DATA MANAGEMENT FOR NEUROSCIENCE:

THE BIDS STANDARD AND DATALAD

AN INTRODUCTION

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Research Center Jülich

Slides: https://github.com/datalad-handbook/course/

WHAT IS (RESEARCH) DATA MANAGEMENT?

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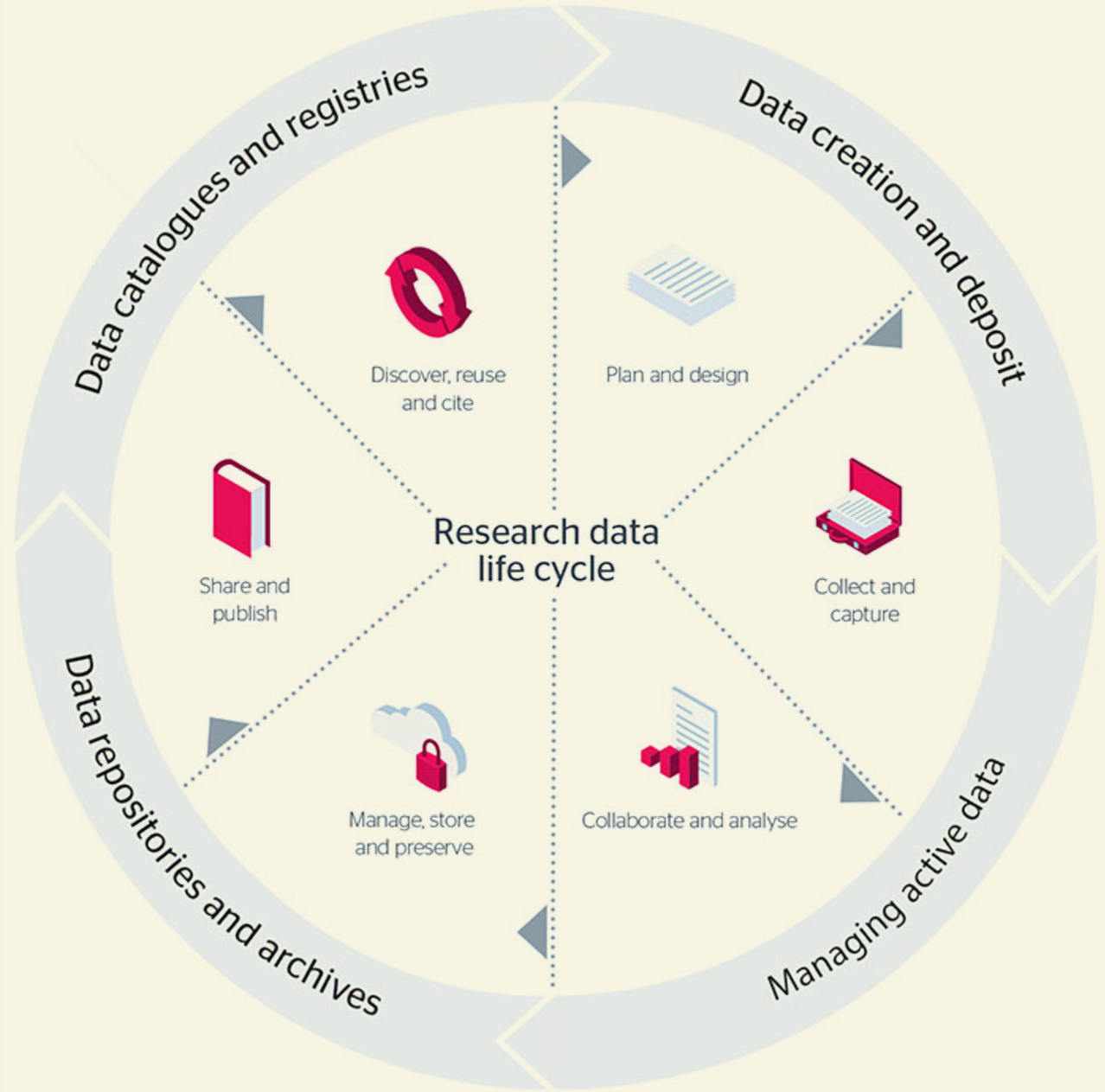

