Text_Mining Continued

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Learning Objective

- Analyze sentiment as it changes through a text
- Graph word clouds

Resources

Text Mining with R by Julia Silge and David Robinson.

Sentiment Analysis

Sections 2.1 - 2.3 in the book.

Naive approach: sentiment of each word and add them up for a given amount of text. This approach does not take into account word qualifiers like not, never, always, etc. Generally, if we add up over many paragraphs, the positive and negative words will cancel each other out. So, we are usually better off adding either by sentence or by paragraph.

There are several sentiment lexicons we can use:

- AFINN from Finn ?rup Nielsen,
- bing from Bing Liu and collaborators
- nrc from Saif Mohammad and Peter Turney

```
sentiments
```

```
## # A tibble: 6,786 x 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
```

```
sentiments %>% arrange(word)
```

```
## # A tibble: 6,786 x 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
```

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

```
## # A tibble: 2,477 x 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
```

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

```
## # A tibble: 6,786 x 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
```

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

```
## # A tibble: 13,901 x 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 13,891 more rows
```

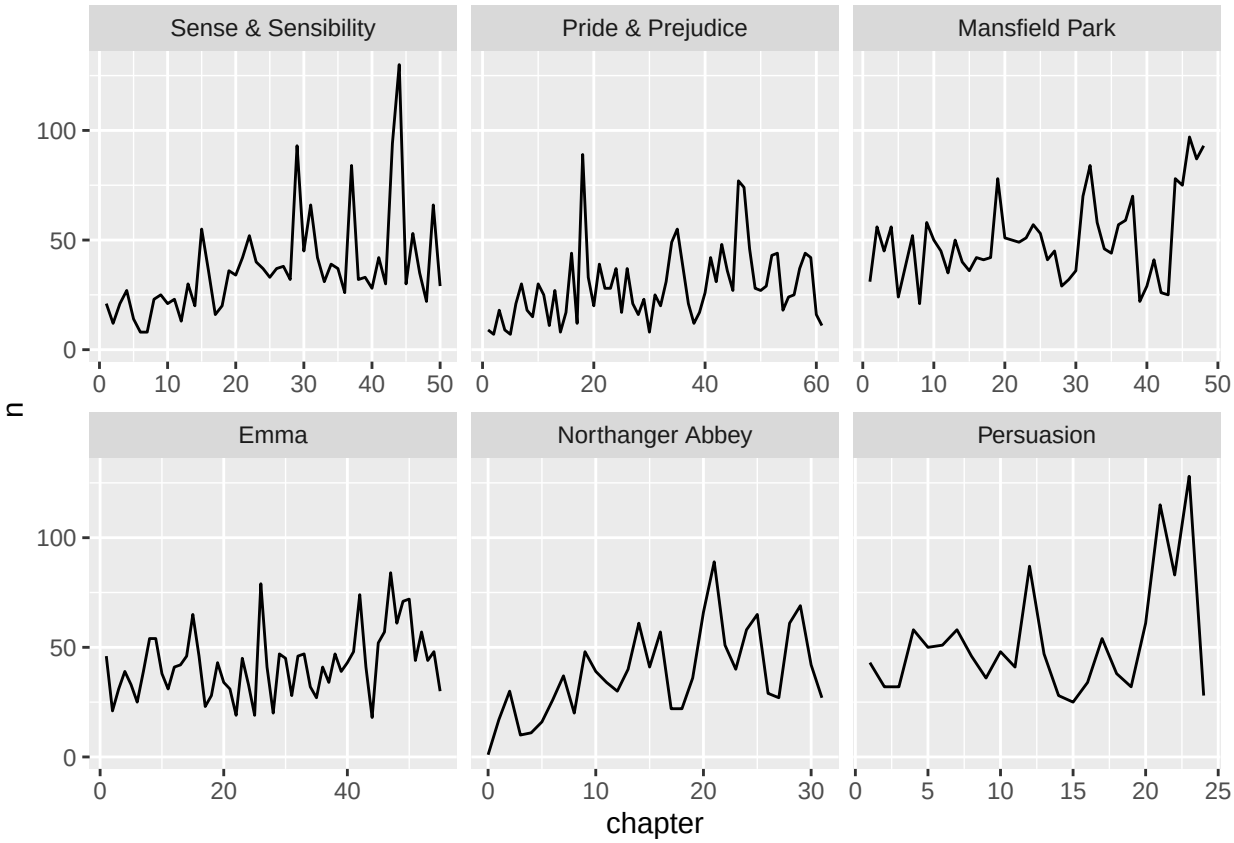
Since the nrc lexicon gives us the emotion, we can look at words labelled as fear if we choose.

```
tidy_books <- austen_books() %>%
  group_by(book) %>%
  mutate(linenumber = row_number(),
         chapter = cumsum(str_detect(text,
                   regex("^chapter [\\divxlc]",
                  ignore_case = TRUE)))) %>%
  ungroup() %>%
  # use word so the inner_join will match with the nrc lexicon
  unnest_tokens(word, text)

# select only the words from the nrc lexicon that are "fear" words
nrcfear <- get_sentiments("nrc") %>%
  filter(sentiment == "fear")

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

