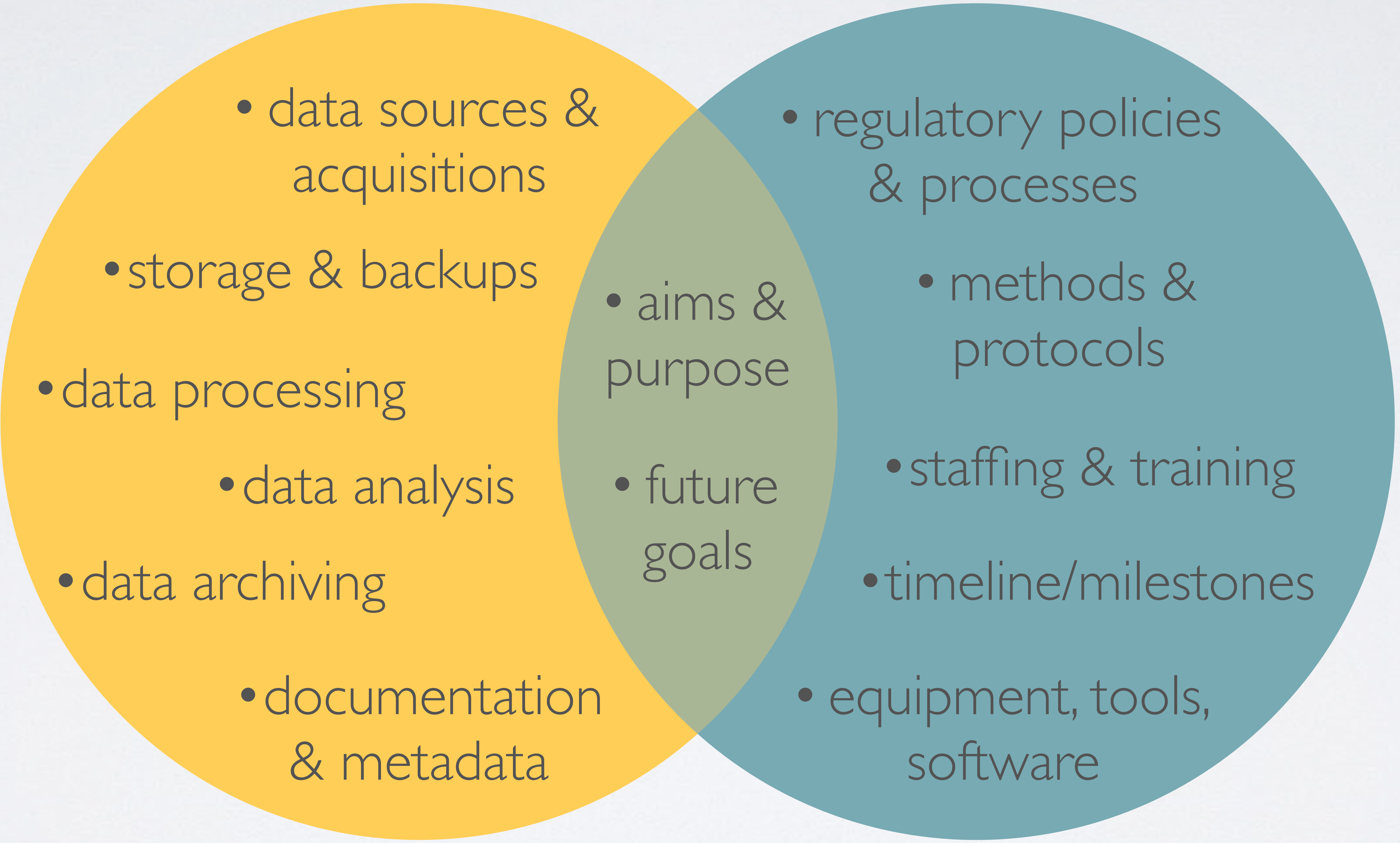
Getting Credit for Sharing Your Data (Part I): Good Enough Data Management Practices

Alaina Pearce

Project vs Data Management



Data Management

- data sources & acquisitions
- storage & backups
- data processing
- data analysis
- data archiving
- documentation & metadata

- aims & purpose
- future goals

Project Management

- regulatory policies & processes
- methods & protocols
- staffing & training
- timeline/milestones
- equipment, tools, software

Goal: extract meaningful insight and information

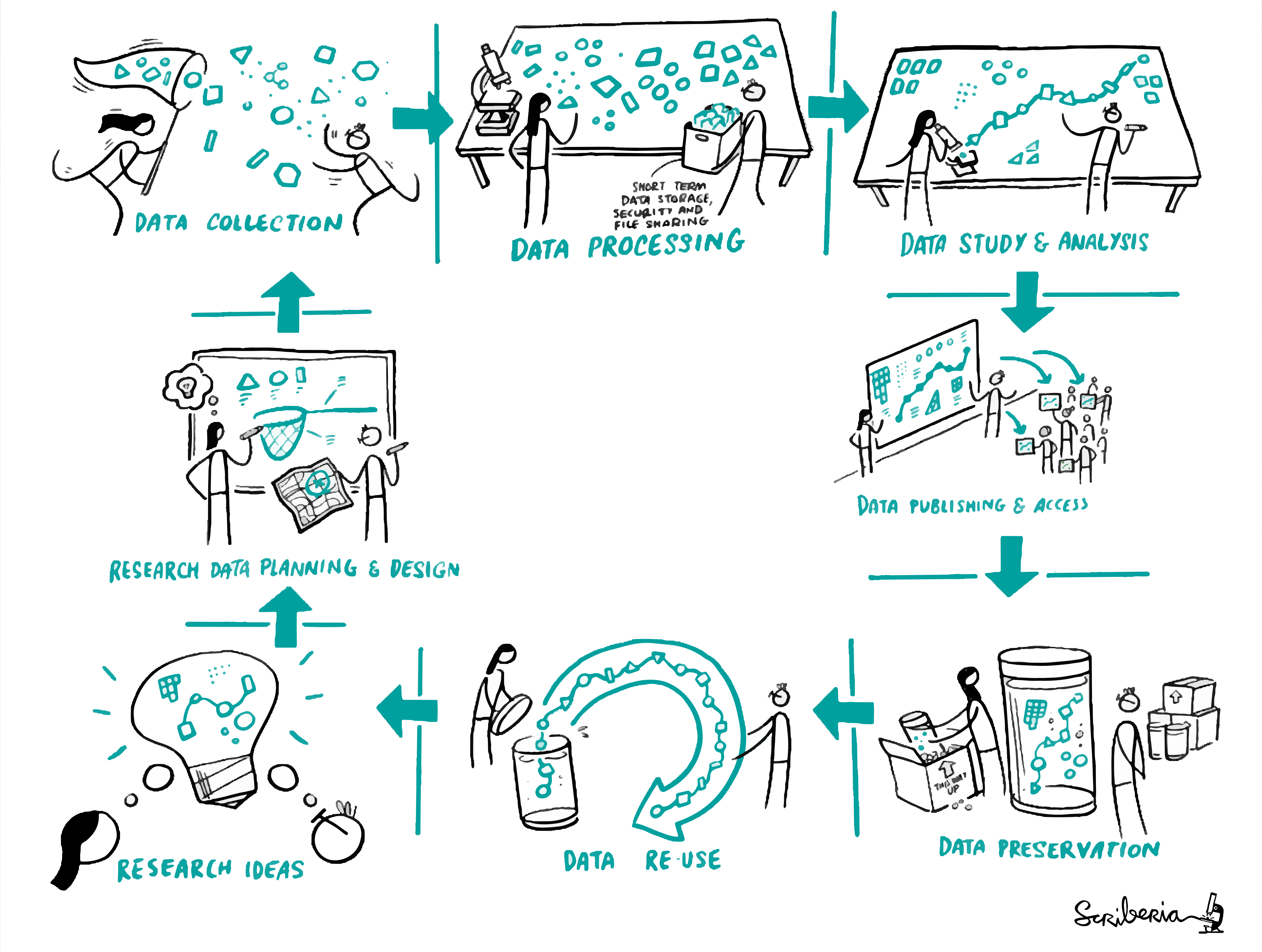
Goal: meet project goals within set timelines

With What Time???

‘Good Enough’

- (relatively) low effort
- shallow learning curve
- beneficial to current and future you
- increases ‘openness’ of research

Project Lifecycle



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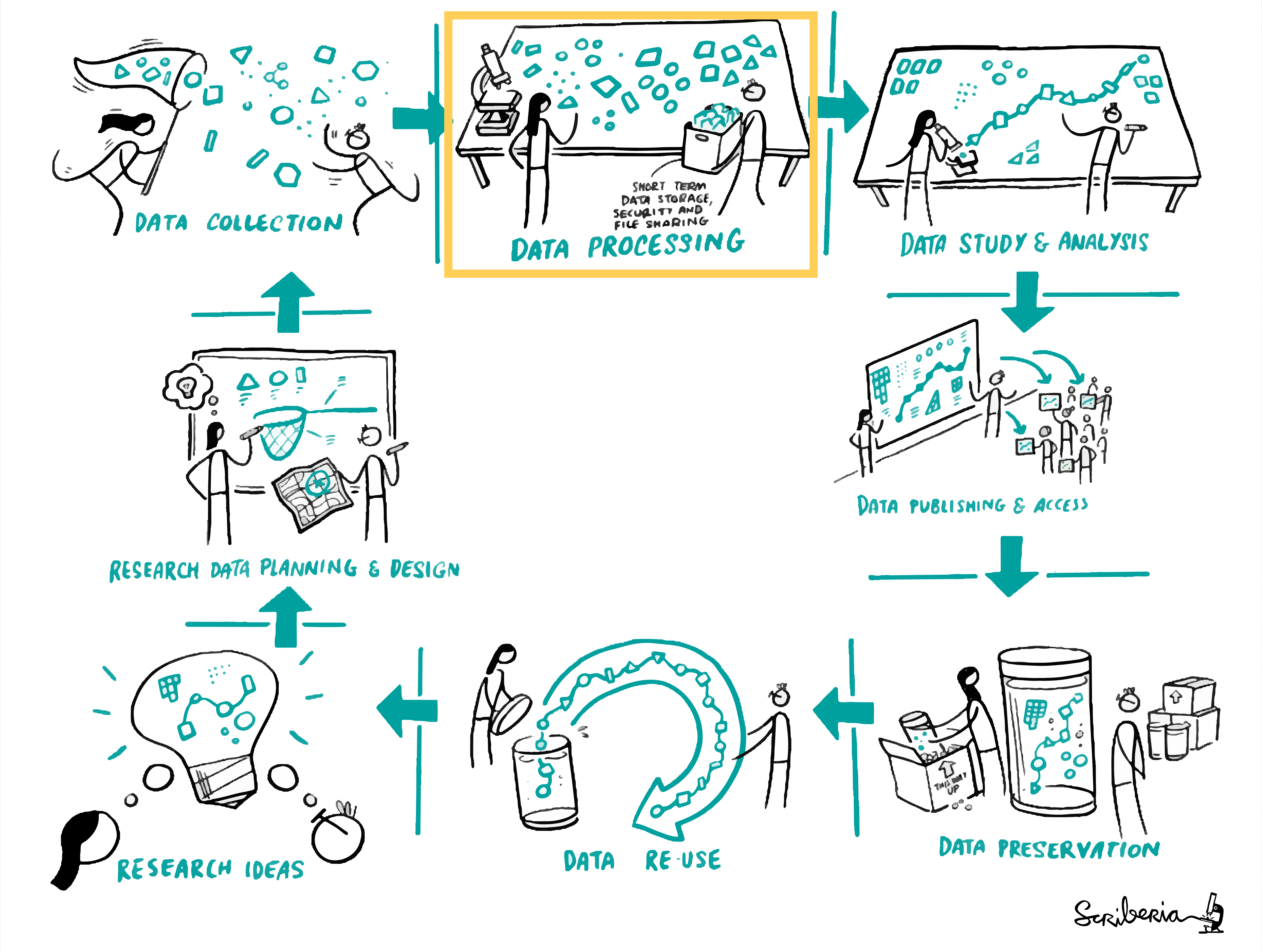
Project Lifecycle



