A brief introduction to regular expressions

Data Wrangling: Session 5

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Load the packages, as always

```
library(here)      # manage file paths
library(socviz)    # data and some useful functions
```

```
library(tidyverse) # your friend and mine
library(gapminder) # gapminder data
library(stringr)
```

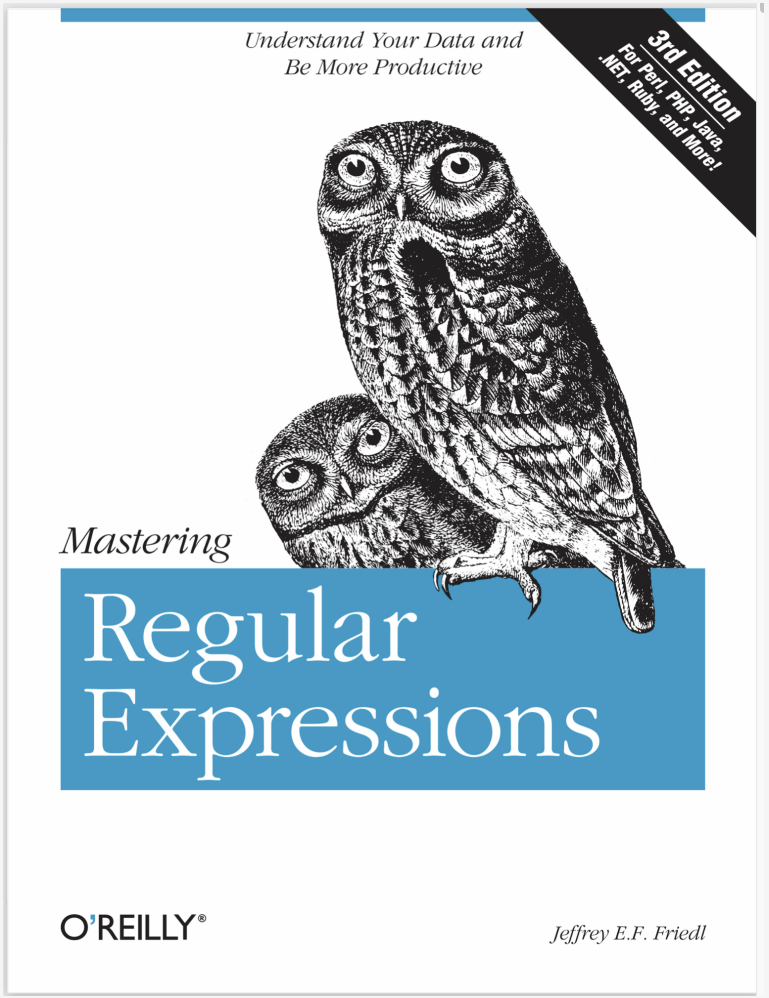
Regular Expressions

Or, waiter, there appears to be a language inside my language

stringr is your gateway to regexps

```
library(stringr) # It's loaded by default with library(tidyverse)
```

regexps are their own whole world



This book is a thing of beauty.

Searching for patterns

A regular expression is a way of searching for a piece of text, or *pattern*, inside some larger body of text, called a *string*.

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The simplest sort of search is like the "Find" functionality in a Word Processor, where the pattern is a literal letter, number, punctuation mark, word or series of words and the text is a document that gets searched one line at a time. The next step up is "Find and Replace".

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Every pattern-searching function in `stringr` has the same basic form:

```
str_view(<STRING>, <PATTERN>, [...]) # where [...] means "maybe some options"
```

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```

Functions that *replace* as well as *detect* strings all have this form:

```
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```

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Every pattern-searching function in `stringr` has the same basic form:

```
str_view(<STRING>, <PATTERN>, [...]) # where [...] means "maybe some options"
```

Functions that *replace* as well as *detect* strings all have this form:

```
str_replace(<STRING>, <PATTERN>, <REPLACEMENT>)
```

(If you think about it, `<STRING>`, `<PATTERN>` and `<REPLACEMENT>` above are all kinds of pattern: they are meant to "stand for" all kinds of text, not be taken literally.)

Searching for patterns

Here I'll follow the exposition in Wickham & Grolemund (2017).