```
## # A tibble: 364 x 2
##    word         n
##  * <chr>    <int>
##  1 doubt       98
##  2 ill         72
##  3 afraid      65
##  4 marry       63
##  5 change      61
##  6 bad         60
##  7 feeling     56
##  8 bear        52
##  9 creature    39
## 10 obliging    34
## # ... with 354 more rows
```

See if you can plot the fear by chapter.

```
fear_chapter <- tidy_books %>%
 inner_join(nrcfear) %>%
 group_by(book,chapter) %>%
 count()
fear_chapter %>%
  ggplot(aes(chapter, n)) +
  geom_line() +
  facet_wrap(~book, scales = "free_x")
```



What other sentiments are there in nrc that we could look at?

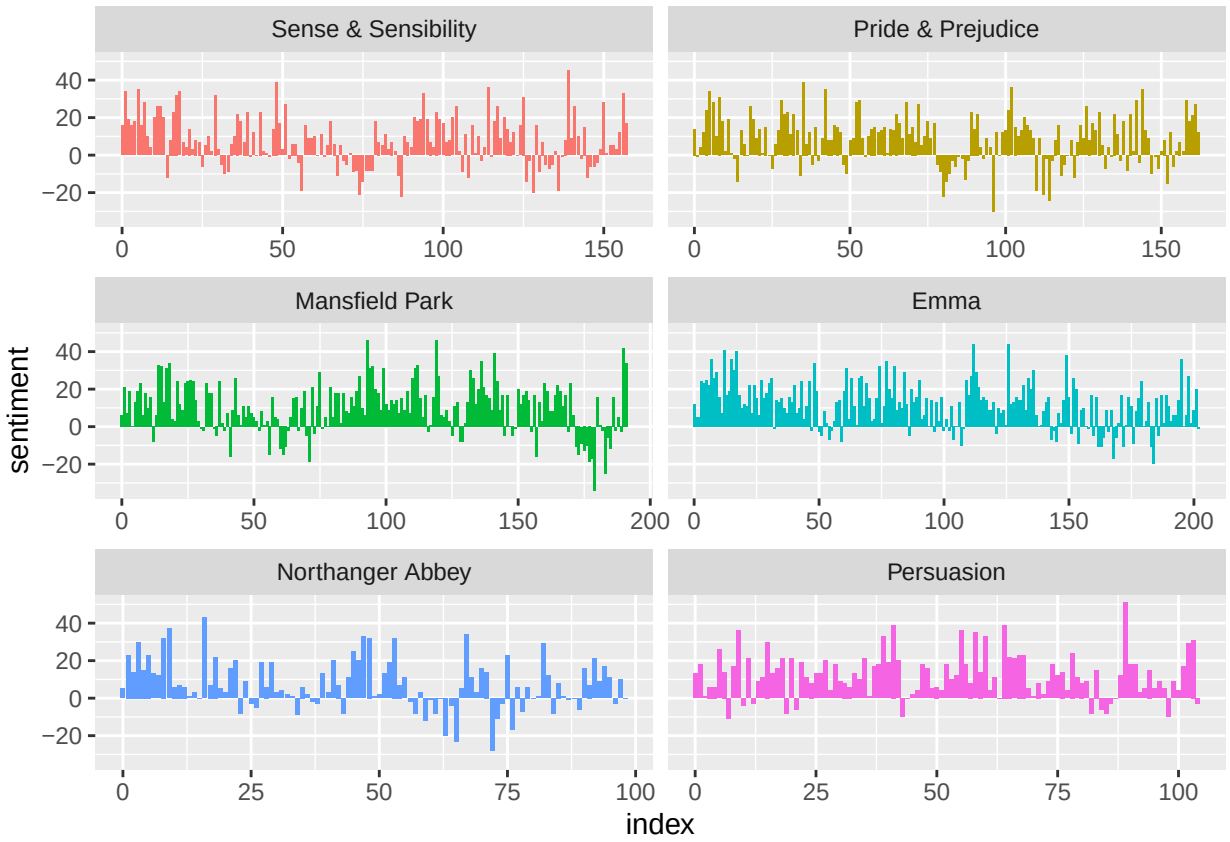
```
get_sentiments("nrc") %>%
  group_by(sentiment) %>%
  count()
```

