

DATA MANAGEMENT FOR NEUROSCIENCE:

THE BIDS STANDARD AND DATALAD

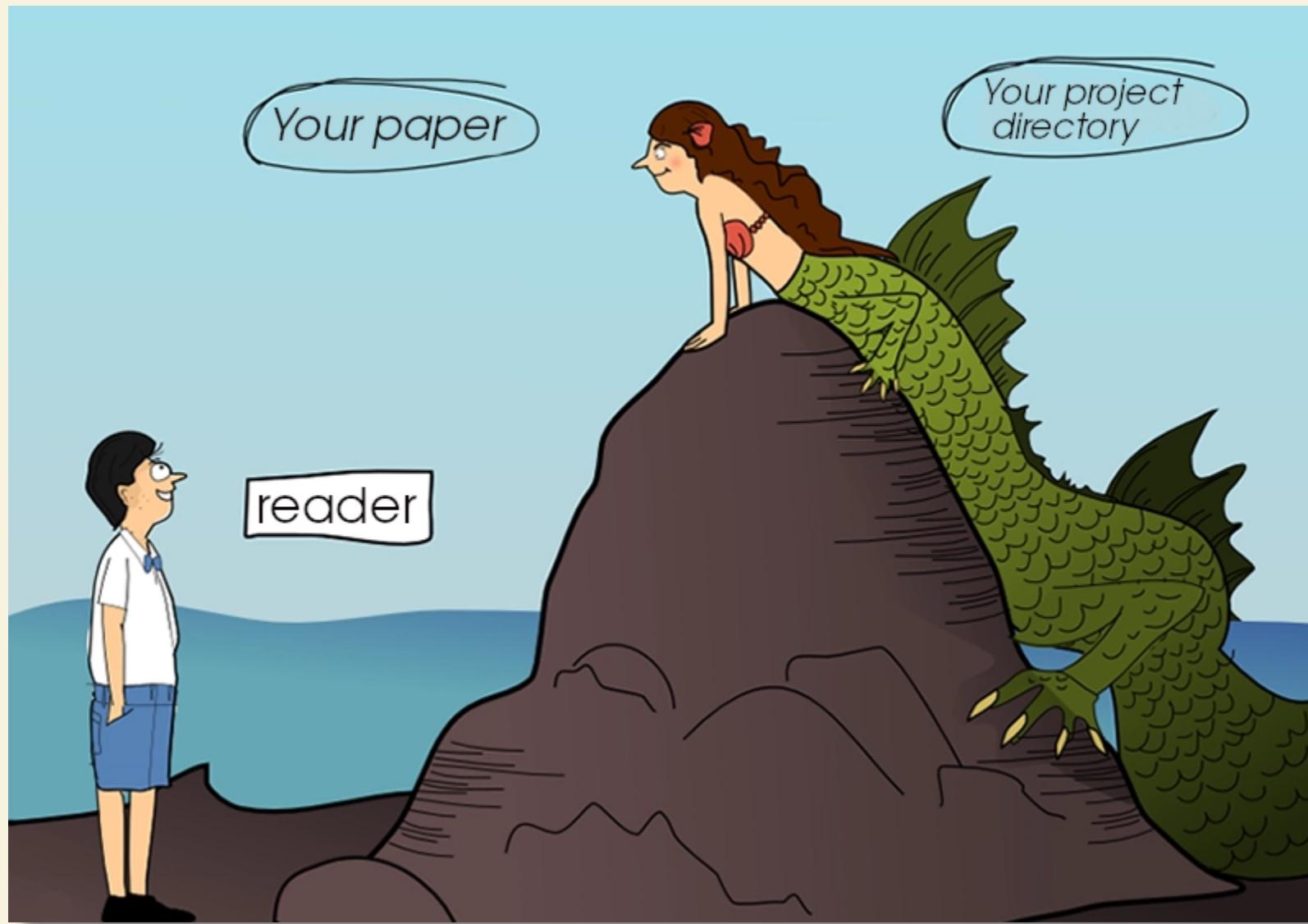
AN INTRODUCTION

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 @AdinaKrik



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Institute of Neuroscience and Medicine, Brain & Behavior (INM-7)
Research Center Jülich

WHY DATA MANAGEMENT?



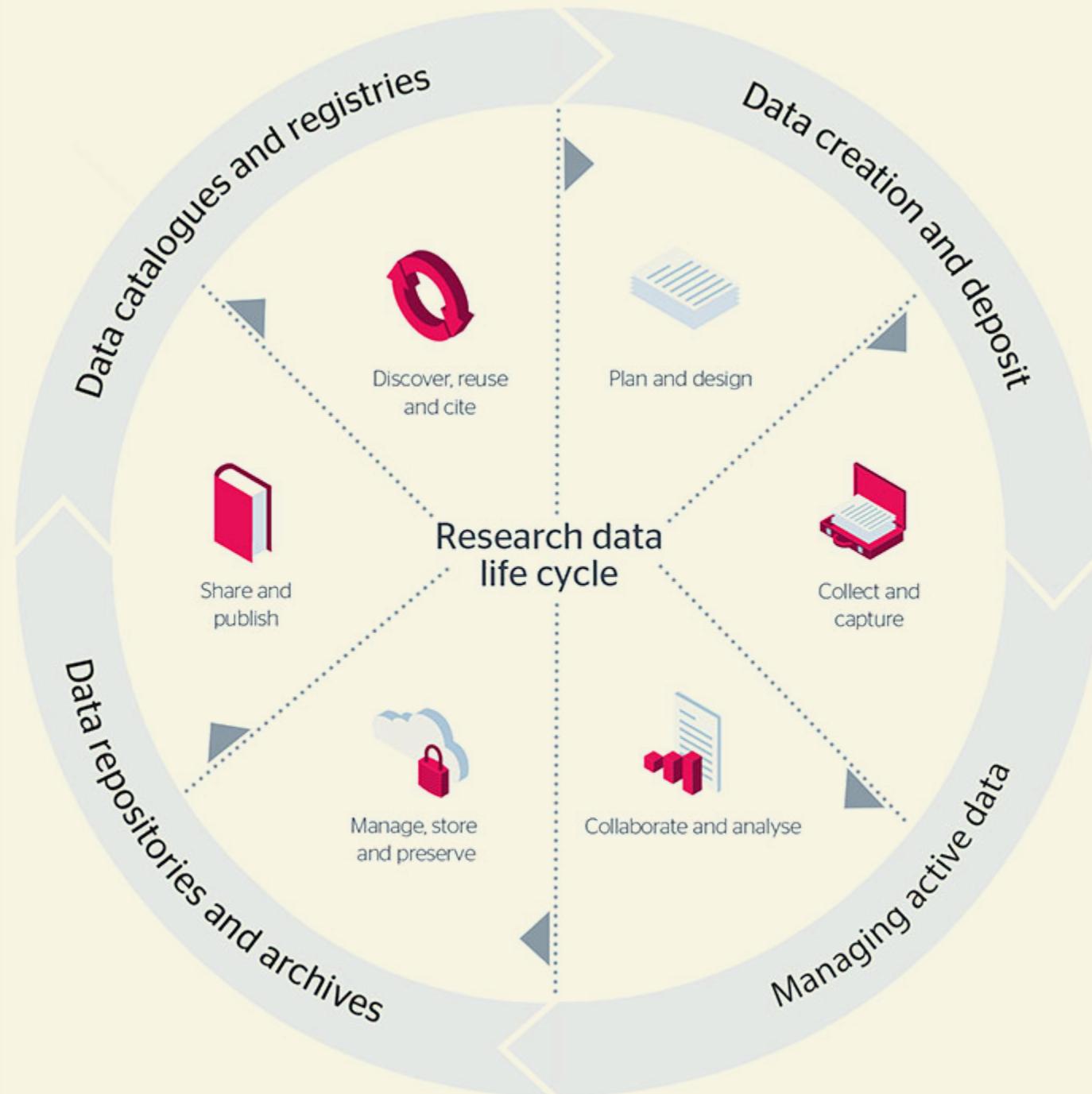
WHAT IS (RESEARCH) DATA MANAGEMENT?