```
x ← c("apple", "banana", "pear")

str_view(x, "an")
```

```
## [2] │ b<an><an>a
```

Searching for patterns

Regular expressions get their real power from *wildcards*, i.e. tokens that match more than just literal strings, but also more general and more complex patterns.

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The most general pattern-matching token is, "Match everything!" This is represented by the period, or `.`]

Searching for patterns

Regular expressions get their real power from *wildcards*, i.e. tokens that match more than just literal strings, but also more general and more complex patterns.

The most general pattern-matching token is, "Match everything!" This is represented by the period, or `.`]

But ... if "`.`" matches any character, how do you specifically match the character "`.`"?

Escaping

You have to "escape" the period to tell the regex you want to match it exactly, rather than interpret it as meaning "match anything".

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regexs use the backslash, ****, to signal "escape the next character".

To match a ".", you need the regex "**\.**"

Hang on, I see a further problem

We use strings to represent regular expressions. `\` is also used as an escape symbol in strings. So to create the regular expression `.` we need the string "`\.`"

```
# To create the regular expression, we need \\
dot ← "\\."

# But the expression itself only contains one:
writeLines(dot)
```

```
## \.
```

```
# And this tells R to look for an explicit .
str_view(c("abc", "a.c", "bef"), "a\\.c")
```

```
## [2] │ <a.c>
```

But … then how do you match a literal \?

```
x ← "a\\b"
writeLines(x)
```

```
## a\b
```

```
#> a\b

str_view(x, "\\\\") # you need four!
```

```
## [1] │ a<\>b
```

But … then how do you match a literal \?

This is the price we pay for having to express searches for patterns using a language containing these same characters, which we may also want to search for.

I *promise* this will pay off

Use **^** to match the start of a string.

Use **$** to match the end of a string.

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Use **$** to match the end of a string.

```
x ← c("apple", "banana", "pear")
str_view(x, "^a")
```

```
## [1] │ <a>pple
```

I *promise* this will pay off

Use ^ to match the start of a string.

Use $ to match the end of a string.

```
x ← c("apple", "banana", "pear")
str_view(x, "^a")
```

```
## [1] │ <a>pple
```

```
str_view(x, "a$")
```

```
## [2] │ banan<a>
```

Matching start and end

To force a regular expression to only match a complete string, anchor it with both ^ and $

Matching start and end

To force a regular expression to only match a complete string, anchor it with both **^** and **$**

```
x ← c("apple pie", "apple", "apple cake")
str_view(x, "apple")
```

```
## [1] │ <apple> pie
## [2] │ <apple>
## [3] │ <apple> cake
```

Matching start and end

To force a regular expression to only match a complete string, anchor it with both **^** and **$**

```
x ← c("apple pie", "apple", "apple cake")
str_view(x, "apple")
```

```
## [1] │ <apple> pie
## [2] │ <apple>
## [3] │ <apple> cake
```

```
str_view(x, "^apple$")
```

```
## [2] │ <apple>
```

Matching character classes

`\d` matches any digit.

`\s` matches any whitespace (e.g. space, tab, newline).

`[abc]` matches a, b, or c.

`[^abc]` matches anything except a, b, or c.

Matching the *special* characters

Look for a literal character that normally has special meaning in a regex

```
str_view(c("abc", "a.c", "a*c", "a c"), "a[.]c")
```

```
## [2] │ <a.c>
```

Matching the *special* characters

Look for a literal character that normally has special meaning in a regex

```
str_view(c("abc", "a.c", "a*c", "a c"), "a[.]c")
```

```
## [2] │ <a.c>
```

```
str_view(c("abc", "a.c", "a*c", "a c"), ".[*]c")
```

```
## [3] │ <a*c>
```

Alternation

Use parentheses to make the precedence of | clear:

```
str_view(c("groy", "grey", "griy", "gray"), "gr(e|a)y")
```

```
## [2] │ <grey>
## [4] │ <gray>
```

Repeated patterns

? is 0 or 1

+ is 1 or more

***** is 0 or more

```
x ← "1888 is the longest year in Roman numerals: MDCCCLXXXVIII"
str_view(x, "CC?")
```

