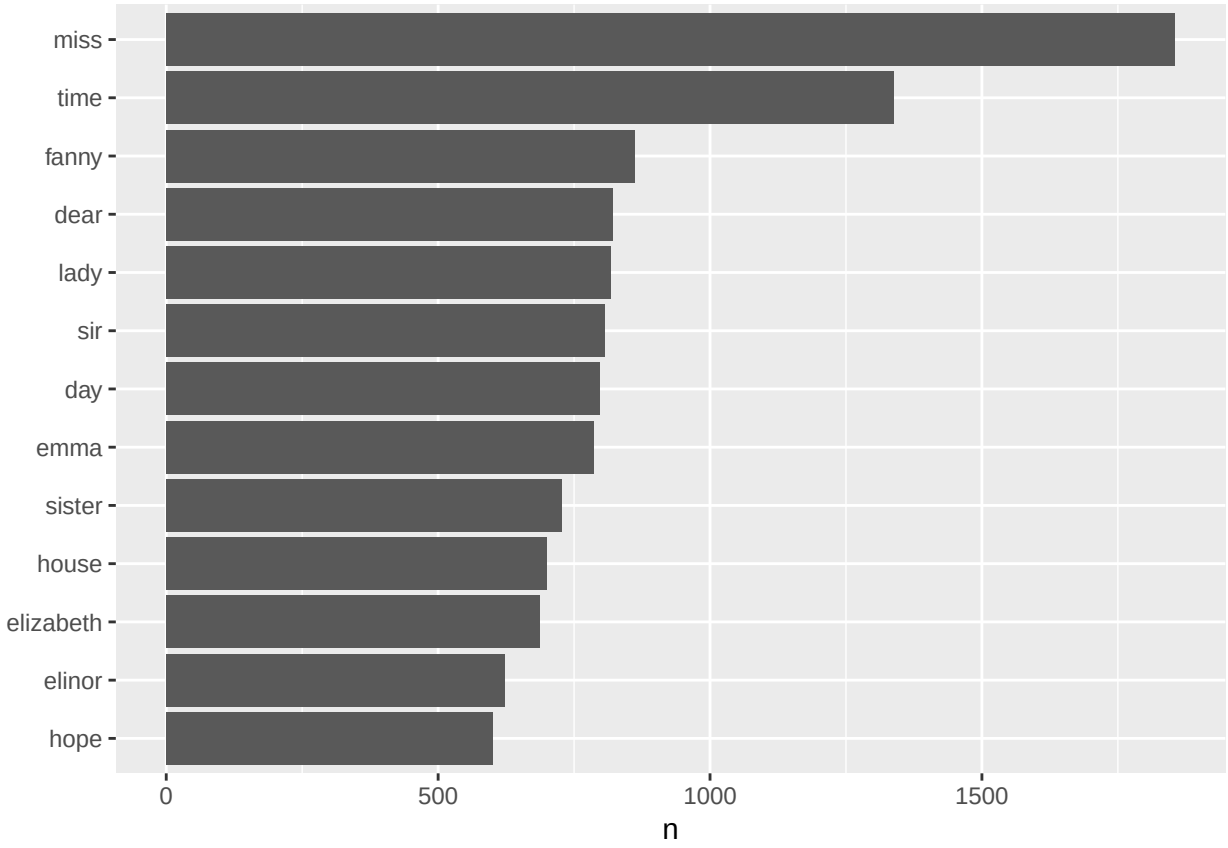
```
## # A tibble: 4 x 2
##    line text
##   <int> <chr>
## 1     1 Because I could not stop for Death -
## 2     2 He kindly stopped for me -
## 3     3 The Carriage held but just Ourselves -
## 4     4 and Immortality
```

```
## # A tibble: 20 x 2
##     line word
##    <int> <chr>
##  1     1 because
##  2     1 i
##  3     1 could
##  4     1 not
##  5     1 stop
##  6     1 for
##  7     1 death
```

```
##  8     2 he
##  9     2 kindly
## 10     2 stopped
## 11     2 for
## 12     2 me
## 13     3 the
## 14     3 carriage
## 15     3 held
## 16     3 but
## 17     3 just
## 18     3 ourselves
## 19     4 and
## 20     4 immortality
```

```
## # A tibble: 73,422 x 4
##    text                  book                linenumber chapter
##    <chr>                 <fct>                    <int>   <int>
##  1 SENSE AND SENSIBILITY Sense & Sensibility          1       0
##  2 ""                    Sense & Sensibility          2       0
##  3 by Jane Austen        Sense & Sensibility          3       0
##  4 ""                    Sense & Sensibility          4       0
##  5 (1811)                Sense & Sensibility          5       0
##  6 ""                    Sense & Sensibility          6       0
##  7 ""                    Sense & Sensibility          7       0
##  8 ""                    Sense & Sensibility          8       0
##  9 ""                    Sense & Sensibility          9       0
## 10 CHAPTER 1             Sense & Sensibility         10       1
## # ... with 73,412 more rows
```

```
## Joining, by = "word"
```



Gutenberg: tidy text format

```
hgwells <- gutenberg_download(c(35, 36, 5230, 159))
```

```
## Determining mirror for Project Gutenberg from http://www.gutenberg.org/robot/harvest
```

```
## Using mirror http://aleph.gutenberg.org
```

```
bronte <- gutenberg_download(c(1260, 768, 969, 9182, 767))
```

```
tidy_hgwells <- hgwells %>% unnest_tokens(word, text) %>% anti_join(stop_words)
```

```
## Joining, by = "word"
```

```
tidy_hgwells %>% count(word, sort = TRUE)
```

```
## # A tibble: 11,769 x 2
##    word       n
##    <chr>  <int>
##  1 time     454
##  2 people   302
##  3 door     260
##  4 heard    249
##  5 black    232
##  6 stood    229
##  7 white    222
##  8 hand     218
##  9 kemp     213
```

```
## 10 eyes     210
## # ... with 11,759 more rows
```

```
tidy_bronte <- bronte %>% unnest_tokens(word, text) %>% anti_join(stop_words)
```

```
## Joining, by = "word"
```

```
tidy_bronte %>% count(word, sort = TRUE)
```