```
## # A tibble: 10 x 2
## # Groups:   sentiment [10]
##    sentiment        n
##    <chr>        <int>
##  1 anger         1247
##  2 anticipation   839
##  3 disgust       1058
##  4 fear          1476
##  5 joy            689
##  6 negative      3324
##  7 positive      2312
##  8 sadness       1191
##  9 surprise       534
## 10 trust         1231
```

Now, let's use 80 line blocks and use bing to categorize each word as positive or negative. We will spread them to get the counts in separate columns and then add a column with the net = positive - negative

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

```
  mutate(sentiment = positive - negative)

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



Modifying what contributes to sentiment analysis

Section 2.4 in online book.

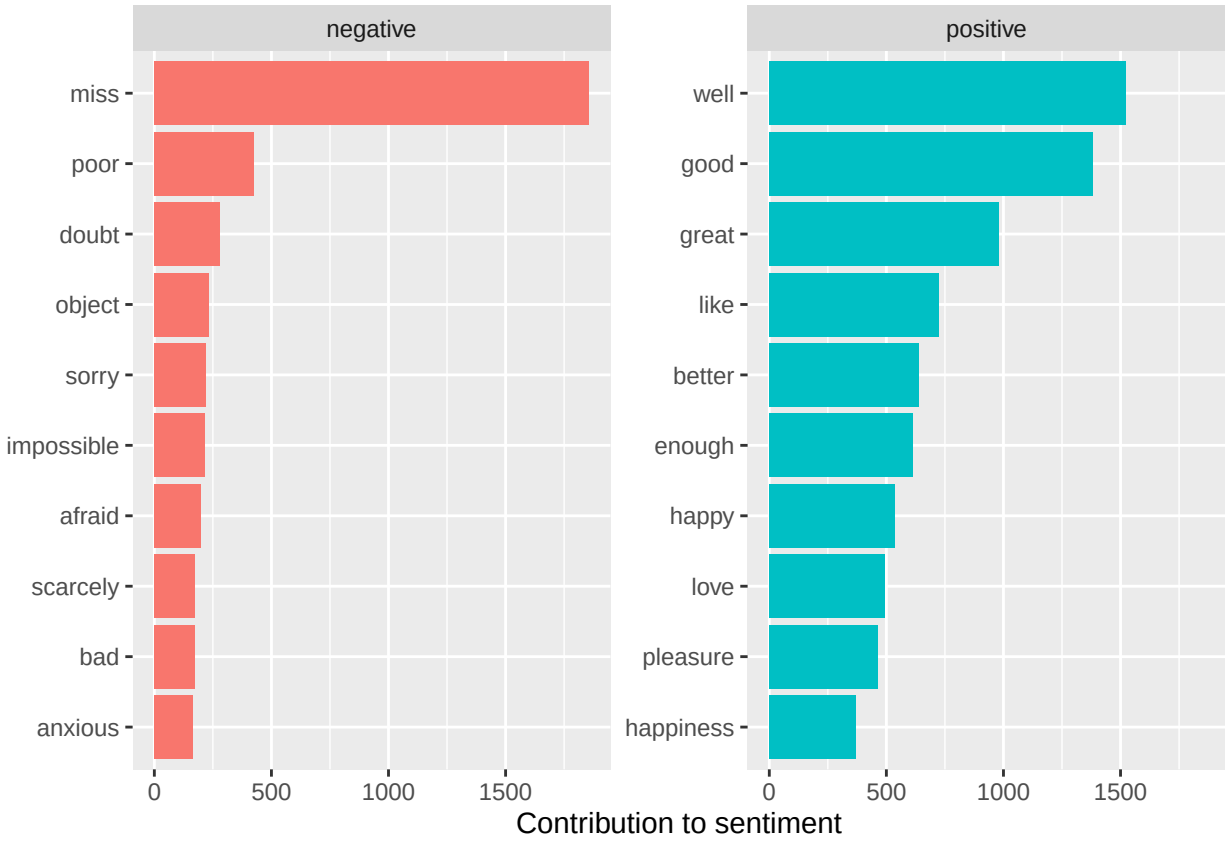
We should probably look at which words contribute to the positive and negative sentiment and be sure we want to include them.