```
## [1] │ 1888 is the longest year in Roman numerals: MD<CC><C>LXXXVIII
```

Repeated patterns

? is 0 or 1

+ is 1 or more

***** is 0 or more

```
str_view(x, "CC+")
```

```
## [1] │ 1888 is the longest year in Roman numerals: MD<CCC>LXXXVIII
```

Repeated patterns

? is 0 or 1

+ is 1 or more

***** is 0 or more

```
x ← "1888 is the longest year in Roman numerals: MDCCCLXXXVIII"
str_view(x, 'C[LX]+')
```

```
## [1] │ 1888 is the longest year in Roman numerals: MDCC<CLXXX>VIII
```

Exact numbers of repetitions

`{n}` is exactly n

`{n,}` is n or more

`{,m}` is at most m

`{n,m}` is between n and m

```
str_view(x, "C{2}")
```

```
## [1] │ 1888 is the longest year in Roman numerals: MD<CC>CLXXXVIII
```

Exact numbers of repetitions

`{n}` is exactly n

`{n,}` is n or more

`{,m}` is at most m

`{n,m}` is between n and m

```
str_view(x, "C{2,}")
```

```
## [1] │ 1888 is the longest year in Roman numerals: MD<CCC>LXXXVIII
```

`{n}` is exactly n

`{n,}` is n or more

`{,m}` is at most m

`{n,m}` is between n and m

```
str_view(x, "C{2,3}")
```

Exact numbers of repetitions

`{n}` is exactly n

`{n,}` is n or more

`{,m}` is at most m

`{n,m}` is between n and m

By default these are *greedy* matches. You can make them "lazy", matching the shortest string possible by putting a **?** after them. **This is often very useful!**

```
str_view(x, 'C[LX]+?')
```

```
## [1] │ 1888 is the longest year in Roman numerals: MDCC<CL>XXXVIII
```

And finally ... backreferences

```
fruit # built into stringr
```

```
##  [1] "apple"            "apricot"          "avocado"
##  [4] "banana"           "bell pepper"      "bilberry"
##  [7] "blackberry"       "blackcurrant"     "blood orange"
## [10] "blueberry"        "boysenberry"      "breadfruit"
## [13] "canary melon"     "cantaloupe"       "cherimoya"
## [16] "cherry"           "chili pepper"     "clementine"
## [19] "cloudberry"       "coconut"          "cranberry"
## [22] "cucumber"         "currant"          "damson"
## [25] "date"             "dragonfruit"      "durian"
## [28] "eggplant"         "elderberry"       "feijoa"
## [31] "fig"              "goji berry"       "gooseberry"
## [34] "grape"            "grapefruit"       "guava"
## [37] "honeydew"         "huckleberry"      "jackfruit"
## [40] "jambul"           "jujube"           "kiwi fruit"
## [43] "kumquat"          "lemon"            "lime"
## [46] "loquat"           "lychee"           "mandarine"
## [49] "mango"            "mulberry"         "nectarine"
## [52] "nut"              "olive"            "orange"
## [55] "pamelo"           "papaya"           "passionfruit"
## [58] "peach"            "pear"             "persimmon"
## [61] "physalis"         "pineapple"        "plum"
## [64] "pomegranate"      "pomelo"           "purple mangosteen"
## [67] "quince"           "raisin"           "rambutan"
## [70] "raspberry"        "redcurrant"       "rock melon"
## [73] "salal berry"      "satsuma"          "star fruit"
## [76] "strawberry"       "tamarillo"        "tangerine"
## [79] "ugli fruit"       "watermelon"
```

Grouping and backreferences

Find all fruits that have a repeated pair of letters:

```
str_view(fruit, "(..)\\1", match = TRUE)
```

```
##  [4] │ b<anan>a
## [20] │ <coco>nut
## [22] │ <cucu>mber
## [41] │ <juju>be
## [56] │ <papa>ya
## [73] │ s<alal> berry
```

Grouping and backreferences

Backreferences and grouping will be very useful for string *replacements*.

OK that was a lot

Learning and testing regexps

Practice with a tester like https://regexr.com

Or an app like Patterns

The regex engine or "flavor" used by `stringr` is Perl- or PCRE-like.

Example: Politics and Placenames

```
library(ukelection2019)
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019
```

