Data import & Data organization in spreadsheets

ds4owd - data science for openwashdata

Lars Schöbitz

2023-11-21

Learning Objectives (for this week)

1. Learners can import data from files in CSV and XLSX format located in sub-directories of the root directory.
2. Learners can explain the difference between the vector class character and the vector class factor.
3. Learners can discuss the difference between unprocessed raw data, processed analysis-ready data, and data underlying a publication.
4. Learners can apply 12 principles for data organisation in spreadsheets to the layout of a provided dataset.

Homework module 3

Task 3: Data for a country of your choice

- for the country you live or work in
- for the year 2000 and 2020
- for all variables that are not “safely managed sanitation services”

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  filter(iso3 == "UGA",
         year %in% c(2000, 2020),
         varname_short != "san_sm")
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```

```r
sanitation_uga |>
  count(iso3, year, varname_short)
```

iso3	year	varname_short	n
UGA	2000	san_bas	3
UGA	2000	san_lim	3
UGA	2000	san_od	3
UGA	2000	san_unimp	3
UGA	2020	san_bas	3
UGA	2020	san_lim	3
UGA	2020	san_od	3
UGA	2020	san_unimp	3

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```
sanitation_uga |>
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```

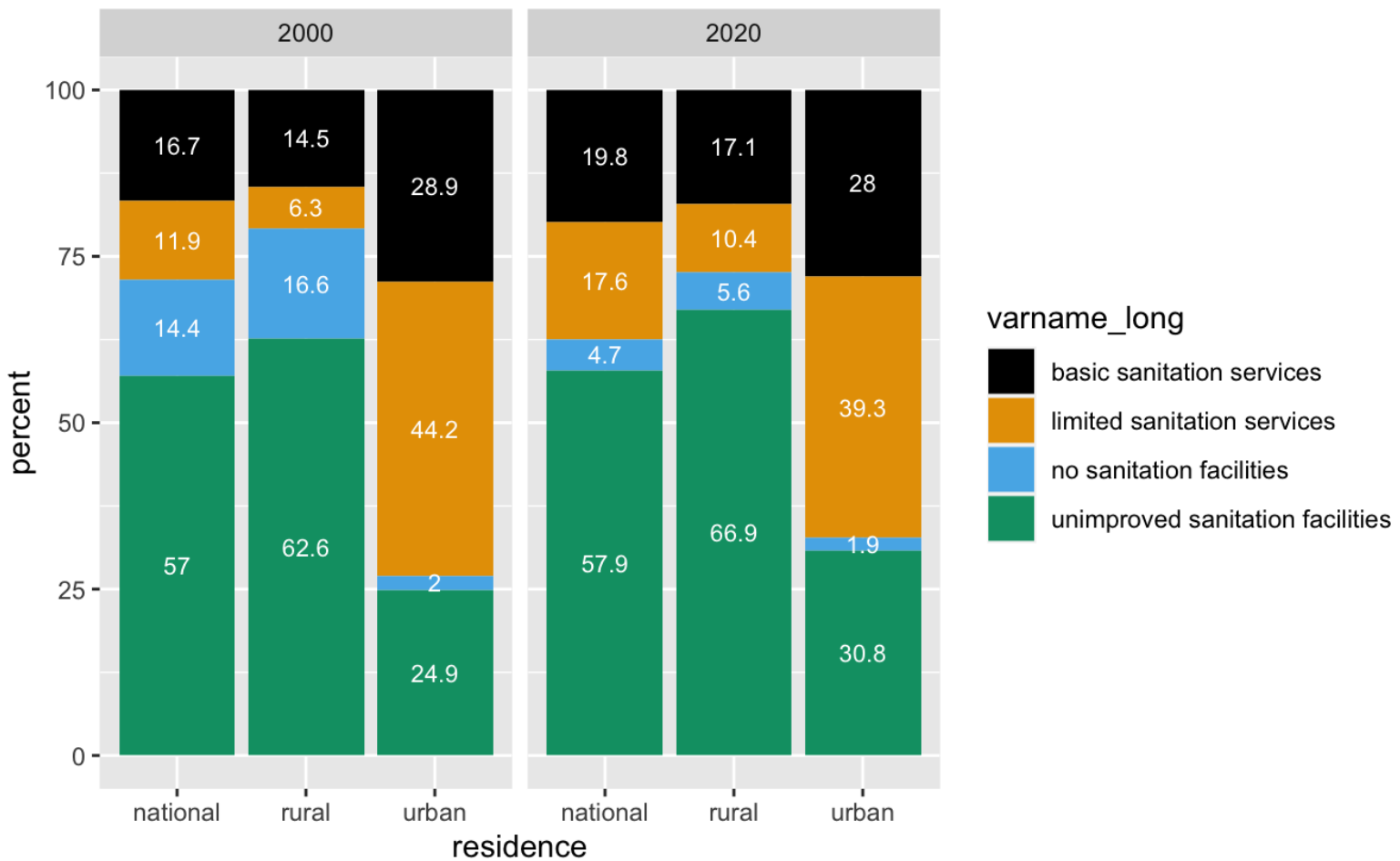
iso3	year	varname_short	n

```
# A tibble: 0 × 4
# ℹ 4 variables: iso3 <chr>, year <dbl>,
varname_short <chr>, n <int>
```

- One row cannot have two values (2000 and 2020) for the same variable
- One year cannot 2000 & 2020 at the same time
- One year is either 2000 or 2020

Task 5 & 6: Make a plot & inspect it

1. Look at the plot that you created. What do you notice about the order of the bars / order of the legend?
2. What would you want to change?
3. Why did we remove “safely managed sanitation services” from the data set in Task 3?