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

bing_word_counts
```

```
## # A tibble: 2,585 x 3
##    word     sentiment     n
##  * <chr>    <chr>     <int>
##  1 miss     negative   1855
##  2 well     positive   1523
```

```
##  3 good     positive   1380
##  4 great    positive    981
##  5 like     positive    725
##  6 better   positive    639
##  7 enough   positive    613
##  8 happy    positive    534
##  9 love     positive    495
## 10 pleasure positive    462
## # ... with 2,575 more rows
```

```
# visualize it
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()
```



Not what we want for Jane Austen novels!! Miss is probably not a negative word, but rather refers to a young girl. Two approaches to fix this:

- take the word miss out of the data before doing the analysis or
- change the sentiment lexicon to no longer have "miss" as a negative

First we will remove the word *miss* by adding it to the stop words.

```
custom_stop_words <- bind_rows(data_frame(
      word = c("miss"),
      lexicon = c("custom")),
       stop_words)

custom_stop_words
```

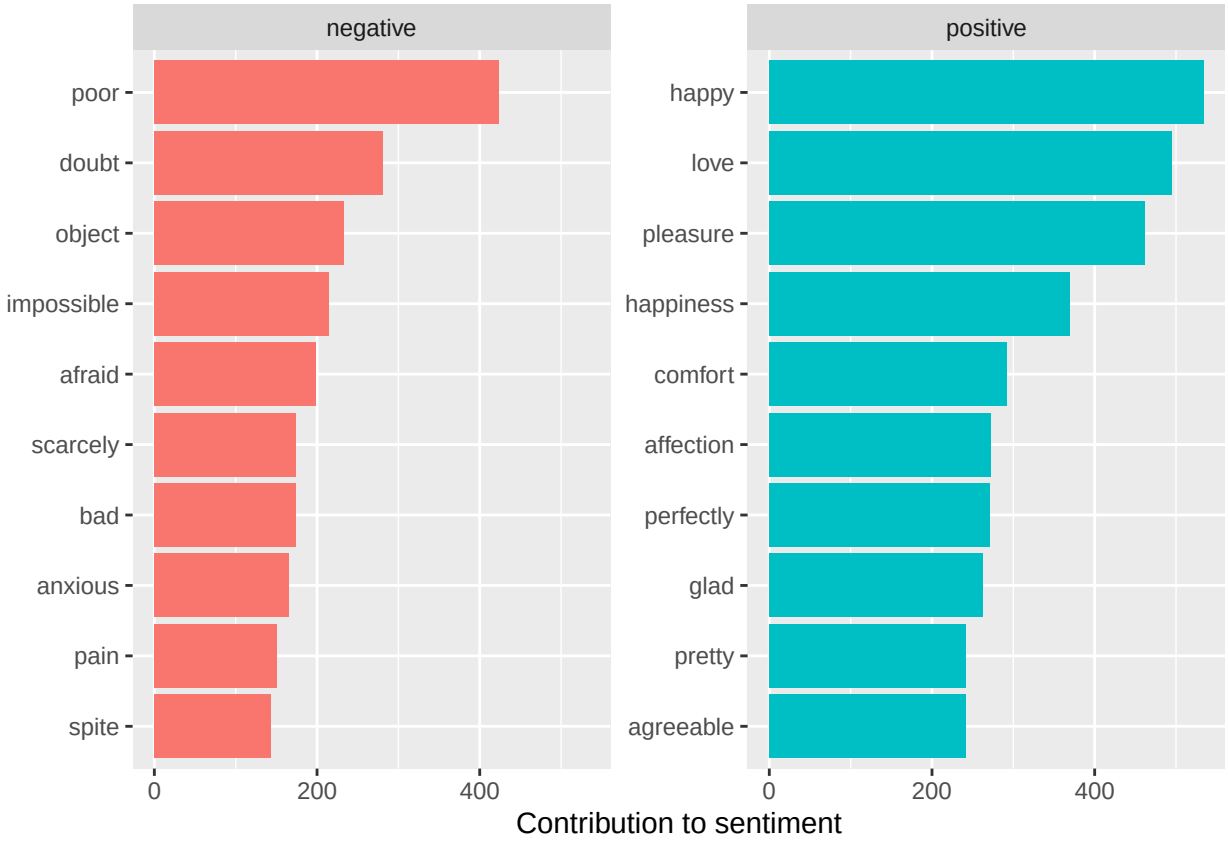
```