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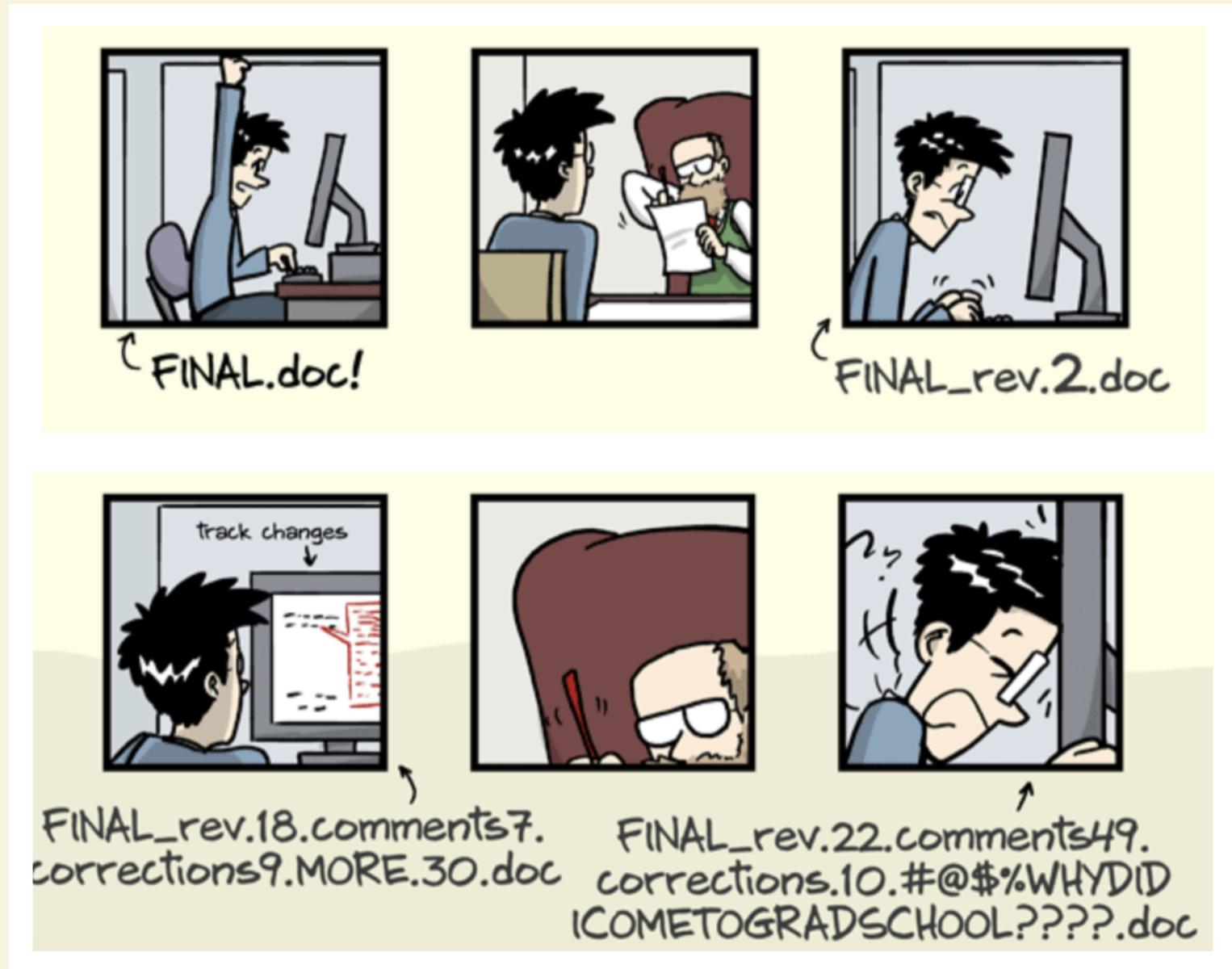


HOW IS (RESEARCH) DATA MANAGEMENT POSSIBLE?

There are tools and concepts that can help:

- **Version control** your data
- **Standardize** file names and organization
- **Document everything**, ideally automatically

WHY VERSION CONTROL?



WHY STANDARDS?

I SENT YOU THE DATA.

THANKS!

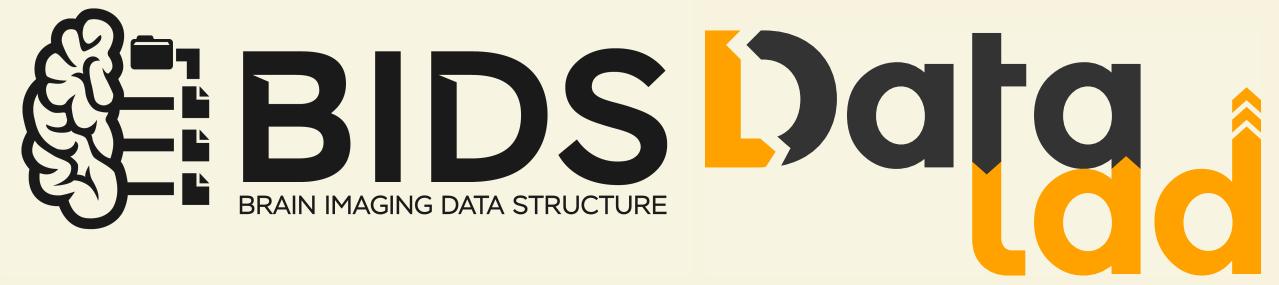
...THIS IS A WORD DOCUMENT
CONTAINING AN EMBEDDED PHOTO
YOU TOOK OF YOUR SCREEN
WITH THE SPREADSHEET OPEN.

YEAH? DOES YOUR COMPUTER
NOT SUPPORT .NORM FILES?
MAYBE YOU NEED TO UPDATE.



SINCE EVERYONE SENDS STUFF THIS
WAY ANYWAY, WE SHOULD JUST
FORMALIZE IT AS A STANDARD.

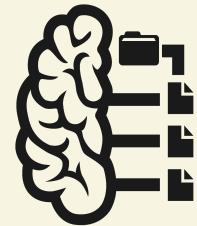




TOOLS THAT CAN HELP WITH DATA MANAGEMENT



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BIDS

BRAIN IMAGING DATA STRUCTURE



What is it?

TOOLS THAT CAN HELP WITH DATA MANAGEMENT



BIDS

BRAIN IMAGING DATA STRUCTURE

Data
Lad

What is it?

Why should I use it?

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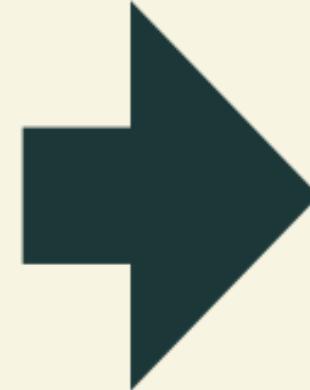
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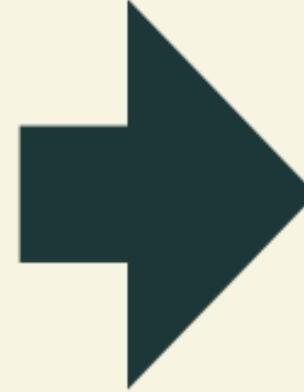
```
dicomdir/
  1208200617178_22/
    1208200617178_22_8973.dcm
    1208200617178_22_8943.dcm
    1208200617178_22_2973.dcm
    1208200617178_22_8923.dcm
    1208200617178_22_4473.dcm
    1208200617178_22_8783.dcm
    1208200617178_22_7328.dcm
    1208200617178_22_9264.dcm
    1208200617178_22_9967.dcm
    1208200617178_22_3894.dcm
    1208200617178_22_3899.dcm
  1208200617178_23/
  1208200617178_24/
  1208200617178_25/
```



```
my_dataset/
  participants.tsv
  sub-01/
    anat/
      sub-01_T1w.nii.gz
    func/
      sub-01_task-rest_bold.nii.gz
      sub-01_task-rest_bold.json
    dwi/
      sub-01_dwi.nii.gz
      sub-01_dwi.json
      sub-01_dwi.bval
      sub-01_dwi.bvec
  sub-02/
  sub-03/
  sub-04/
```



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dicomdir/
  1208200617178_22/
    1208200617178_22_8973.dcm
    1208200617178_22_8943.dcm
    1208200617178_22_2973.dcm
    1208200617178_22_8923.dcm
    1208200617178_22_4473.dcm
    1208200617178_22_8783.dcm
    1208200617178_22_7328.dcm
    1208200617178_22_9264.dcm
    1208200617178_22_9967.dcm
    1208200617178_22_3894.dcm
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my_dataset/
  participants.tsv
  sub-01/
    anat/
      sub-01_T1w.nii.gz
    func/
      sub-01_task-rest_bold.nii.gz
      sub-01_task-rest_bold.json
    dwi/
      sub-01_dwi.nii.gz
      sub-01_dwi.json
      sub-01_dwi.bval
      sub-01_dwi.bvec
  sub-02/
  sub-03/
  sub-04/
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BIDS is a standard for a multitude of neuroimaging data (MRI, EEG, ...). It defines a data organization, naming schemes for files, and meta data descriptors.