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Task 5 & 6: Make a plot & inspect it

1. Look at the plot that you created. What do you notice about the order of the bars / order of the legend? alphabetical order
2. What would you want to change? put in order of the “sanitation ladder”
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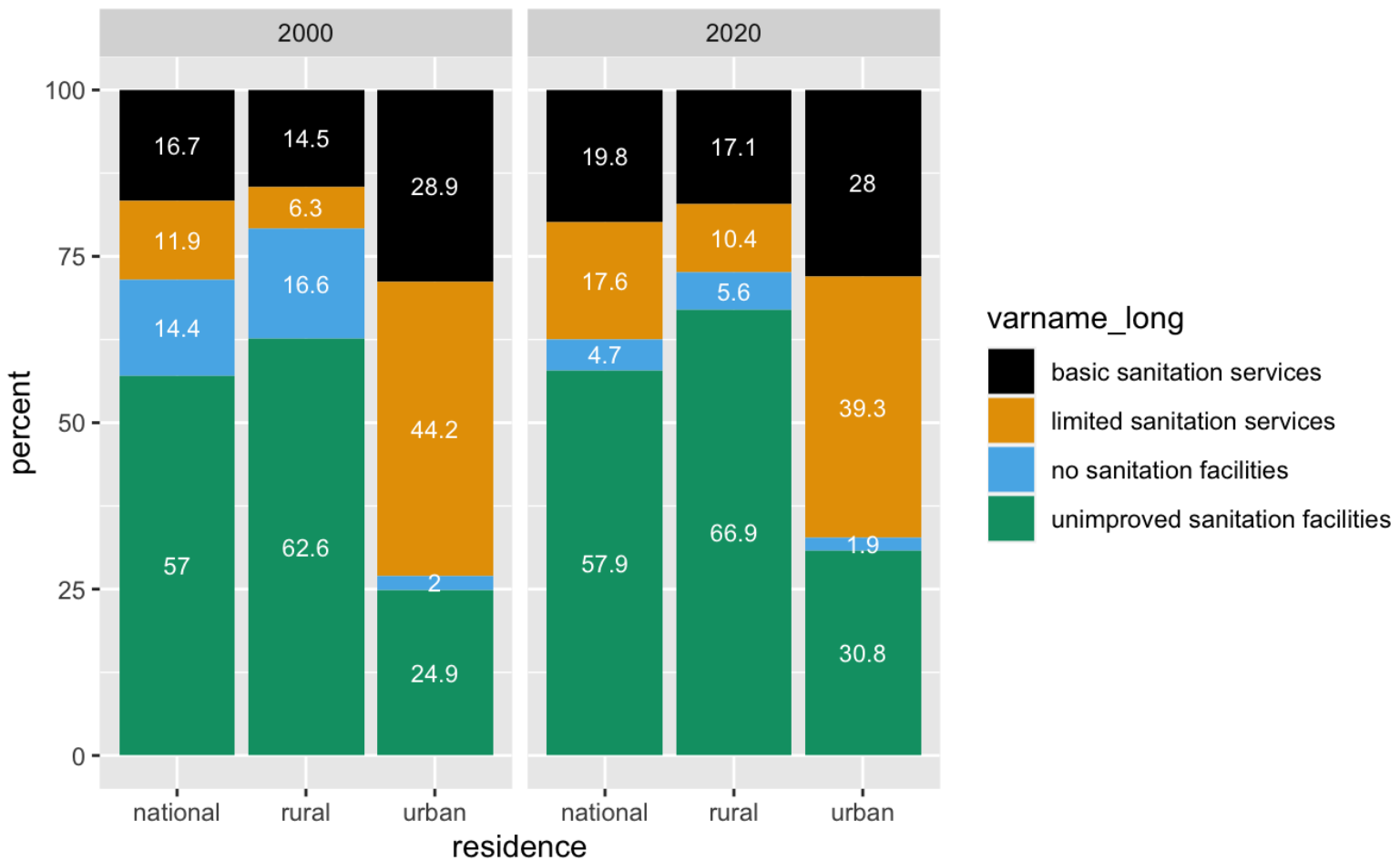

