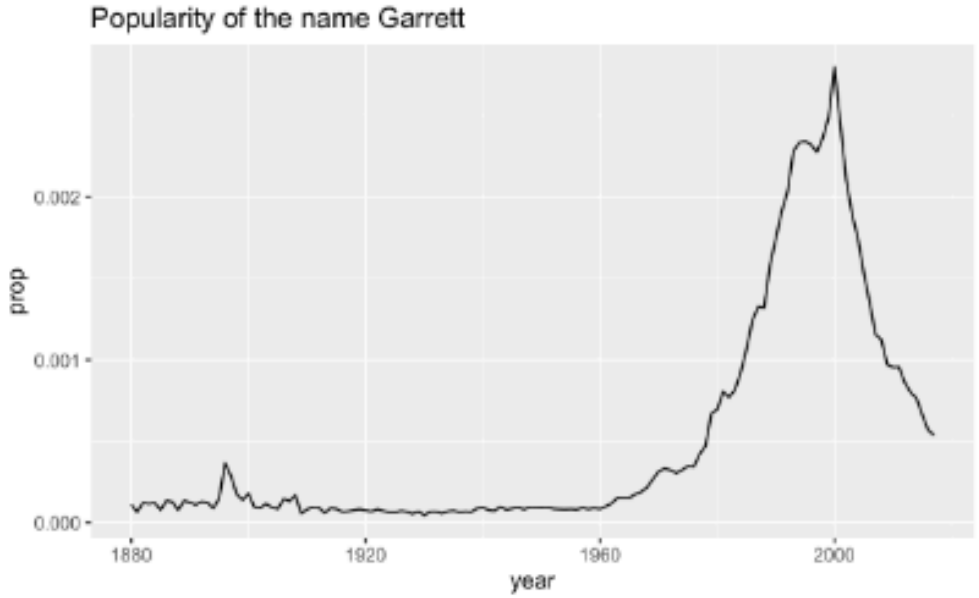
Your name

The history of your name

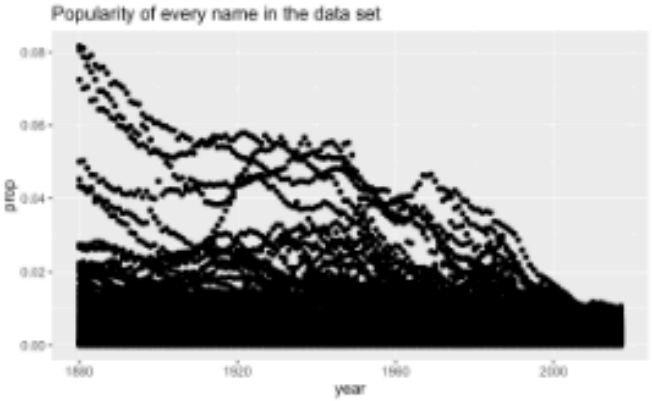
You can use the data in `babynames` to make graphs like this, which reveal the history of a name, perhaps your name.



But before you do, you will need to trim down `babynames`. At the moment, there are more rows in `babynames` than you need to build your plot.

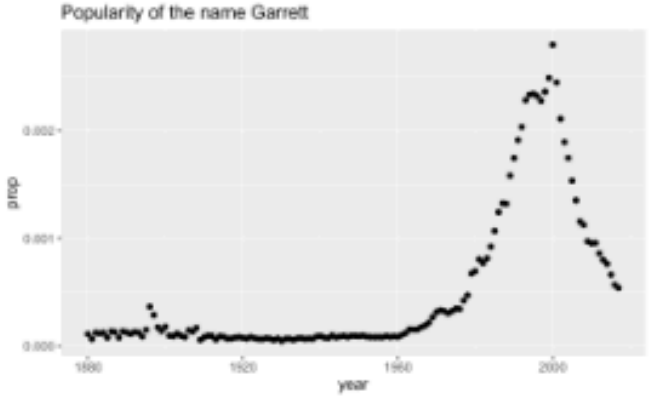
An example

To see what I mean, consider how I made the plot above: I began with the entire data set, which if plotted as a scatterplot would've looked like this.