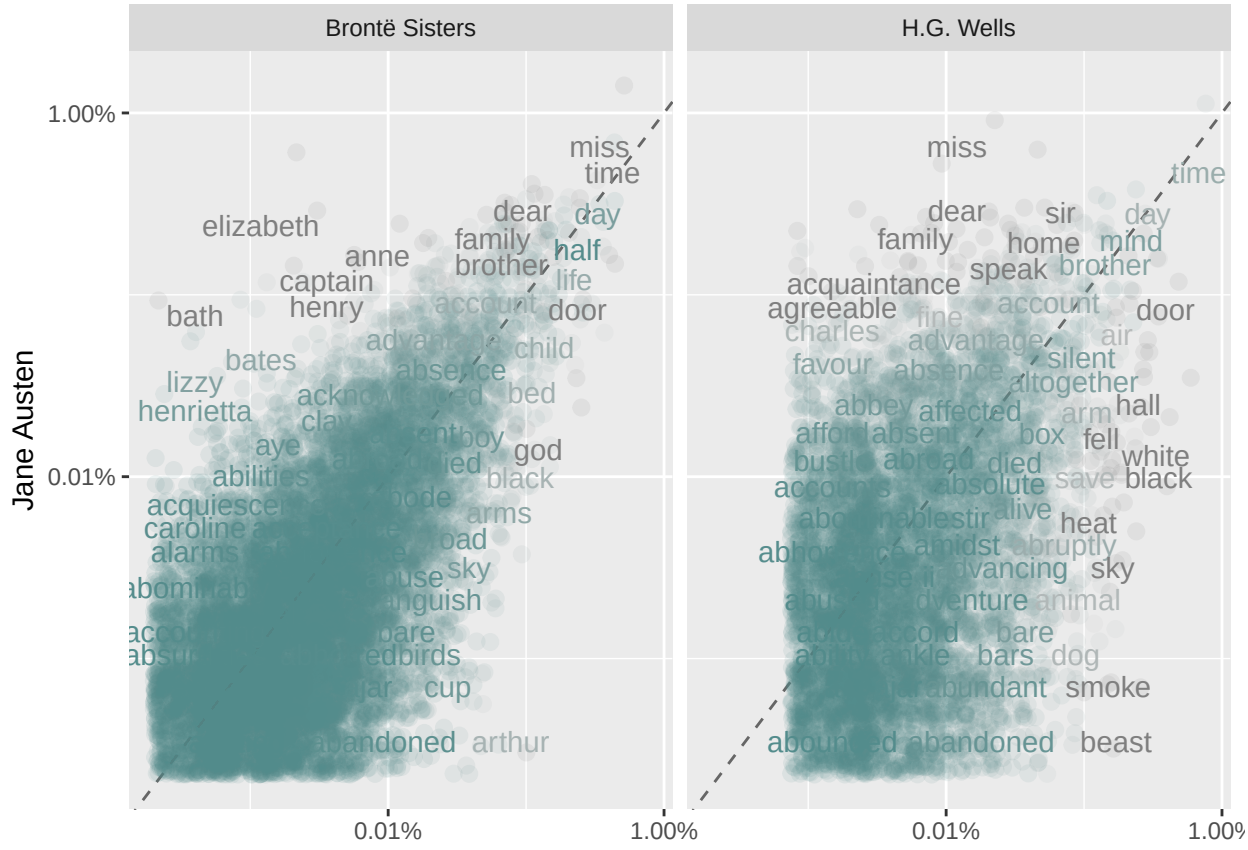
```
## # A tibble: 23,050 x 2
##    word       n
##    <chr>  <int>
##  1 time    1065
##  2 miss     855
##  3 day      827
##  4 hand     768
##  5 eyes     713
##  6 night    647
##  7 heart    638
##  8 looked   601
##  9 door     592
## 10 half     586
## # ... with 23,040 more rows
```

```
frequency <- bind_rows(mutate(tidy_bronte, author = "Brontë Sisters"), mutate(tidy_hgwells,
    author = "H.G. Wells"), mutate(tidy_books, author = "Jane Austen")) %>%
    mutate(word = str_extract(word, "[a-z']+")) %>% count(author, word) %>%
    group_by(author) %>% mutate(proportion = n/sum(n)) %>% select(-n) %>% spread(author,
    proportion) %>% gather(author, proportion, `Brontë Sisters`:`H.G. Wells`)

# expect a warning about rows with missing values being removed
ggplot(frequency, aes(x = proportion, y = `Jane Austen`, color = abs(`Jane Austen` -
    proportion))) + geom_abline(color = "gray40", lty = 2) + geom_jitter(alpha = 0.1,
    size = 2.5, width = 0.3, height = 0.3) + geom_text(aes(label = word), check_overlap = TRUE,
    vjust = 1.5) + scale_x_log10(labels = percent_format()) + scale_y_log10(labels = percent_format()) +
    scale_color_gradient(limits = c(0, 0.001), low = "darkslategray4", high = "gray75") +
    facet_wrap(~author, ncol = 2) + theme(legend.position = "none") + labs(y = "Jane Austen",
    x = NULL)
```

```
## Warning: Removed 41357 rows containing missing values (geom_point).
```

```
## Warning: Removed 41359 rows containing missing values (geom_text).
```




```
cor.test(data = frequency[frequency$author == "Brontë Sisters", ], ~proportion +
    `Jane Austen`)
```

```
##
##  Pearson's product-moment correlation
##
## data:  proportion and Jane Austen
## t = 119.65, df = 10404, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7527869 0.7689641
## sample estimates:
##       cor
## 0.7609938
```

```
cor.test(data = frequency[frequency$author == "H.G. Wells", ], ~proportion +
    `Jane Austen`)
```

```
##
##  Pearson's product-moment correlation
##
## data:  proportion and Jane Austen
## t = 36.441, df = 6053, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.4032800 0.4445987
## sample estimates:
##       cor
```

```
## 0.4241601
```

Sentiment Analysis

```
nrcjoy <- get_sentiments("nrc") %>% filter(sentiment == "joy")

tidy_books %>% filter(book == "Emma") %>% inner_join(nrcjoy) %>% count(word,
    sort = TRUE)
```