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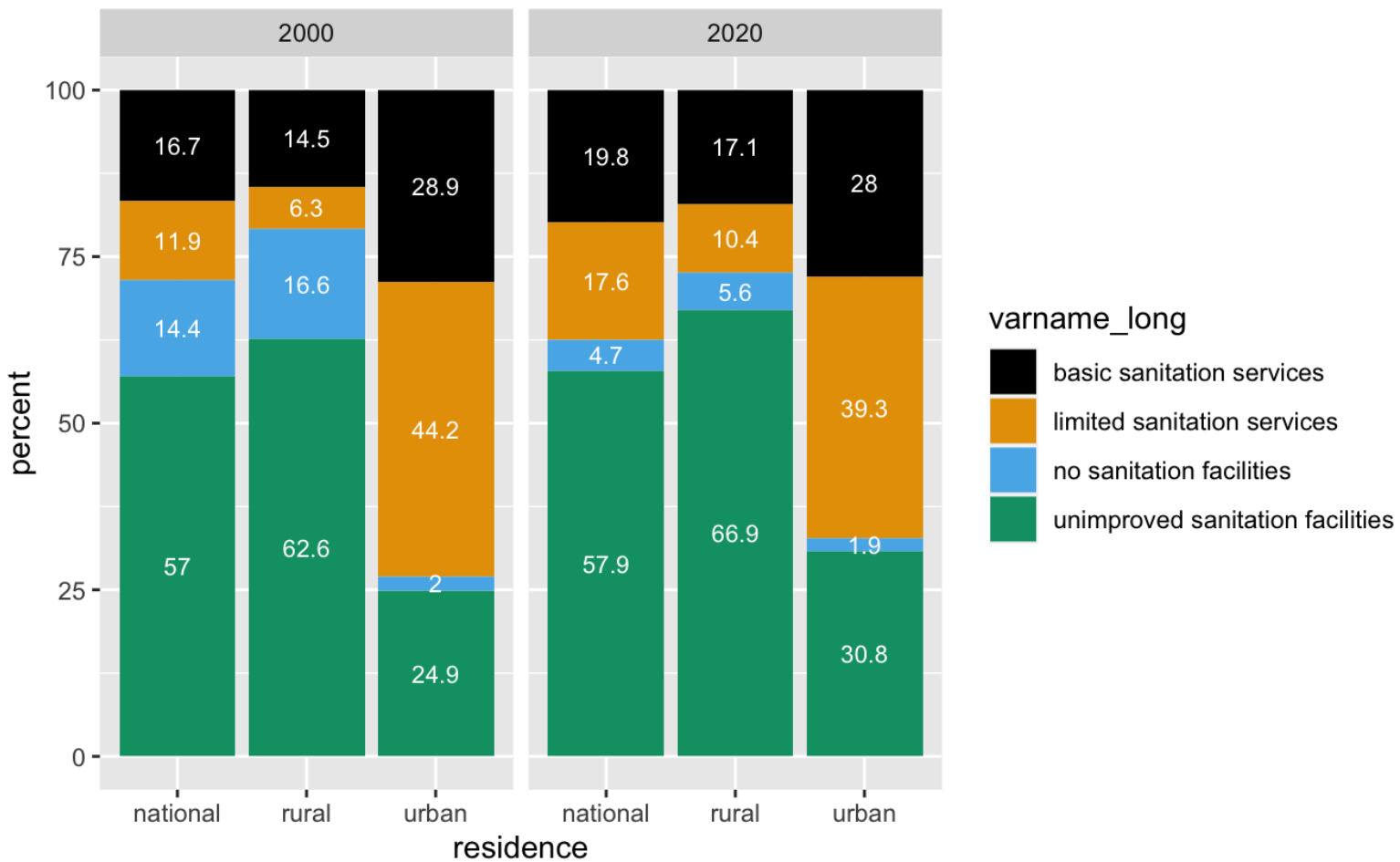

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Sanitation ladder?

varname_short	varname_long	simplified
san_sm	safely managed sanitation services	a decent toilet that's not shared, and where pee & poo safely moved & treated
san_bas	basic sanitation services (improved sanitation facilities which are not shared)	a decent toilet that's not shared
san_lim	limited sanitation services (improved sanitation facilities which are shared)	a decent toilet that's shared
san_unimp	unimproved sanitation facilities	an inadequate toilet
san_od	no sanitation facilities (open defecation)	no toilet