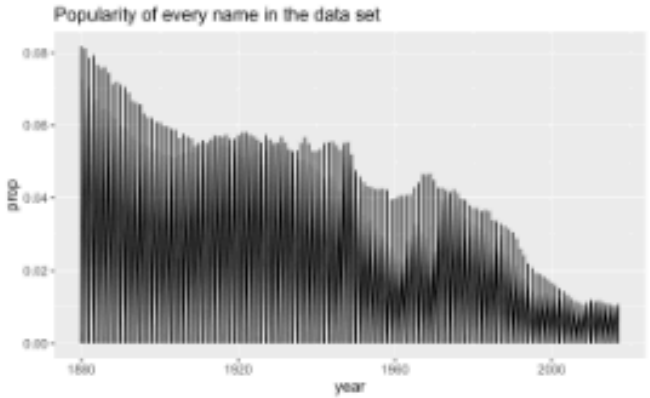


I then narrowed the data to just the rows that contain my name, before plotting the data with a line geom. Here's how the rows with just my name look as a scatterplot.

I then narrowed the data to just the rows that contain my name, before plotting the data with a line geom. Here's how the rows with just my name look as a scatterplot.



If I had skipped this step, my line graph would've connected all of the points in the large data set, creating an uninformative graph.



Your goal in this section is to repeat this process for your own name (or a name that you choose). Along the way, you will learn a set of functions that isolate information within a data set.

Isolating data

This type of task occurs often in Data Science: you need to extract data from a table before you can use it. You can do this task quickly with three functions that come in the dplyr package:

1. **select()** - which extracts columns from a data frame
2. **filter()** - which extracts rows from a data frame
3. **arrange()** - which moves important rows to the top of a data frame

Each function takes a data frame or tibble as it's first argument and returns a new data frame or tibble as its output.

select()

`select()` extracts columns of a data frame and returns the columns as a new data frame. To use `select()`, pass it the name of a data frame to extract columns from, and then the names of the columns to extract. The column names do not need to appear in quotation marks or be prefixed with a `$`; `select()` knows to find them in the data frame that you supply.

Exercise - select()

Use the example below to get a feel for `select()`. Can you extract just the `name` column? How about the `name` and `year` columns? How about all of the columns except `prop`?

Code | Start Over | Solution | Run Code

```
1 select(babynames, name, sex)
2
3
```

```
# A tibble: 1,924,665 x 2
   name      sex
   <chr>     <chr>
 1 Mary      F
 2 Anna      F
 3 Emma      F
 4 Elizabeth F
 5 Minnie    F
 6 Margaret  F
 7 Ida       F
 8 Alice     F
 9 Bertha    F
10 Sarah     F
# … with 1,924,655 more rows
```

select() helpers

You can also use a series of helpers with `select()`. For example, if you place a minus sign before a column name, `select()` will return every column but that column. Can you predict how the minus sign will work here?

Code | Start Over | Run Code

```
1 select(babynames, -c(n, prop))
2
3
```

The table below summarizes the other `select()` helpers that are available in dplyr. Study it, and then click "Continue" to test your understanding.

Helper Function	Use	Example
-	Columns except	`select(babynames, -prop)`
:	Columns between (inclusive)	`select(babynames, year:n)`
contains()	Columns that contains a string	`select(babynames, contains("n"))`
ends_with()	Columns that ends with a string	`select(babynames, ends_with("n"))`
matches()	Columns that matches a regex	`select(babynames, matches("n"))`
num_range()	Columns with a numerical suffix in the range	Not applicable with `babynames`
one_of()	Columns whose name appear in the given set	`select(babynames, one_of(c("sex", "gender")))`
starts_with()	Columns that starts with a string	`select(babynames, starts_with("n"))`

✓ select() quiz

Which of these is not a way to select the `name` and `n` columns together?

- select(babynames, -c(year, sex, prop)) ✗
- select(babynames, name:n) ✗
- select(babynames, starts_with("n")) ✗
- select(babynames, ends_with("n")) ✓

Correct!

filter()

`filter()` extracts rows from a data frame and returns them as a new data frame. As with `select()`, the first argument of `filter()` should be a data frame to extract rows from. The arguments that follow should be logical tests; `filter()` will return every row for which the tests return `TRUE`.

✓ filter in action

For example, the code chunk below returns every row with the name "Sea" in `babynames`.

```
filter(babynames, name == "Sea")
```

```
## # A tibble: 4 x 5
##    year sex   name      n       prop
##   <dbl> <chr> <chr> <int>      <dbl>
## 1  1982 F     Sea       5 0.00000276
## 2  1985 M     Sea       6 0.00000312
## 3  1986 M     Sea       5 0.0000026
## 4  1998 F     Sea       5 0.00000258
```

✓ Logical tests

To get the most from filter, you will need to know how to use R's logical test operators, which are summarised below.