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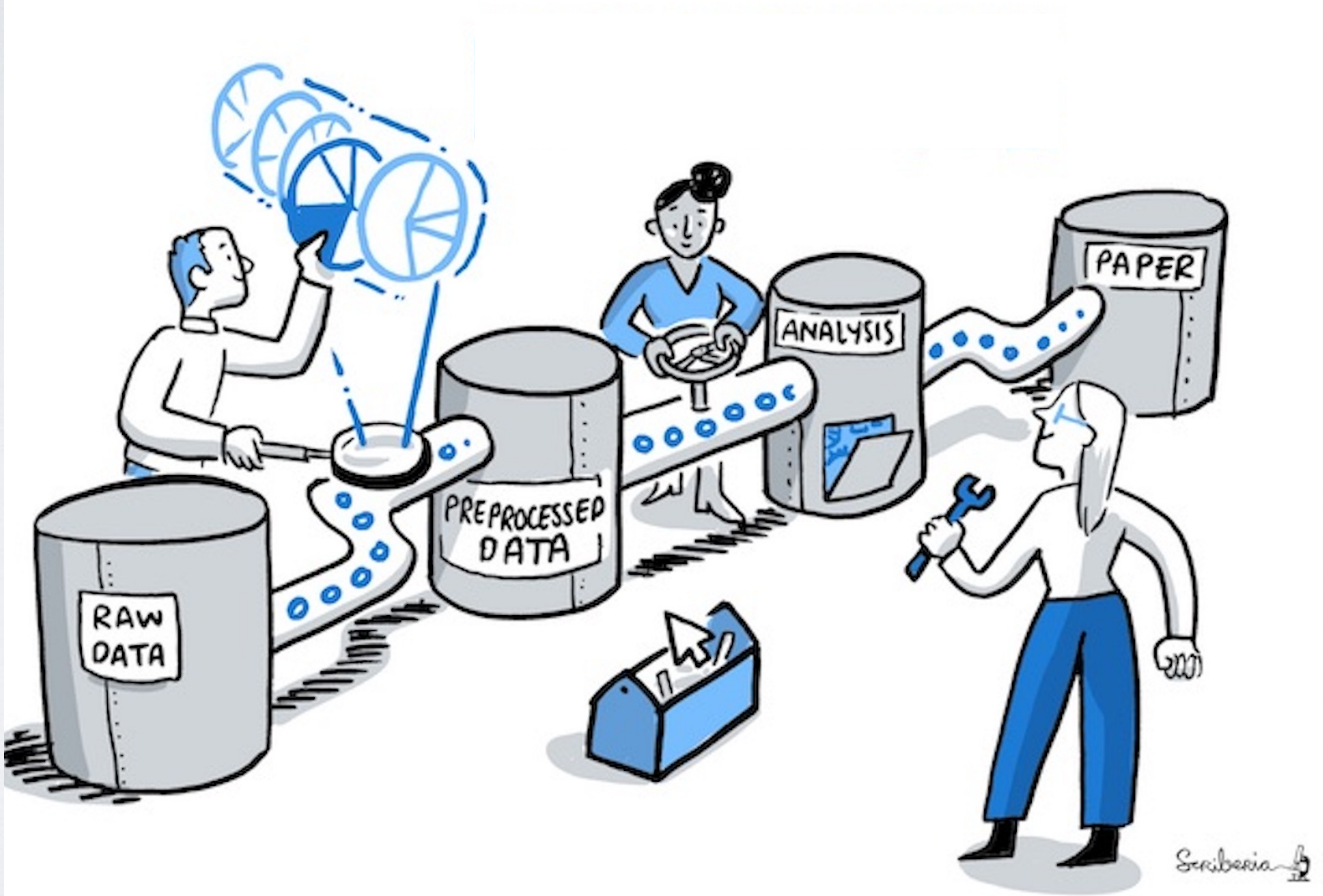
Data Processing Pipelines



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1. Preserve Raw Data

Raw Data: data as it was originally collected

Save in data in its original form and DO NOT alter or 'improve' it

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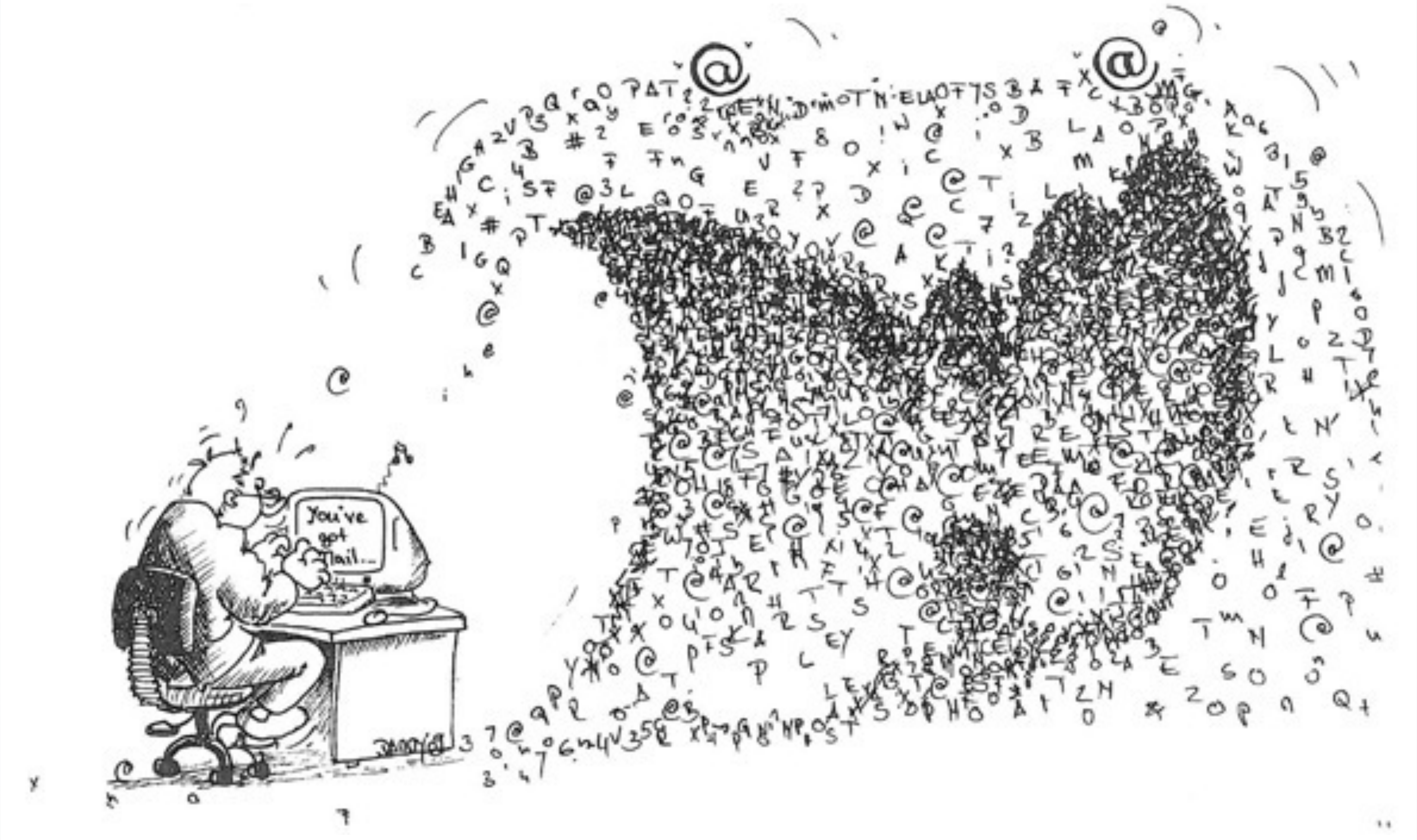
Raw Data: data as it was originally collected

Save in data in its original form and DO NOT alter or 'improve' it

What makes this 'Open'?

- Stable starting point
- Test reproducibility of pipeline
- Recover from mishaps
- Experiment without fear

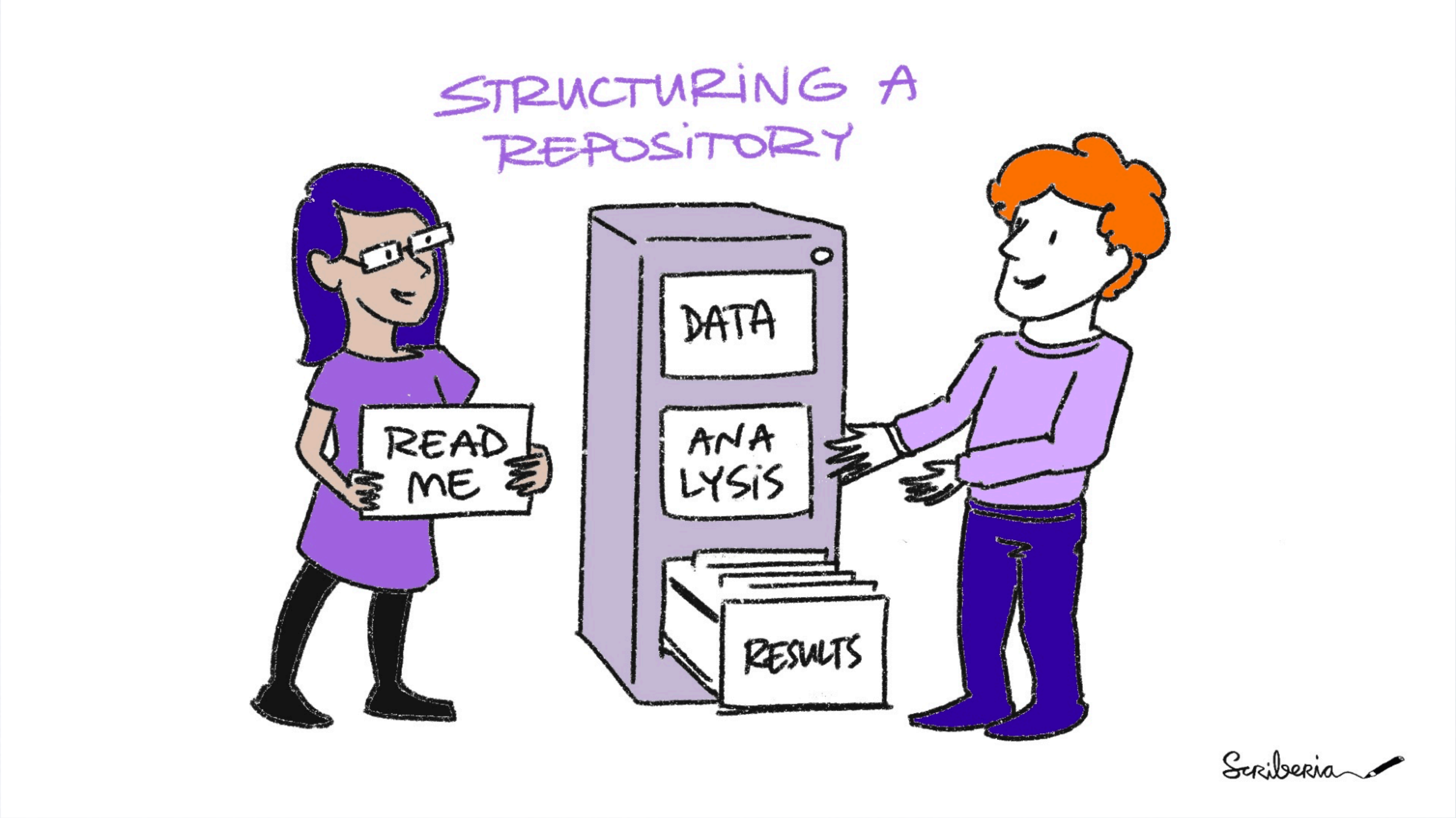
Data Tsunami



2. Create a Central Hub

Goals:

- Identify file/contents in a clear way
- Have a consistent approach across projects and collaborators
- Should be meaningful but brief



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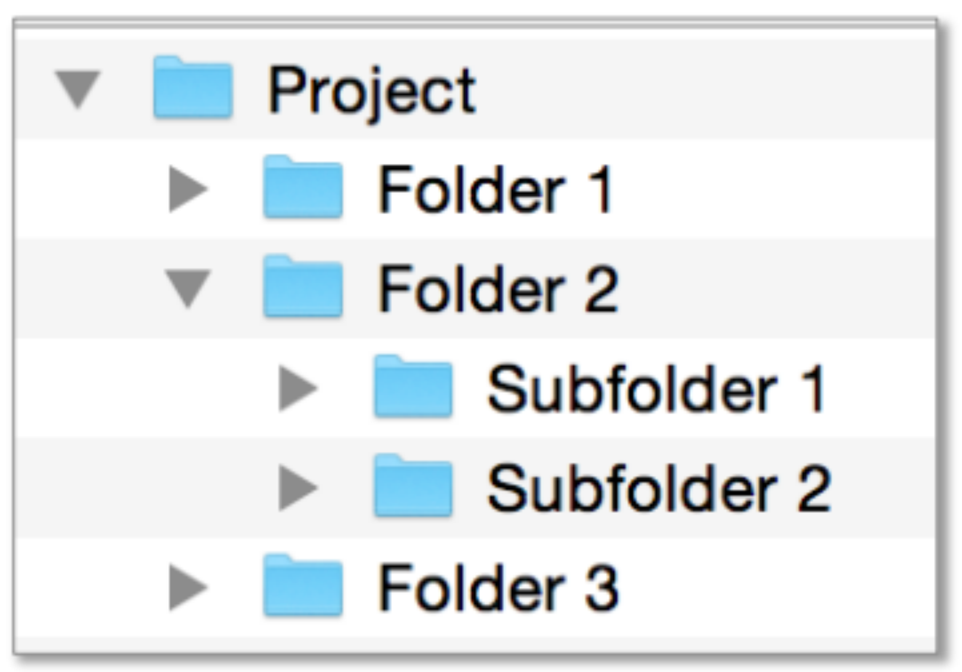
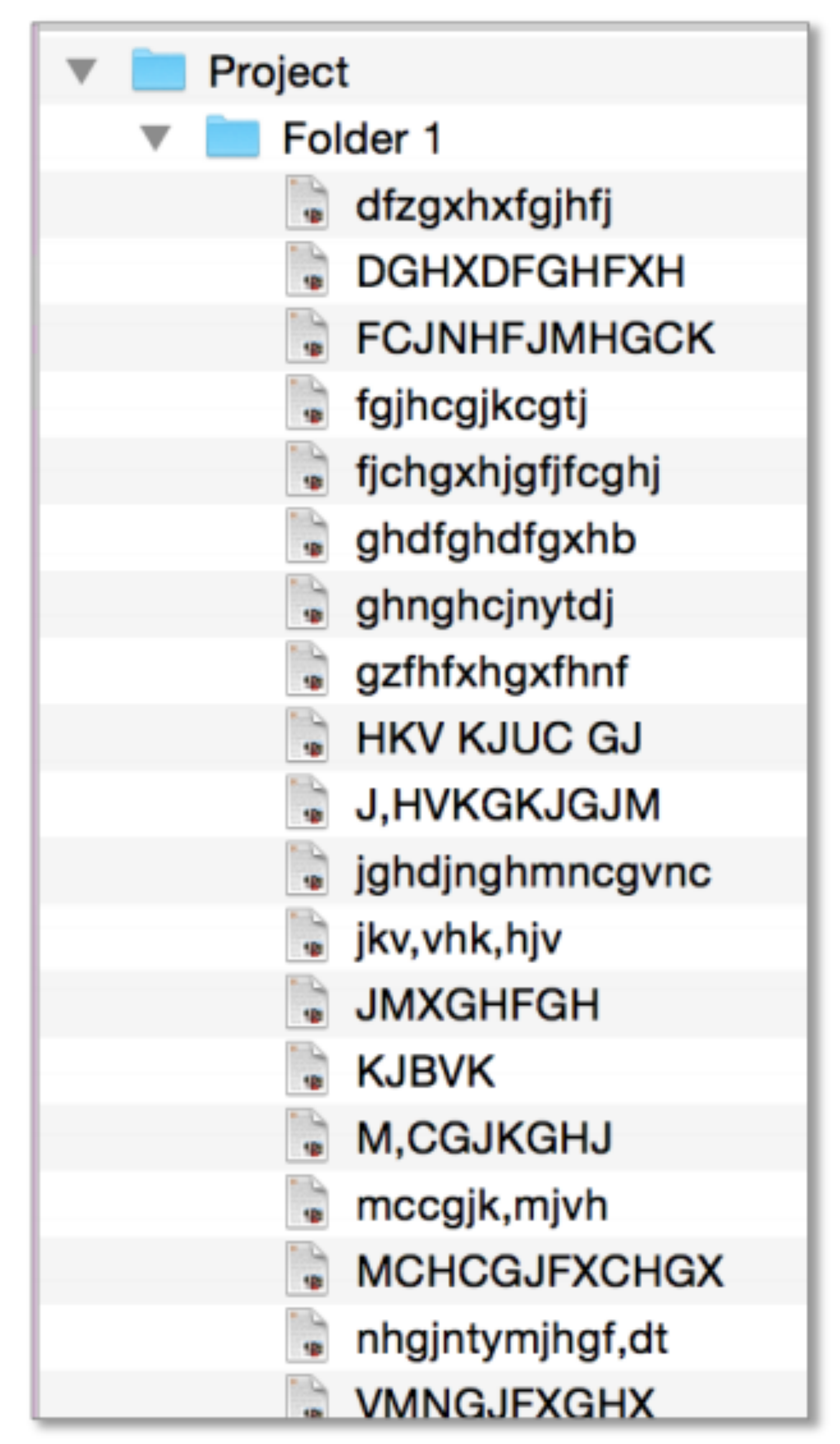
Create a Central Hub

Directory Structures: organization of files into a hierarchical structure

- Create a directory for each project
- Use a consistent structure
- Separate data management from project management
- Keep subfolder categories narrow to limit number of files in each one



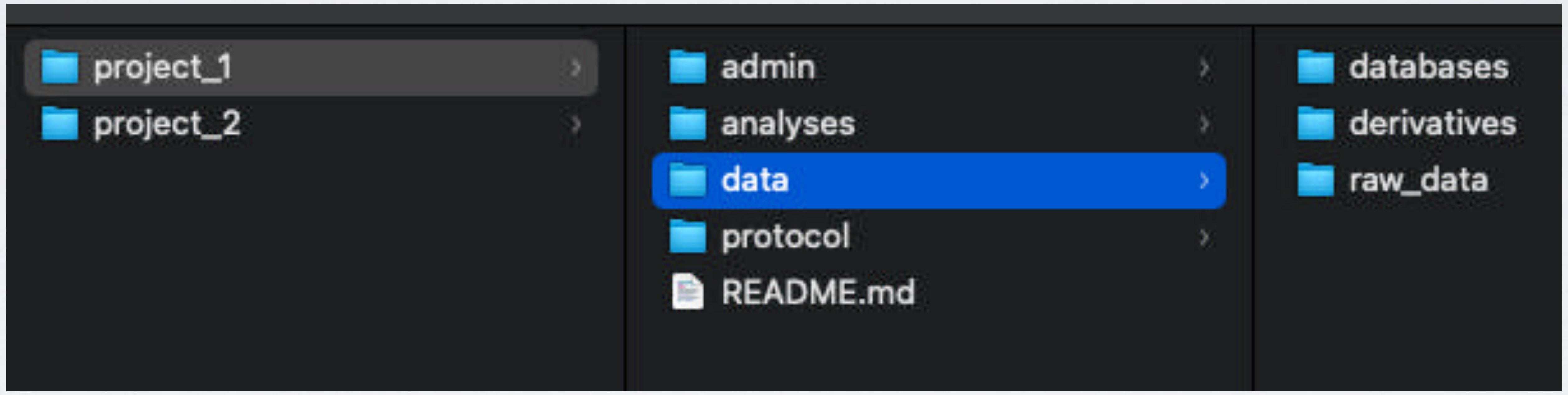
Project
Folder 1
Folder 2
Subfolder 1
Subfolder 2
Folder 3



Project
Folder 1
dfzgxhxfgjhfj
DGHXDFGHFXH
FCJNHFJMHGCK
fgjhcgjkcgtj
fjchgxhjgfjfcghj
ghdfghdfgxhb
ghnghcjnytdj
gzfhfxhgxfhnf
HKV KJUC GJ
J,HVKGKJGJM
jghdjnghmncgvnc
jkv,vhk,hjv
JMXGHFGH
KJBVK
M,CGJKGHJ
mccgjk,mjvh
MCHCGJFXCHGX
nhgjntymjhgf,dt
VMNGJFXGHX

