

Regular Expressions

Data Wrangling, Session 5

Kieran Healy
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

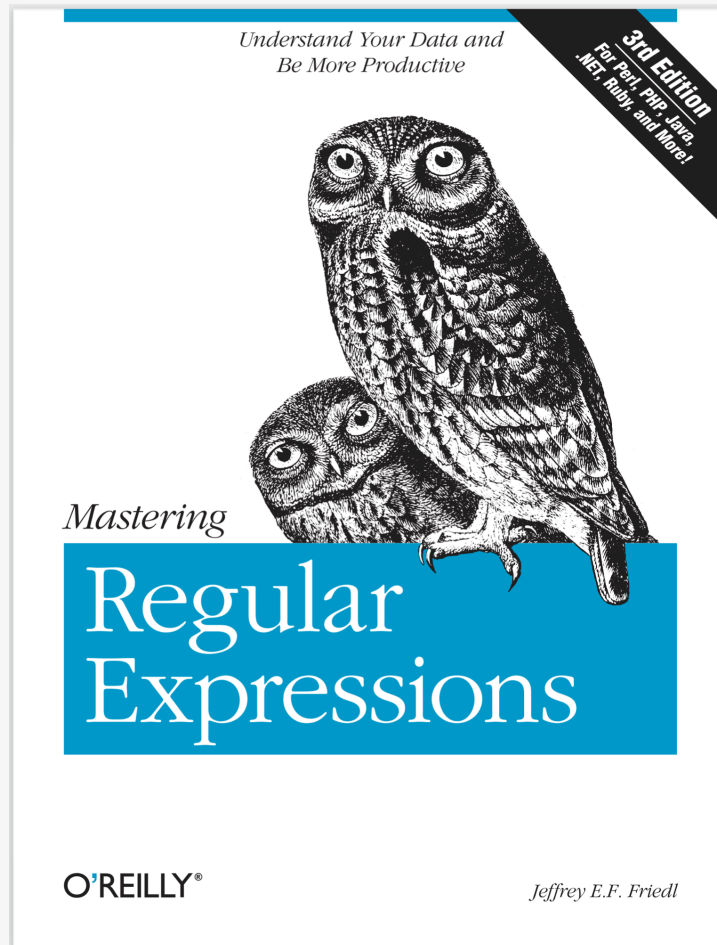
Or, waiter, there appears to be a language inside my language

stringr is your gateway to regexps

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

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. 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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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:

```
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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", html=FALSE)
```

```
[2] | b<an><an>a
```

Searching for patterns

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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.

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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 literal character `.`?

Escaping

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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”.

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

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 ... 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(ela)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.

Regexps 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
votes vote_share_percent
<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 Independe... 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...
2704 8.5
```

Example: Politics and Placenames

```
library(ukelection2019)

ukvote2019 >
  group_by(constituency)
```

```
# A tibble: 3,320 × 13
# Groups:   constituency [650]
   cid      constituency electorate party_name candidate
votes vote_share_percent
  <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 Independe... 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 × 13  
# Groups:   constituency [650]  
   cid constituency electorate party_name candidate  
votes vote_share_percent  
  <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
```


Example: Politics and Placenames

```
library(ukelection2019)
```

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

```
# A tibble: 650 × 13  
  cid      constituency electorate party_name candidate  
votes vote_share_percent  
  <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  
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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 × 14
  constituency party_name shire field dale pool ton
wood saint port ford
  <chr>          <chr>      <lgl> <lgl> <lgl> <lgl> <lgl>
<lgl> <lgl> <lgl> <lgl>
1 Aberavon      Labour      FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
2 Aberconwy     Conservat... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
3 Aberdeen No... Scottish ... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
4 Aberdeen So... Scottish ... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
5 Aberdeenshi... Conservat... TRUE  FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
6 Airdrie & S... Scottish ... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
7 Aldershot     Conservat... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
8 Aldridge-Br... Conservat... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
9 Altrincham ... Conservat... FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE FALSE
10 Alyn & Dees... Labour      FALSE FALSE FALSE FALSE FALSE
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(part_name, toponym) ►  
  filter(part_name %in% c("Conservative", "Labour"))
```

```
# A tibble: 6,816 × 4  
# Groups:   part_name, toponym [24]  
  constituency part_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(part_name, toponym) ►  
  filter(part_name %in% c("Conservative", "Labour")) ►  
  group_by(toponym, part_name)
```

```
# A tibble: 6,816 × 4  
# Groups:   toponym, part_name [24]  
  constituency part_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
```

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```
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
```

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```
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
```

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```
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
```

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```
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
```

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```
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
```