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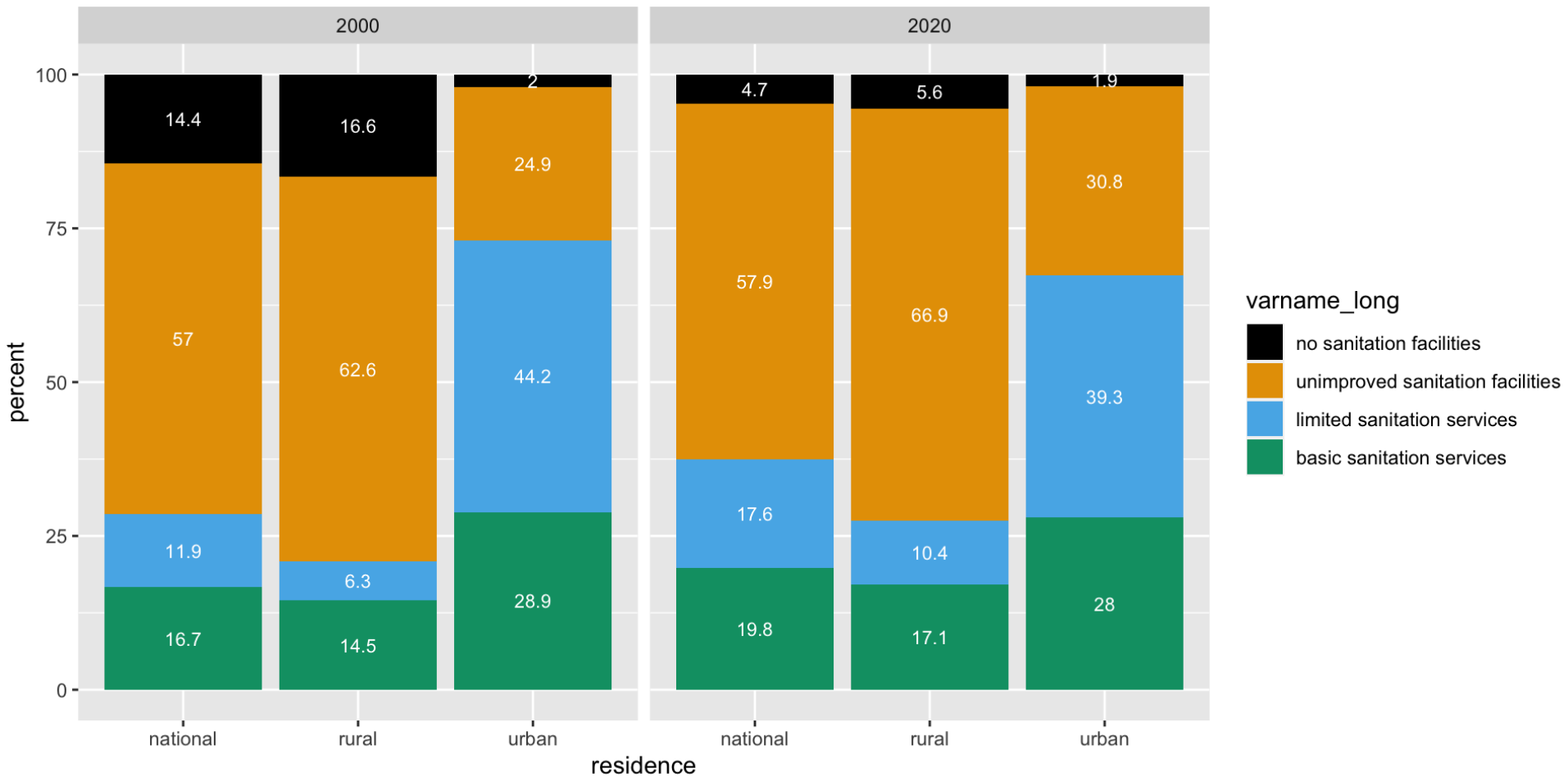

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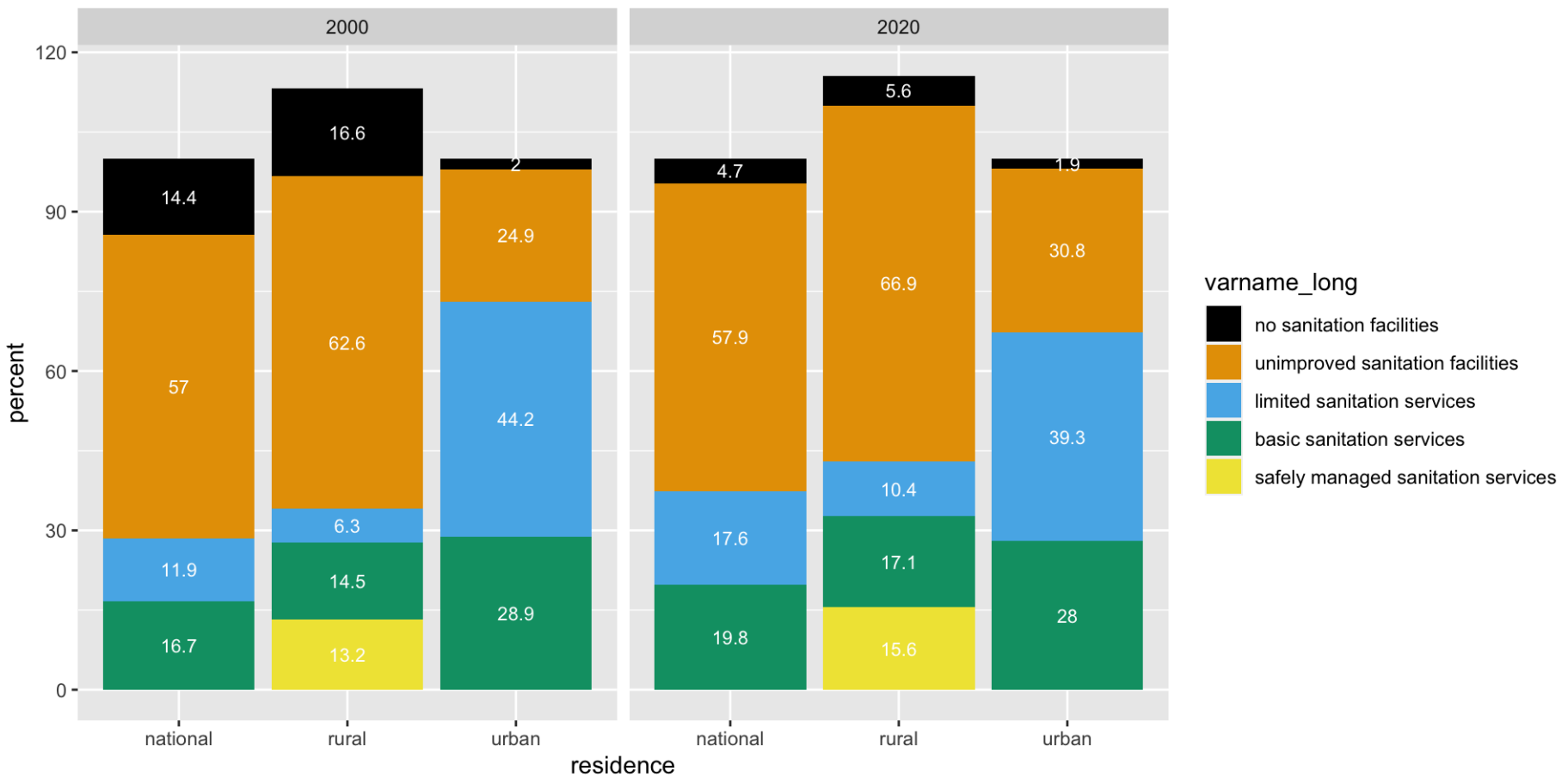

