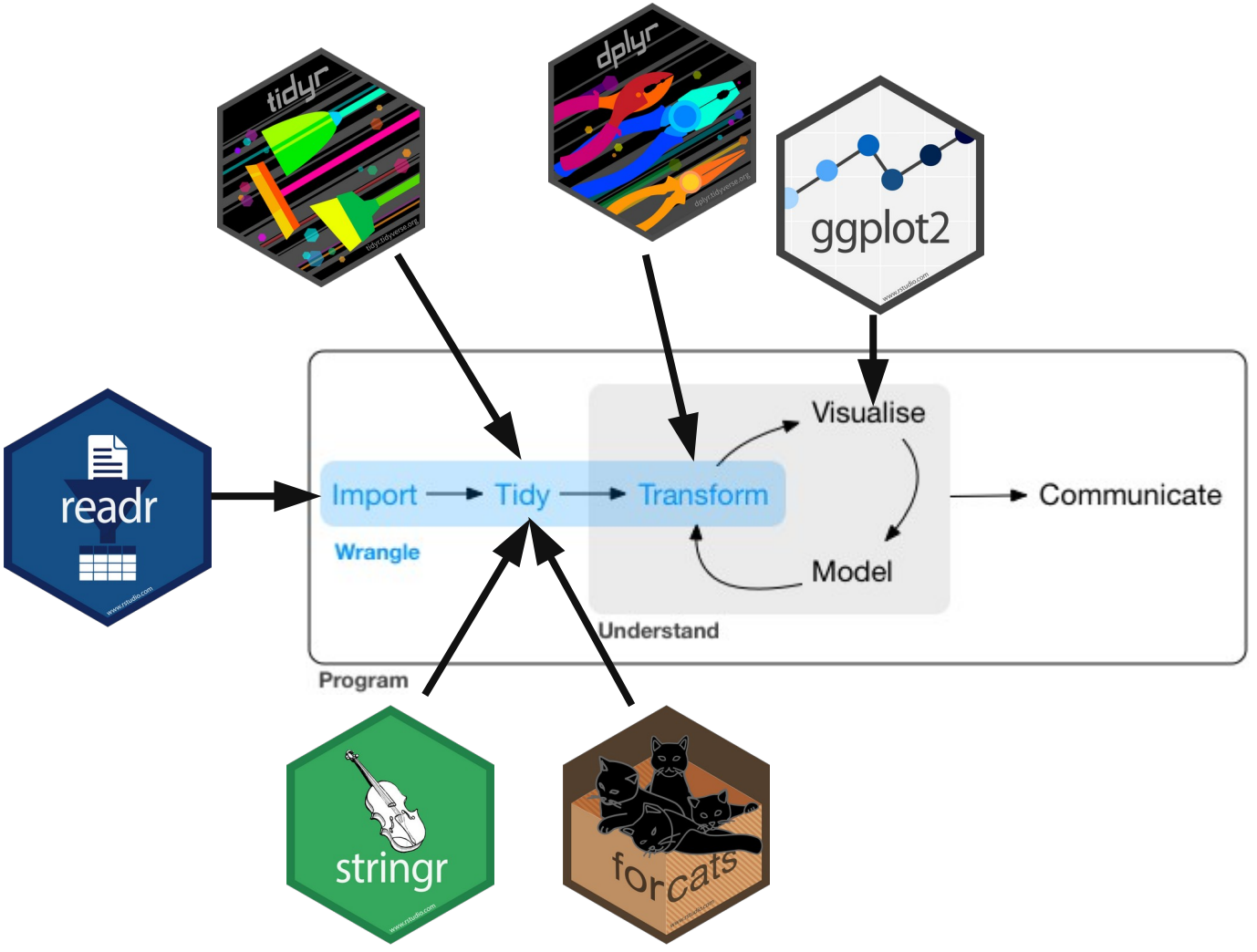
GG606

Exploration & Data Types

Homework

- Pick a year: https://doi.org/10.5683/SP3/OUWVZ3 (physical, chemical, biological)
- Use this: https://doi.org/10.5683/SP2/TNYTQL
  “NW-20-C2-Chronology-Dspec50-2019-with-self-attenuation-SimpleView.xlsx”
  “NW-50-Chronology-Dspec649-2019-withdensity-SIMPLEVIEW with graphs v3.tab”