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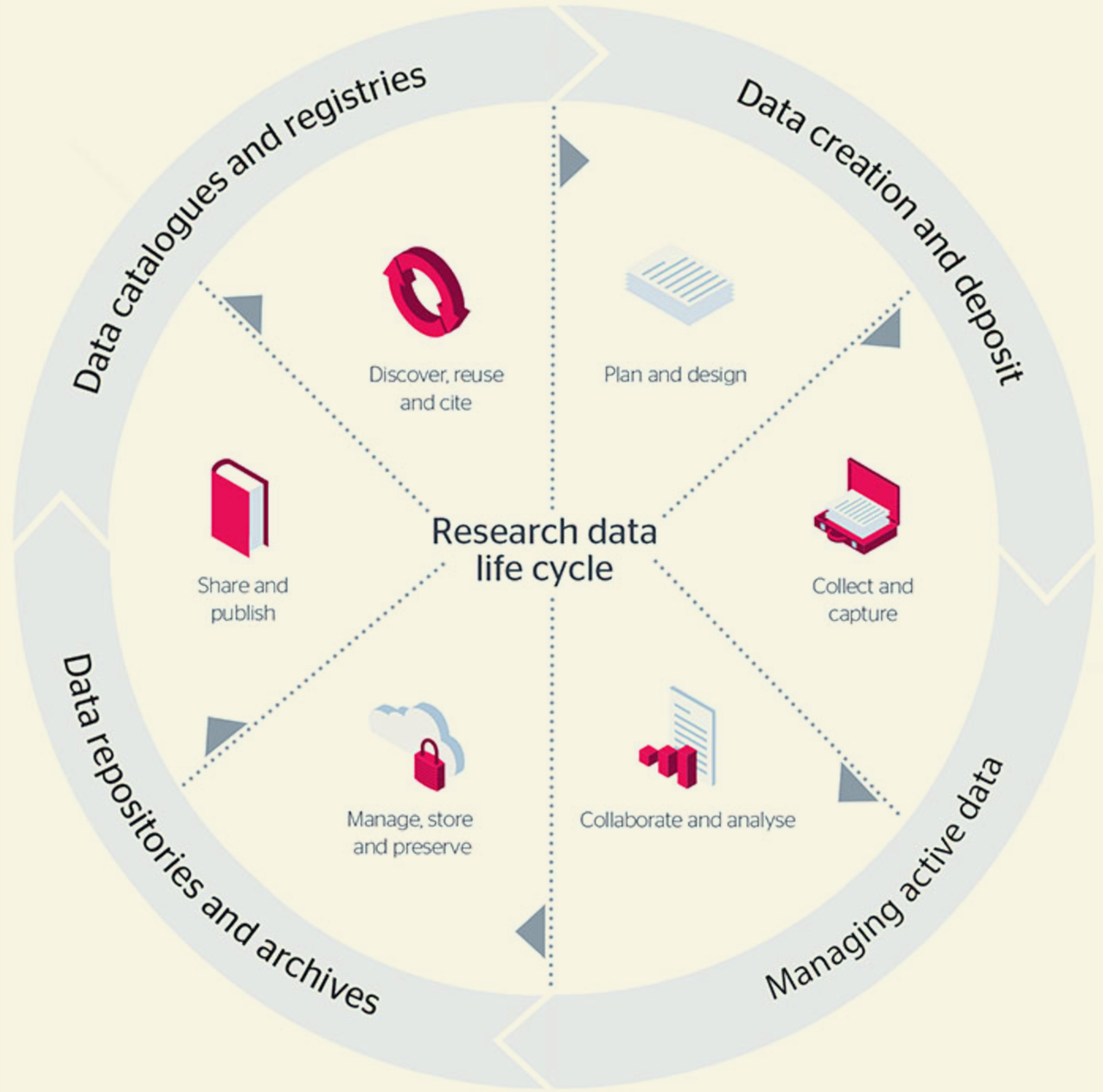
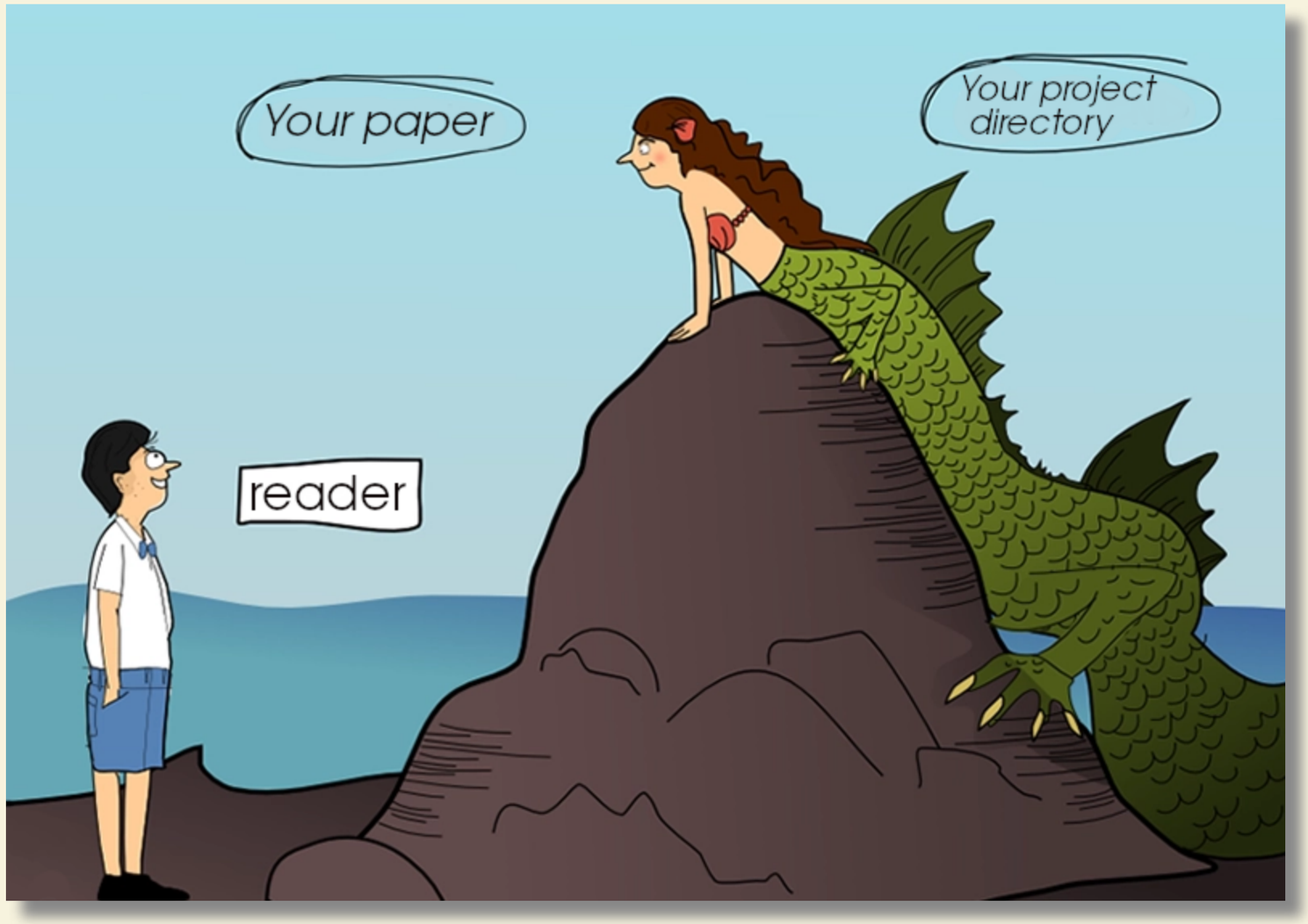