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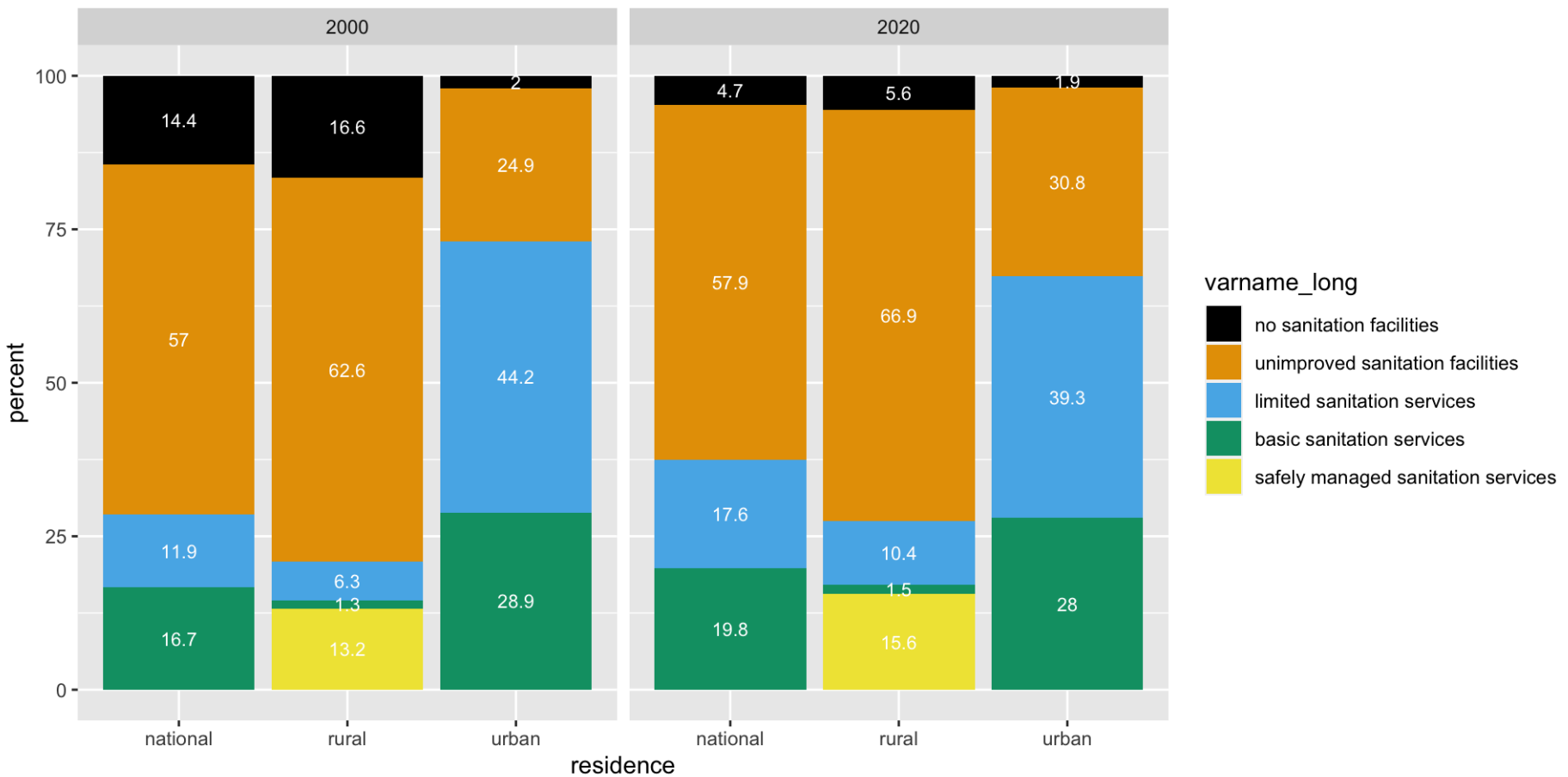