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BIDS exist for (a growing amount of) different modalities. There is constant (open!) development of all of them





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Useful links and pointers

- ➲ Read the [paper](#)
- ➲ Get started with the [BIDS starter-kit](#)
- Work through the Stanford Center for Reproducible Neuroscience [BIDS Tutorial Series](#)
- ➲ Use the [BIDS validator](#) to check your datasets
- ➲ Get involved on [Github](#) to help shape BIDS to your needs. You can also checkout the [Google discussion group](#)
- ➲ Follow [@BIDS-standard](#)

Data



DataLad is a data management multitool.



Let's see it in action

REPRODUCIBLE PAPER - A MAGIC TRICK?

If curious, you can read up all the details and a step-by-step instruction [here](#).

Data Lad IN BRIEF

- A command-line tool, available for all major operating systems (Linux, macOS/OSX, Windows)
- Build on top of Git and Git-annex
- Allows...
 - ... version-controlling arbitrarily large content,
 - ... easily sharing and obtaining data (note: no data hosting!),
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☞ For more: Read the DataLad Handbook



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 - Datasets can be nested: *linked subdirectories*

EXPERIENCE A DATALAD DATASET

Code to follow along:

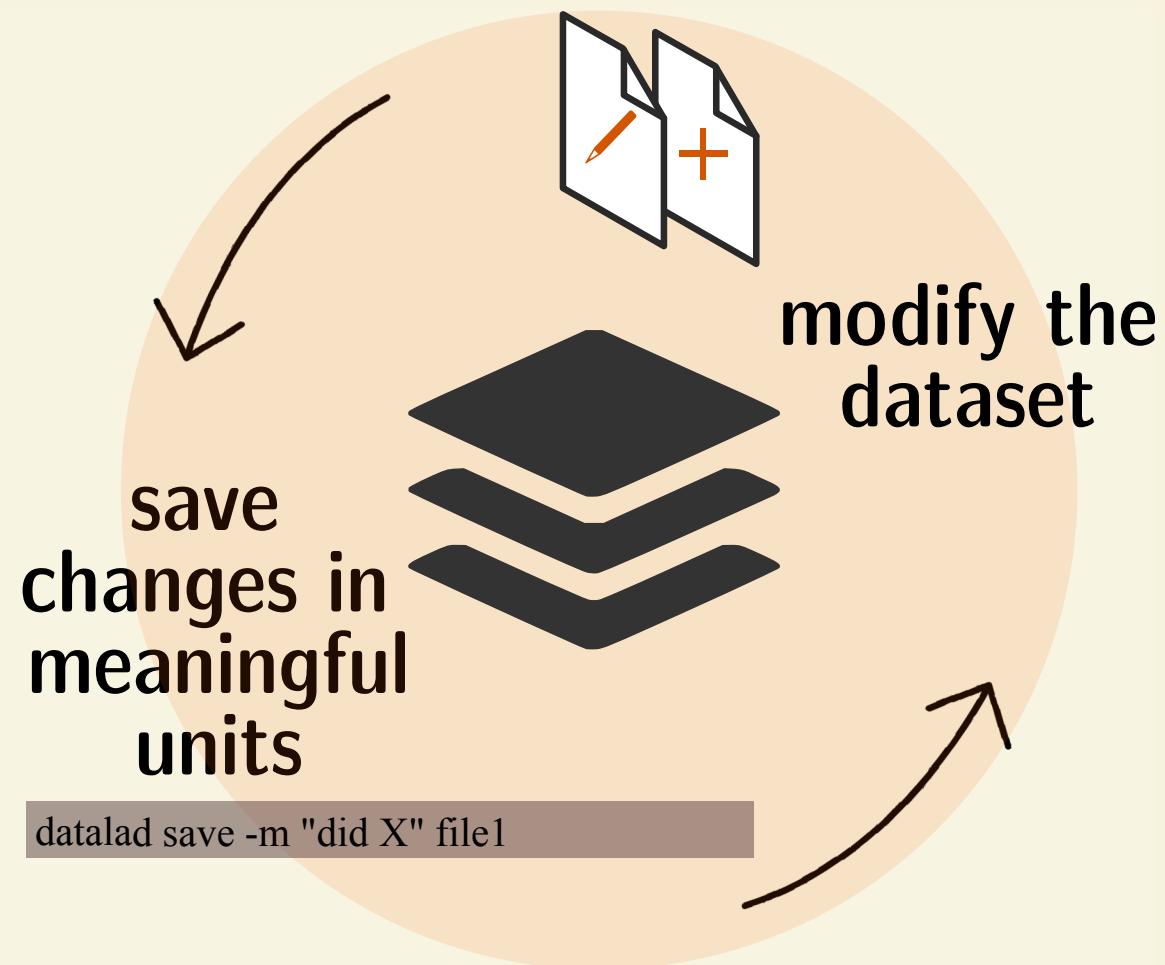
http://handbook.datalad.org/en/latest/code_from_chapters/01_dataset_basics_code.html

LOCAL VERSION CONTROL

Procedurally, version control is easy with DataLad!

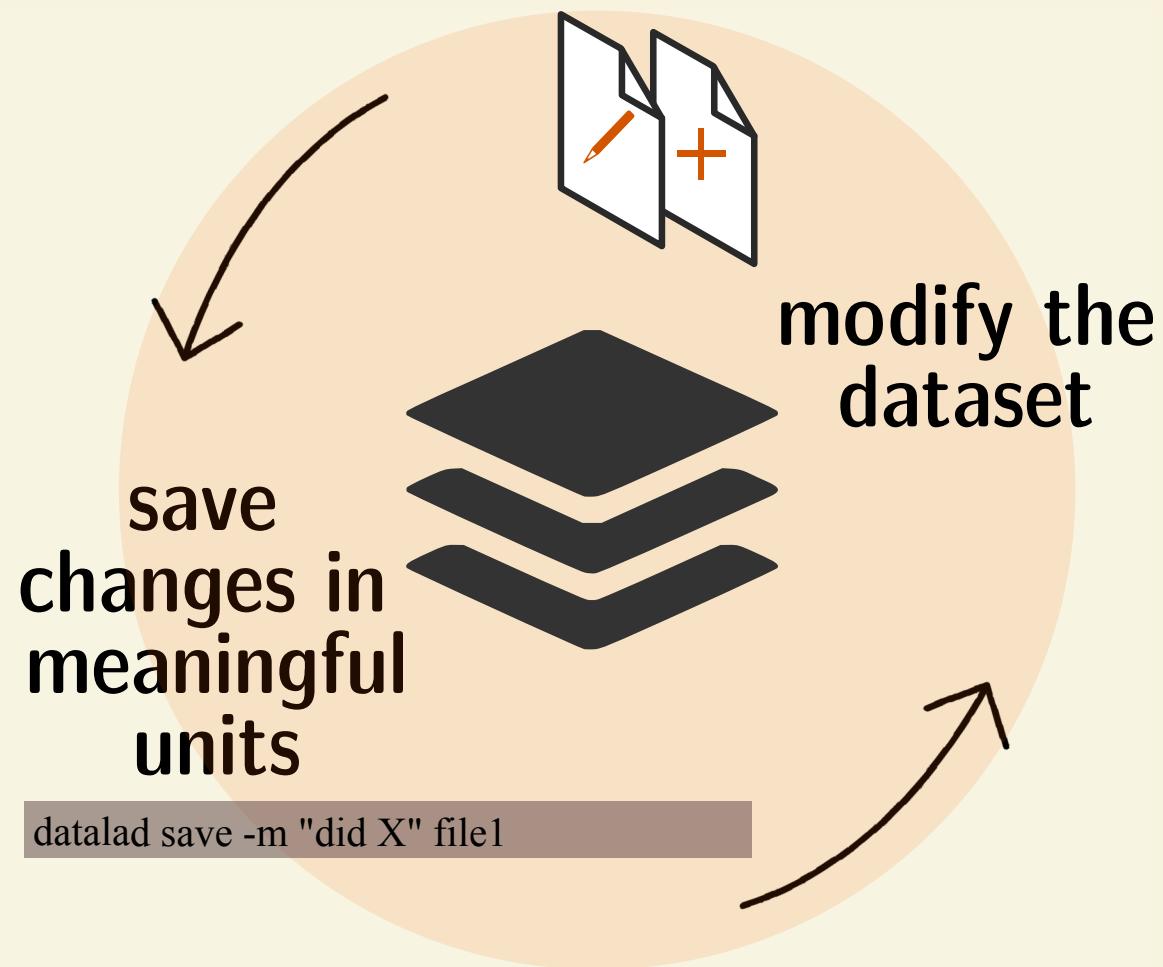
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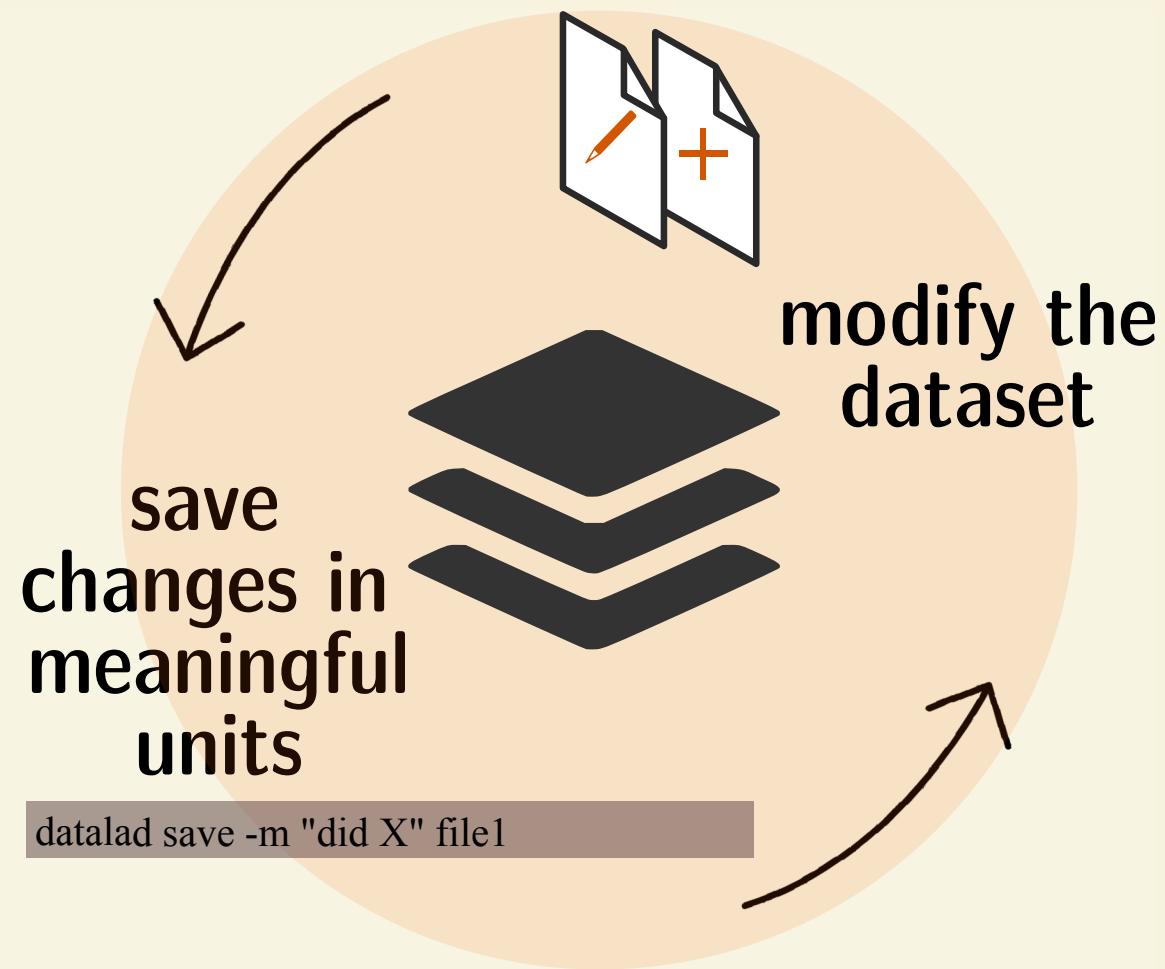
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Advice:

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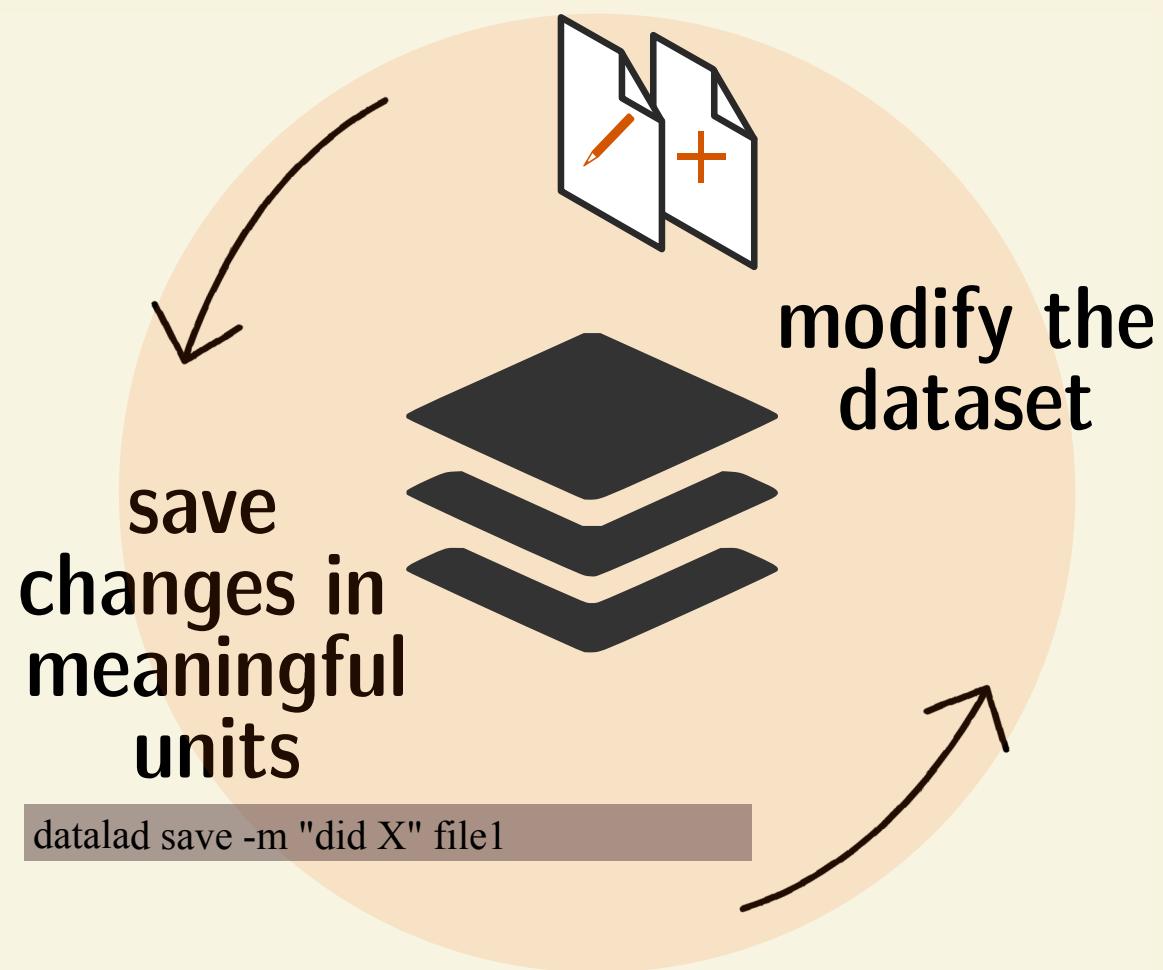


- Save *meaningful* units of change

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- Advice:
- Save *meaningful* units of change
 - Attach helpful commit messages

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A clean dataset status is good practice.

FROM HERE

"FINAL".doc



FINAL.doc!



FINAL_rev.2.doc



FINAL_rev.6.COMMENTS.doc



FINAL_rev.8.comments5.
CORRECTIONS.doc



JORGE CHAM © 2012

FINAL_rev.18.comments7.
corrections9.MORE.30.doc FINAL_rev.22.comments49.
corrections.10.#@\$%WHYDID
ICOMETOGRAD SCHOOL????.doc

FROM HERE TO THIS:



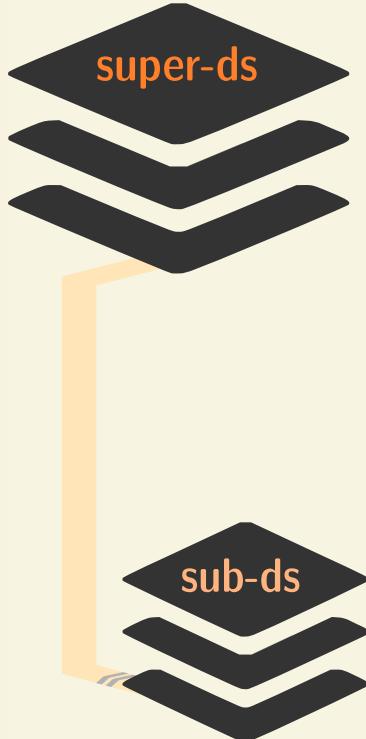
FROM HERE TO THIS:



BUT: Version control is only one aspect of data management

CONSUMING DATASETS

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DataLad-101/
books/
byte-of-python.pdf
progit.pdf
TLCL.pdf
recordings/
longnow/
Long_Now__Conv[...]/
...
Long_Now__Seminars[...]/
2003_12_13[...]
2003_11_15[...]
...
notes.txt

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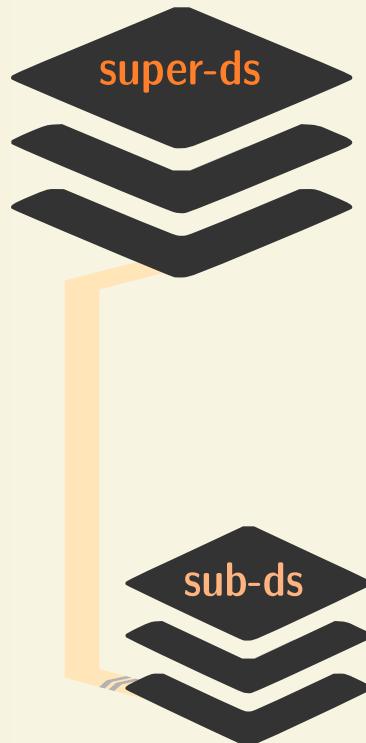
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! DataLad can obtain required subdataset content on demand. Only content elements actually required for an analysis are present. Directory structure is expanded recursively as needed.