- Research data management is a key component for reproducibility, efficiency, and impact/reach of data analysis projects

WHY DATA MANAGEMENT?



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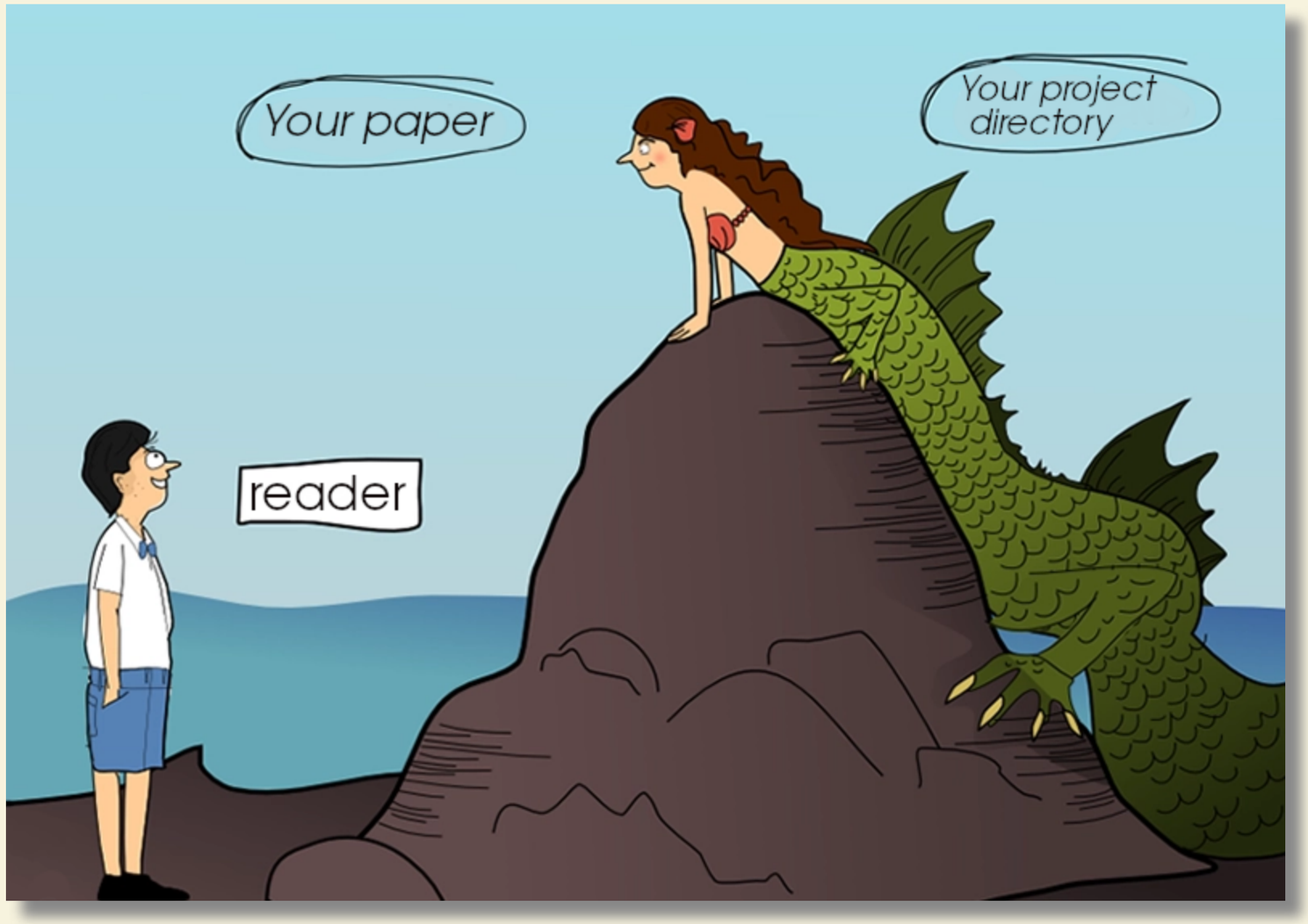