Homework


tidyr
dplyr
ggplot2
readr
Import
Tidy
Transform
Visualise
Model
Communicate
Wrangle
Understand
Program
stringr
forcats

Transformations

- Look in the `nycflights13::flights` tibble
- Many data types (`dttm`)
- Factor `fctr` is not there but is v useful

dplyr

- “grammar of data manipulation”
- `mutate()` adds new variables that are functions of existing variables
- `select()` picks variables based on their names
- `filter()` picks cases based on their values
- `summarise()` reduces multiple values down to a single summary
- `arrange()` changes the ordering of the rows
- `group_by()` allows you to perform any operation “by group”

Python: pandas, dplython, siuba

dplyr

- `filter(flights, month == 1, day == 1)`
  - data.frame/tibble, expression(s)
- `filter(flights, month = 1)`
  - Why the error?
- Try more complex

dplyr

- `filter(starwars, species == "Human")`

dplyr

- `filter(flights, month == 11 | month == 12)`
- Logical operators

dplyr

- `filter(flights, !(arr_delay > 120 | dep_delay > 120))`
- `filter(flights, arr_delay ⩽ 120, dep_delay ⩽ 120)`

dplyr

- Find all flights that
  - Flew to Houston (IAH or HOU)
  - Were operated by United, American, or Delta
  - From JFK to LAX on Christmas Day

Order rows

- `arrange()` orders the rows of a data frame by the values of selected columns
- `desc()` sorted in descending order
- `arrange(flights, desc(dep_delay))`

Select Columns

- `select()` columns by name or range
- `select(flights, year, month, day)`
- `select(flights, year:day)`
- `select(flights, 1:3)`
- `select(flights, -(month:minute))`

Select + Helpers

- `starts_with("abc")`
- `ends_with("xyz")`
- `contains("ijk")`
- `matches("(.)\\1")`
- `?select()`

Mutate

- ```
  flights_sml ← select(flights,
    year:day,
    ends_with("delay"),
    distance,
    air_time
  )
  ```
- ```
  mutate(flights_sml,
    gain = dep_delay – arr_delay,
    speed = distance / air_time * 60
  )
  ```

Transmute

- ```
  flights_sml ← select(flights,
    year:day,
    ends_with("delay"),
    distance,
    air_time
  )
  ```
- ```
  transmute(flights_sml,
    gain = dep_delay - arr_delay,
    speed = distance / air_time * 60
  )
  ```

