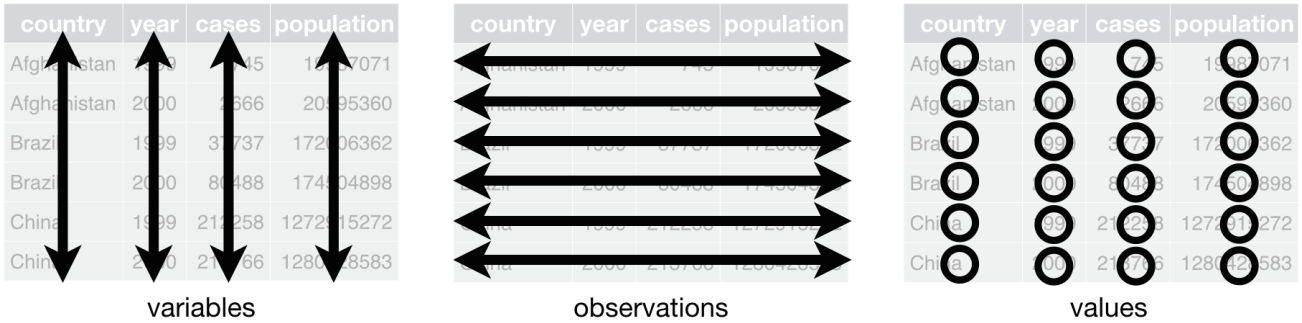
Lesson 10: Tidy data

Learning objectives

- Describe the concept of tidy data
- Determine whether a dataset is in tidy format
- Use tidyr::pivot_wider() and tidyr::pivot_longer() to reshape data frames
- Use tidyr::unite() and tidyr::separate() to merge or separate information from different columns

Three inter-related rules that make a dataset tidy:

- Each variable is a column; each column is a variable.
- Each observation is a row; each row is an observation.
- Each value is a cell; each cell is a single value.



Different ways to display the same data

Which structure is tidy?

	country	year	cases	population
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

	country	year	type	count
1	Afghanistan	1999	cases	745
2	Afghanistan	1999	population	19987071
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5	Brazil	1999	cases	37737
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7	Brazil	2000	cases	80488
8	Brazil	2000	population	174504898
9	China	1999	cases	212258
10	China	1999	population	1272915272
11	China	2000	cases	213766
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	country	year	rate
1	Afghanistan	1999	745/19987071
2	Afghanistan	2000	2666/20595360
3	Brazil	1999	37737/172006362
4	Brazil	2000	80488/174504898
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	country	1999	2000
	row names		
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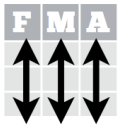
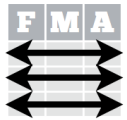
3	China	1272915272	1280428583

In a tidy data set:



Each **variable** is saved in its own **column**

&



Each **observation** is saved in its own **row**

Different ways to display the same data

Tidy data

	country	year	cases	population
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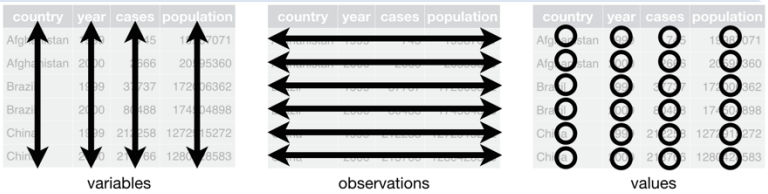
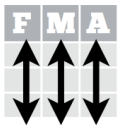
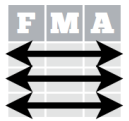


In a tidy data set:



Each **variable** is saved in its own **column**

&



Each **observation** is saved in its own **row**

Exercise

Compute the rate for table2, and table4a + table4b. You will need to perform four operations:

- Extract the number of TB cases per country per year.
- Extract the matching population per country per year.
- Divide cases by population, and multiply by 10000.
- Store back in the appropriate place.

Which representation is easiest to work with? Which is hardest? Why?