2. Create a Central Hub

Directory Structures: organization of files into a hierarchical structure



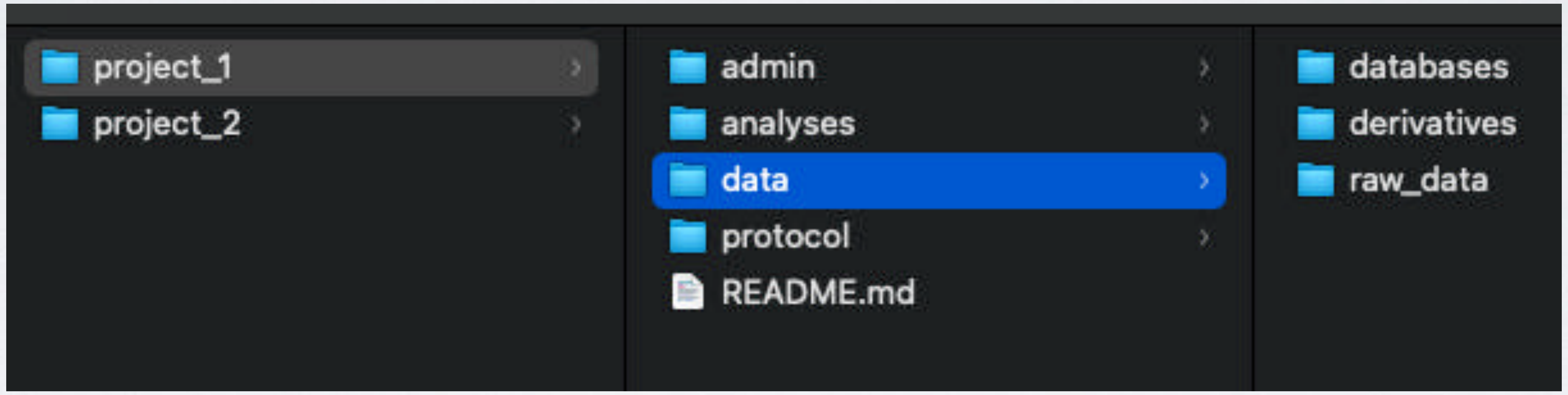
project_1
project_2

admin
analyses
data
protocol
README.md

databases
derivatives
raw_data

2. Create a Central Hub

Directory Structures: organization of files into a hierarchical structure



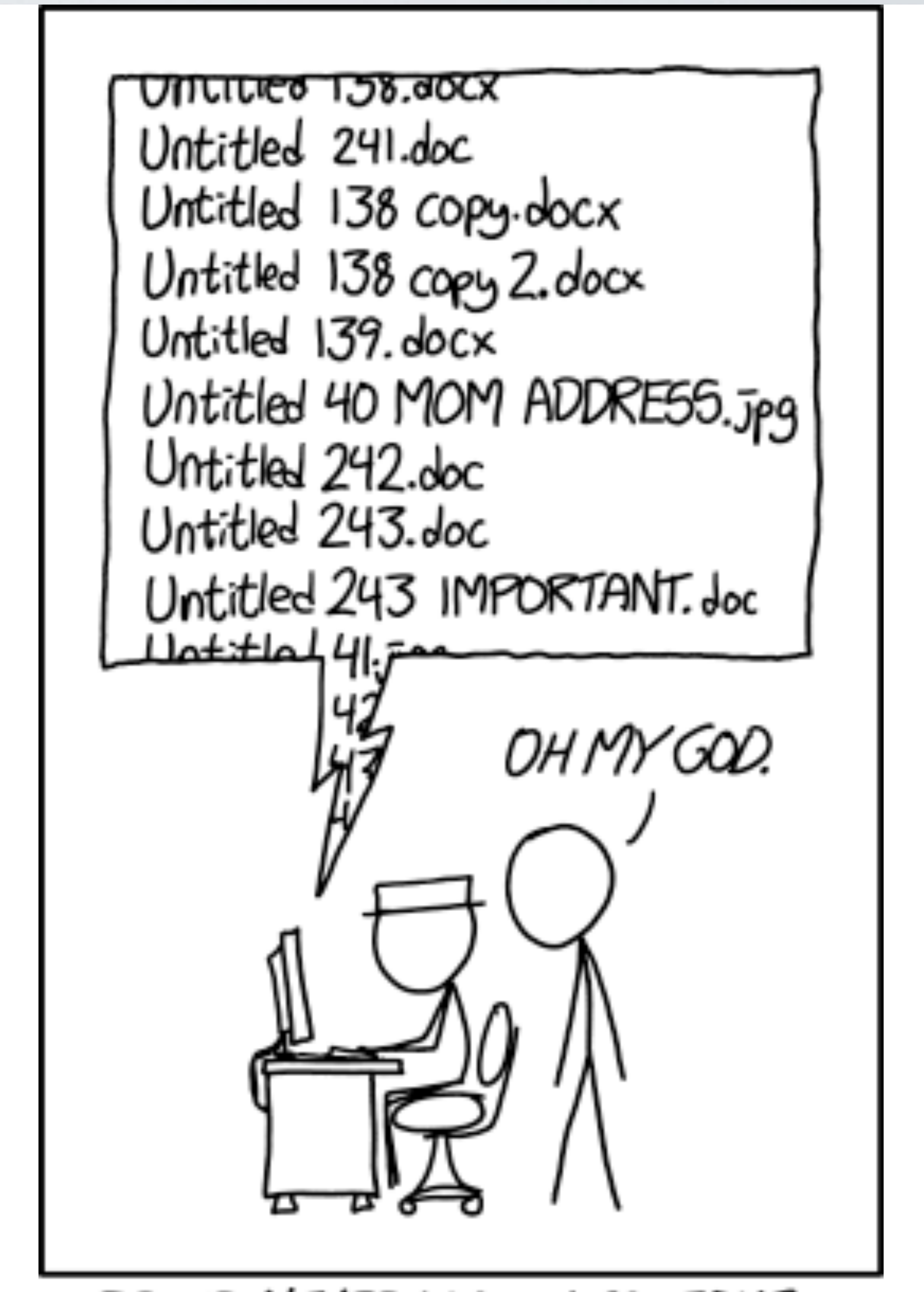
What makes this 'Open'?

- Easy to find data, code, protocol
- Consistent (at least within lab)
- Bigger Lift: match field standards (e.g. , BIDS, MIxS)

3. Use Meaningful Names

Goals:

- Identify file/contents in a clear way
- Have a consistent approach across projects and collaborators
- Should be meaningful but brief

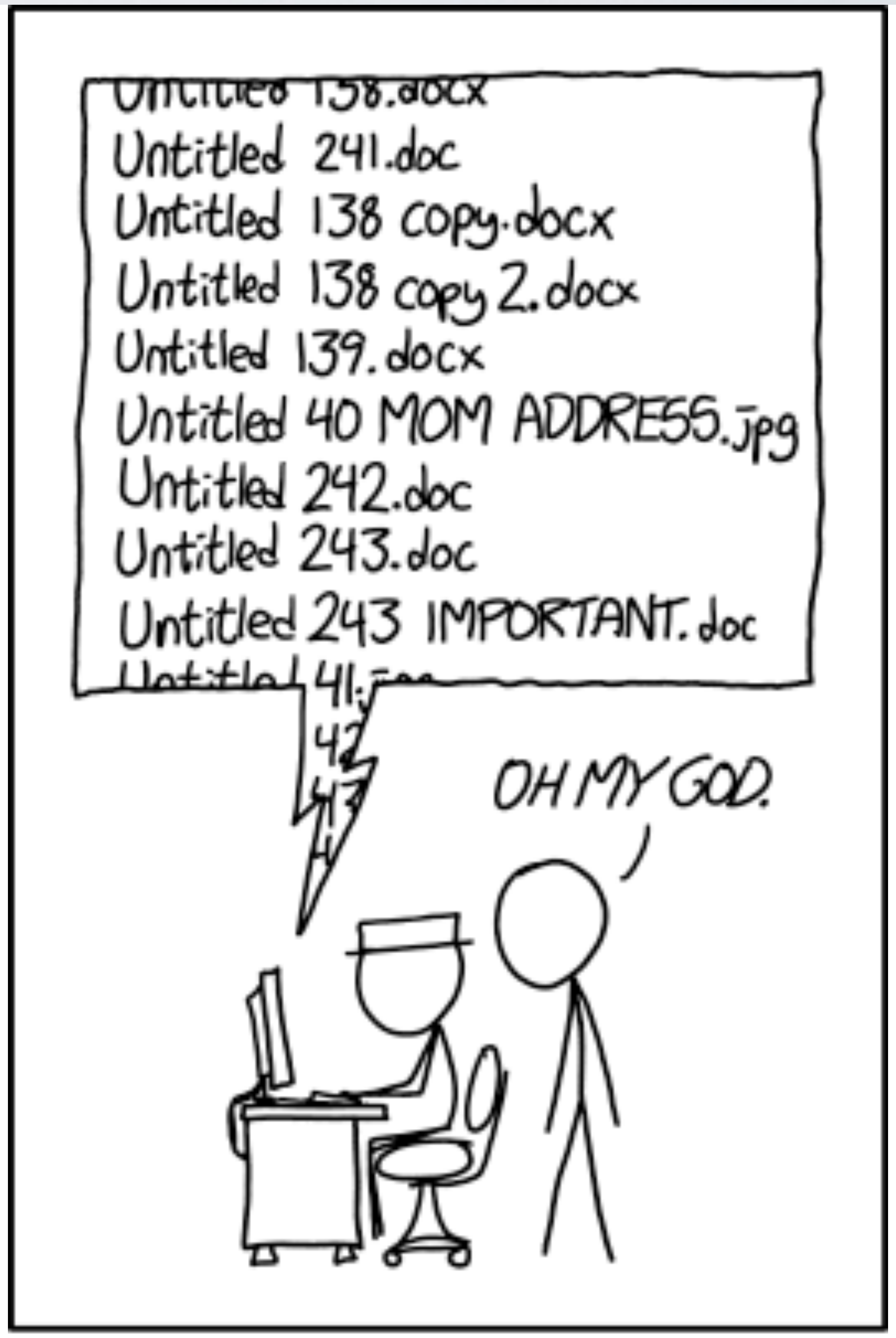


PROTIP: NEVER LOOK IN SOMEONE ELSE'S DOCUMENTS FOLDER.

3. Use Meaningful Names

Leverage filenames to help you manage complex projects

- Human Readable: names should clearly describe content in the simplest way possible (e.g., ‘code’, ‘data’)
- Computer Readable: ability of a computer to parse a name
  - Use ‘-‘ or ‘_’ in place of spaces
  - No special characters (e.g, ‘&’, ‘#’, ‘^’, etc)