Logical operator	tests	Example
`>`	Is `x` greater than `y`?	`x > y`
`>=`	Is `x` greater than or equal to `y`?	`x >= y`
`<`	Is `x` less than `y`?	`x < y`
`<=`	Is `x` less than or equal to `y`?	`x <= y`
`==`	Is `x` equal to `y`?	`x == y`
`!=`	Is `x` not equal to `y`?	`x != y`
`is.na()`	Is `x` an `NA`?	`is.na(x)`
`!is.na()`	Is `x` not an `NA`?	`!is.na(x)`

✓ Exercise - Logical Operators

See if you can use the logical operators to manipulate our code below to show:

- All of the names where prop is greater than or equal to 0.08
- All of the children named "Khaleesi"
- All of the names that have a missing value for `n` (Hint: this should return an empty data set).

Code | Start Over | Solution | Run Code

```
1 filter(babynames, name == "Sea")
2
3
```

```
# A tibble: 4 x 5
   year sex   name      n       prop
  <dbl> <chr> <chr> <int>      <dbl>
1  1982 F     Sea       5 0.00000276
2  1985 M     Sea       6 0.00000312
3  1986 M     Sea       5 0.0000026
4  1998 F     Sea       5 0.00000258
```

✓ Two common mistakes

When you use logical tests, be sure to look out for two common mistakes. One appears in each code chunk below. Can you find them? When you spot a mistake, fix it and then run the chunk to confirm that it works.

```
filter(babynames, name = "Sea")
```

Code | Start Over | Solution | Run Code | Submit Answer

```
1 filter(babynames, name == "Sea")
2
3
```

```
# A tibble: 4 x 5
   year sex   name      n       prop
  <dbl> <chr> <chr> <int>      <dbl>
1  1982 F     Sea       5 0.00000276
2  1985 M     Sea       6 0.00000312
3  1986 M     Sea       5 0.0000026
4  1998 F     Sea       5 0.00000258
```

"Good Job! Remember to use == instead of = when testing for equality."

```
filter(babynames, name == Sea)
```

Code | Start Over | Solution | Run Code | Submit Answer

```
1 filter(babynames, name == "Sea")
2
3
```

```
# A tibble: 4 x 5
   year sex   name      n       prop
  <dbl> <chr> <chr> <int>      <dbl>
1  1982 F     Sea       5 0.00000276
2  1985 M     Sea       6 0.00000312
3  1986 M     Sea       5 0.0000026
4  1998 F     Sea       5 0.00000258
```

"Good Job! As written this code would check that name is equal to the contents of the object named Sea, which does not exist."

✓ Two mistakes - Recap

When you use logical tests, be sure to look out for these two common mistakes:

1. using `=` instead of `==` to test for equality.
2. forgetting to use quotation marks when comparing strings, e.g. `name == Abby`, instead of `name == "Abby"`

✓ Combining tests

If you provide more than one test to `filter()`, `filter()` will combine the tests with an **and** statement (`&`): it will only return the rows that satisfy all of the tests.

To combine multiple tests in a different way, use R's Boolean operators. For example, the code below will return all of the children named Sea or Anemone.

```
filter(babynames, name == "Sea" | name == "Anemone")
```

```
## # A tibble: 5 x 5
##    year sex   name        n       prop
##   <dbl> <chr> <chr>   <int>      <dbl>
## 1  1982 F     Sea         5 0.00000276
## 2  1985 M     Sea         6 0.00000312
## 3  1986 M     Sea         5 0.0000026
## 4  1998 F     Sea         5 0.00000258
## 5  2012 F     Anemone     6 0.0000031
```

✓ Boolean operators

You can find a complete list or base R's boolean operators in the table below.