Mutate/Transmute

- Arithmetic
- Functions
- Vector-based
- Logical
- Rank
- Cumulative

Grouped Summaries

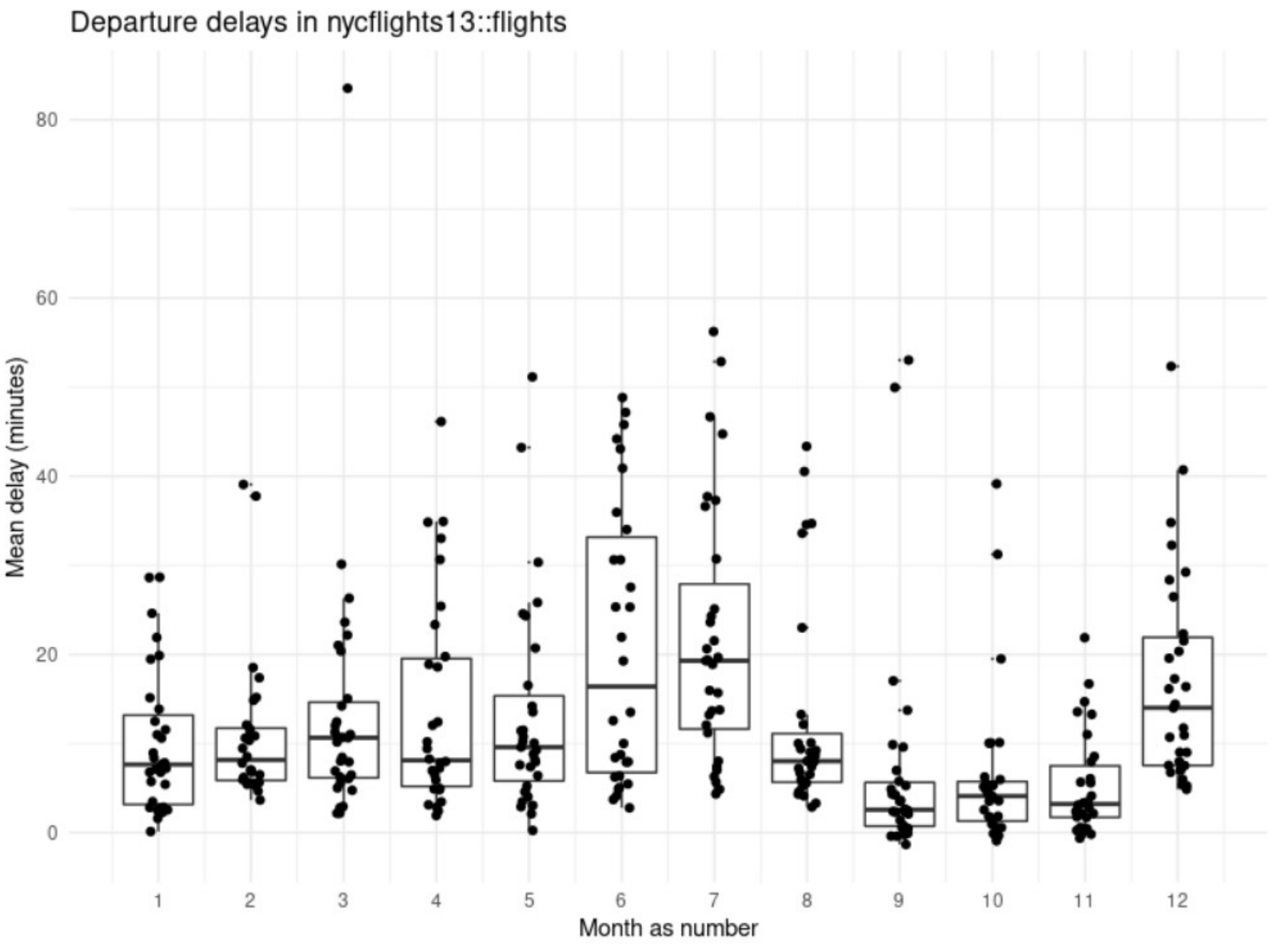
- Collapses data.frame to a single row
  - `summarise(flights, delay = mean(dep_delay, na.rm = TRUE))`
- More powerful when grouped

```
> summarise(flights, delay = mean(dep_delay, na.rm = TRUE))
# A tibble: 1 x 1
  delay
  <dbl>
1  12.6
```

Grouped Summaries

- `by_day ← group_by(flights, year, month, day)`
- `summarise(by_day, delay = mean(dep_delay, na.rm = TRUE))`

```
> by_day ← group_by(flights, year, month, day)
> summarise(by_day, delay = mean(dep_delay, na.rm = TRUE))
`summarise()` regrouping output by 'year', 'month' (override with `.groups` argument)
# A tibble: 365 x 4
# Groups:   year, month [12]
    year month   day delay
   <int> <int> <int> <dbl>
 1  2013     1     1 11.5
 2  2013     1     2 13.9
```


Departure delays in nycflights13::flights
Mean delay (minutes)
0
20
40
60
80
1
2
3
4
5
6
7
8
9
10
11
12
Month as number

Multiple Operations

- The `magrittr` pipe to chain operation (improved semantics) %>%

5.3 |> vs. %>%

While |> and %>% behave identically for simple cases, there are a few crucial differences. These are most likely to affect you if you're a long-term user of %>% who has taken advantage of some of the more advanced features. But they're still good to know about even if you've never used %>% because you're likely to encounter some of them when reading wild-caught code.

- By default, the pipe passes the object on its left-hand side to the first argument of the function on the right-hand side. %>% allows you to change the placement with a . placeholder. For example, x %>% f(1) is equivalent to f(x, 1) but x %>% f(1, .) is equivalent to f(1, x). R 4.2.0 added a _ placeholder to the base pipe, with one additional restriction: the argument has to be named. For example, x |> f(1, y = _) is equivalent to f(1, y = x).

https://r4ds.hadley.nz/workflow-pipes.html#vs.