```
## # A tibble: 3,320 × 13
##    cid     constituency electorate party_name cand
##    <chr>   <chr>             <int> <chr>      <chr
##  1 W07000… Aberavon          50747 Labour     Step
##  2 W07000… Aberavon          50747 Conservat… Char
##  3 W07000… Aberavon          50747 The Brexi… Glen
##  4 W07000… Aberavon          50747 Plaid Cym… Nige
##  5 W07000… Aberavon          50747 Liberal D… Shei
##  6 W07000… Aberavon          50747 Independe… Capt
##  7 W07000… Aberavon          50747 Green      Gior
##  8 W07000… Aberconwy         44699 Conservat… Robi
##  9 W07000… Aberconwy         44699 Labour     Emil
## 10 W07000… Aberconwy         44699 Plaid Cym… Lisa
## # ℹ 3,310 more rows
## # ℹ 6 more variables: vote_share_change <dbl>, tot
## #   vrank <int>, turnout <dbl>, fname <chr>, lname
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency)
```

```
## # A tibble: 3,320 × 13
## # Groups:   constituency [650]
##    cid     constituency electorate party_name cand
##    <chr>   <chr>             <int> <chr>      <chr
##  1 W07000… Aberavon          50747 Labour     Step
##  2 W07000… Aberavon          50747 Conservat… Char
##  3 W07000… Aberavon          50747 The Brexi… Glen
##  4 W07000… Aberavon          50747 Plaid Cym… Nige
##  5 W07000… Aberavon          50747 Liberal D… Shei
##  6 W07000… Aberavon          50747 Independe… Capt
##  7 W07000… Aberavon          50747 Green      Gior
##  8 W07000… Aberconwy         44699 Conservat… Robi
##  9 W07000… Aberconwy         44699 Labour     Emil
## 10 W07000… Aberconwy         44699 Plaid Cym… Lisa
## # ℹ 3,310 more rows
## # ℹ 6 more variables: vote_share_change <dbl>, tot
## #   vrank <int>, turnout <dbl>, fname <chr>, lname
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes)
```

```
## # A tibble: 650 × 13
## # Groups:   constituency [650]
##    cid     constituency electorate party_name cand
##    <chr>   <chr>             <int> <chr>      <chr
##  1 W07000… Aberavon          50747 Labour     Step
##  2 W07000… Aberconwy         44699 Conservat… Robi
##  3 S14000… Aberdeen No…      62489 Scottish … Kirs
##  4 S14000… Aberdeen So…      65719 Scottish … Step
##  5 S14000… Aberdeenshi…      72640 Conservat… Andr
##  6 S14000… Airdrie & S…      64008 Scottish … Neil
##  7 E14000… Aldershot         72617 Conservat… Leo
##  8 E14000… Aldridge-Br…      60138 Conservat… Wend
##  9 E14000… Altrincham …      73096 Conservat… Graha
## 10 W07000… Alyn & Dees…      62783 Labour     Mark
## # ℹ 640 more rows
## # ℹ 6 more variables: vote_share_change <dbl>, tot
## #   vrank <int>, turnout <dbl>, fname <chr>, lname
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes) ▷
  ungroup()
```

```
## # A tibble: 650 × 13
##    cid     constituency electorate party_name cand
##    <chr>   <chr>              <int> <chr>      <chr
##  1 W07000… Aberavon           50747 Labour     Step
##  2 W07000… Aberconwy          44699 Conservat… Robi
##  3 S14000… Aberdeen No…       62489 Scottish … Kirs
##  4 S14000… Aberdeen So…       65719 Scottish … Step
##  5 S14000… Aberdeenshi…       72640 Conservat… Andr
##  6 S14000… Airdrie & S…       64008 Scottish … Neil
##  7 E14000… Aldershot          72617 Conservat… Leo
##  8 E14000… Aldridge-Br…       60138 Conservat… Wend
##  9 E14000… Altrincham …       73096 Conservat… Graha
## 10 W07000… Alyn & Dees…       62783 Labour     Mark
## # ℹ 640 more rows
## # ℹ 6 more variables: vote_share_change <dbl>, tot
## #   vrank <int>, turnout <dbl>, fname <chr>, lname
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes) ▷
  ungroup() ▷
  select(constituency, party_name)
```