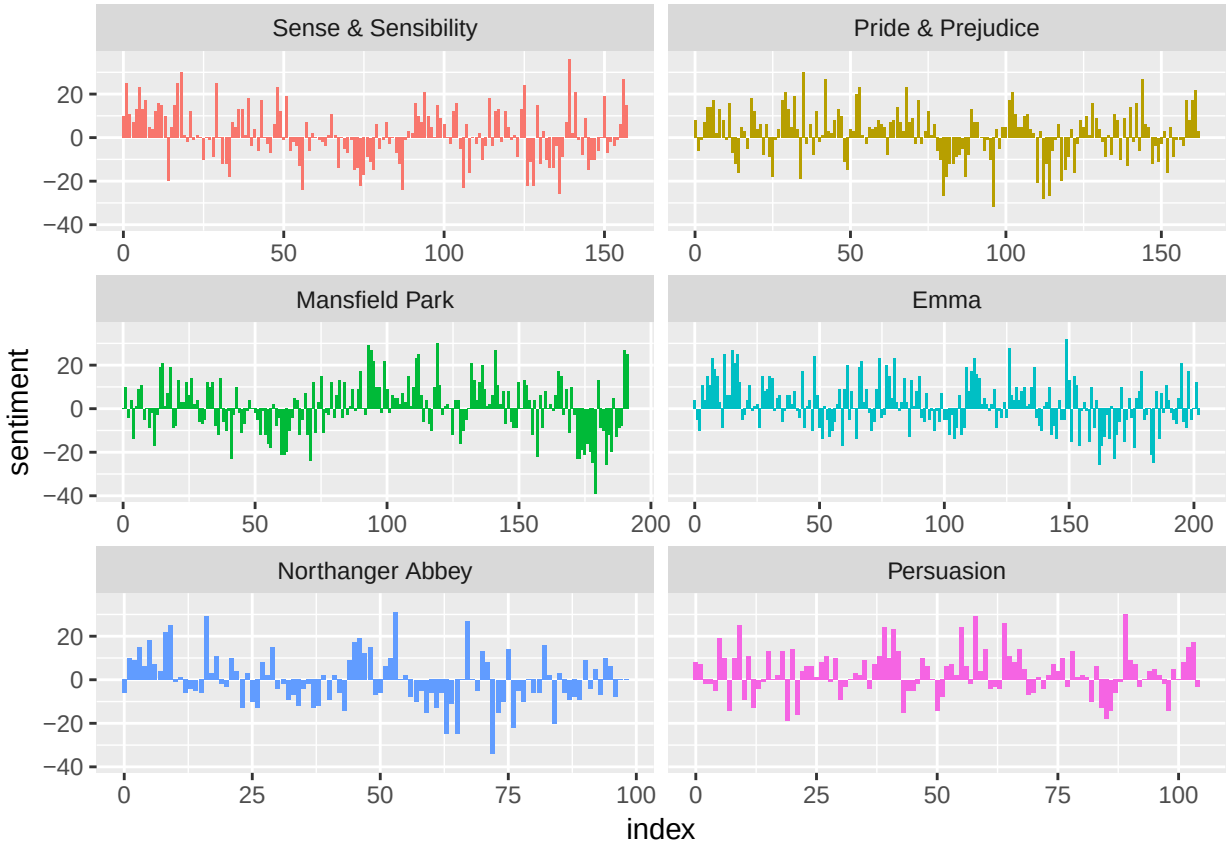
```
## Joining, by = "word"
```

```
## # A tibble: 298 x 2
##    word          n
##    <chr>     <int>
##  1 friend      166
##  2 hope        143
##  3 happy       125
##  4 love        117
##  5 deal         92
##  6 found        92
##  7 happiness    76
##  8 pretty       68
##  9 true         66
## 10 comfort      65
## # ... with 288 more rows
```

```
janeaustensentiment <- tidy_books %>% inner_join(get_sentiments("bing")) %>%
    count(book, index = linenumber%/%80, sentiment) %>% spread(sentiment, n,
    fill = 0) %>% mutate(sentiment = positive - negative)
```

```
## Joining, by = "word"
```

```
ggplot(janeaustensentiment, aes(index, sentiment, fill = book)) + geom_col(show.legend = FALSE) +
    facet_wrap(~book, ncol = 2, scales = "free_x")
```



Most common positive and negative words

```
bing_word_counts <- tidy_books %>% inner_join(get_sentiments("bing")) %>% count(word,
    sentiment, sort = TRUE) %>% ungroup()
```

```
## Joining, by = "word"
```