Pipe Example

- Q: relationship btwn distance and avg delay for each location
  - Group flights by destination.
  - Summarise to compute distance, average delay, and number of flights.
  - Filter to remove noisy points and Honolulu airport, which is almost twice as far away as the next closest airport.

Pipe Example

```
delays ← flights %>%
  group_by(dest) %>%
  summarise(
    count = n(),
    dist = mean(distance, na.rm = TRUE),
    delay = mean(arr_delay, na.rm = TRUE)
  ) %>%
  filter(count > 20, dest ≠ "HNL")
```

Tidy

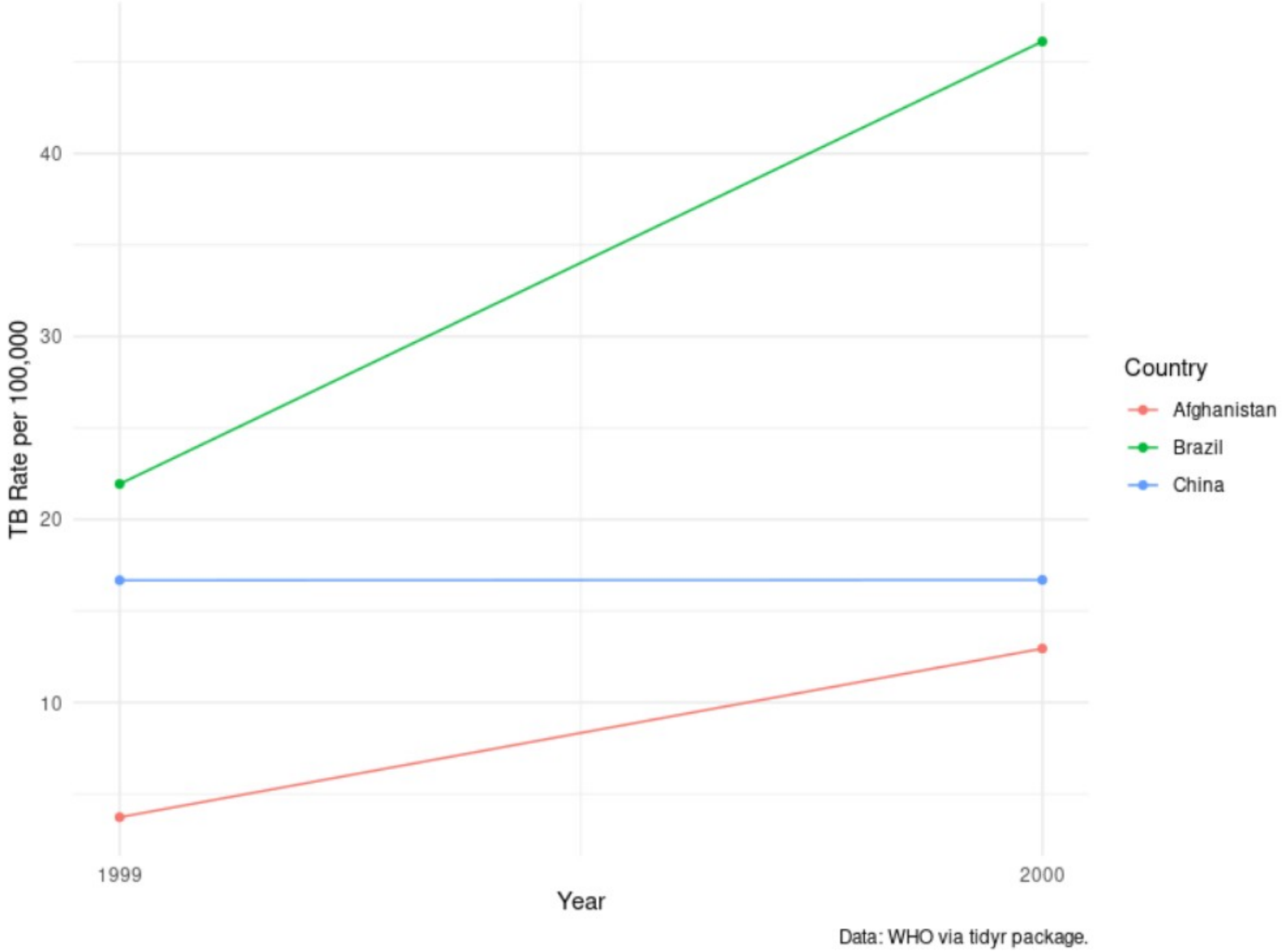
- Examples of tidy data: TB cases
- `table1`
- `table2`
- `table3`
- `table4a`
- `table4b`

```
table1
#> # A tibble: 6 x 4
#>   country      year  cases population
#>   <chr>       <int>  <int>      <int>
#> 1 Afghanistan  1999    745   19987071
#> 2 Afghanistan  2000   2666   20595360
#> 3 Brazil       1999  37737  172006362
#> 4 Brazil       2000  80488  174504898
#> 5 China        1999 212258 1272915272
#> 6 China        2000 213766 1280428583
table2
#> # A tibble: 12 x 4
#>   country      year type           count
#>   <chr>       <int> <chr>          <int>
#> 1 Afghanistan  1999 cases            745
#> 2 Afghanistan  1999 population  19987071
#> 3 Afghanistan  2000 cases           2666
#> 4 Afghanistan  2000 population  20595360
#> 5 Brazil       1999 cases          37737
#> 6 Brazil       1999 population 172006362
#> # … with 6 more rows
```