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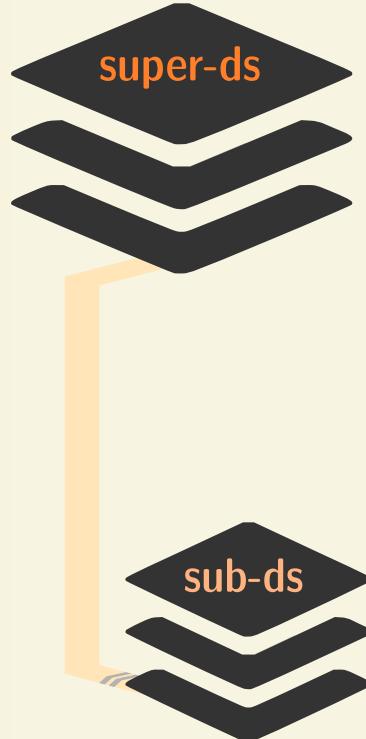
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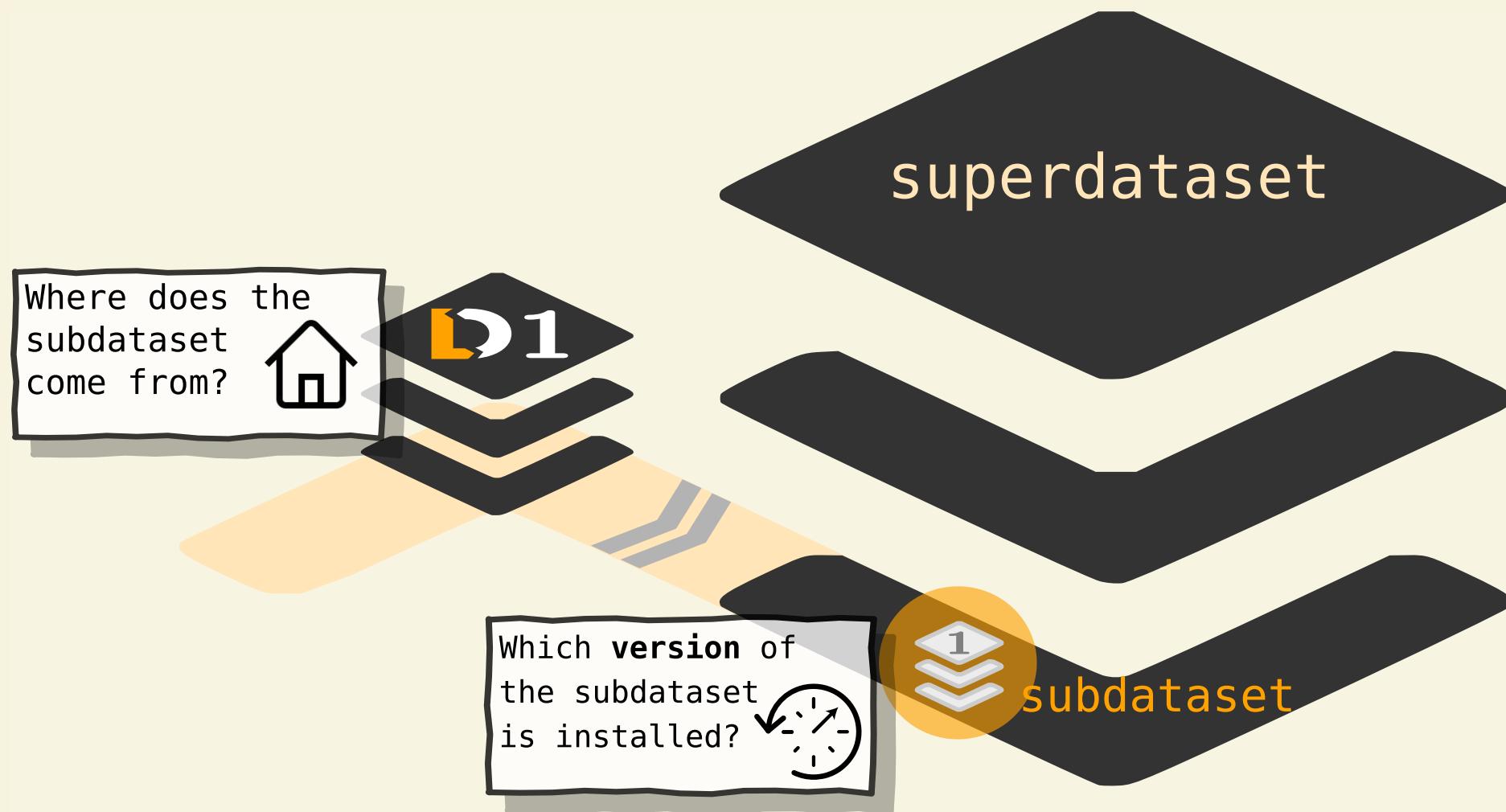
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DATASET NESTING