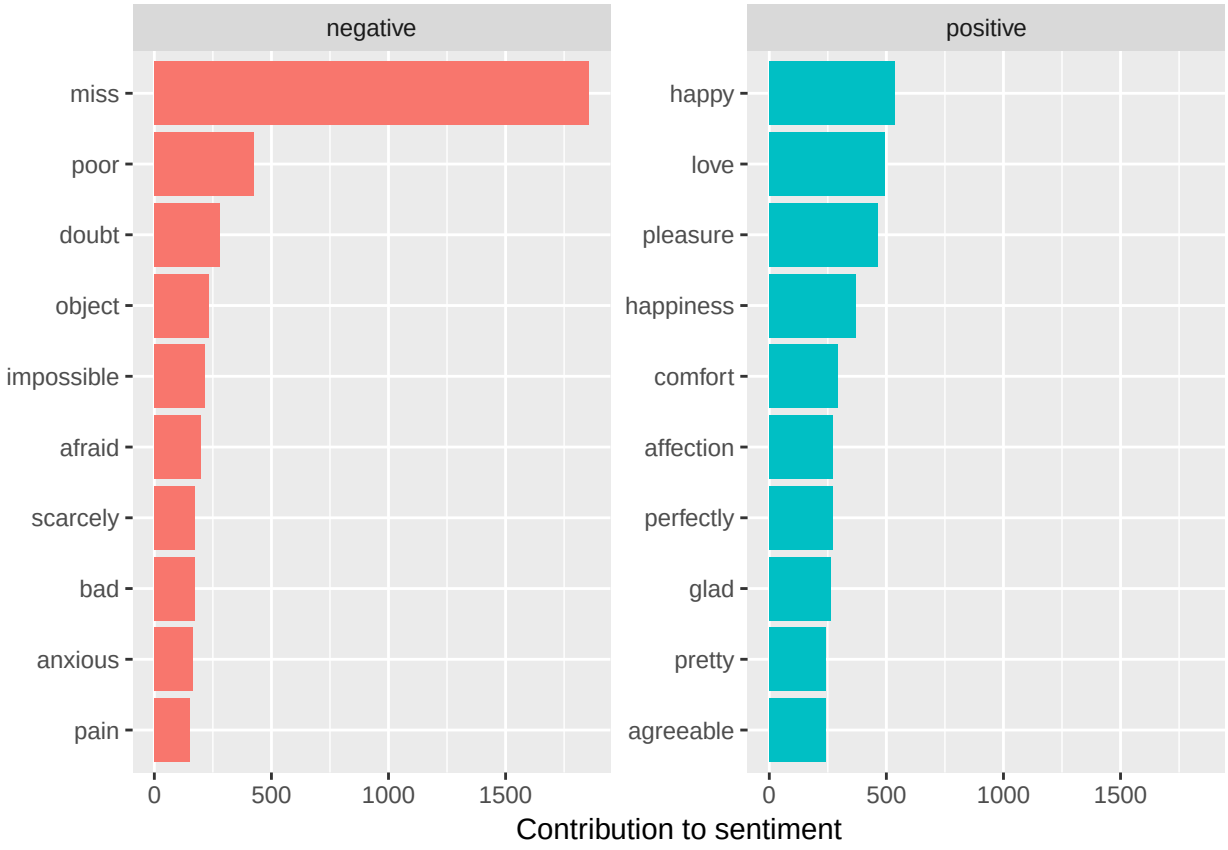
```
bing_word_counts
```

```
## # A tibble: 2,555 x 3
##    word      sentiment     n
##    <chr>     <chr>     <int>
##  1 miss      negative   1855
##  2 happy     positive    534
##  3 love      positive    495
##  4 pleasure  positive    462
##  5 poor      negative    424
##  6 happiness positive    369
##  7 comfort   positive    292
##  8 doubt     negative    281
##  9 affection positive    272
## 10 perfectly positive    271
## # ... with 2,545 more rows
```

```
bing_word_counts %>% group_by(sentiment) %>% top_n(10) %>% ungroup() %>% mutate(word = reorder(word,
    n)) %>% ggplot(aes(word, n, fill = sentiment)) + geom_col(show.legend = FALSE) +
```

```
    facet_wrap(~sentiment, scales = "free_y") + labs(y = "Contribution to sentiment",
    x = NULL) + coord_flip()
```

```
## Selecting by n
```




```
# add 'miss' as a custom stop word
custom_stop_words <- bind_rows(data_frame(word = c("miss"), lexicon = c("custom")),
    stop_words)

custom_stop_words
```

```
## # A tibble: 1,150 x 2
##    word        lexicon
##    <chr>       <chr>
##  1 miss        custom
##  2 a           SMART
##  3 a's         SMART
##  4 able        SMART
##  5 about       SMART
##  6 above       SMART
##  7 according   SMART
##  8 accordingly SMART
##  9 across      SMART
## 10 actually    SMART
## # ... with 1,140 more rows
```

Wordclouds

```
tidy_books %>% anti_join(stop_words) %>% count(word) %>% with(wordcloud(word,
    n, max.words = 100))
```

```
## Joining, by = "word"
```

```
## Warning in wordcloud(word, n, max.words = 100): lady could not be fit on
## page. It will not be plotted.
```

```
## Warning in wordcloud(word, n, max.words = 100): day could not be fit on
## page. It will not be plotted.
```

```
## Warning in wordcloud(word, n, max.words = 100): woodhouse could not be fit
## on page. It will not be plotted.
```


```
tidy_books %>% inner_join(get_sentiments("bing")) %>% count(word, sentiment,
    sort = TRUE) %>% acast(word ~ sentiment, value.var = "n", fill = 0) %>%
    comparison.cloud(colors = c("gray20", "gray80"), max.words = 100)
```

```
## Joining, by = "word"
```

Units beyond just words

Word and Document Frequency

Term Frequency

```
book_words <- austen_books() %>% unnest_tokens(word, text) %>% count(book, word,
    sort = TRUE) %>% ungroup()

total_words <- book_words %>% group_by(book) %>% summarize(total = sum(n))

book_words <- left_join(book_words, total_words)
```

```
## Joining, by = "book"
```

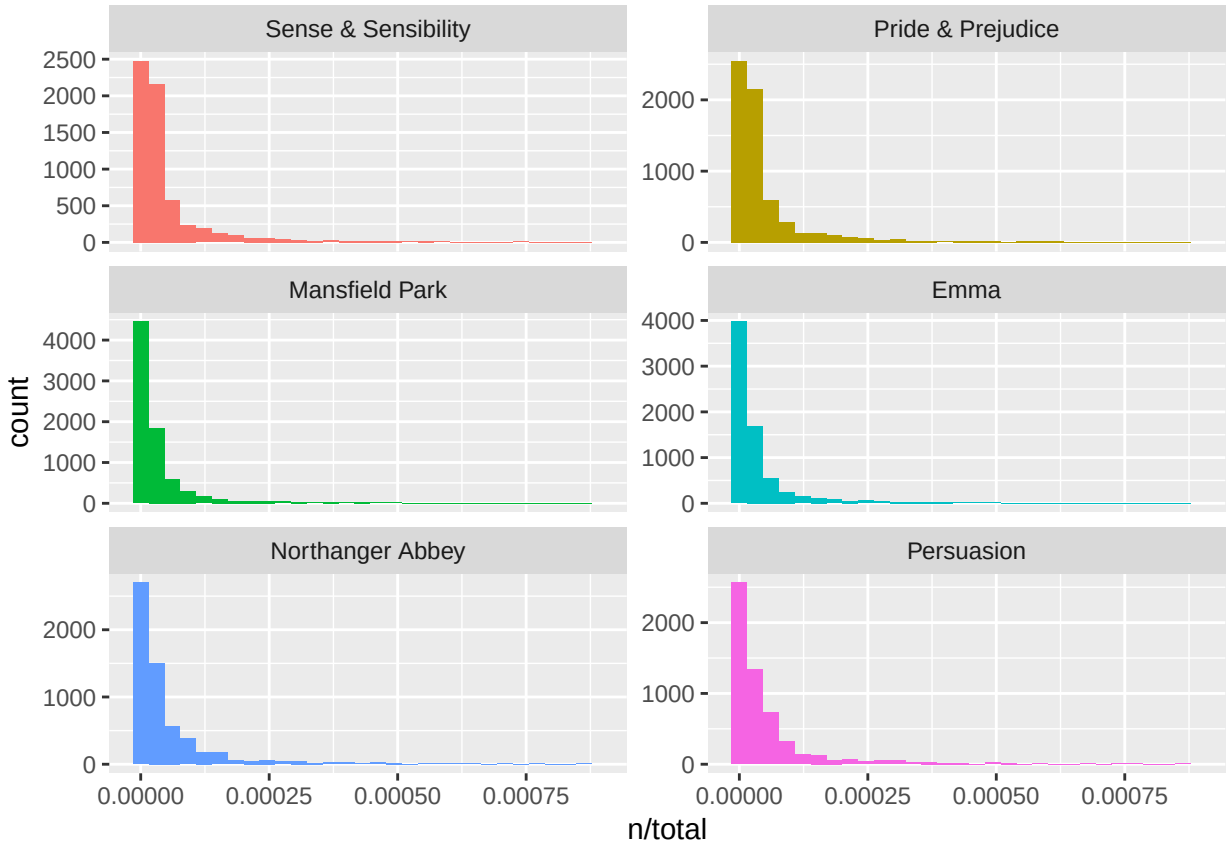
```
head(book_words)
```

```
## # A tibble: 6 x 4
##   book           word      n  total
##   <fct>          <chr> <int>  <int>
## 1 Mansfield Park the    6206 160460
## 2 Mansfield Park to     5475 160460
## 3 Mansfield Park and    5438 160460
## 4 Emma           to     5239 160996
## 5 Emma           the    5201 160996
## 6 Emma           and    4896 160996
```

```
ggplot(book_words, aes(n/total, fill = book)) + geom_histogram(show.legend = FALSE) +
    xlim(NA, 9e-04) + facet_wrap(~book, ncol = 2, scales = "free_y")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 896 rows containing non-finite values (stat_bin).
```