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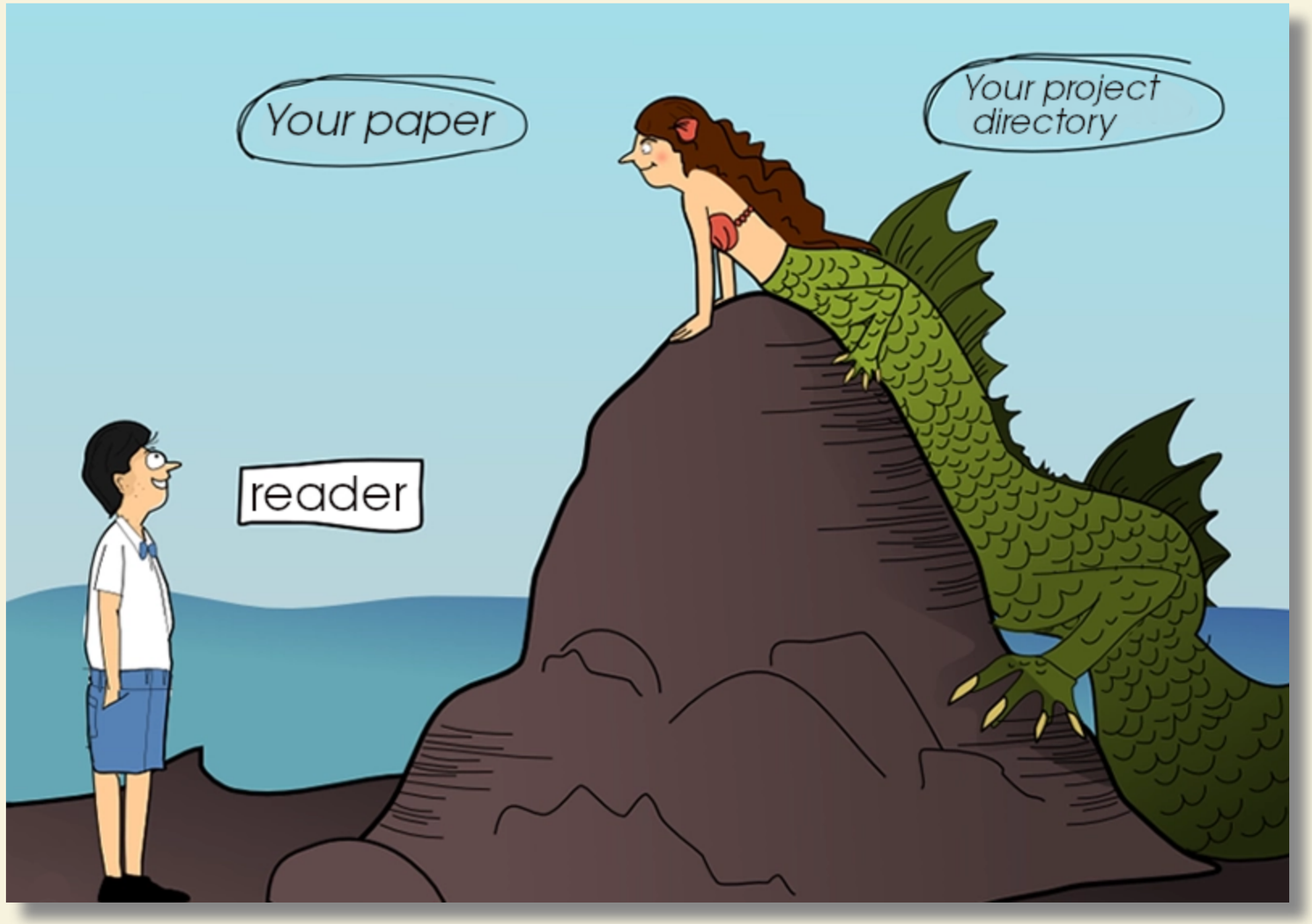

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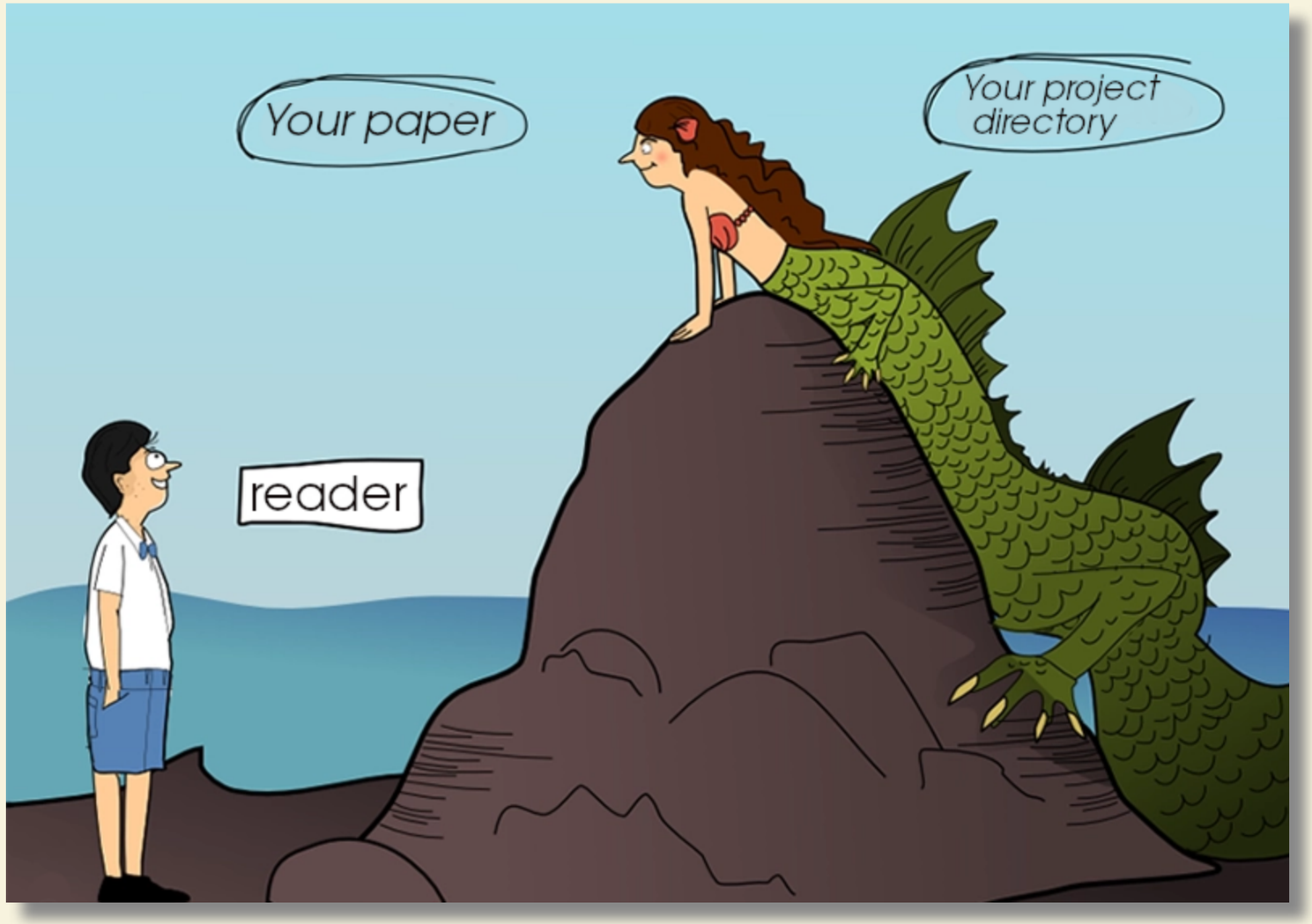