```
## # A tibble: 650 × 2
##    constituency                      party_name
##    <chr>                             <chr>
##  1 Aberavon                          Labour
##  2 Aberconwy                         Conservative
##  3 Aberdeen North                    Scottish Nationa
##  4 Aberdeen South                    Scottish Nationa
##  5 Aberdeenshire West & Kincardine   Conservative
##  6 Airdrie & Shotts                  Scottish Nationa
##  7 Aldershot                         Conservative
##  8 Aldridge-Brownhills               Conservative
##  9 Altrincham & Sale West            Conservative
## 10 Alyn & Deeside                    Labour
## # ℹ 640 more rows
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes) ▷
  ungroup() ▷
  select(constituency, party_name) ▷
  mutate(shire = str_detect(constituency, "shire"),
         field = str_detect(constituency, "field"),
         dale = str_detect(constituency, "dale"),
         pool = str_detect(constituency, "pool"),
         ton = str_detect(constituency, "(ton$)|(ton )"),
         wood = str_detect(constituency, "(wood$)|(wood )"),
         saint = str_detect(constituency, "(St )|(Saint)"),
         port = str_detect(constituency, "(Port)|(port)"),
         ford = str_detect(constituency, "(ford$)|(ford )"),
         by = str_detect(constituency, "(by$)|(by )"),
         boro = str_detect(constituency, "(boro$)|(boro )|(borough$)|(borou
         ley = str_detect(constituency, "(ley$)|(ley )|(leigh$)|(leigh )"))
```

```
## # A tibble: 650 × 14
##    constituency party_name shire field dale  pool
##    <chr>        <chr>      <lgl> <lgl> <lgl> <lgl>
##  1 Aberavon     Labour     FALSE FALSE FALSE FALSE
##  2 Aberconwy    Conservat… FALSE FALSE FALSE FALSE
##  3 Aberdeen No… Scottish … FALSE FALSE FALSE FALSE
##  4 Aberdeen So… Scottish … FALSE FALSE FALSE FALSE
##  5 Aberdeenshi… Conservat… TRUE  FALSE FALSE FALSE
##  6 Airdrie & S… Scottish … FALSE FALSE FALSE FALSE
##  7 Aldershot    Conservat… FALSE FALSE FALSE FALSE
##  8 Aldridge-Br… Conservat… FALSE FALSE FALSE FALSE
##  9 Altrincham … Conservat… FALSE FALSE FALSE FALSE
## 10 Alyn & Dees… Labour     FALSE FALSE FALSE FALSE
## # ℹ 640 more rows
## # ℹ 3 more variables: by <lgl>, boro <lgl>, ley <l
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes) ▷
  ungroup() ▷
  select(constituency, party_name) ▷
  mutate(shire = str_detect(constituency, "shire"),
         field = str_detect(constituency, "field"),
         dale = str_detect(constituency, "dale"),
         pool = str_detect(constituency, "pool"),
         ton = str_detect(constituency, "(ton$)|(ton )"),
         wood = str_detect(constituency, "(wood$)|(wood )"),
         saint = str_detect(constituency, "(St )|(Saint)"),
         port = str_detect(constituency, "(Port)|(port)"),
         ford = str_detect(constituency, "(ford$)|(ford )"),
         by = str_detect(constituency, "(by$)|(by )"),
         boro = str_detect(constituency, "(boro$)|(boro )|(borough$)|(borou
         ley = str_detect(constituency, "(ley$)|(ley )|(leigh$)|(leigh )"))
  pivot_longer(shire:ley, names_to = "toponym")
```

```
## # A tibble: 7,800 × 4
##    constituency party_name toponym value
##    <chr>        <chr>      <chr>   <lgl>
##  1 Aberavon     Labour     shire   FALSE
##  2 Aberavon     Labour     field   FALSE
##  3 Aberavon     Labour     dale    FALSE
##  4 Aberavon     Labour     pool    FALSE
##  5 Aberavon     Labour     ton     FALSE
##  6 Aberavon     Labour     wood    FALSE
##  7 Aberavon     Labour     saint   FALSE
##  8 Aberavon     Labour     port    FALSE
##  9 Aberavon     Labour     ford    FALSE
## 10 Aberavon     Labour     by      FALSE
## # ℹ 7,790 more rows
```

Example: Politics and Placenames