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Types of variables - Remember?

numerical

discrete variables

- non-negative
- whole numbers
- e.g. number of students, roll of a dice

continuous variables

- infinite number of values
- also dates and times
- e.g. length, weight, size

non-numerical

categorical variables

- finite number of values
- distinct groups (e.g. EU countries, continents)
- **ordinal** if levels have natural ordering (e.g. week days, school grades)

Factors in R

My turn: Factors in R

Sit back and enjoy!

Take a break

Please get up and move! Let your emails rest in peace.

Your turn: md-04a-exercises - factors

1. Open posit.cloud in your browser (use your bookmark).
2. Open the ds4owd workspace for the course.
3. In the File Manager in the bottom right window, locate the `md-04a-factors-your-turn.qmd` file and click on it to open it in the top left window.
4. Follow instructions in the file

25:00

Data import

Reading rectangular data into R

CSV & XLSX

readr

- `read_csv()` - comma delimited files
- `read_csv2()` - semicolon separated files (common in countries where , is used as the decimal place)
- `read_tsv()` - tab delimited files
- `read_delim()` - reads in files with any delimiter
- ...

readxl

- `read_excel()` - read xls or xlsx files
- ...

Reading data from CSV files

- import unprocessed raw data

```
1 waste <- read_csv("data/raw/waste-city-level.csv")
2
3 waste
```

```
# A tibble: 367 × 113
   iso3c region_id country_name       income_id city_name additional_data_annu…¹
   <chr> <chr>     <chr>              <chr>     <chr>     <chr>
 1 AFG   SAS       Afghanistan        LIC       Jalalabad <NA>
 2 AFG   SAS       Afghanistan        LIC       Kandahar  <NA>
 3 AFG   SAS       Afghanistan        LIC       Mazar-E-… <NA>
 4 AFG   SAS       Afghanistan        LIC       Kabul     <NA>
 5 AFG   SAS       Afghanistan        LIC       HiratÂ    <NA>
 6 AGO   SSF       Angola             LMC       Luanda    <NA>
 7 ALB   ECS       Albania            UMC       Korca     <NA>
 8 ALB   ECS       Albania            UMC       Vlora     <NA>
 9 ARE   MEA       United Arab Emira… HIC       Abu Dhabi <NA>
10 ARE   MEA       United Arab Emira… HIC       Dubai     <NA>
# ℹ 357 more rows
# ℹ abbreviated name: ¹additional_data_annual_budget_for_waste_management_year
# ℹ 107 more variables: additional_data_annual_solid_waste_budget_year <chr>,
#   additional_data_annual_swm_budget_2017_year <dbl>,
#   additional_data_annual_swm_budget_year <dbl>,
#   additional_data_annual_waste_budget_year <dbl>,
```

Writing data as CSV files

- transform data
- export processed analysis-ready data

```r
# data transformation
waste_sml <- waste |>
  select(country_name, city_name, iso3c, income_id,
         total_msw_total_msw_generated_tons_year,
         population_population_number_of_people) |>
  rename(country = country_name,
         city = city_name,
         generation_tons_year = total_msw_total_msw_generated_tons_year,
         population = population_population_number_of_people)

# export processed analysis-ready data
write_csv(waste_sml, "data/processed/waste-city-level-sml.csv")
```

Reading data from XLSX files

- import unprocessed raw data

```
sludge <- read_excel("data/raw/tbl-01-faecal-sludge-analysis.xlsx",
                     sheet = 1)
sludge
```

```
# A tibble: 20 × 6
      id date_sample         system      location      users     ts
   <dbl> <dttm>              <chr>       <chr>         <dbl>  <dbl>
 1     1 2023-11-01 00:00:00 pit latrine household         5 136.
 2     2 2023-11-01 00:00:00 pit latrine household         7 102.
 3     3 2023-11-01 00:00:00 pit latrine household        NA  57.0
 4     4 2023-11-01 00:00:00 pit latrine household         6  27.0
 5     5 2023-11-01 00:00:00 pit latrine household        12  97.3
 6     6 2023-11-02 00:00:00 septic tank household         7  78.2
 7     7 2023-11-02 00:00:00 septic tank household        14  15.2
 8     8 2023-11-02 00:00:00 septic tank household         4  29.4
 9     9 2023-11-02 00:00:00 septic tank household        10  64.2
10    10 2023-11-02 00:00:00 septic tank household        12   8.01
11    11 2023-11-03 00:00:00 pit latrine public toilet    50  11.2
12    12 2023-11-03 00:00:00 pit latrine public toilet    32  84.0
13    13 2023-11-03 00:00:00 pit latrine public toilet    41  55.9
14    14 2023-11-03 00:00:00 pit latrine public toilet   160  15.3
15    15 2023-11-03 00:00:00 pit latrine public toilet    20  22.6
16    16 2023-11-04 00:00:00 septic tank public toilet    26   8.72
```

