

# Regular Expressions

*Data Wrangling, Session 5*

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Code Horizons

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# A brief introduction to regular expressions

# 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)
```

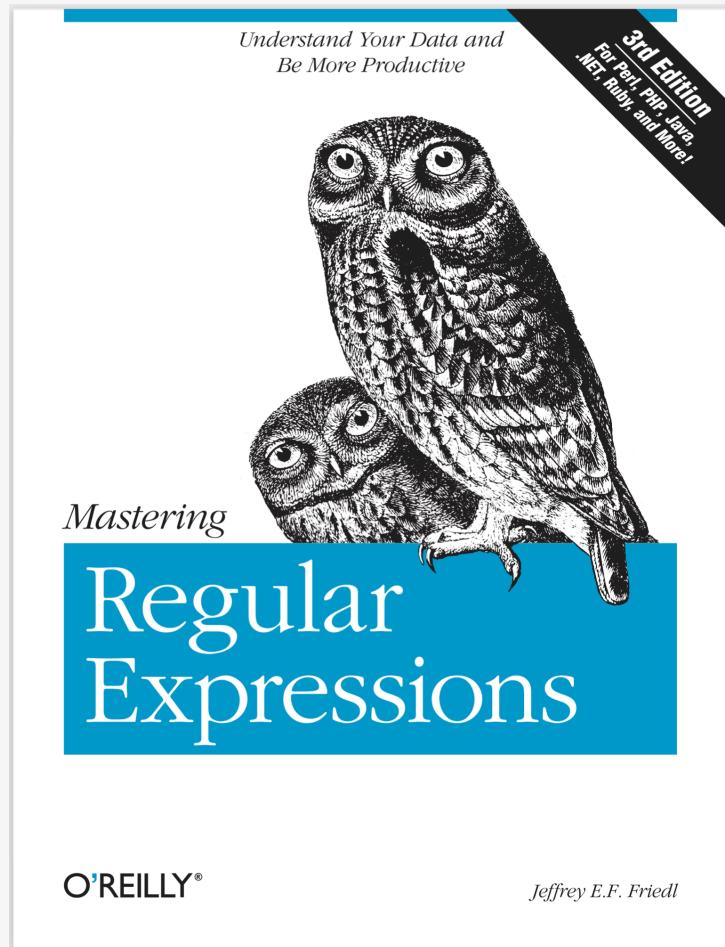
# Regular Expressions

*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)
```

# regexprs 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. The pattern is a literal letter, number, punctuation mark, word or series of words; the text is a document 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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```
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```

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", html=FALSE)  
[2] | b<an><an>a
```

# Searching for patterns

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

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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 literal character `.`?

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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 ... 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 ... 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*

# Matching start and end

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

```
x ← c("apple", "banana", "pear")
str_view(x, "^a")
[1] | <a>pple
```

# Matching start and end

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

```
x ← c("apple", "banana", "pear")
str_view(x, "^a")  
[1] | <a>pple
```

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

```
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 `$`

```
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>
```

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

```
[3] | <a*c>
```

This works for most (but not all) regex metacharacters: `$ . | ? * + () [ {`.

Unfortunately, a few characters have special meaning even inside a character class and must be handled with backslash escapes. These are `] \ ^` and `-`

# Alternation

Use parentheses to make the precedence of the ‘or’ operator | 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
```

# 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{2,3}")  
[1] | 1888 is the longest year in Roman numerals: MD<CCC>LXXXVIII
```

# 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 regexps use *greedy* matches. You can make them match the *shortest* string possible by putting a ? after them. **This is often very useful!**

```
str_view(x, 'C{2,3}?')  
[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

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"
```

# 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 <https://regex101.com>

Or an app like [Patterns](#)

The regex engine or “flavor” used by [stringr](#) is Perl- or PCRE2-like.

# Regexp in practice

# Example: Politics and Placenames

```
library(ukelection2019)
```

# Example: Politics and Placenames

```
library(ukelection2019)  
ukvote2019
```

```
# A tibble: 3,320 × 13  
  cid      constituency electorate party_name candidate  
  <chr>    <chr>        <int> <chr>     <chr>  
  <int>          <dbl>  
  1 W07000... Aberavon      50747 Labour   Stephen ...  
  17008           53.8  
  2 W07000... Aberavon      50747 Conservat... Charlott...  
  6518            20.6  
  3 W07000... Aberavon      50747 The Brexi... Glenda D...  
  3108            9.8  
  4 W07000... Aberavon      50747 Plaid Cym... Nigel Hu...  
  2711            8.6  
  5 W07000... Aberavon      50747 Liberal D... Sheila K...  
  1072            3.4  
  6 W07000... Aberavon      50747 Independen... Captain ...  
  731             2.3  
  7 W07000... Aberavon      50747 Green      Giorgia ...  
  450             1.4  
  8 W07000... Aberconwy     44699 Conservat... Robin Mi...  
  14687           46.1  
  9 W07000... Aberconwy     44699 Labour    Emily Ow...  
  12653           39.7  
 10 W07000... Aberconwy     44699 Plaid Cym... Lisa Goo...
```