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- Funders & publishers require it
- Scientific peers increasingly expect it
- The quality and efficiency of your work improves

HOW DO YOU SPEND YOUR TIME?

CrowdFlower

DataScience Report 2017

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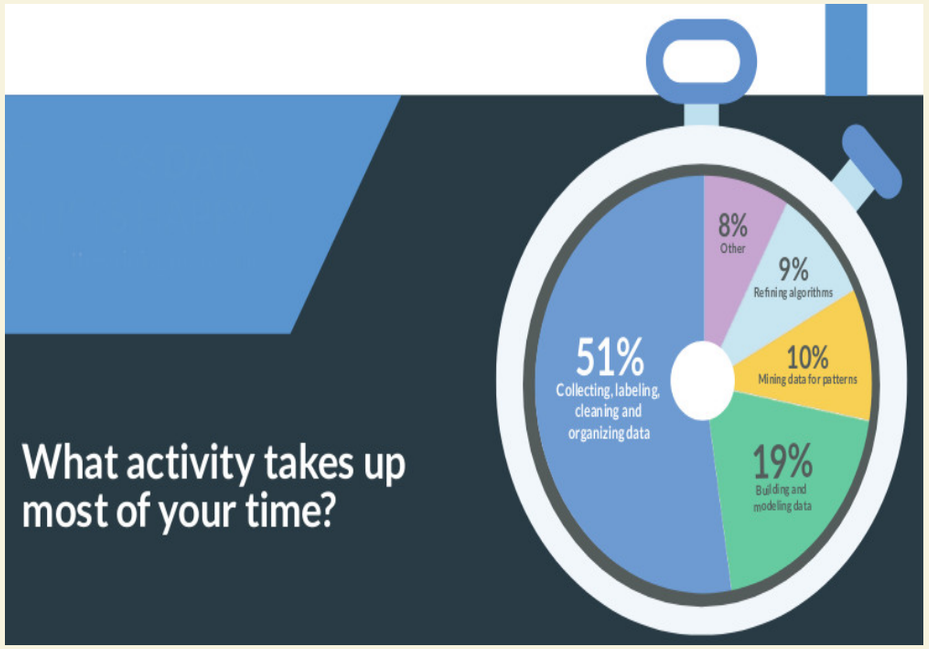

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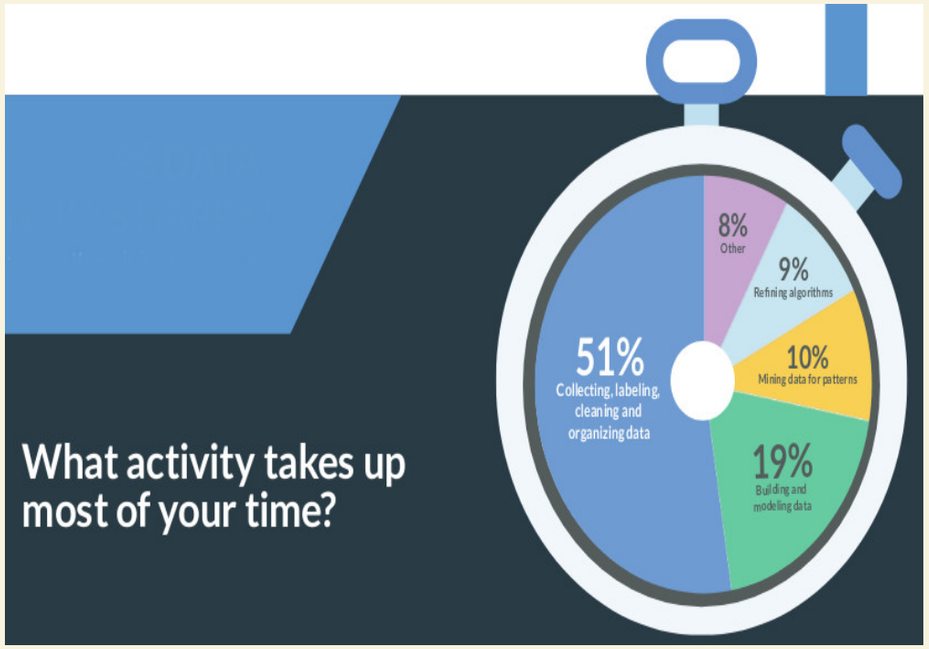