Writing data as CSV files

- transform data
- export data underlying a publication

```r
# data transformation
tbl_sludge_summary <- sludge |>
  filter(!is.na(users)) |>
  group_by(system, location) |>
  summarise(
    count = n(),
    mean_ts = mean(ts),
    sd_ts = sd(ts),
    median_ts = median(ts)
  )

# export data underlying a publication
write_csv(tbl_sludge_summary, "data/final/tbl-01-faecal-sludge-summary.csv")
```

system	location	count	mean_ts	sd_ts	median_ts
pit latrine	household	4	90.7	45.9	99.9
pit latrine	public toilet	5	37.8	31.3	22.6
septic tank	household	5	39.0	30.8	29.4
septic tank	public toilet	5	20.4	14.3	15.6

(Research) Data Management

Examples of terms used when managing data.

term	folder	explanation	file format
unprocessed raw data	raw	data that is not processed and remains in its original form and file	often XLSX, also CSV and others
processed analysis-ready data	processed	data that is processed to prepare for an analysis and is exported in its new form as a new file	CSV
final data underlying a publication	final	data that is the result of an analysis (e.g descriptive statistics or data visualization) and shown in a report, but then also exported in its new form as a new file	CSV

Take a break

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My turn: Import data from XLSX

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Your turn: md-04a-exercises - import

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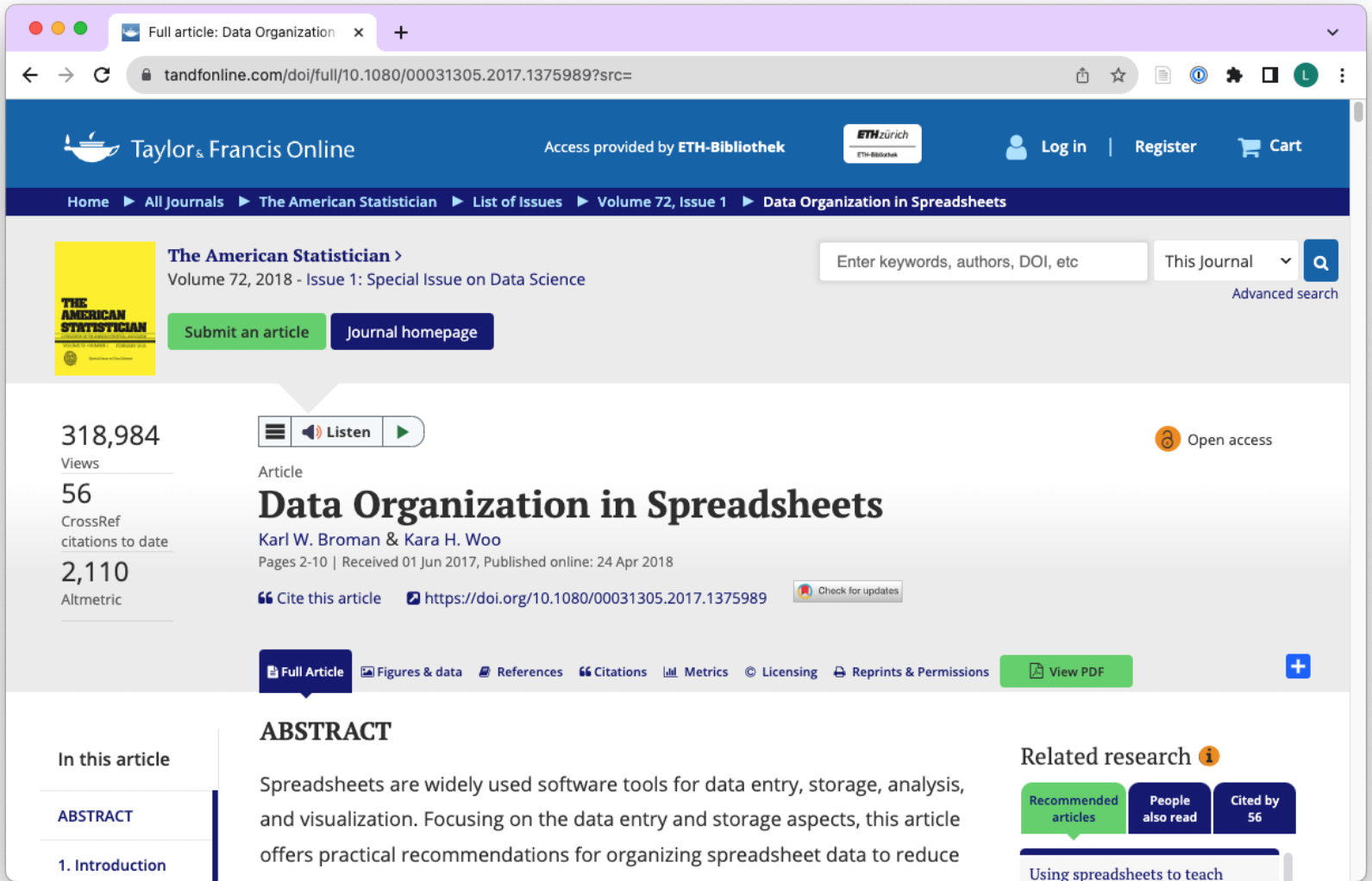
20:00

Data Organization in Spreadsheets

Data Organization in Spreadsheets



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open wash data.