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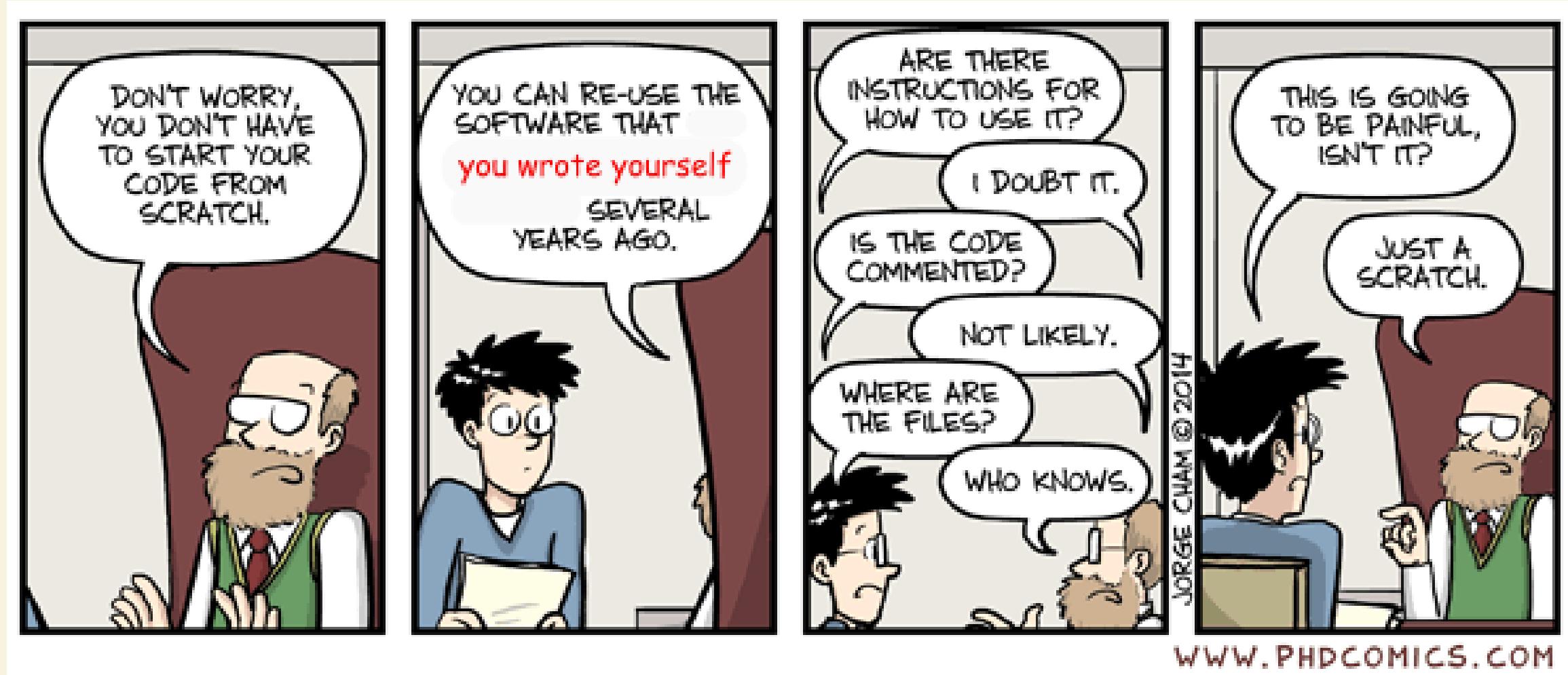
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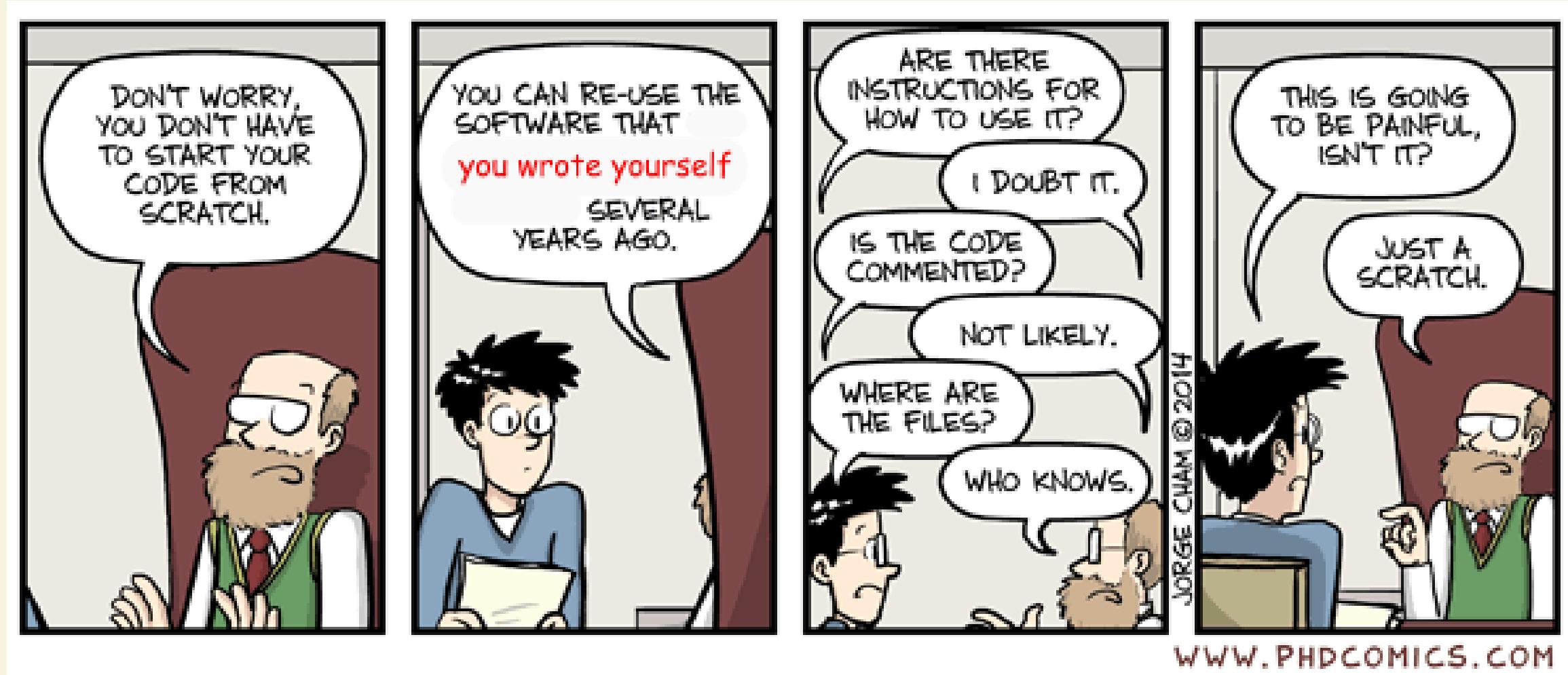
The superdataset records only the *version state* of the subdataset.

REPRODUCIBLE DATA ANALYSIS



REPRODUCIBLE DATA ANALYSIS

Image credit: Full comic at <http://phdcomics.com/comics.php?f=1979>



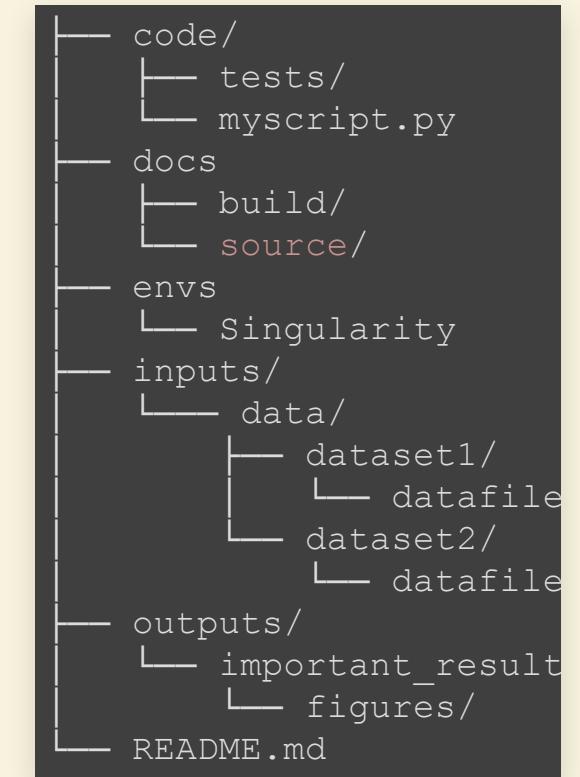
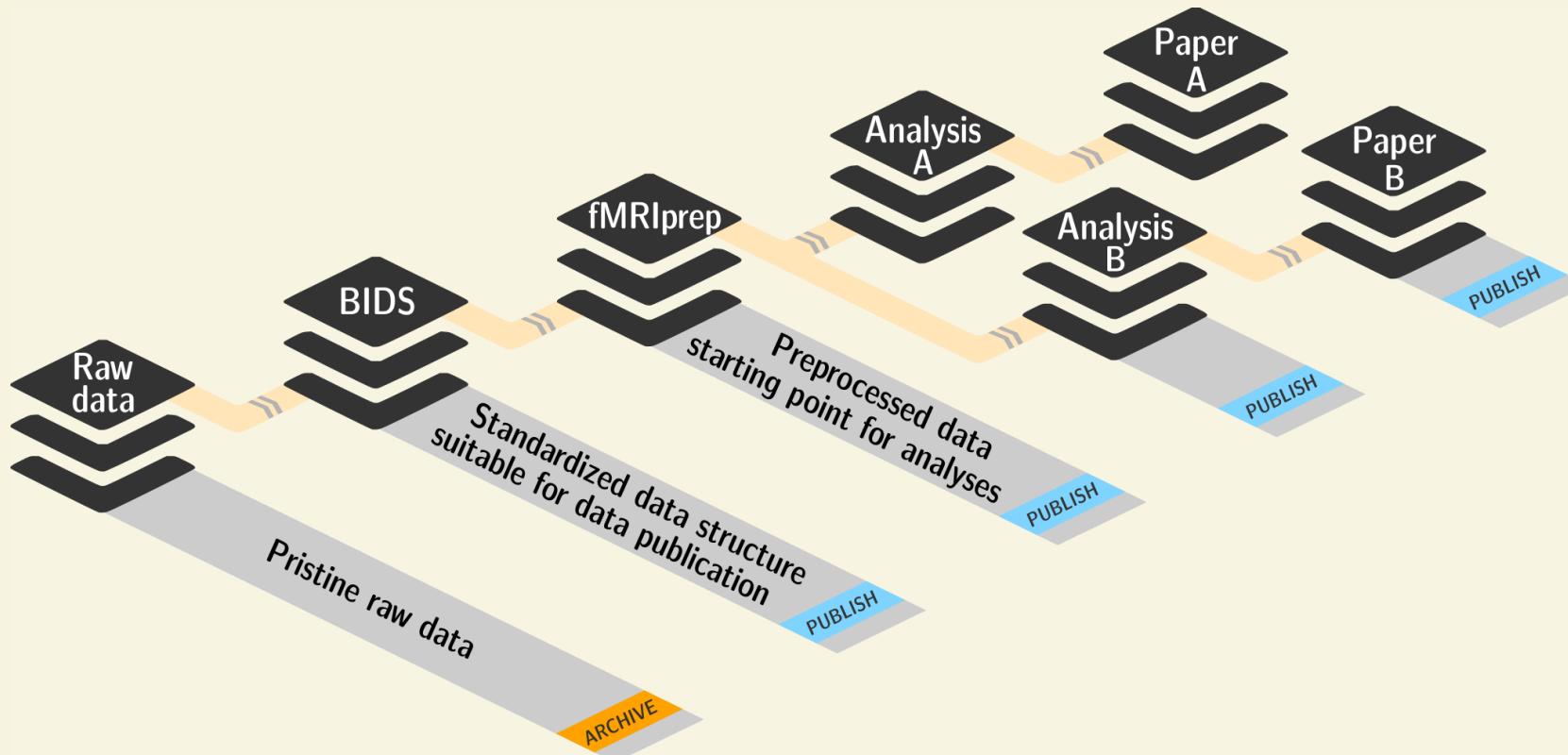
Code to follow along:

http://handbook.datalad.org/en/latest/code_from_chapters/10_yoda_code.html

BASIC ORGANIZATIONAL PRINCIPLES FOR DATASETS

Keep everything clean and modular

- An analysis is a superdataset, its components are subdatasets, and its structure modular