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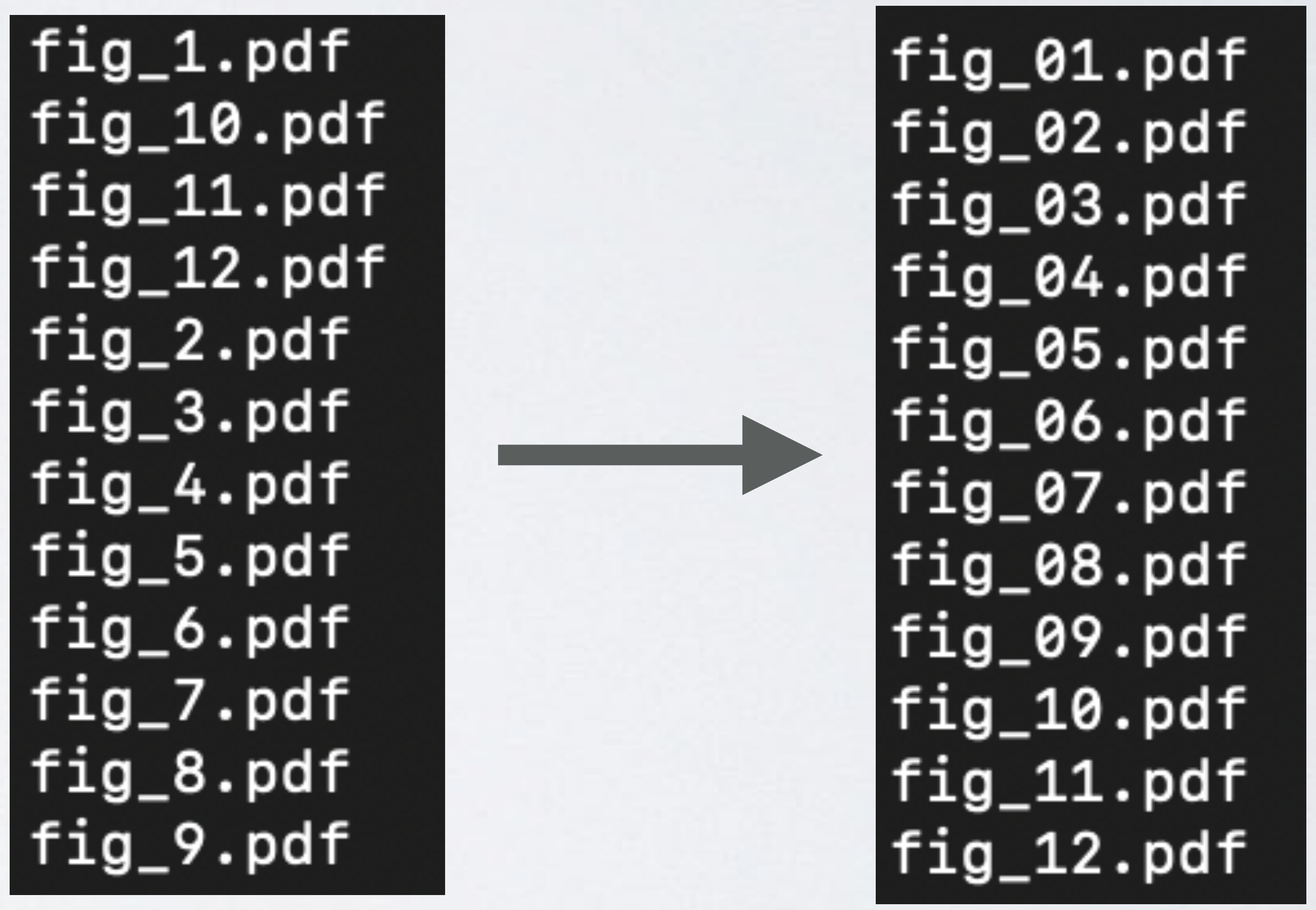
  - No special characters (e.g, ‘&’, ‘#’, ‘^’, etc)
- Sortable: help you find what you need in the future
  - Dates: YYYY-MM-DD
  - Study IDs: Pad with zeros



```
fig_1.pdf
fig_10.pdf
fig_11.pdf
fig_12.pdf
fig_2.pdf
fig_3.pdf
fig_4.pdf
fig_5.pdf
fig_6.pdf
fig_7.pdf
fig_8.pdf
fig_9.pdf
```

```
fig_01.pdf
fig_02.pdf
fig_03.pdf
fig_04.pdf
fig_05.pdf
fig_06.pdf
fig_07.pdf
fig_08.pdf
fig_09.pdf
fig_10.pdf
fig_11.pdf
fig_12.pdf
```

3. Use Meaningful Names

Leverage filenames to help you manage complex projects

Do **NOT** Use

- Spaces
- Periods (except for file extensions)
- Other special characters (&, *, ^, etc)

DO Use

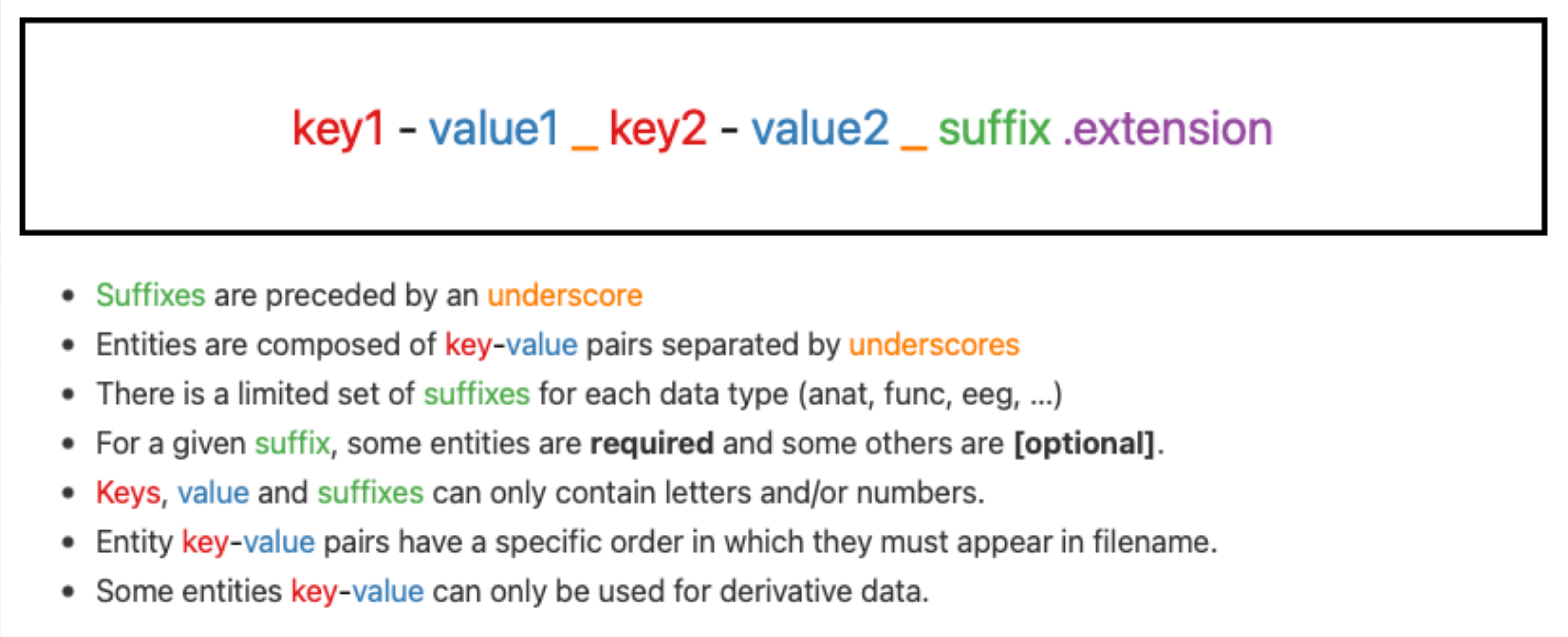
- CamelCase
- snake_case
- YYYYMMDD date format
- Pad numbers with zeros (e.g., 001)

3. Use Meaningful Names

Leverage filenames to help you manage complex projects

Key-Value Pairs in the Brain Imaging Data Structure (BIDS):

- sub-035_task-memory_events.txt
- sub-035_ses-2_task-memory_events.txt



key1 - value1 _ key2 - value2 _ suffix .extension

- Suffixes are preceded by an underscore
- Entities are composed of key-value pairs separated by underscores
- There is a limited set of suffixes for each data type (anat, func, eeg, ...)
- For a given suffix, some entities are **required** and some others are **[optional]**.
- Keys, value and suffixes can only contain letters and/or numbers.
- Entity key-value pairs have a specific order in which they must appear in filename.
- Some entities key-value can only be used for derivative data.

https://bids-standard.github.io/bids-starter-kit/folders_and_files/files.html

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  - No special characters (e.g, '&', '#', '^', etc)
- Sortable: help you find what you need in the future
  - Dates: YYYY-MM-DD
  - Study IDs: Pad with zeros

What makes this 'Open'?

- Makes data more findable
- Can be a form of metadata
- Bigger Lift: adopt field standards

Worksheet - Directory Structures and File Naming

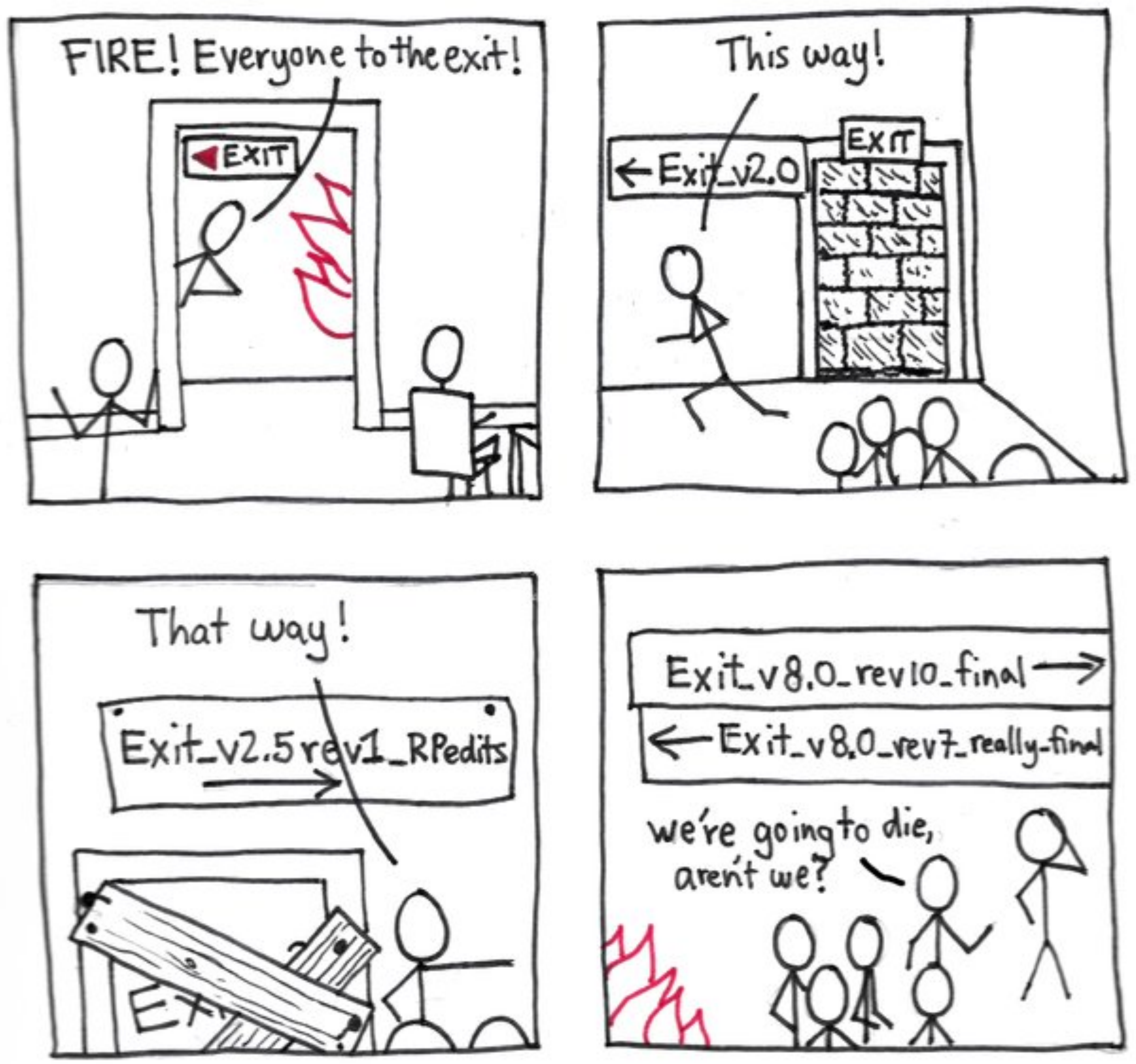
4. Preserve the Journey

Version control: tracking and managing changes to documents or code

FIRE! Everyone to the exit!
EXIT
This way!
Exit_v2.0
EXIT
That way!
Exit_v2.5rev1_RPedits
EXIT
Exit_v8.0_rev10_final
Exit_v8.0_rev7_really-final
we're going to die, aren't we?
Stop, Drop, and Use a Versioning System
@redpenblackpen