## # A tibble: 1,150 x 2
##    word        lexicon
##  * <chr>       <chr>
##  1 miss        custom
##  2 a           SMART
##  3 a's         SMART
##  4 able        SMART
##  5 about       SMART
##  6 above       SMART
##  7 according   SMART
##  8 accordingly SMART
##  9 across      SMART
## 10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

```
# Now, let's redo with the new stop words.
tidy_books_no_miss <- austen_books() %>%
  group_by(book) %>%
  mutate(linenumber = row_number(),
         chapter = cumsum(str_detect(text,
                    regex("^chapter [\\divxlc]",
                   ignore_case = TRUE)))) %>%
  ungroup() %>%
  # use word so the inner_join will match with the nrc lexicon
  unnest_tokens(word, text) %>%
  anti_join(custom_stop_words)

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

bing_word_counts
```

```
## # A tibble: 2,554 x 3
##    word      sentiment     n
##  * <chr>     <chr>     <int>
##  1 happy     positive    534
##  2 love      positive    495
##  3 pleasure  positive    462
##  4 poor      negative    424
##  5 happiness positive    369
##  6 comfort   positive    292
##  7 doubt     negative    281
##  8 affection positive    272
##  9 perfectly positive    271
```

```
## 10 glad      positive    263
## # ... with 2,544 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()
```