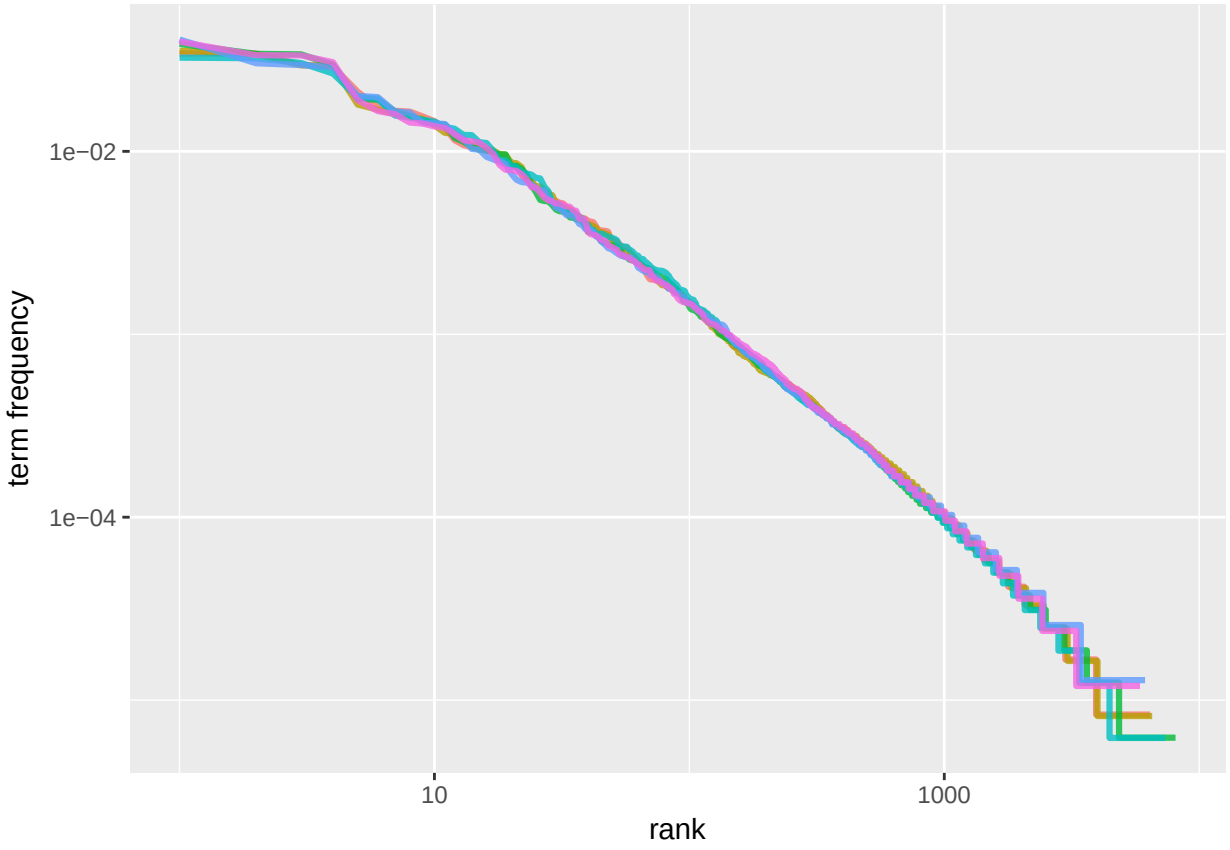
Zipf's Law

```
freq_by_rank <- book_words %>% group_by(book) %>% mutate(rank = row_number(),
    `term frequency` = n/total)
```

```
head(freq_by_rank)
```

```
## # A tibble: 6 x 6
## # Groups:   book [2]
##   book           word      n  total  rank `term frequency`
##   <fct>          <chr> <int>  <int> <int>            <dbl>
## 1 Mansfield Park the     6206 160460     1           0.0387
## 2 Mansfield Park to      5475 160460     2           0.0341
## 3 Mansfield Park and     5438 160460     3           0.0339
## 4 Emma           to      5239 160996     1           0.0325
## 5 Emma           the     5201 160996     2           0.0323
## 6 Emma           and     4896 160996     3           0.0304
```

```
freq_by_rank %>% ggplot(aes(rank, `term frequency`, color = book)) + geom_line(size = 1.1,
    alpha = 0.8, show.legend = FALSE) + scale_x_log10() + scale_y_log10()
```