4. Preserve the Journey

Version control: tracking and managing changes to documents or code

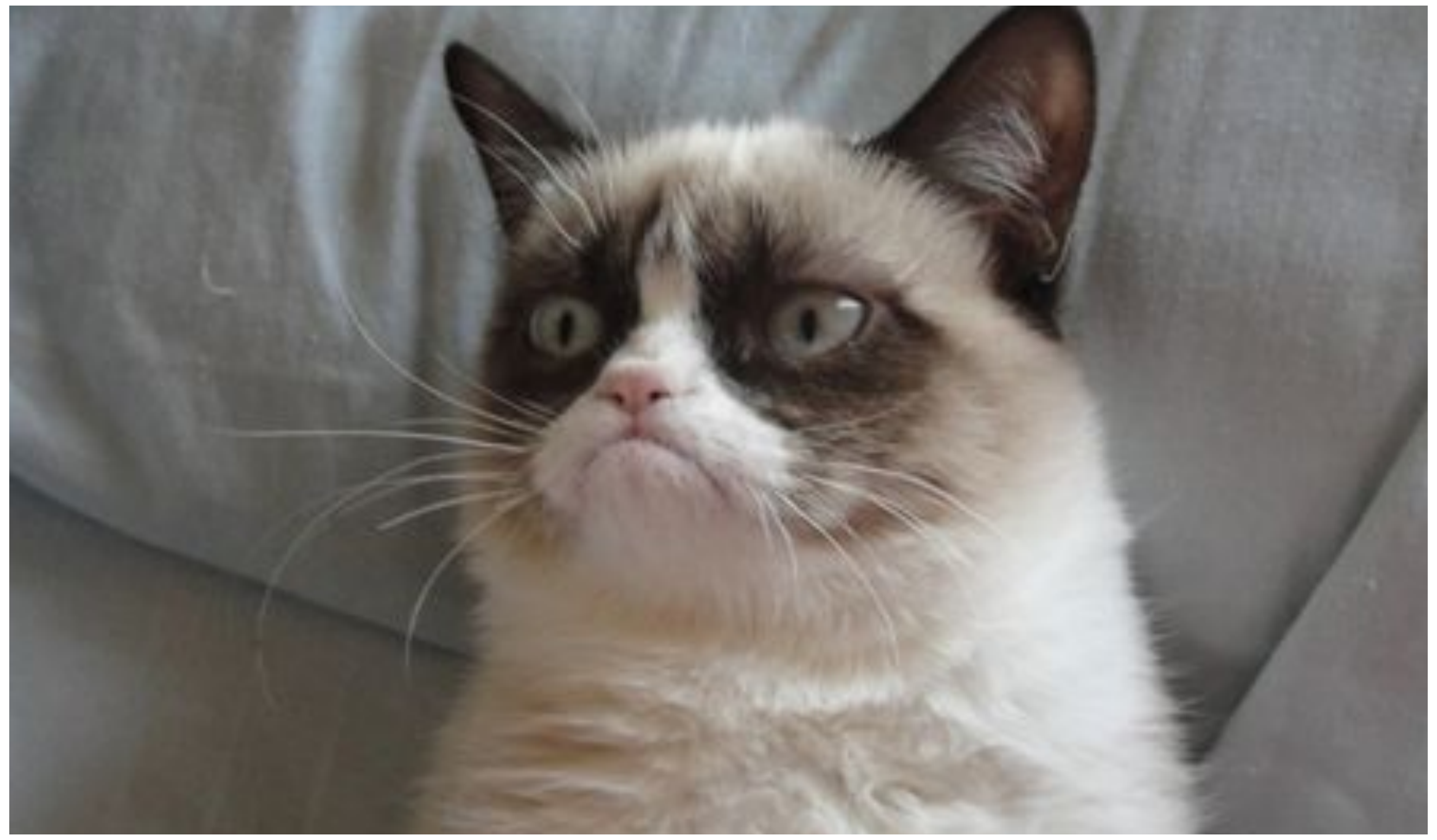

FIRE! Everyone to the exit!
EXIT
This way!
Exit_v2.0
EXIT
That way!
Exit_v2.5rev1_RPedits
EX
Exit_v8.0_rev10_final
Exit_v8.0_rev7_really-final
we're going to die, aren't we?

Stop, Drop, and Use a Versioning System
@redpenblackpen

- Manual: use file naming to document drafts (e.g., dates, version numbers)
- Software: git, GitHub, subversion
- Allows you to trace your steps

4. Preserve the Journey

Version control: tracking and managing changes to documents or code



99 little bugs in the code
99 little bugs
Take one down and compile it
117 little bugs in the code...

- Manual: use file naming to document drafts (e.g., dates, version numbers)
- Software: git, GitHub, subversion
- Allows you to trace your steps

4. Preserve the Journey

Version control: tracking and managing changes to documents or code

What makes this 'Open'?

- Documents project and data history
- Can reproduce process if needed
- Bigger Lift: use a version control software (e.g., git)

- Manual: use file naming to document drafts (e.g., dates, version numbers)
- Software: git, GitHub, subversion
- Allows you to trace your steps

5. Avoid Manual Manipulations

- Manual data manipulations leave no trace
  - Hard to reproduce
  - Error prone

- Alternatives:
  - Save Syntax in SPSS
  - Include calculations in variable descriptions
  - Script data cleaning

I DON'T ALWAYS USE COPY AND PASTE
BUT WHEN I DO, I COPY OVER THE THING I WAS TRYING TO PASTE.

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  - Hard to reproduce
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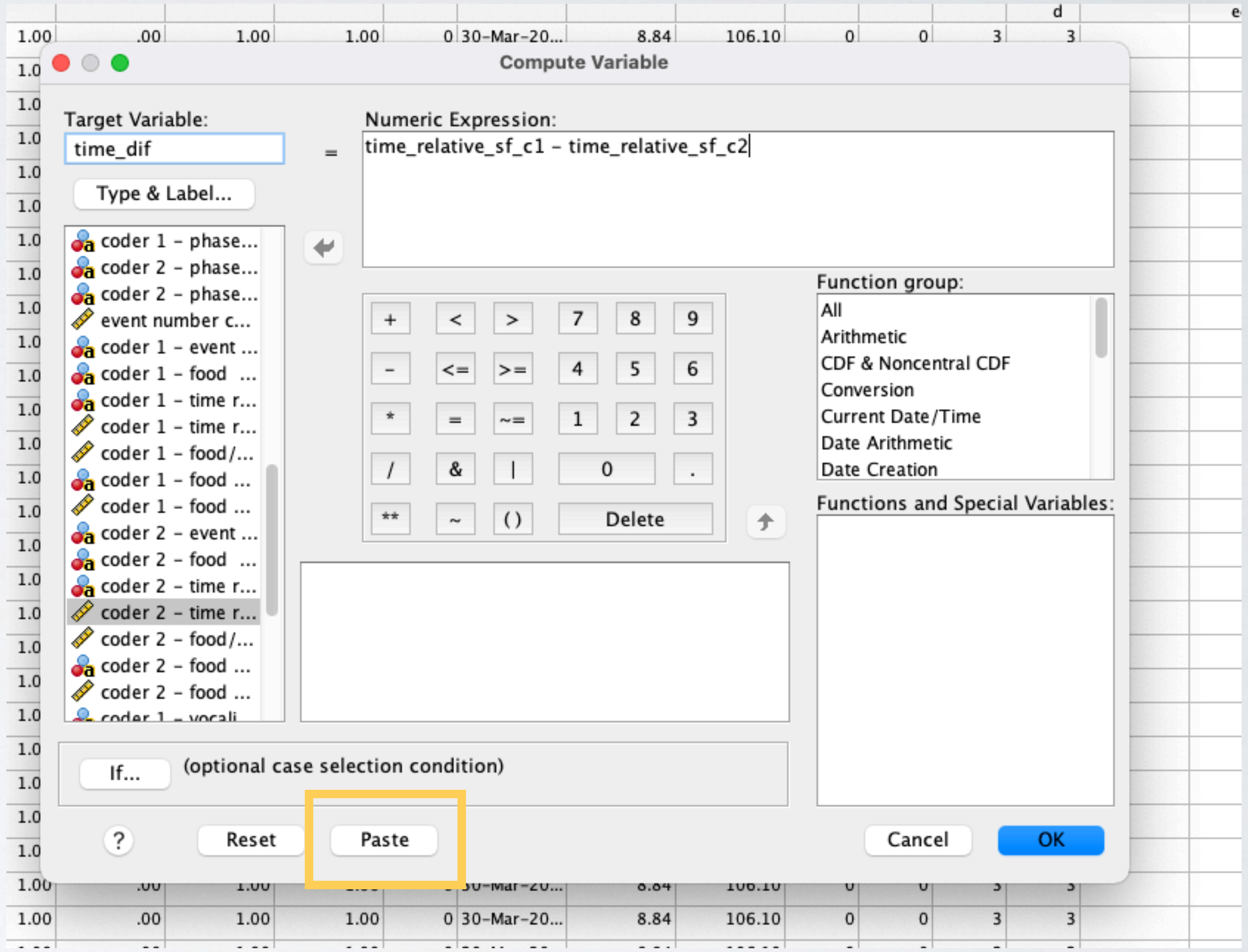


Compute Variable

Target Variable: time_dif

Numeric Expression: time_relative_sf_c1 - time_relative_sf_c2

5. Avoid Manual Manipulations

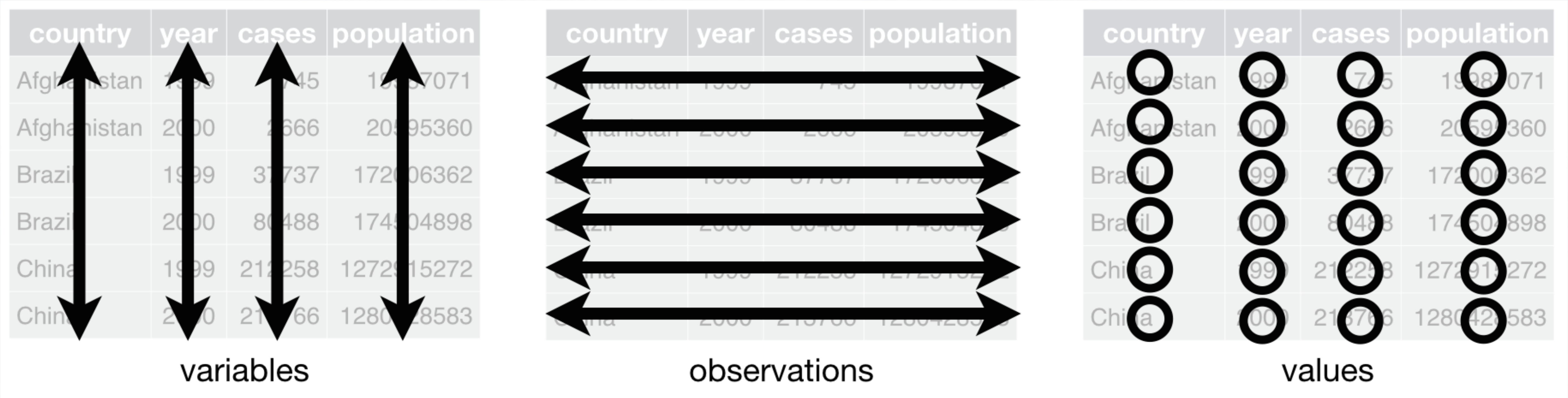
- Manual data manipulations leave no trace
  - Hard to reproduce
  - Error prone

- Alternatives:
  - Save Syntax in SPSS
  - Include calculations in variable descriptions
  - Script data cleaning

What makes this 'Open'?