Boolean operator	represents	Example
&	Are *both* `A` and `B` true?	`A & B`
`|`	Are *one or both* of `A` and `B` true?	`A | B`
!	Is `A` *not* true?	`!A`
xor()	Is *one and only one* of `A` and `B` true?	`xor(A, B)`
%in%	Is `x` in the set of `a`, `b`, and `c`?	`x %in% c(a, b, c)`
any()	Are *any* of `A`, `B`, or `C` true?	`any(A, B, C)`
all()	Are *all* of `A`, `B`, or `C` true?	`all(A, B, C)`

✓ Exercise - Combining tests

Use Boolean operators to alter the code chunk below to return only the rows that contain:

- *Girls* named Sea
- Names that were used by exactly 5 or 6 children in 1880
- Names that are one of Acura, Lexus, or Yugo

Code | Start Over | Solution | Run Code

```
1 filter(babynames, name == "Sea" | name == "Anemone")
2
3
```

```
# A tibble: 5 x 5
   year sex   name        n       prop
  <dbl> <chr> <chr>   <int>      <dbl>
1  1982 F     Sea         5 0.00000276
2  1985 M     Sea         6 0.00000312
3  1986 M     Sea         5 0.0000026
4  1998 F     Sea         5 0.00000258
5  2012 F     Anemone     6 0.0000031
```

✓ Two more common mistakes

Logical tests also invite two common mistakes that you should look out for. Each is displayed in a code chunk below, one produces an error and the other is needlessly verbose. Diagnose the chunks and then fix the code.

```
filter(babynames, 10 < n < 20)
```

Code | Start Over | Solution | Run Code | Submit Answer

```
filter(babynames, 10 < n, n < 20)


```

```
# A tibble: 365,458 x 5
    year sex   name           n      prop
   <dbl> <chr> <chr>      <int>     <dbl>
 1  1880 F     Antoinette    19 0.000195
 2  1880 F     Clementine    19 0.000195
 3  1880 F     Edythe        19 0.000195
 4  1880 F     Harriette     19 0.000195
 5  1880 F     Libbie        19 0.000195
 6  1880 F     Lilian        19 0.000195
 7  1880 F     Lue           19 0.000195
 8  1880 F     Lutie         19 0.000195
 9  1880 F     Magdalena     19 0.000195
10  1880 F     Meda          19 0.000195
# … with 365,448 more rows
```

"Good job! You cannot combine two logical tests in R without using a Boolean operator (or at least a comma between filter arguments)."

```
filter(babynames, n == 5 | n == 6 | n == 7 | n == 8 | n == 9)
```

Code | Start Over | Solution | Run Code | Submit Answer

```
filter(babynames, n %in% c(5, 6, 7, 8, 9))


```

```
# A tibble: 811,195 x 5
    year sex   name           n      prop
   <dbl> <chr> <chr>      <int>     <dbl>
 1  1880 F     Adela          9 0.0000922
 2  1880 F     Althea         9 0.0000922
 3  1880 F     Amalia         9 0.0000922
 4  1880 F     Amber          9 0.0000922
 5  1880 F     Angelina       9 0.0000922
 6  1880 F     Annabelle      9 0.0000922
 7  1880 F     Anner          9 0.0000922
 8  1880 F     Arie           9 0.0000922
 9  1880 F     Clarice        9 0.0000922
10  1880 F     Corda          9 0.0000922
# … with 811,185 more rows
```

"Good job! Although the first code works, you should make your code more concise by collapsing multiple or statements into an %in% statement when possible."

arrange()

`arrange()` returns all of the rows of a data frame reordered by the values of a column. As with `select()`, the first argument of `arrange()` should be a data frame and the remaining arguments should be the names of columns. If you give `arrange()` a single column name, it will return the rows of the data frame reordered so that the row with the lowest value in that column appears first, the row with the second lowest value appears second, and so on. If the column contains character strings, `arrange()` will place them in alphabetical order.

✓ Exercise - arrange()

Use the code chunk below to arrange babynames by `n`. Can you tell what the smallest value of `n` is?

Code | Start Over | Solution | Run Code | Submit Answer

```
1 arrange(babynames, n)
2
3
```

```
# A tibble: 1,924,665 x 5
    year sex   name          n      prop
   <dbl> <chr> <chr>     <int>     <dbl>
 1  1880 F     Adelle        5 0.0000512
 2  1880 F     Adina         5 0.0000512
 3  1880 F     Adrienne      5 0.0000512
 4  1880 F     Albertine     5 0.0000512
 5  1880 F     Alya          5 0.0000512
 6  1880 F     Ana           5 0.0000512
 7  1880 F     Araminta      5 0.0000512
 8  1880 F     Arthur        5 0.0000512
 9  1880 F     Birtha        5 0.0000512
10  1880 F     Bulah         5 0.0000512
# … with 1,924,655 more rows
```

"Good job! The compiler of `babynames` used 5 as a cutoff; a name only made it into babynames for a given year and gender if it was used for five or more children."