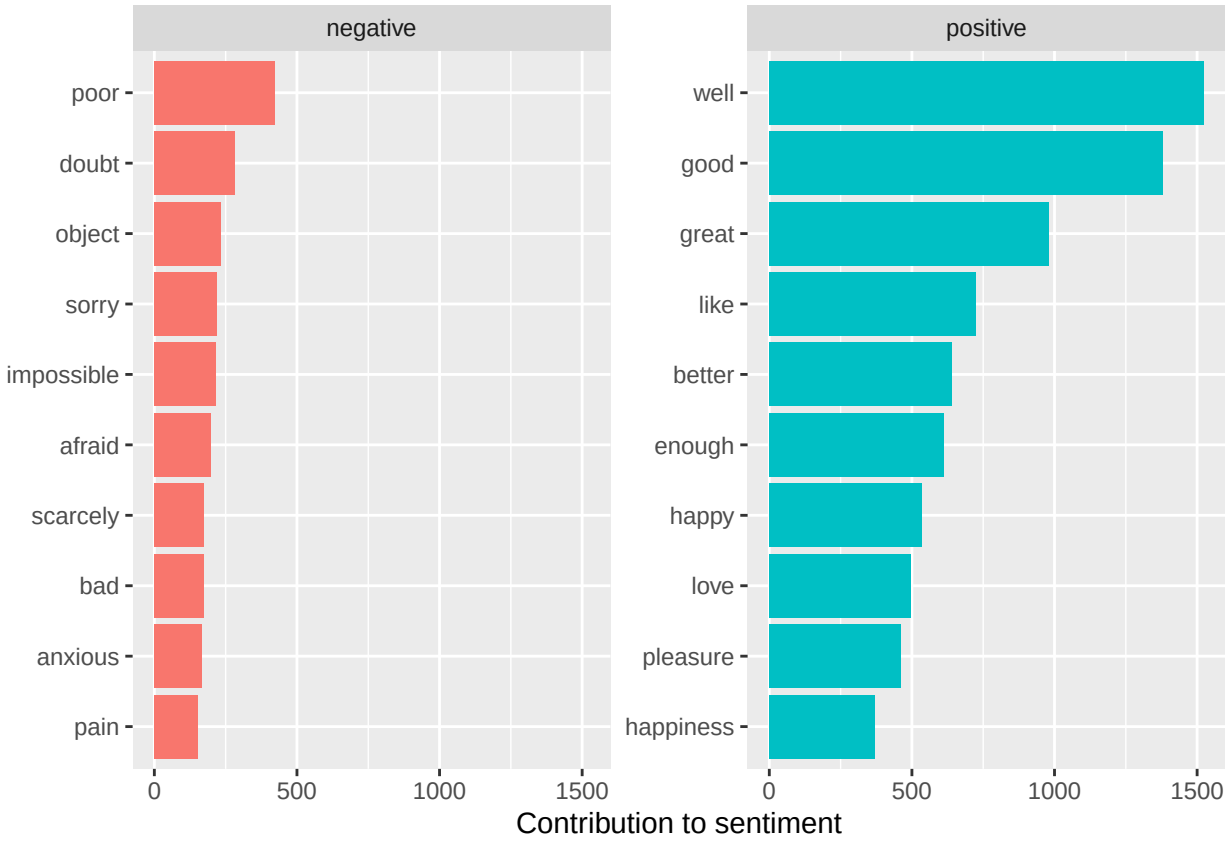
A different approach would be to leave it in the analysis, but remove the word "miss" from the bing sentiment lexicon.

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

bing_word_counts
```

```
## # A tibble: 2,584 x 3
```

```
##    word     sentiment     n
##  * <chr>    <chr>     <int>
##  1 well     positive   1523
##  2 good     positive   1380
##  3 great    positive    981
##  4 like     positive    725
##  5 better   positive    639
##  6 enough   positive    613
##  7 happy    positive    534
##  8 love     positive    495
##  9 pleasure positive    462
## 10 poor     negative    424
## # ... with 2,574 more rows
```

```
# visualize it
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()
```



- **Exercise 3:** Let's look at how the sentiment changes across the length of a book by looking at 80 lines at a time. Compare how sentiment changes in Victor Hugo's Les Miserables and Charles Dickens' A Tale of Two Cities. Look at negative vs positive sentiment. Then pick a sentiment like joy or anger or fear or ... and see how that sentiment compares.

WordCloud plots

Sections 2.5 - 2.7 in book.

We can do wordcloud plots where the frequency of the word in the text determines the size of the word in the wordcloud. We can also color the words based on the sentiment.

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


```
library(reshape2)

tidy_books %>%
  inner_join(bing_no_miss) %>%
  count(word, sentiment, sort = TRUE) %>%
  acast(word ~ sentiment, value.var = "n", fill = 0) %>%
  comparison.cloud(colors = c("red", "blue"),
```

```
                    max.words = 100)
```