- Data processing will be reproducible
- Can reverse to original data if needed
- Bigger Lift: move away from GUI-based analysis software to open code/syntax based programs (e.g., R, python)

6. 'Tidy' Your Data



- Every variable is in its own column
- Each participant/sample is in its own row
- Each value is in its own cell

6. ‘Tidy’ Your Data

- Use open file formats — csv, html, txt, jpeg

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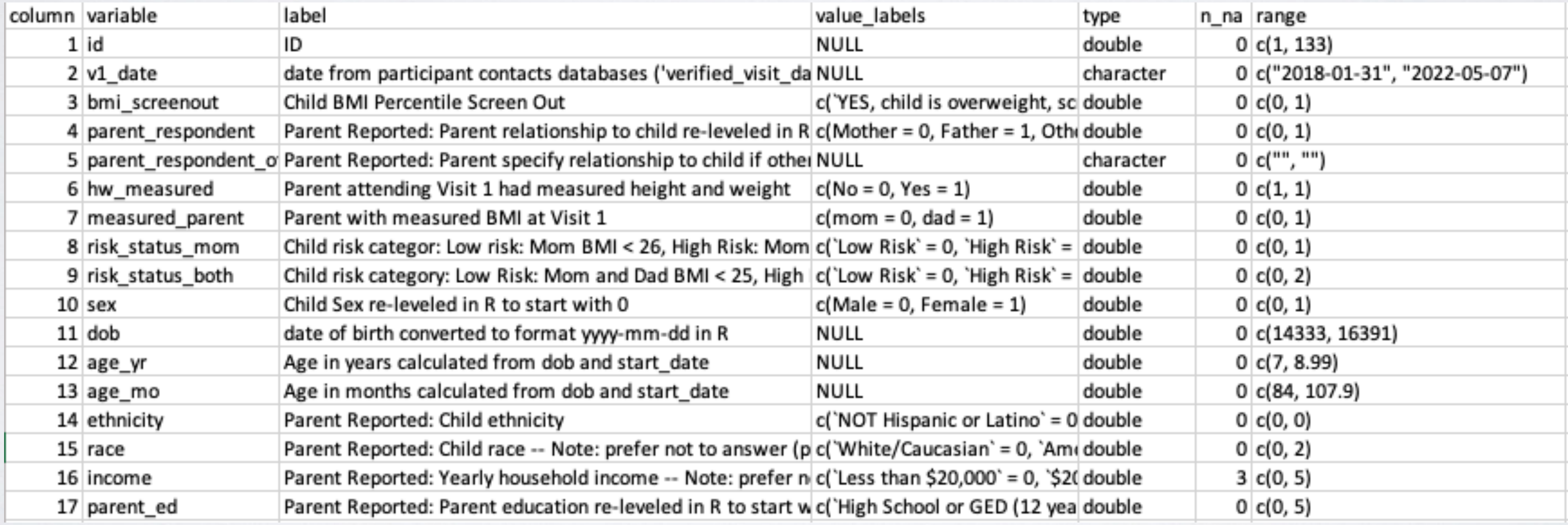
- Use open file formats — csv, html, txt, jpeg
- Create a data dictionary



column	variable	label	value_labels	type	n_na	range
1	id	ID	NULL	double	0	c(1, 133)
2	v1_date	date from participant contacts databases ('verified_visit_da	NULL	character	0	c("2018-01-31", "2022-05-07")
3	bmi_screenout	Child BMI Percentile Screen Out	c(`YES, child is overweight, sc	double	0	c(0, 1)
4	parent_respondent	Parent Reported: Parent relationship to child re-leveled in R	c(Mother = 0, Father = 1, Oth	double	0	c(0, 1)
5	parent_respondent_o	Parent Reported: Parent specify relationship to child if othe	NULL	character	0	c("", "")
6	hw_measured	Parent attending Visit 1 had measured height and weight	c(No = 0, Yes = 1)	double	0	c(1, 1)
7	measured_parent	Parent with measured BMI at Visit 1	c(mom = 0, dad = 1)	double	0	c(0, 1)
8	risk_status_mom	Child risk categor: Low risk: Mom BMI < 26, High Risk: Mom	c(`Low Risk` = 0, `High Risk` =	double	0	c(0, 1)
9	risk_status_both	Child risk category: Low Risk: Mom and Dad BMI < 25, High	c(`Low Risk` = 0, `High Risk` =	double	0	c(0, 2)
10	sex	Child Sex re-leveled in R to start with 0	c(Male = 0, Female = 1)	double	0	c(0, 1)
11	dob	date of birth converted to format yyyy-mm-dd in R	NULL	double	0	c(14333, 16391)
12	age_yr	Age in years calculated from dob and start_date	NULL	double	0	c(7, 8.99)
13	age_mo	Age in months calculated from dob and start_date	NULL	double	0	c(84, 107.9)
14	ethnicity	Parent Reported: Child ethnicity	c(`NOT Hispanic or Latino` = 0	double	0	c(0, 0)
15	race	Parent Reported: Child race -- Note: prefer not to answer (p	c(`White/Caucasian` = 0, `Am	double	0	c(0, 2)
16	income	Parent Reported: Yearly household income -- Note: prefer n	c(`Less than $20,000` = 0, `$2	double	3	c(0, 5)
17	parent_ed	Parent Reported: Parent education re-leveled in R to start w	c(`High School or GED (12 yea	double	0	c(0, 5)

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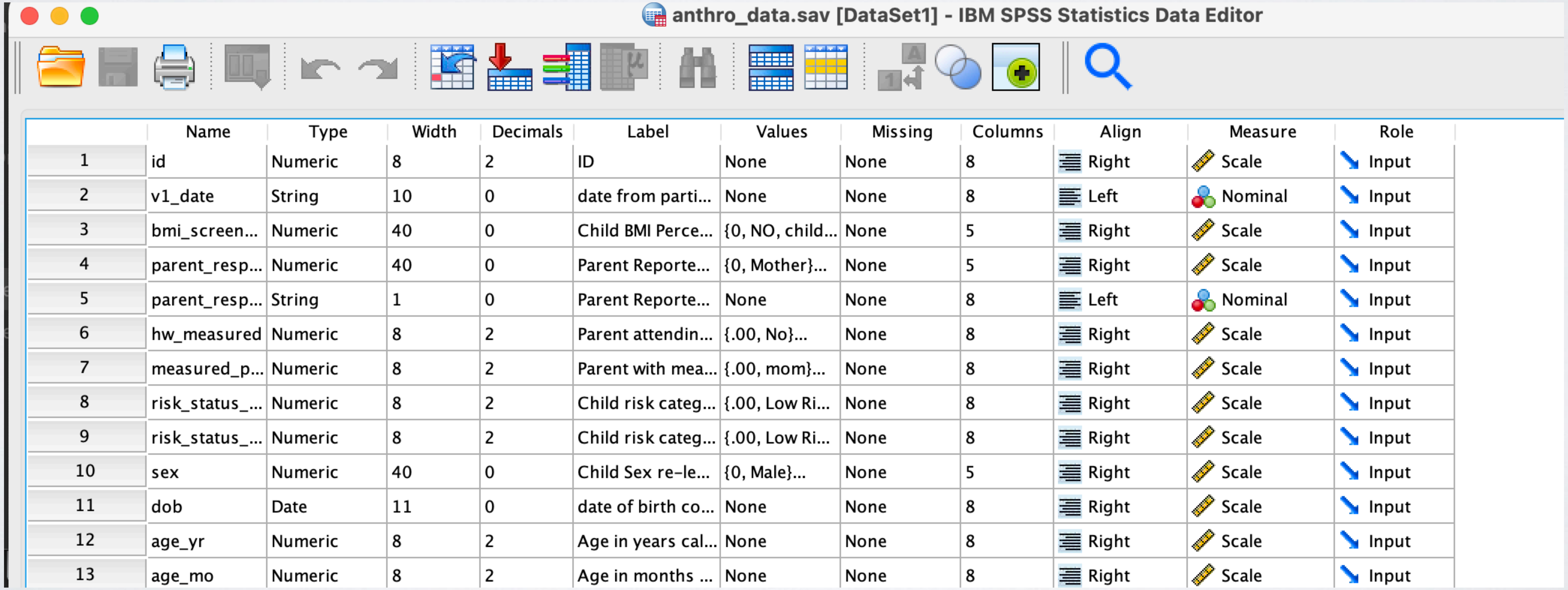

anthro_data.sav [DataSet1] - IBM SPSS Statistics Data Editor

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	id	Numeric	8	2	ID	None	None	8	Right	Scale	Input
2	v1_date	String	10	0	date from parti...	None	None	8	Left	Nominal	Input
3	bmi_screen...	Numeric	40	0	Child BMI Perce...	{0, NO, child...	None	5	Right	Scale	Input
4	parent_resp...	Numeric	40	0	Parent Reporte...	{0, Mother}...	None	5	Right	Scale	Input
5	parent_resp...	String	1	0	Parent Reporte...	None	None	8	Left	Nominal	Input
6	hw_measured	Numeric	8	2	Parent attendin...	{.00, No}...	None	8	Right	Scale	Input
7	measured_p...	Numeric	8	2	Parent with mea...	{.00, mom}...	None	8	Right	Scale	Input
8	risk_status_...	Numeric	8	2	Child risk categ...	{.00, Low Ri...	None	8	Right	Scale	Input
9	risk_status_...	Numeric	8	2	Child risk categ...	{.00, Low Ri...	None	8	Right	Scale	Input
10	sex	Numeric	40	0	Child Sex re-le...	{0, Male}...	None	5	Right	Scale	Input
11	dob	Date	11	0	date of birth co...	None	None	8	Right	Scale	Input
12	age_yr	Numeric	8	2	Age in years cal...	None	None	8	Right	Scale	Input
13	age_mo	Numeric	8	2	Age in months ...	None	None	8	Right	Scale	Input

6. ‘Tidy’ Your Data

- Use open file formats — csv, html, txt, jpeg
- Create a data dictionary
- One piece of information per cell

height
5 ft 6 in
5 ft 2 in
7 ft
5 ft 11 in

→

height_ft	height_in
5	6
5	2
7	0
5	11

6. 'Tidy' Your Data

- Use open file formats — csv, html, txt, jpeg
- Create a data dictionary
- One piece of information per cell
- Do not use highlighting/font color as data

height
5 ft 6 in
5 ft 2 in
7 ft
5 ft 11 in

→

height_ft	height_in	check_height
5	6	0
5	2	0
7	0	1
5	11	0

6. ‘Tidy’ Your Data

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- Create a data dictionary
- One piece of information per cell
- Do not use highlighting/font color as data

What makes this ‘Open’?