✓ Tie breakers

If you supply additional column names, `arrange()` will use them as tie breakers to order rows that have identical values in the earlier columns. Add to the code below, to make `prop` a tie breaker. The result should first order rows by value of `n` and then reorder rows within each value of `n` by values of `prop`.

Code | Start Over | Solution | Run Code

```
1 arrange(babynames, n)
2
3
```

```
# A tibble: 1,924,665 x 5
    year sex   name          n      prop
   <dbl> <chr> <chr>     <int>     <dbl>
 1  1880 F     Adelle        5 0.0000512
 2  1880 F     Adina         5 0.0000512
 3  1880 F     Adrienne      5 0.0000512
 4  1880 F     Albertine     5 0.0000512
 5  1880 F     Alya          5 0.0000512
 6  1880 F     Ana           5 0.0000512
 7  1880 F     Araminta      5 0.0000512
 8  1880 F     Arthur        5 0.0000512
 9  1880 F     Birtha        5 0.0000512
10  1880 F     Bulah         5 0.0000512
# … with 1,924,655 more rows
```

✓ desc

If you would rather arrange rows in the opposite order, i.e. from *large* values to *small* values, surround a column name with `desc()`. `arrange()` will reorder the rows based on the largest values to the smallest.

Add a `desc()` to the code below to display the most popular name for 2017 (the largest year in the dataset) instead of 1880 (the smallest year in the dataset).

Code | Start Over | Solution | Run Code

```
1 arrange(babynames, year, desc(prop))
2
3
```

```
# A tibble: 1,924,665 x 5
    year sex   name        n   prop
   <dbl> <chr> <chr>   <int>  <dbl>
 1  1880 M     John     9655 0.0815
 2  1880 M     William  9532 0.0805
 3  1880 F     Mary     7065 0.0724
 4  1880 M     James    5927 0.0501
 5  1880 M     Charles  5348 0.0452
 6  1880 M     George   5126 0.0433
 7  1880 M     Frank    3242 0.0274
 8  1880 F     Anna     2604 0.0267
 9  1880 M     Joseph   2632 0.0222
10  1880 M     Thomas   2534 0.0214
# … with 1,924,655 more rows
```

Think you have it? Click Continue to test yourself.

✓ arrange() quiz

Which name was the most popular for a single gender in a single year? In the code chunk below, use `arrange()` to make the row with the largest value of `prop` appear at the top of the data set.

Code | Start Over | Solution | Run Code

```
1 arrange(babynames, desc(prop))
2
3
```

```
# A tibble: 1,924,665 x 5
    year sex   name        n   prop
   <dbl> <chr> <chr>   <int>  <dbl>
 1  1880 M     John     9655 0.0815
 2  1881 M     John     8769 0.0810
 3  1880 M     William  9532 0.0805
 4  1883 M     John     8894 0.0791
 5  1881 M     William  8524 0.0787
 6  1882 M     John     9557 0.0783
 7  1884 M     John     9388 0.0765
 8  1882 M     William  9298 0.0762
 9  1886 M     John     9026 0.0758
10  1885 M     John     8756 0.0755
# … with 1,924,655 more rows
```

Now arrange `babynames` so that the row with the largest value of `n` appears at the top of the data frame. Will this be the same row? Why or why not?

Code | Start Over | Solution | Run Code | Submit Answer

```
1 arrange(babynames, desc(n))
2
3
4
```

```
# A tibble: 1,924,665 x 5
    year sex   name        n   prop
   <dbl> <chr> <chr>   <int>  <dbl>
 1  1947 F     Linda   99686 0.0548
 2  1948 F     Linda   96209 0.0552
 3  1947 M     James   94756 0.0510
 4  1957 M     Michael 92695 0.0424
 5  1947 M     Robert  91642 0.0493
 6  1949 F     Linda   91016 0.0518
 7  1956 M     Michael 90620 0.0423
 8  1958 M     Michael 90520 0.0420
 9  1948 M     James   88588 0.0497
10  1954 M     Michael 88514 0.0428
# … with 1,924,655 more rows
```

%>%

✓ Steps

Notice how each dplyr function takes a data frame as input and returns a data frame as output. This makes the functions easy to use in a step by step fashion. For example, you could:

1. Filter babynames to just boys born in 2017
2. Select the `name` and `n` columns from the result
3. Arrange those columns so that the most popular names appear near the top.

```
boys_2017 <- filter(babynames, year == 2017, sex == "M")
boys_2017 <- select(boys_2017, name, n)
boys_2017 <- arrange(boys_2017, desc(n))
boys_2017
```

```
## # A tibble: 14,160 x 2
##    name         n
##    <chr>    <int>
##  1 Liam     18728
##  2 Noah     18326
##  3 William  14904
##  4 James    14232
##  5 Logan    13974
##  6 Benjamin 13733
##  7 Mason    13502
##  8 Elijah   13268
##  9 Oliver   13141
## 10 Jacob    13106
## # … with 14,150 more rows
```

✓ Redundancy

The result shows us the most popular boys names from 2017, which is the most recent year in the data set. But take a look at the code. Do you notice how we re-create `boys_2017` at each step so we will have something to pass to the next step? This is an inefficient way to write R code.

You could avoid creating `boys_2017` by nesting your functions inside of each other, but this creates code that is hard to read:

```
arrange(select(filter(babynames, year == 2017, sex == "M"), name, n), desc(n))
```

The dplyr package provides a third way to write sequences of functions: the pipe.

✓ %>%

The pipe operator `%>%` performs an extremely simple task: it passes the result on its left into the first argument of the function on its right. Or put another way, `x %>% f(y)` is the same as `f(x, y)`. This piece of code punctuation makes it easy to write and read series of functions that are applied in a step by step way. For example, we can use the pipe to rewrite our code above:

```
babynames %>%
  filter(year == 2017, sex == "M") %>%
  select(name, n) %>%
  arrange(desc(n))
```

```
## # A tibble: 14,160 x 2
##    name          n
##    <chr>     <int>
##  1 Liam      18728
##  2 Noah      18326
##  3 William   14904
##  4 James     14232
##  5 Logan     13974
##  6 Benjamin  13733
##  7 Mason     13502
##  8 Elijah    13268
##  9 Oliver    13141
## 10 Jacob     13106
## # … with 14,150 more rows
```

As you read the code, pronounce `%>%` as "then". You'll notice that dplyr makes it easy to read pipes. Each function name is a verb, so our code resembles the statement, "Take babynames, *then* filter it by name and sex, *then* select the name and n columns, *then* arrange the results by descending values of n."

dplyr also makes it easy to write pipes. Each dplyr function returns a data frame that can be piped into another dplyr function, which will accept the data frame as its first argument. In fact, dplyr functions are written with pipes in mind: each function does one simple task. dplyr expects you to use pipes to combine these simple tasks to produce sophisticated results.

✓ Exercise - Pipes

I'll use pipes for the remainder of the tutorial, and I will expect you to as well. Let's practice a little by writing a new pipe in the chunk below. The pipe should:

1. Filter babynames to just the girls that were born in 2017
2. Select the `name` and `n` columns
3. Arrange the results so that the most popular names are near the top.

Try to write your pipe without copying and pasting the code from above.

Code | Start Over | Solution | ▶ Run Code

```
babynames %>%
  filter(year == 2017, sex == "F") %>%
  select(name, n) %>%
  arrange(desc(n))
```

```
# A tibble: 18,309 x 2
   name          n
   <chr>     <int>
 1 Emma      19738
 2 Olivia    18632
 3 Ava       15902
 4 Isabella  15100
 5 Sophia    14831
 6 Mia       13437
 7 Charlotte 12893
 8 Amelia    11800
 9 Evelyn    10675
10 Abigail   10551
# … with 18,299 more rows
```

✓ Your name

You've now mastered a set of skills that will let you easily plot the popularity of your name over time. In the code chunk below, use a combination of dplyr and ggplot2 functions with `%>%` to:

1. Trim `babynames` to just the rows that contain your name and your sex
2. Trim the result to just the columns that will appear in your graph (not strictly necessary, but useful practice)
3. Plot the results as a line graph with `year` on the x axis and `prop` on the y axis

Note that the first argument of `ggplot()` takes a data frame, which means you can add `ggplot()` directly to the end of a pipe. However, you will need to switch from `%>%` to `+` to finish adding layers to your plot.

Code | Start Over | Solution | Run Code

```
babynames %>%
  filter(name == "Garrett", sex == "M") %>%
  select(year, prop) %>%
  ggplot() +
    geom_line(aes(x = year, y = prop)) +
    labs(title = "Popularity of the name Garrett")


```