Data Organization in Spreadsheets

Read the paper (it's part of your homework), but you can also:

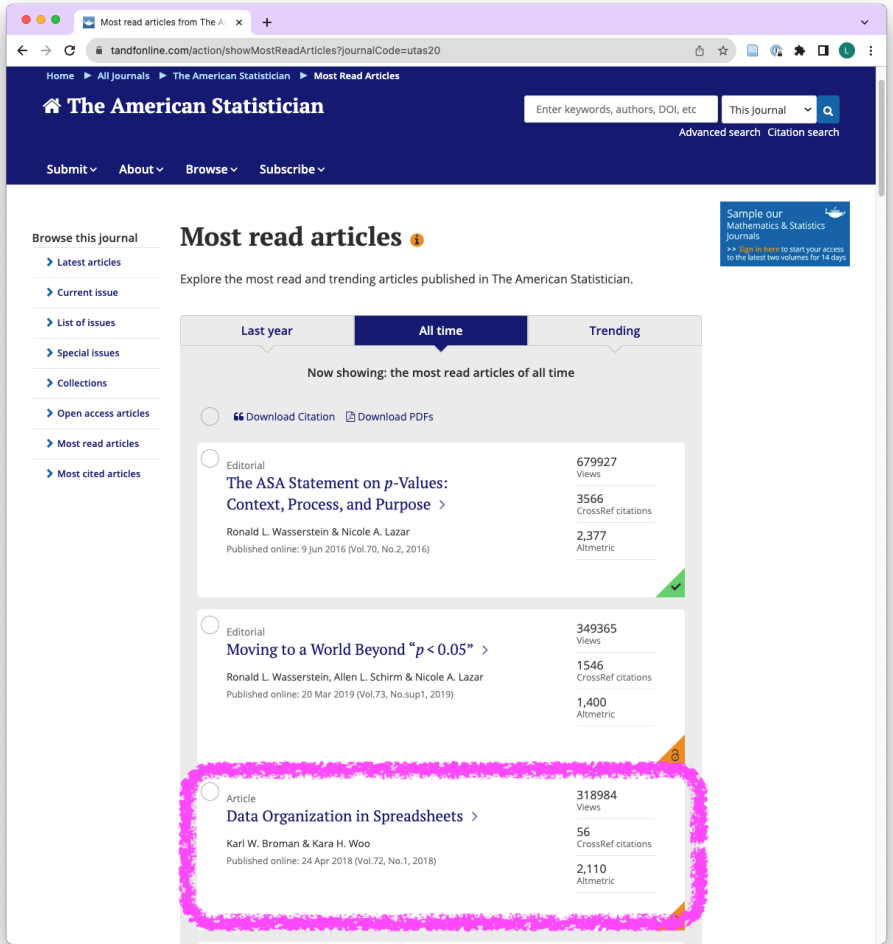
- Go through the annotated slides: https://kbroman.org/Talk_DataOrg/dataorg_notes.pdf
- Watch Karl Broman give the talk (02:36 to 45:00): https://youtu.be/t74E0a90gkA?t=156
- Read the content on a website: https://kbroman.org/dataorg/

Data Organization in Spreadsheets

But, especially apply it to your data

Data Organization in Spreadsheets

Why? Because following a set of rules for organizing data everyone's live a little better.



- 3rd most viewed paper on The American Statistician
- 310'000+ views
- widely accepted as minimal standards

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open wash data.

Data Organization in Spreadsheets

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README.md

Data organization in spreadsheets

Slides for a talk for the OSGA Webinar Series, on 24 Sept 2021, based on my paper of the same title with Kara Woo. Also see the related website.

PDF of slides: https://kbroman.org/Talk_DataOrg/dataorg.pdf

PDF of slides with notes: https://kbroman.org/Talk_DataOrg/dataorg_notes.pdf

Video of presentation: https://youtu.be/t74E0a90gkA

License

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Homework assignments module 4

ds4owd-001.github.io/website/

Module 4 documentation

ds4owd-001.github.io/website/modules/md-04.html

404

File not found

The site configured at this address does not contain the requested file.

If this is your site, make sure that the filename case matches the URL as well as any file permissions.
For root URLs (like `http://example.com/`) you must provide an `index.html` file.

Read the full documentation for more information about using **GitHub Pages**.

GitHub Status — @githubstatus

Homework due date

- Homework assignment due: Monday, November 20th
- Correction & feedback phase up to: Thursday, November 23rd

Wrap-up

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Thanks! 🌻

Slides created via revealjs and Quarto: https://quarto.org/docs/presentations/revealjs/ Access slides as PDF on GitHub