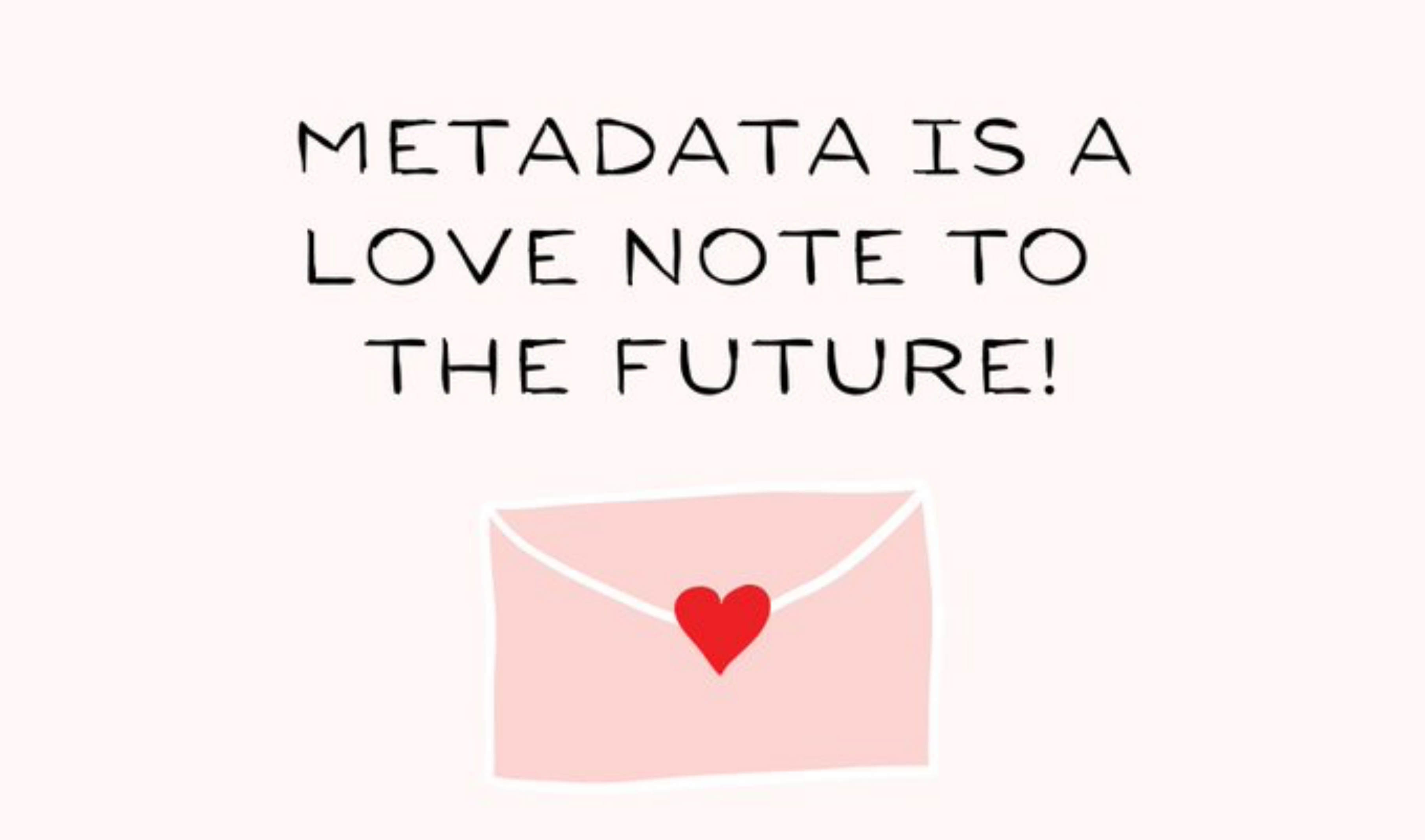
- Open formats are accessible
- All data are computer readable
- Data are documented
- Makes data re-use and sharing easier

7. Metadata Magic

Metadata: the who, what, when, where, and why of your data

Easiest: when in doubt, document

- Data dictionaries
- Standard operating procedures manuals
- Lab notebooks
- changelog file (document versions)
- README
    - Description of folders/files
    - Can provide instructions on use of code/ data
    - License information

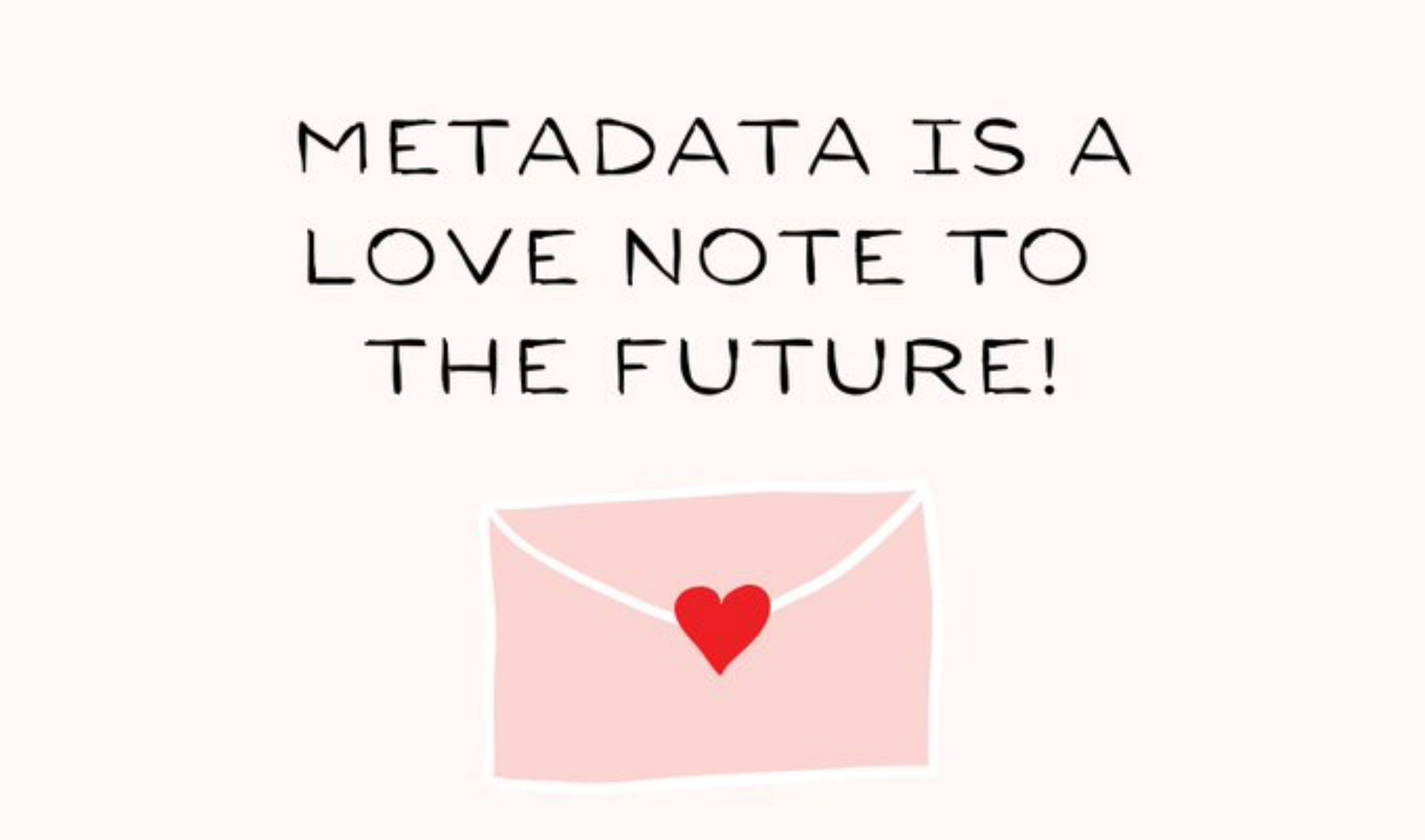


7. Metadata Magic

Metadata: the who, what, when, where, and why of your data

Medium Effort: Data Manual

- Larger
- More verbose and detailed
- Can include science/rational/citations
- Like a user manual for data



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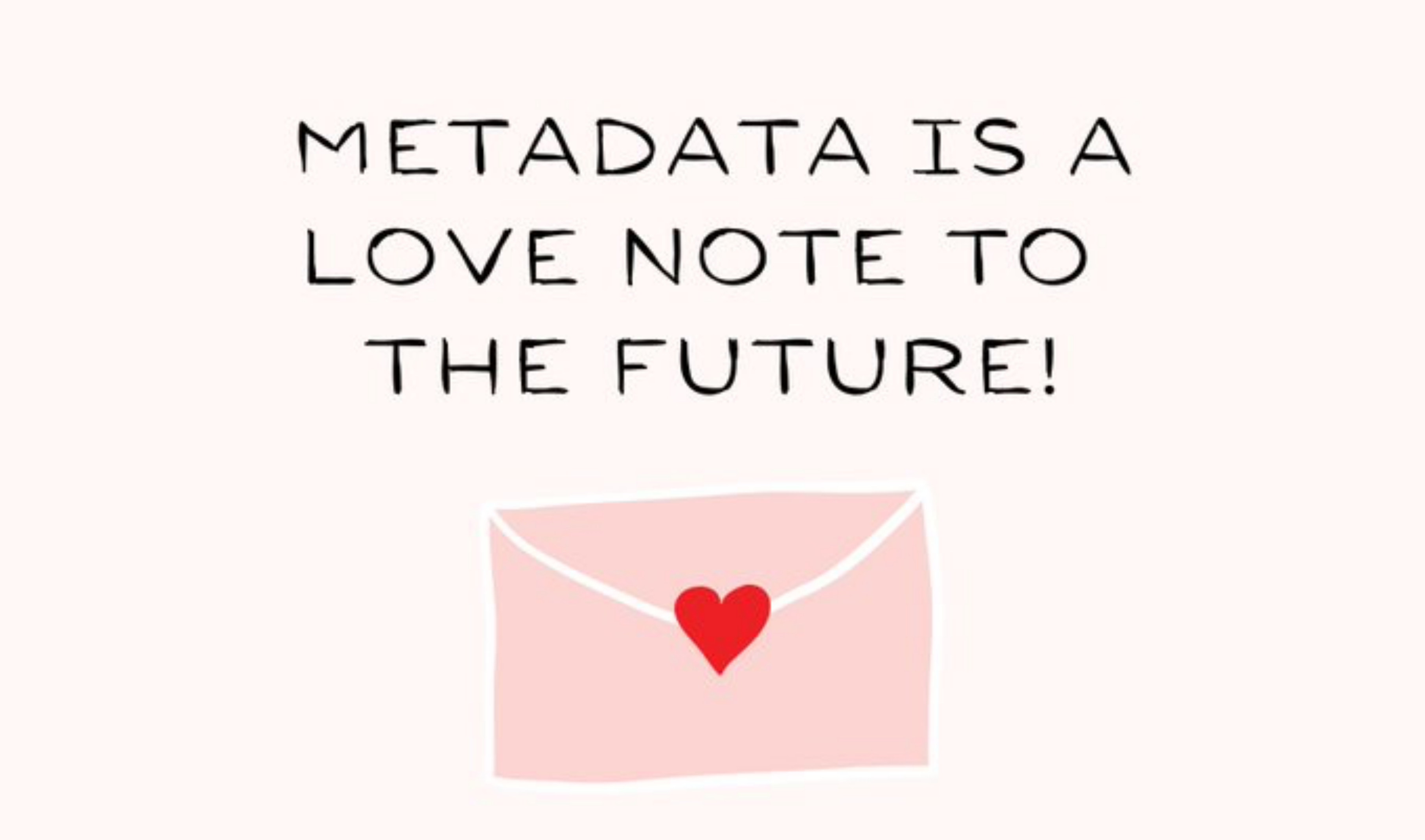
Bigger Lift: Structured Metadata

- Often laid out in fields
- Can require use of shared vocabularies
- Often field/data type specific



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Bigger Lift: Structured Metadata

- Often laid out in fields
- Can require use of shared vocabularies
- Often field/data type specific

What makes this 'Open'?

- Makes data more findable
- Helps others (and future you) understand the data
- Shared vocabularies help to harmonize data within a field

‘Good Enough’ Practices

1. Preserve Raw Data
2. Create a Central Hub
3. Use Meaningful Names
4. Preserve the Journey
5. Avoid Manual Manipulations
6. ‘Tidy’Your Data
7. Metadata Magic