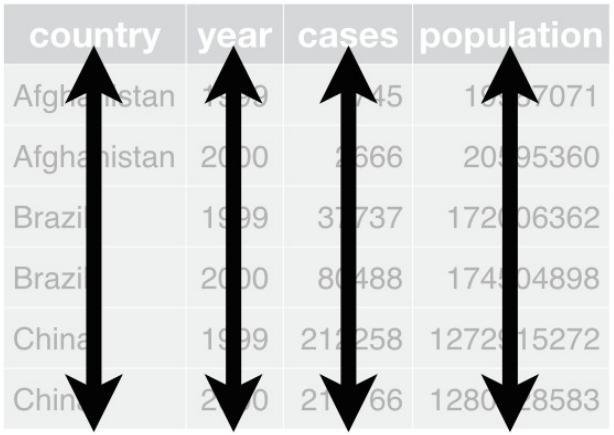
https://r4ds.had.co.nz/tidy-data.html

Plot Rate per 100,000

- Start with `table1`
- Calc rate
- Make plot


40
30
20
10
TB Rate per 100,000
1999
2000
Year
Country
Afghanistan
Brazil
China
Data: WHO via tidyr package.

Tidying



variables

observations

values

Pivoting

- Not PivotTable
- Data often organised to facilitate entry or quick visualisations

Longer

- Take wide, make long
- ```
  table4a %>%
    pivot_longer(c(`1999`, `2000`),
    names_to = "year", values_to = "cases")
  ```


  ```

Joining

- `tidy4a ← table4a %>% pivot_longer(c(`1999`, `2000`), names_to = "year", values_to = "cases")`
- `tidy4b ← table4b %>% pivot_longer(c(`1999`, `2000`), names_to = "year", values_to = "population")`
- `left_join(tidy4a, tidy4b)`

```
#> Joining, by = c("country", "year")
#> # A tibble: 6 x 4
#>   country     year   cases population
#>   <chr>       <chr>  <int>      <int>
#> 1 Afghanistan 1999     745   19987071
#> 2 Afghanistan 2000    2666   20595360
#> 3 Brazil      1999   37737  172006362
#> 4 Brazil      2000   80488  174504898
#> 5 China       1999  212258 1272915272
#> 6 China       2000  213766 1280428583
```

Separate & Unite

- Take long, make wide
- ```
  table3 %>%
    separate()
  ```
- ```
  table5 %>%
    unite()
  ```

Homework

- Found dataset: load, tidy, save, plots
  - Put R-Script and figure in discord
- Same with `nycflights13::weather`
- Work through example to tidy the entire `tidyr::who` dataset in Chapter 12
  - https://r4ds.had.co.nz/tidy-data.html
  - Put a plot with at least 6 countries in discord