The bind_tf_idf function

```
book_words <- book_words %>% bind_tf_idf(word, book, n)
head(book_words)
```

```
## # A tibble: 6 x 7
##   book           word      n  total     tf   idf tf_idf
##   <fct>          <chr> <int>  <int>  <dbl> <dbl>  <dbl>
## 1 Mansfield Park the     6206 160460 0.0387     0      0
## 2 Mansfield Park to      5475 160460 0.0341     0      0
## 3 Mansfield Park and     5438 160460 0.0339     0      0
## 4 Emma           to      5239 160996 0.0325     0      0
## 5 Emma           the     5201 160996 0.0323     0      0
## 6 Emma           and     4896 160996 0.0304     0      0
```

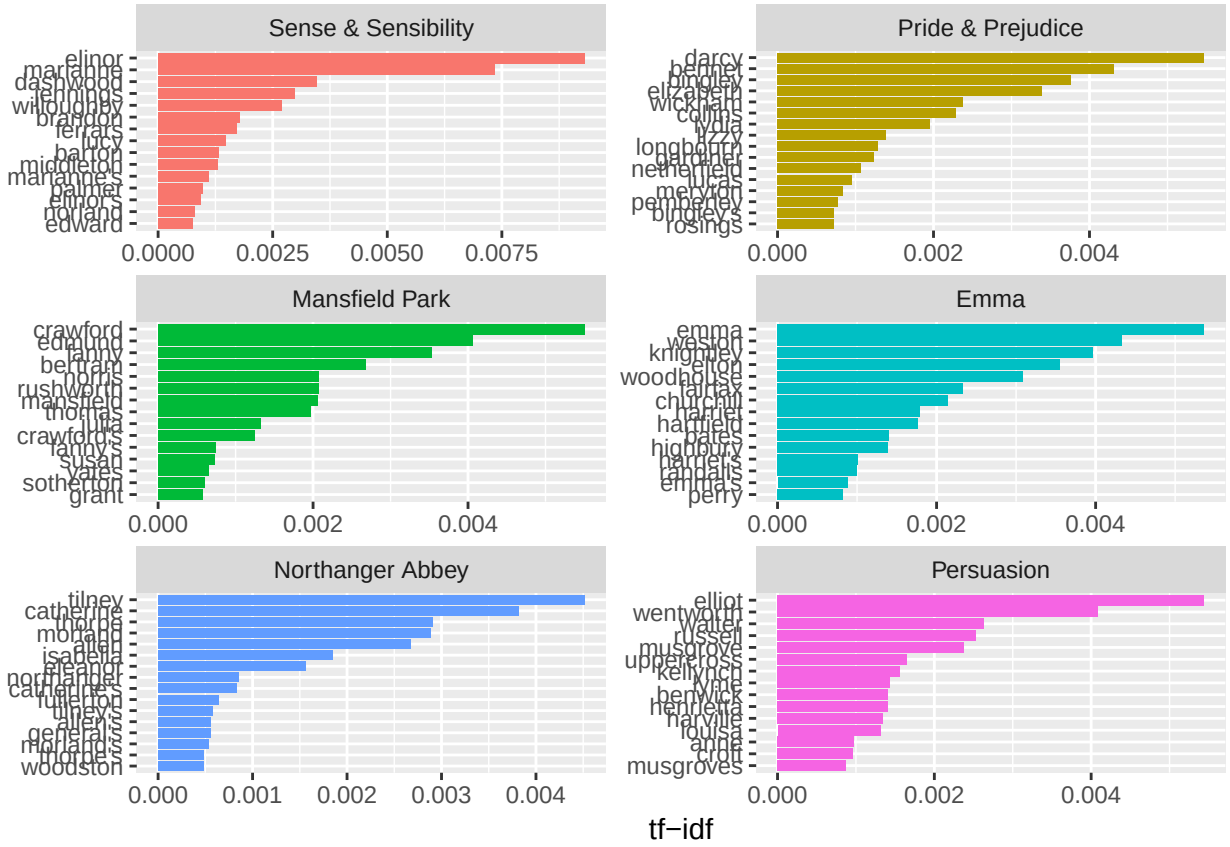
```
book_words %>% select(-total) %>% arrange(desc(tf_idf))
```

```
## # A tibble: 40,379 x 6
##    book                word          n      tf   idf  tf_idf
##    <fct>               <chr>     <int>   <dbl> <dbl>   <dbl>
##  1 Sense & Sensibility elinor      623 0.00519  1.79 0.00931
##  2 Sense & Sensibility marianne    492 0.00410  1.79 0.00735
##  3 Mansfield Park      crawford    493 0.00307  1.79 0.00551
##  4 Pride & Prejudice   darcy       373 0.00305  1.79 0.00547
##  5 Persuasion          elliot      254 0.00304  1.79 0.00544
##  6 Emma                emma        786 0.00488  1.10 0.00536
```

```
##  7 Northanger Abbey    tilney      196 0.00252  1.79 0.00452
##  8 Emma                weston      389 0.00242  1.79 0.00433
##  9 Pride & Prejudice   bennet      294 0.00241  1.79 0.00431
## 10 Persuasion          wentworth   191 0.00228  1.79 0.00409
## # ... with 40,369 more rows
```

```
book_words %>% arrange(desc(tf_idf)) %>% mutate(word = factor(word, levels = rev(unique(word)))) %>%
    group_by(book) %>% top_n(15) %>% ungroup %>% ggplot(aes(word, tf_idf, fill = book)) +
    geom_col(show.legend = FALSE) + labs(x = NULL, y = "tf-idf") + facet_wrap(~book,
    ncol = 2, scales = "free") + coord_flip()
```

```
## Selecting by tf_idf
```



A corpus of physics texts

```
physics <- gutenberg_download(c(37729, 14725, 13476, 5001), meta_fields = "author")
```

```
physics_words <- physics %>% unnest_tokens(word, text) %>% count(author, word,
    sort = TRUE) %>% ungroup()
```