```
place_tab ← ukvote2019 ▷
  group_by(constituency) ▷
  slice_max(votes) ▷
  ungroup() ▷
  select(constituency, party_name) ▷
  mutate(shire = str_detect(constituency, "shire"),
         field = str_detect(constituency, "field"),
         dale = str_detect(constituency, "dale"),
         pool = str_detect(constituency, "pool"),
         ton = str_detect(constituency, "(ton$)|(ton )"),
         wood = str_detect(constituency, "(wood$)|(wood )"),
         saint = str_detect(constituency, "(St )|(Saint)"),
         port = str_detect(constituency, "(Port)|(port)"),
         ford = str_detect(constituency, "(ford$)|(ford )"),
         by = str_detect(constituency, "(by$)|(by )"),
         boro = str_detect(constituency, "(boro$)|(boro )|(borough$)|(borough )"),
         ley = str_detect(constituency, "(ley$)|(ley )|(leigh$)|(leigh )")) ▷
  pivot_longer(shire:ley, names_to = "toponym")
```

Example: Politics and Placenames

```
place_tab
```

```
## # A tibble: 7,800 × 4
##    constituency party_name toponym value
##    <chr>        <chr>      <chr>   <lgl>
##  1 Aberavon     Labour     shire   FALSE
##  2 Aberavon     Labour     field   FALSE
##  3 Aberavon     Labour     dale    FALSE
##  4 Aberavon     Labour     pool    FALSE
##  5 Aberavon     Labour     ton     FALSE
##  6 Aberavon     Labour     wood    FALSE
##  7 Aberavon     Labour     saint   FALSE
##  8 Aberavon     Labour     port    FALSE
##  9 Aberavon     Labour     ford    FALSE
## 10 Aberavon     Labour     by      FALSE
## # ℹ 7,790 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym)
```

```
## # A tibble: 7,800 × 4
## # Groups:   party_name, toponym [120]
##    constituency party_name toponym value
##    <chr>        <chr>      <chr>   <lgl>
##  1 Aberavon     Labour     shire   FALSE
##  2 Aberavon     Labour     field   FALSE
##  3 Aberavon     Labour     dale    FALSE
##  4 Aberavon     Labour     pool    FALSE
##  5 Aberavon     Labour     ton     FALSE
##  6 Aberavon     Labour     wood    FALSE
##  7 Aberavon     Labour     saint   FALSE
##  8 Aberavon     Labour     port    FALSE
##  9 Aberavon     Labour     ford    FALSE
## 10 Aberavon     Labour     by      FALSE
## # ℹ 7,790 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour"))
```

```
## # A tibble: 6,816 × 4
## # Groups:   party_name, toponym [24]
##    constituency party_name toponym value
##    <chr>        <chr>      <chr>   <lgl>
##  1 Aberavon     Labour     shire   FALSE
##  2 Aberavon     Labour     field   FALSE
##  3 Aberavon     Labour     dale    FALSE
##  4 Aberavon     Labour     pool    FALSE
##  5 Aberavon     Labour     ton     FALSE
##  6 Aberavon     Labour     wood    FALSE
##  7 Aberavon     Labour     saint   FALSE
##  8 Aberavon     Labour     port    FALSE
##  9 Aberavon     Labour     ford    FALSE
## 10 Aberavon     Labour     by      FALSE
## # ℹ 6,806 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name)
```

```
## # A tibble: 6,816 × 4
## # Groups:   toponym, party_name [24]
##    constituency party_name toponym value
##    <chr>        <chr>      <chr>   <lgl>
##  1 Aberavon     Labour     shire   FALSE
##  2 Aberavon     Labour     field   FALSE
##  3 Aberavon     Labour     dale    FALSE
##  4 Aberavon     Labour     pool    FALSE
##  5 Aberavon     Labour     ton     FALSE
##  6 Aberavon     Labour     wood    FALSE
##  7 Aberavon     Labour     saint   FALSE
##  8 Aberavon     Labour     port    FALSE
##  9 Aberavon     Labour     ford    FALSE
## 10 Aberavon     Labour     by      FALSE
## # ℹ 6,806 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name) ▷
  summarize(freq = sum(value))
```