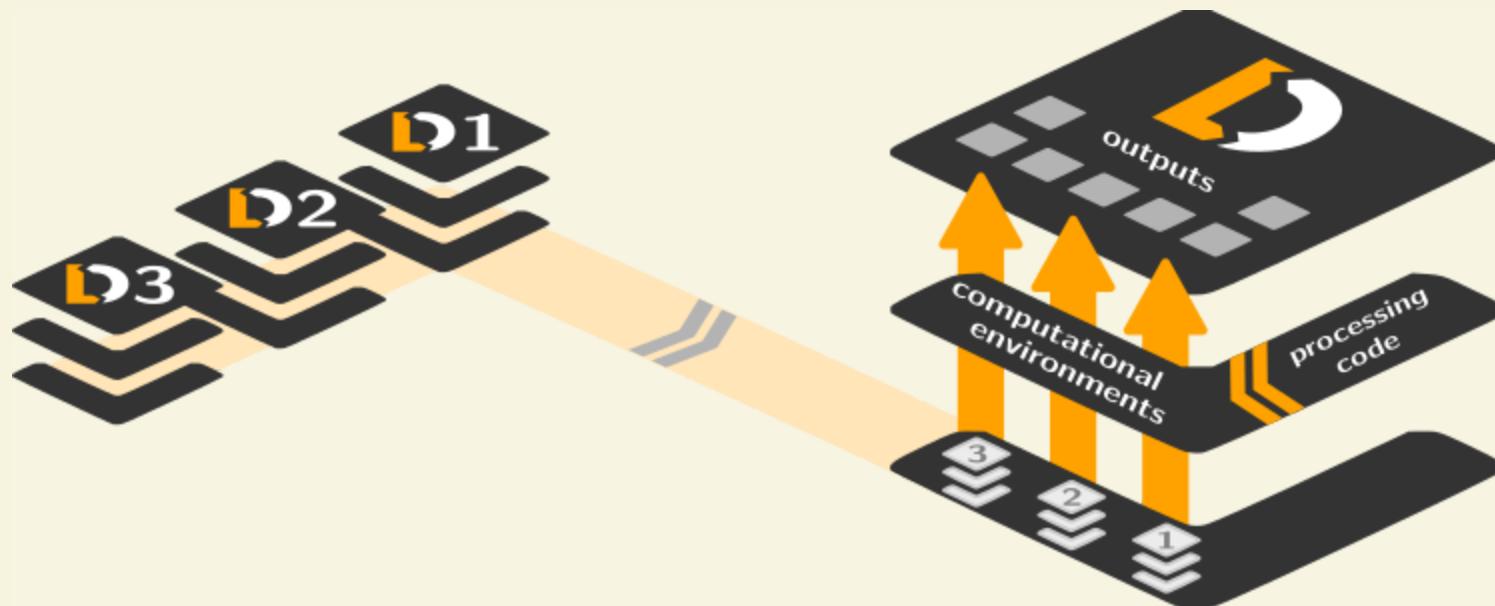


- do not touch/modify raw data: save any results/computations *outside* of input datasets
- Keep a superdataset self-contained: Scripts reference subdatasets or files with *relative paths*

BASIC ORGANIZATIONAL PRINCIPLES FOR DATASETS

Record where you got it from, where it is now, and what you do to it

- Link datasets (as subdatasets), record data origin
- Collect and store provenance of all contents of a dataset that you create

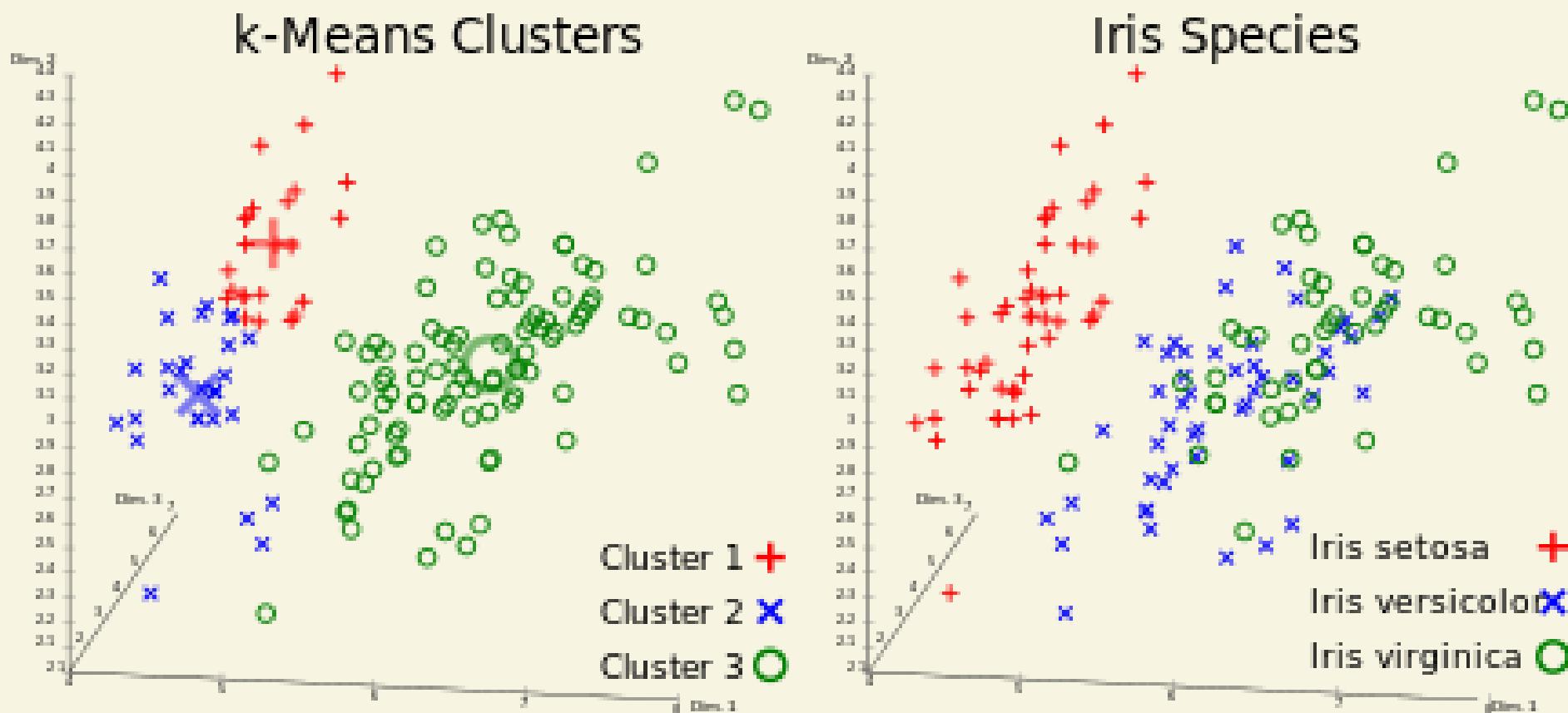
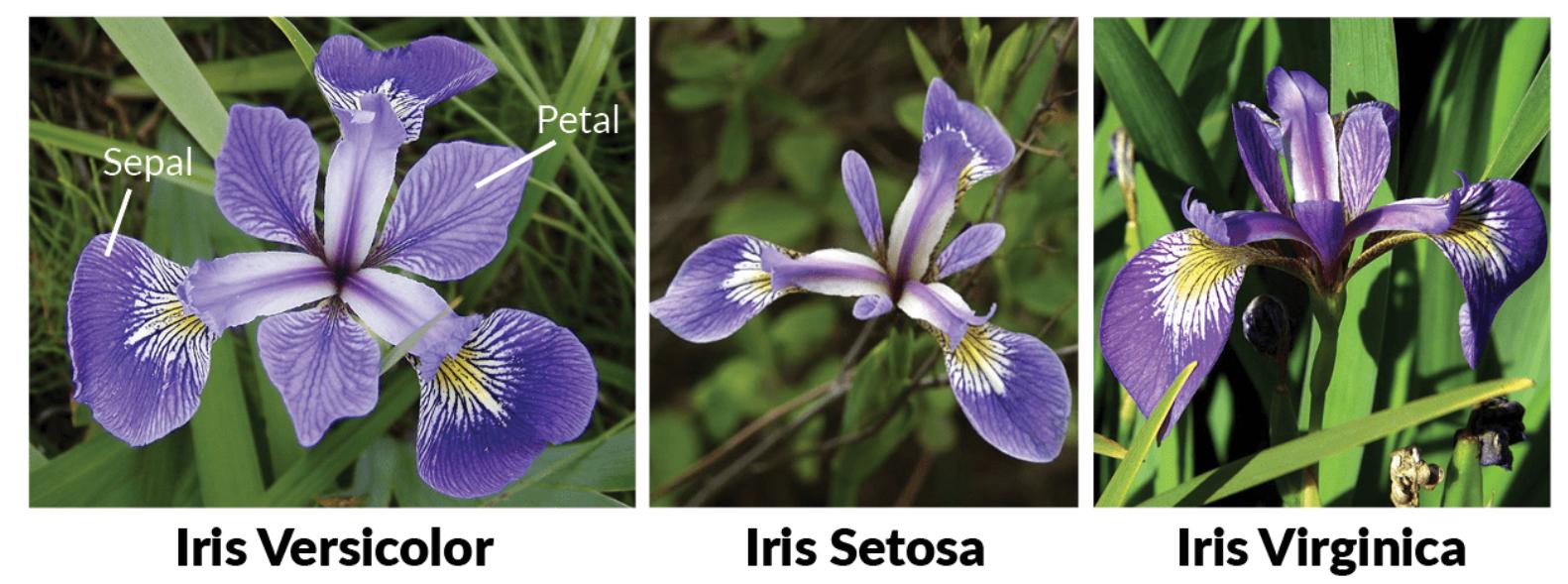