# Example: Politics and Placenames

```
library(ukelection2019)  
  
ukvote2019 %>  
  group_by(constituency)
```

```
# A tibble: 3,320 x 13  
# Groups: constituency [650]  
  cid constituency electorate party_name candidate  
  <chr>    <chr>      <int> <chr>      <chr>  
  <int>          <dbl>  
  1 W07000... Aberavon      50747 Labour     Stephen ...  
  17008           53.8  
  2 W07000... Aberavon      50747 Conservat... Charlott...  
  6518            20.6  
  3 W07000... Aberavon      50747 The Brexi... Glenda D...  
  3108            9.8  
  4 W07000... Aberavon      50747 Plaid Cym... Nigel Hu...  
  2711            8.6  
  5 W07000... Aberavon      50747 Liberal D... Sheila K...  
  1072            3.4  
  6 W07000... Aberavon      50747 Independen... Captain ...  
  731             2.3  
  7 W07000... Aberavon      50747 Green       Giorgia ...  
  450             1.4  
  8 W07000... Aberconwy     44699 Conservat... Robin Mi...  
  14687            46.1  
  9 W07000... Aberconwy     44699 Labour      Emily Ow...  
  12653            39.7  
 10 W07000... Aberconwy     44699 Plaid Cym... Lisa Goo...
```

# Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 %>
  group_by(constituency) %>
  slice_max(votes)
```

```
# A tibble: 650 x 13
# Groups: constituency [650]
  cid    constituency electorate party_name candidate
  <chr>   <chr>          <int> <chr>      <chr>
  <int>                <dbl>
  1 W07000... Aberavon      50747 Labour     Stephen ...
  2 W07000... Aberconwy     44699 Conservat... Robin Mi...
  3 S14000... Aberdeen No... 62489 Scottish ... Kirsty B...
  4 S14000... Aberdeen So... 65719 Scottish ... Stephen ...
  5 S14000... Aberdeenshi... 72640 Conservat... Andrew B...
  6 S14000... Airdrie & S... 64008 Scottish ... Neil Gray
  7 E14000... Aldershot     72617 Conservat... Leo Doch...
  8 E14000... Aldridge-Br... 60138 Conservat... Wendy Mo...
  9 E14000... Altrincham ... 73096 Conservat... Graham B...
 10 W07000... Alyn & Dees... 62783 Labour     Mark Tami
```

# Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 %>
  group_by(constituency) %>
  slice_max(votes) %>
  ungroup()
```

```
# A tibble: 650 x 13
  cid      constituency electorate party_name candidate
  <chr>    <chr>        <int> <chr>      <chr>
  <int>                <dbl>
  1 W07000... Aberavon      50747 Labour     Stephen ...
  17008                 53.8
  2 W07000... Aberconwy    44699 Conservat... Robin Mi...
  14687                 46.1
  3 S14000... Aberdeen No... 62489 Scottish ... Kirsty B...
  20205                 54
  4 S14000... Aberdeen So... 65719 Scottish ... Stephen ...
  20388                 44.7
  5 S14000... Aberdeenshi... 72640 Conservat... Andrew B...
  22752                 42.7
  6 S14000... Airdrie & S... 64008 Scottish ... Neil Gray
  17929                 45.1
  7 E14000... Aldershot    72617 Conservat... Leo Doch...
  27980                 58.4
  8 E14000... Aldridge-Br... 60138 Conservat... Wendy Mo...
  27850                 70.8
  9 E14000... Altrincham ... 73096 Conservat... Graham B...
  26311                 48
  10 W07000... Alyn & Dees... 62783 Labour     Mark Tami
  18271                 42.5
```

# 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 National
  Party
  4 Aberdeen South      Scottish National
  Party
  5 Aberdeenshire West & Kincardine Conservative
  6 Airdrie & Shotts    Scottish National
  Party
  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$)|(boro )|(borough$)|(borough )"),
         ley = str_detect(constituency, "(ley$)|(ley )|(leigh$)|(leigh )"))
```

```
# A tibble: 650 x 14
  constituency party_name shire field dale pool ton
  <chr>        <chr>    <lgl> <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
```

# 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$)|(boro )|(borough$)|(borough )"),
         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
```