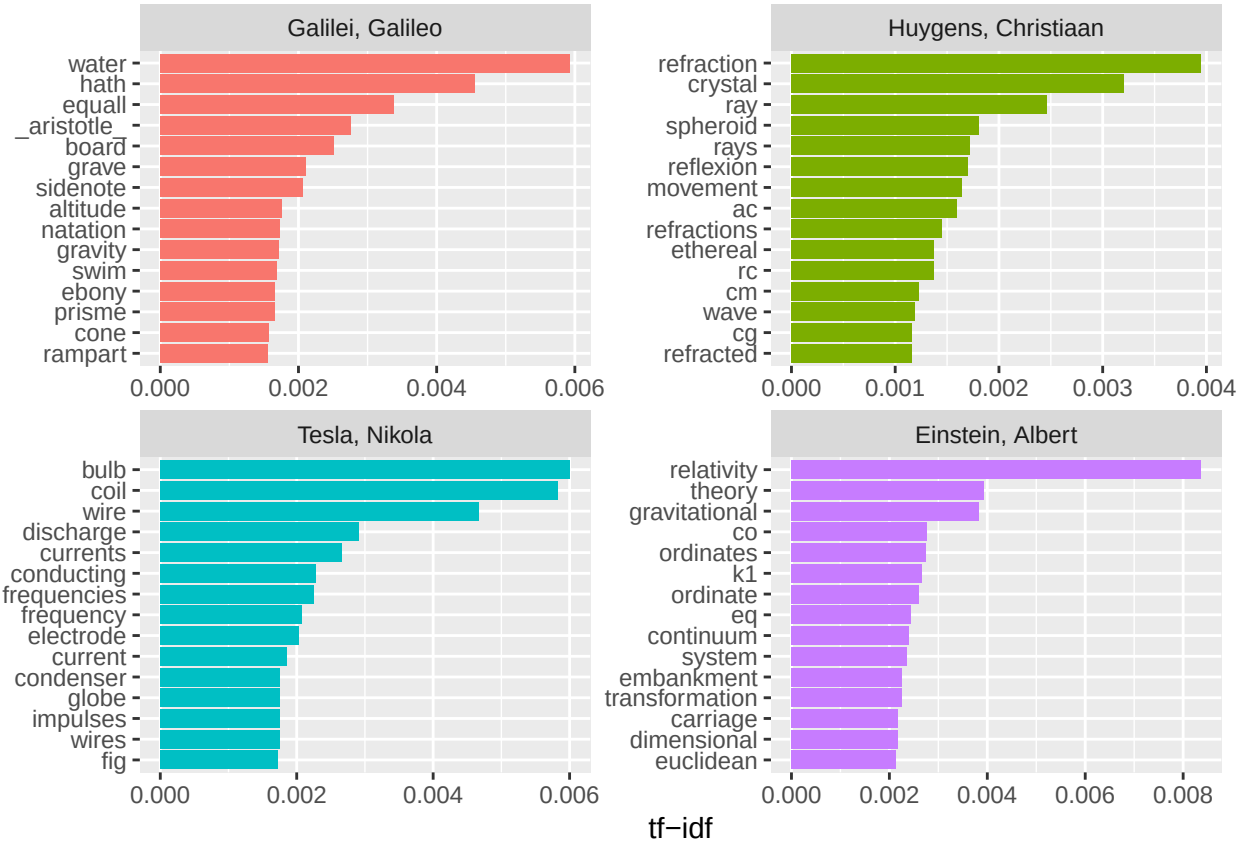
```
head(physics_words)
```

```
## # A tibble: 6 x 3
##   author              word      n
##   <chr>               <chr> <int>
## 1 Galilei, Galileo    the    3760
## 2 Tesla, Nikola       the    3604
```

```
## 3 Huygens, Christiaan the    3553
## 4 Einstein, Albert    the    2994
## 5 Galilei, Galileo    of     2049
## 6 Einstein, Albert    of     2030
```

```
plot_physics <- physics_words %>% bind_tf_idf(word, author, n) %>% arrange(desc(tf_idf)) %>%
    mutate(word = factor(word, levels = rev(unique(word)))) %>% mutate(author = factor(author,
    levels = c("Galilei, Galileo", "Huygens, Christiaan", "Tesla, Nikola", "Einstein, Albert")))

plot_physics %>% group_by(author) %>% top_n(15, tf_idf) %>% ungroup() %>% mutate(word = reorder(word,
    tf_idf)) %>% ggplot(aes(word, tf_idf, fill = author)) + geom_col(show.legend = FALSE) +
    labs(x = NULL, y = "tf-idf") + facet_wrap(~author, ncol = 2, scales = "free") +
    coord_flip()
```



A corpus of _____ texts

```
# gutenberg_metadata %>% filter(title == 'Ramayana, English')
bib <- gutenberg_download(10, meta_fields = "author")
anthem <- gutenberg_download(1249, meta_fields = "author")
sid <- gutenberg_download(2500, meta_fields = "author")
myths_china <- gutenberg_download(15250, meta_fields = "author")
myths_japan <- gutenberg_download(4108, meta_fields = "author")
```

```
anthem_words <- anthem %>% unnest_tokens(word, text) %>% count(author, word,
    sort = TRUE) %>% ungroup()
```

```
anthem_words
```

```
## # A tibble: 2,421 x 3
##    author    word      n
##    <chr>     <chr> <int>
##  1 Rand, Ayn the    1440
##  2 Rand, Ayn we      941
##  3 Rand, Ayn and     883
##  4 Rand, Ayn of      655
##  5 Rand, Ayn to      566
##  6 Rand, Ayn our     409
##  7 Rand, Ayn it      343
##  8 Rand, Ayn in      298
##  9 Rand, Ayn a       293
## 10 Rand, Ayn is      263
## # ... with 2,411 more rows
```

```
bib_words <- bib %>% unnest_tokens(word, text) %>% count(author, word, sort = TRUE) %>%
    ungroup()
```

```
bib_words
```

```
## # A tibble: 12,966 x 3
##    author word      n
##    <chr>  <chr> <int>
##  1 <NA>   the   64023
##  2 <NA>   and   51696
##  3 <NA>   of    34670
##  4 <NA>   to    13580
##  5 <NA>   that  12912
##  6 <NA>   in    12667
##  7 <NA>   he    10419
##  8 <NA>   shall  9838
##  9 <NA>   unto   8997
## 10 <NA>   for    8970
## # ... with 12,956 more rows
```

```
sid_words <- sid %>% unnest_tokens(word, text) %>% count(author, word, sort = TRUE) %>%
    ungroup()
```

```
sid_words
```

```
## # A tibble: 3,606 x 3
##    author         word      n
##    <chr>          <chr> <int>
##  1 Hesse, Hermann the    2045
##  2 Hesse, Hermann and    1365
##  3 Hesse, Hermann to     1145
##  4 Hesse, Hermann of      988
##  5 Hesse, Hermann he      941
##  6 Hesse, Hermann a       911
##  7 Hesse, Hermann his     708
##  8 Hesse, Hermann in      629
##  9 Hesse, Hermann had     524
## 10 Hesse, Hermann was     511
## # ... with 3,596 more rows
```