```
## # A tibble: 24 × 3
## # Groups:   toponym [12]
##    toponym party_name    freq
##    <chr>   <chr>        <int>
##  1 boro    Conservative     7
##  2 boro    Labour           1
##  3 by      Conservative     6
##  4 by      Labour           2
##  5 dale    Conservative     3
##  6 dale    Labour           1
##  7 field   Conservative    10
##  8 field   Labour          10
##  9 ford    Conservative    17
## 10 ford    Labour          12
## # ℹ 14 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name) ▷
  summarize(freq = sum(value)) ▷
  mutate(pct = freq/sum(freq))
```

```
## # A tibble: 24 × 4
## # Groups:   toponym [12]
##    toponym party_name    freq   pct
##    <chr>   <chr>        <int> <dbl>
##  1 boro    Conservative     7 0.875
##  2 boro    Labour           1 0.125
##  3 by      Conservative     6 0.75
##  4 by      Labour           2 0.25
##  5 dale    Conservative     3 0.75
##  6 dale    Labour           1 0.25
##  7 field   Conservative    10 0.5
##  8 field   Labour          10 0.5
##  9 ford    Conservative    17 0.586
## 10 ford    Labour          12 0.414
## # ℹ 14 more rows
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name) ▷
  summarize(freq = sum(value)) ▷
  mutate(pct = freq/sum(freq)) ▷
  filter(party_name == "Conservative")
```

```
## # A tibble: 12 × 4
## # Groups:   toponym [12]
##    toponym party_name    freq   pct
##    <chr>   <chr>        <int> <dbl>
##  1 boro    Conservative     7 0.875
##  2 by      Conservative     6 0.75
##  3 dale    Conservative     3 0.75
##  4 field   Conservative    10 0.5
##  5 ford    Conservative    17 0.586
##  6 ley     Conservative    26 0.722
##  7 pool    Conservative     2 0.286
##  8 port    Conservative     3 0.333
##  9 saint   Conservative     3 0.5
## 10 shire   Conservative    37 0.974
## 11 ton     Conservative    37 0.507
## 12 wood    Conservative     7 0.636
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name) ▷
  summarize(freq = sum(value)) ▷
  mutate(pct = freq/sum(freq)) ▷
  filter(party_name == "Conservative") ▷
  arrange(desc(pct))
```

```
## # A tibble: 12 × 4
## # Groups:   toponym [12]
##    toponym party_name    freq   pct
##    <chr>   <chr>        <int> <dbl>
##  1 shire   Conservative    37 0.974
##  2 boro    Conservative     7 0.875
##  3 by      Conservative     6 0.75
##  4 dale    Conservative     3 0.75
##  5 ley     Conservative    26 0.722
##  6 wood    Conservative     7 0.636
##  7 ford    Conservative    17 0.586
##  8 ton     Conservative    37 0.507
##  9 field   Conservative    10 0.5
## 10 saint   Conservative     3 0.5
## 11 port    Conservative     3 0.333
## 12 pool    Conservative     2 0.286
```

Example: Politics and Placenames

```
place_tab ▷
  group_by(party_name, toponym) ▷
  filter(party_name %in% c("Conservative", "Labour")) ▷
  group_by(toponym, party_name) ▷
  summarize(freq = sum(value)) ▷
  mutate(pct = freq/sum(freq)) ▷
  filter(party_name == "Conservative") ▷
  arrange(desc(pct))
```

```
## # A tibble: 12 × 4
## # Groups:   toponym [12]
##    toponym party_name    freq   pct
##    <chr>   <chr>        <int> <dbl>
##  1 shire   Conservative    37 0.974
##  2 boro    Conservative     7 0.875
##  3 by      Conservative     6 0.75
##  4 dale    Conservative     3 0.75
##  5 ley     Conservative    26 0.722
##  6 wood    Conservative     7 0.636
##  7 ford    Conservative    17 0.586
##  8 ton     Conservative    37 0.507
##  9 field   Conservative    10 0.5
## 10 saint   Conservative     3 0.5
## 11 port    Conservative     3 0.333
## 12 pool    Conservative     2 0.286
```