If I had one thing to tell biologists learning bioinformatics, it would be “write code for humans, write data for computers”
— Vince Buffalo (@vsbuffalo)

Common problems

- One variable might be spread across multiple columns and sometimes values have ended up in column names

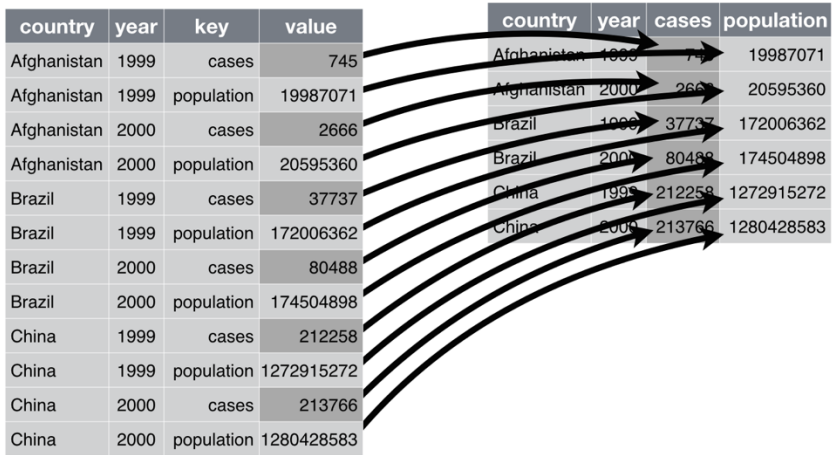
- One observation is spread across multiple rows

pivot_longer()

```
table4a %>%
  pivot_longer(c(`1999`, `2000`), names_to = "year", values_to = "cases")
```

pivot_wider()

```
table2 %>%
    pivot_wider(names_from = type, values_from = count)
```



country	year	key	value
Afghanistan	1999	cases	745
Afghanistan	1999	population	19987071
Afghanistan	2000	cases	2666
Afghanistan	2000	population	20595360
Brazil	1999	cases	37737
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table2

country	year	cases	population
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Brazil	2000	80488	174504898
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separate()

```
table3 %>%
  separate(rate, into = c("cases", "population"))
```

By default, separate() will split values wherever it sees a non-alphanumeric character (i.e. a character that isn't a number or letter)

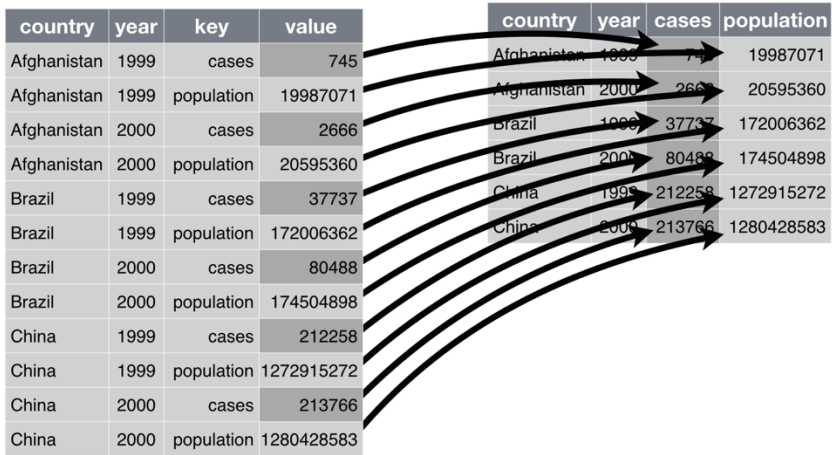

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table2

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Exercise – LOTR data

1. After tidying the data and completing your analysis, you may want to output a table that has each race in its own column. Let's use the pivot_wider() function to make such a table and save it as "lotr_wide"

2. OPTIONAL: Use the pivot_longer() function to transform you lotr_wide back to tidy format.

Exercise

- Make a barchart that shows how many words are spoken by males and females in each of the movies.
  - First with the tidy dataset
  - Then with the wider dataset you just created (with Male and Female word counts in different columns)

Exercise – coronavirus data

- Convert the coronavirus dataset to a wider format where the confirmed cases, deaths and recovered cases are shown in separate columns

- With this wide format data, make a bar chart of the total number of confirmed cases, deaths, and recoveries per day for the US