Document everything:

- Which script produced which output? From which data? In which software environment? ...

Find out more about organizational principles in the [YODA principles!](#)

A CLASSIFICATION ANALYSIS ON THE IRIS FLOWER DATASET

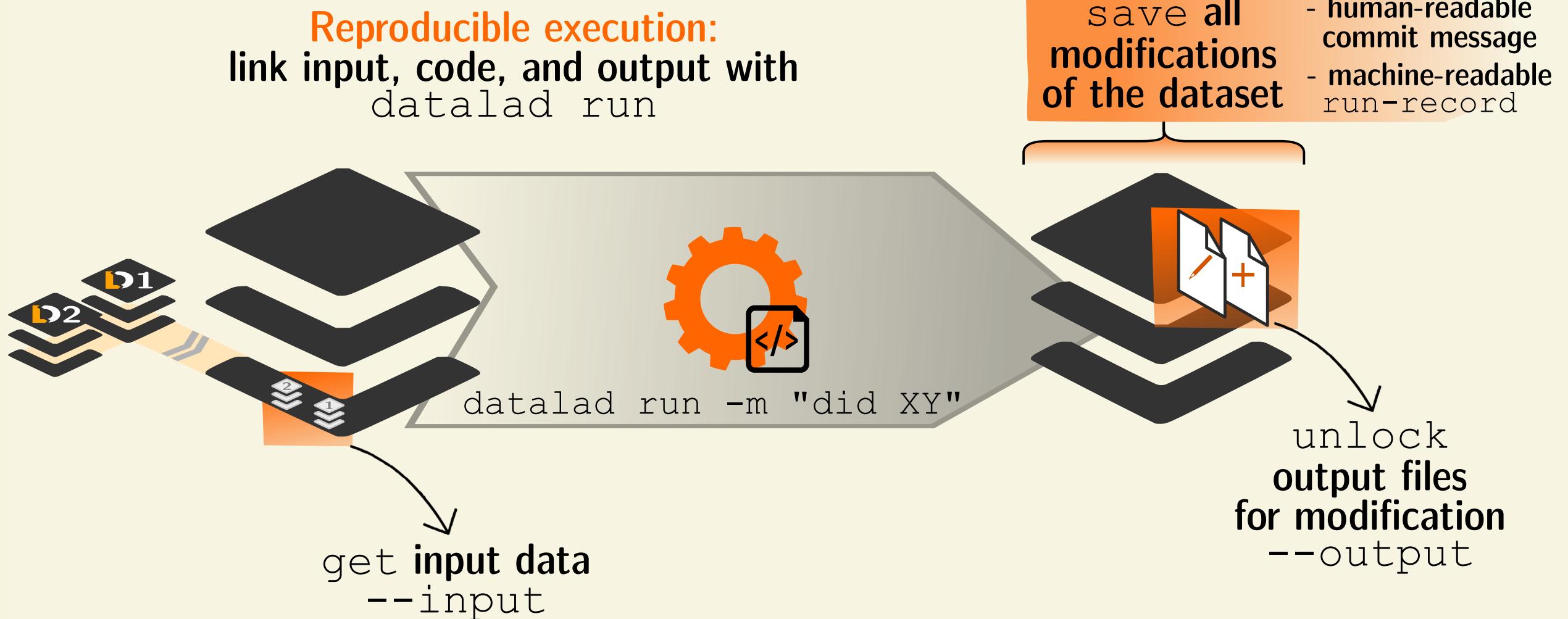


REPRODUCIBLE EXECUTION & PROVENANCE CAPTURE

datalad run

REPRODUCIBLE EXECUTION & PROVENANCE CAPTURE

datalad run



HOW TO GET STARTED WITH BIDS AND DATALAD

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Check out BIDS compliant datasets - with DataLad!

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```
$ datalad install ///openneuro/ds000001
[INFO    ] Cloning http://datasets.datalad.org/openneuro/ds000001 [1 other candidates] into '/tmp
[INFO    ] access to 1 dataset sibling s3-PRIVATE not auto-enabled, enable with:
|       datalad siblings -d "/tmp/ds000001" enable -s s3-PRIVATE
install(ok): /tmp/ds000001 (dataset)

$ cd ds000001
$ ls sub-01/*
sub-01/anat:
sub-01_inplaneT2.nii.gz  sub-01_T1w.nii.gz

sub-01/func:
sub-01_task-balloonanalogrisktask_run-01_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-01_events.tsv
sub-01_task-balloonanalogrisktask_run-02_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-02_events.tsv
sub-01_task-balloonanalogrisktask_run-03_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-03_events.tsv
```

HOW TO GET STARTED WITH BIDS AND DATALAD

Check out BIDS compliant datasets - with DataLad!

```
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[INFO    ] access to 1 dataset sibling s3-PRIVATE not auto-enabled, enable with:
|           datalad siblings -d "/tmp/ds000001" enable -s s3-PRIVATE
install(ok): /tmp/ds000001 (dataset)

$ cd ds000001
$ ls sub-01/*
sub-01/anat:
sub-01_inplaneT2.nii.gz  sub-01_T1w.nii.gz

sub-01/func:
sub-01_task-balloonanalogrisktask_run-01_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-01_events.tsv
sub-01_task-balloonanalogrisktask_run-02_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-02_events.tsv
sub-01_task-balloonanalogrisktask_run-03_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-03_events.tsv
```

Read the DataLad handbook

HOW TO GET STARTED WITH BIDS AND DATALAD

Check out BIDS compliant datasets - with DataLad!

```
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[INFO    ] Cloning http://datasets.datalad.org/openneuro/ds000001 [1 other candidates] into '/tmp
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sub-01_task-balloonanalogrisktask_run-01_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-01_events.tsv
sub-01_task-balloonanalogrisktask_run-02_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-02_events.tsv
sub-01_task-balloonanalogrisktask_run-03_bold.nii.gz
sub-01_task-balloonanalogrisktask_run-03_events.tsv
```

Read the DataLad handbook

An interactive, hands-on crash-course (free and open source)

ACKNOWLEDGEMENTS

The BIDS standard

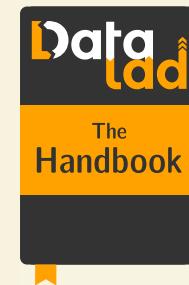
- Chris Gorgolewski
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- Michael Hanke
- Yaroslav Halchenko
- Joey Hess (git-annex)
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The DataLad Handbook

- Laura Waite
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THANK YOU!

QUESTIONS?