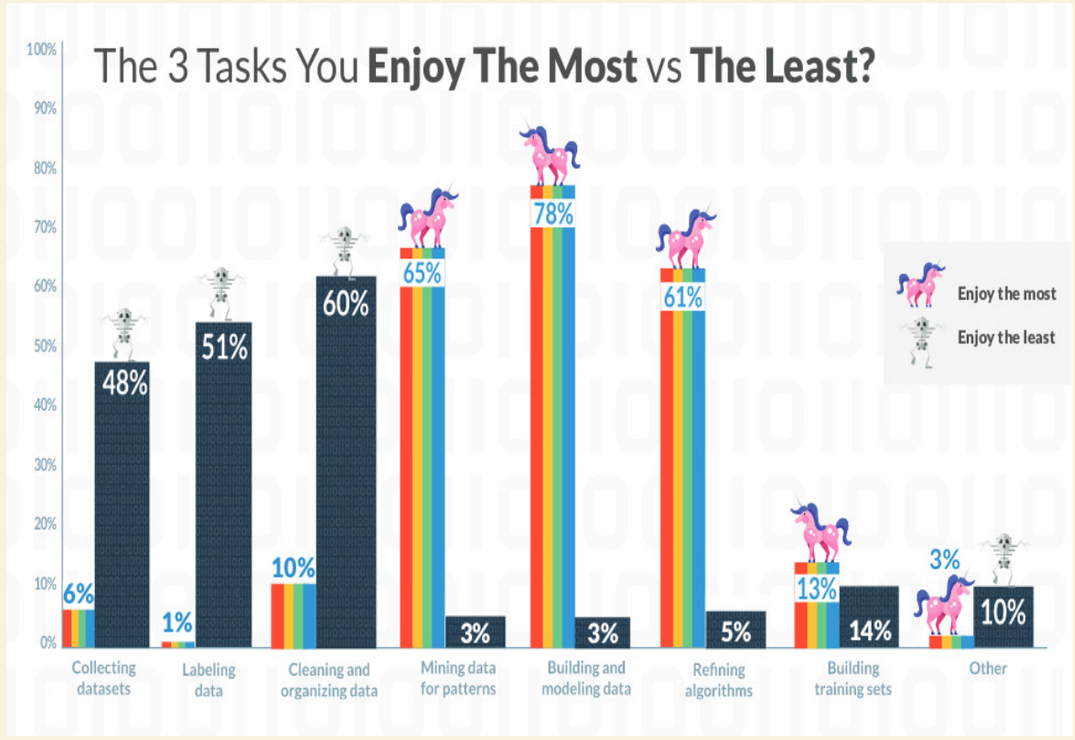

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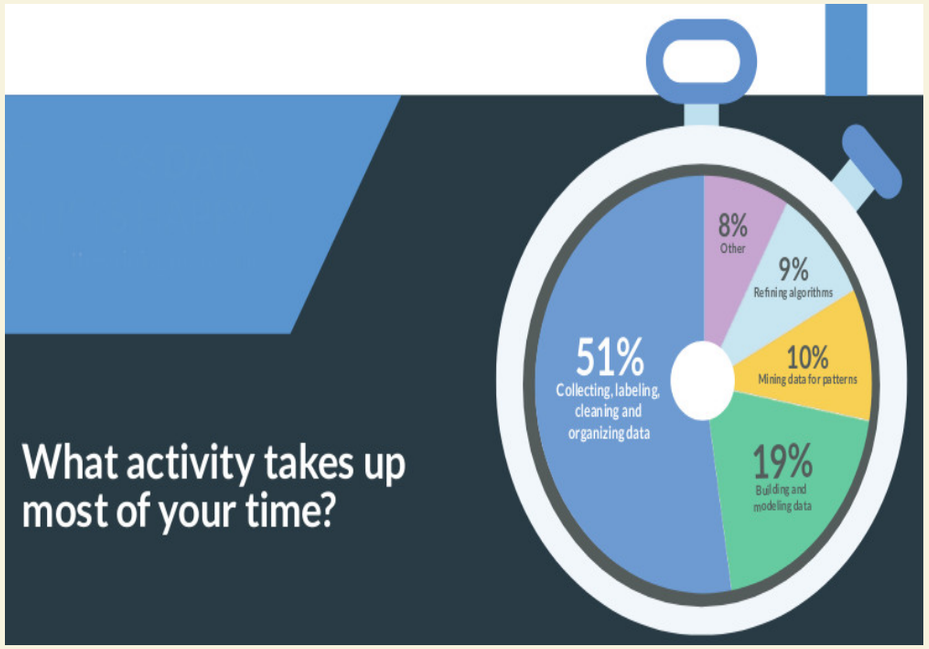