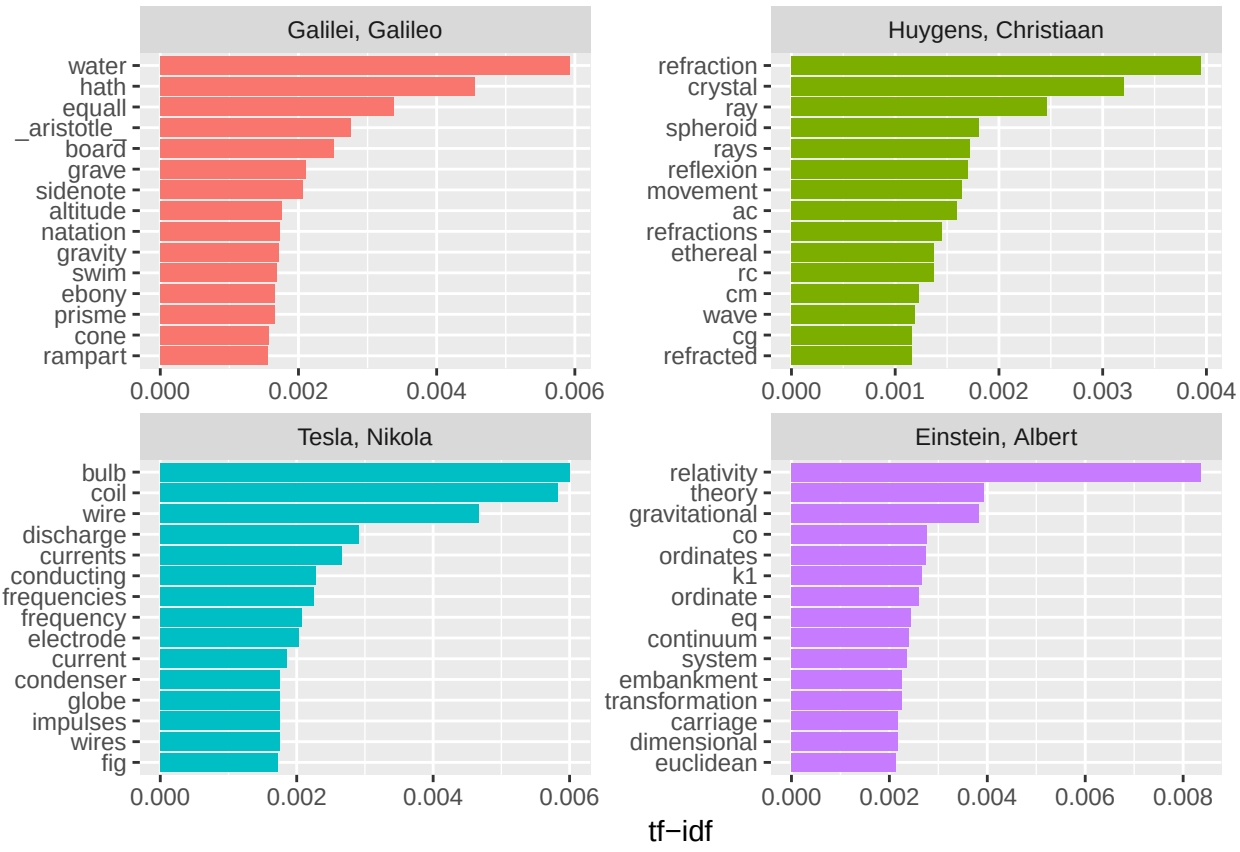
```
myths_china_words <- myths_china %>% unnest_tokens(word, text) %>% count(author,
    word, sort = TRUE) %>% ungroup()

myths_china_words
```

```
## # A tibble: 10,920 x 3
##    author                                      word      n
##    <chr>                                       <chr> <int>
##  1 Werner, E. T. C. (Edward Theodore Chalmers) the   10106
##  2 Werner, E. T. C. (Edward Theodore Chalmers) of     5111
##  3 Werner, E. T. C. (Edward Theodore Chalmers) and    4054
##  4 Werner, E. T. C. (Edward Theodore Chalmers) to     3455
##  5 Werner, E. T. C. (Edward Theodore Chalmers) a      2415
##  6 Werner, E. T. C. (Edward Theodore Chalmers) in     2393
##  7 Werner, E. T. C. (Edward Theodore Chalmers) his    1477
##  8 Werner, E. T. C. (Edward Theodore Chalmers) he     1392
##  9 Werner, E. T. C. (Edward Theodore Chalmers) was    1360
## 10 Werner, E. T. C. (Edward Theodore Chalmers) that    982
## # ... with 10,910 more rows
```

```
plot_bib <- bib_words %>% bind_tf_idf(word, author, n) %>% arrange(desc(tf_idf)) %>%
    mutate(word = factor(word, levels = rev(unique(word)))) %>% mutate(author = factor(author,
    levels = c("Galilei, Galileo", "Huygens, Christiaan", "Tesla, Nikola", "Einstein, Albert")))

plot_physics %>% group_by(author) %>% top_n(15, tf_idf) %>% ungroup() %>% mutate(word = reorder(word,
    tf_idf)) %>% ggplot(aes(word, tf_idf, fill = author)) + geom_col(show.legend = FALSE) +
    labs(x = NULL, y = "tf-idf") + facet_wrap(~author, ncol = 2, scales = "free") +
    coord_flip()
```


Galilei, Galileo
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Huygens, Christiaan
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Tesla, Nikola
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Einstein, Albert
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