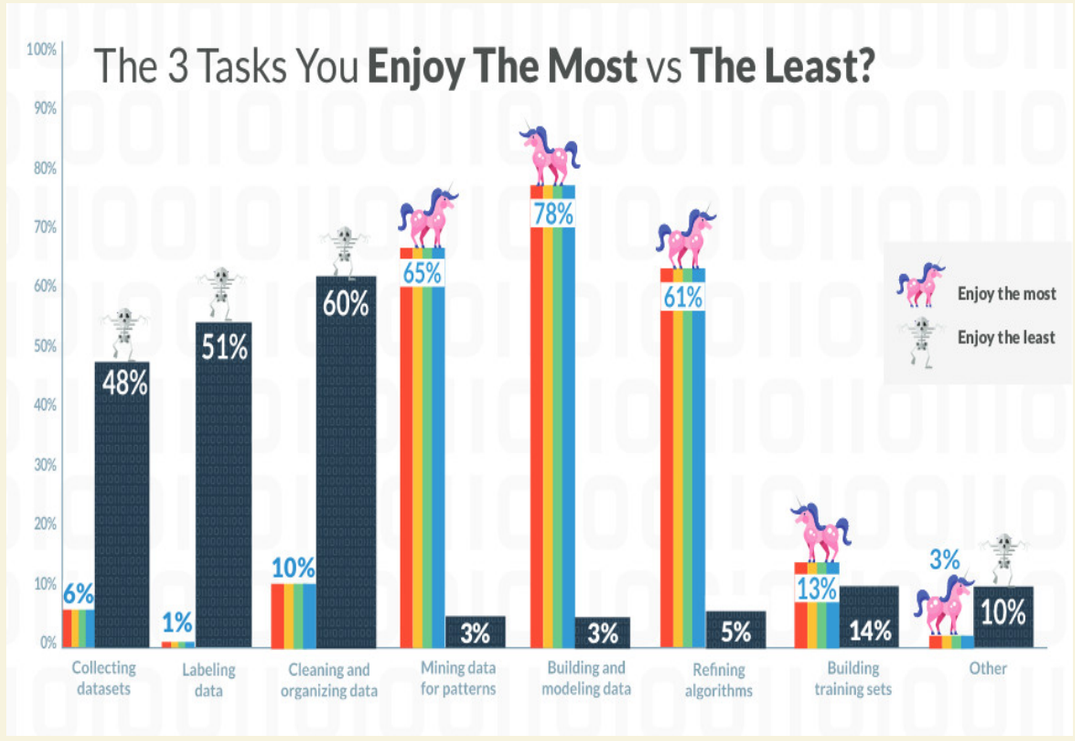

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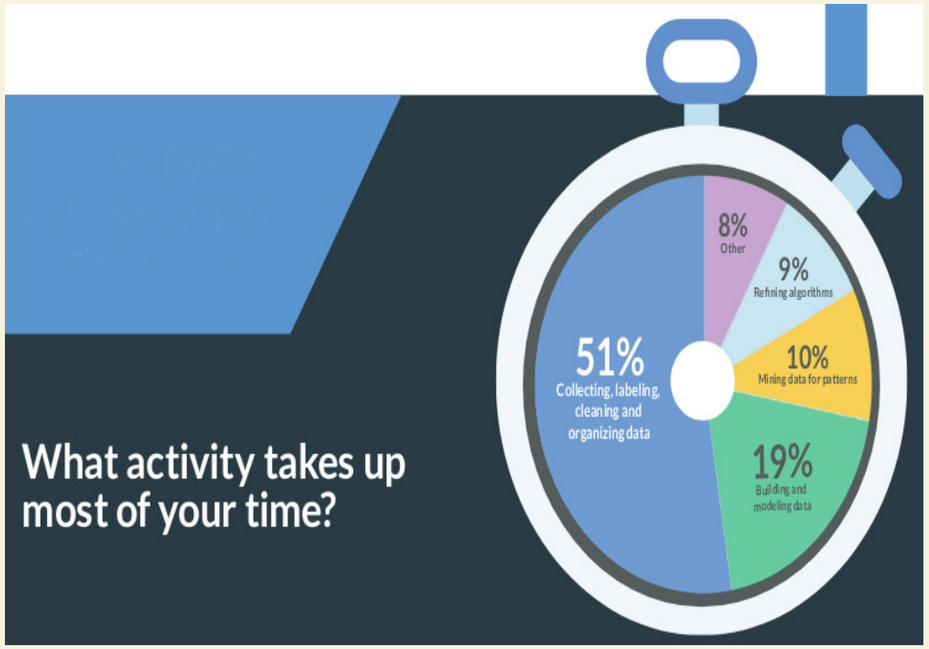

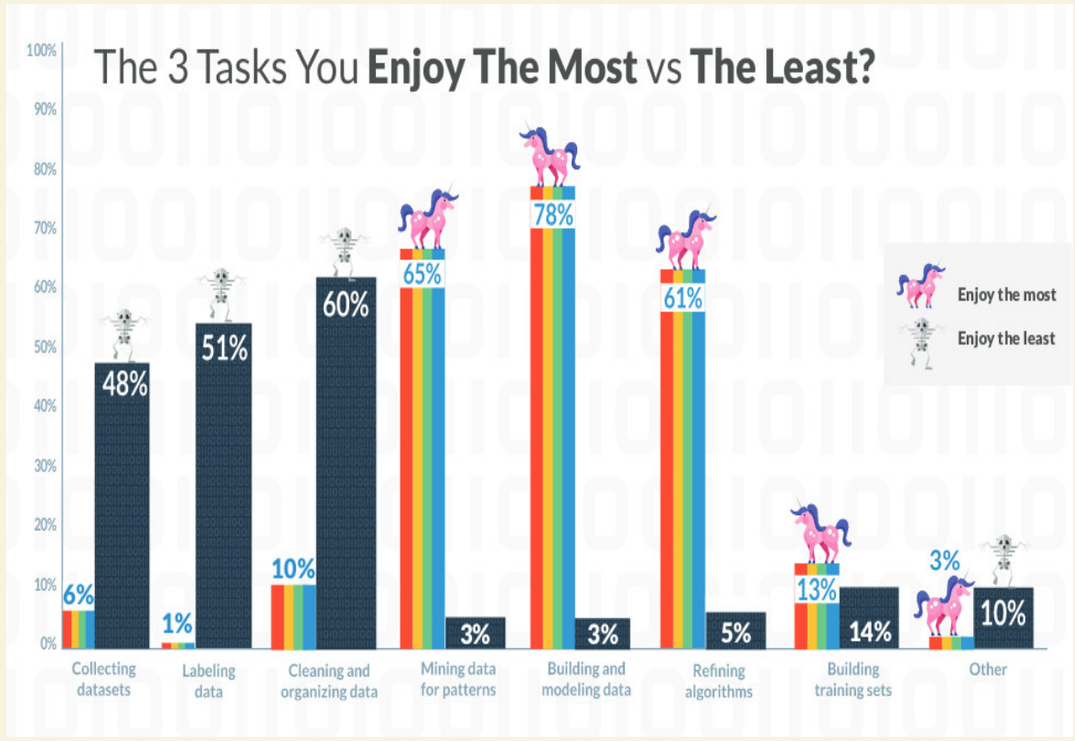

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- Good data management can make your and others work & life much easier!

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

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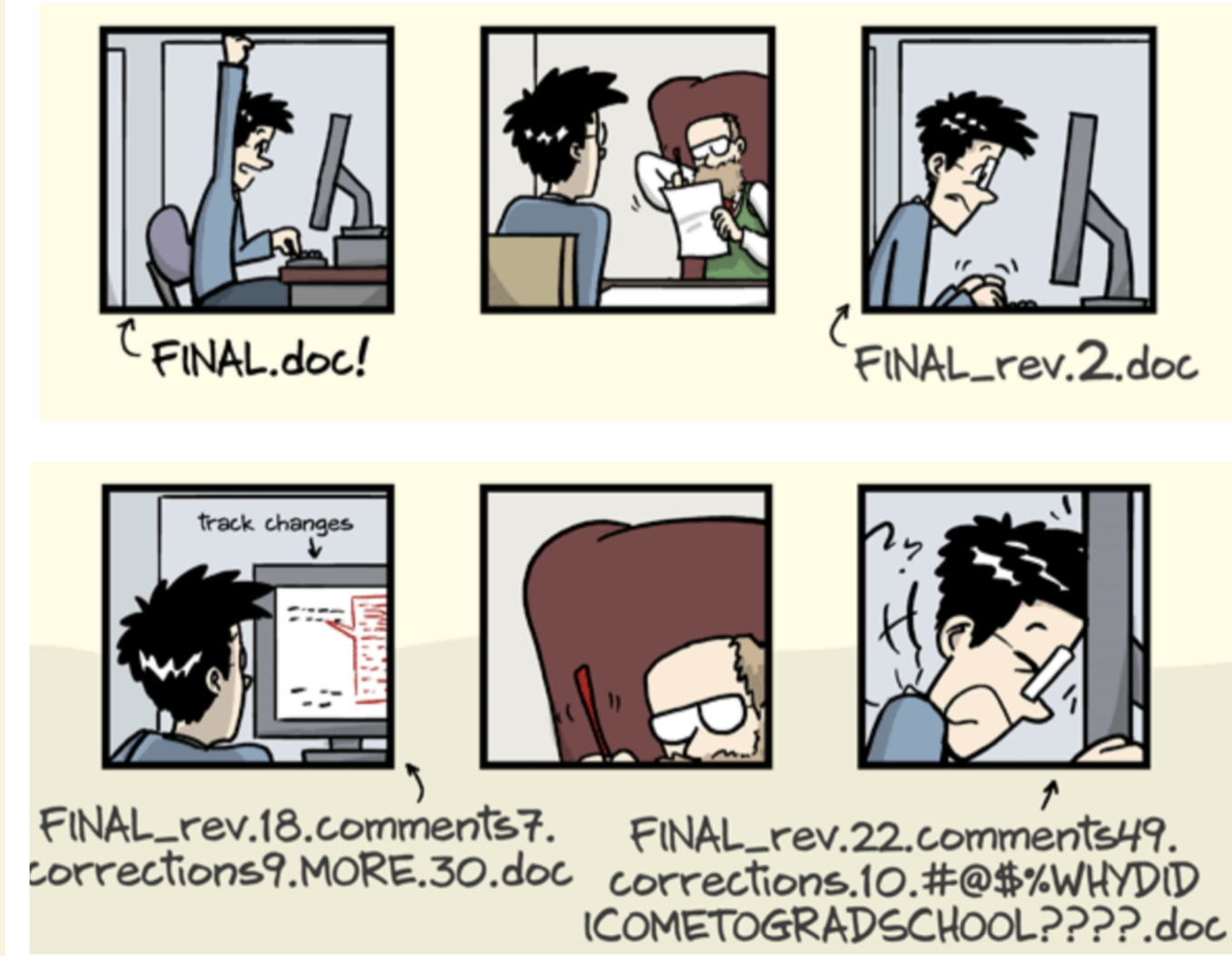

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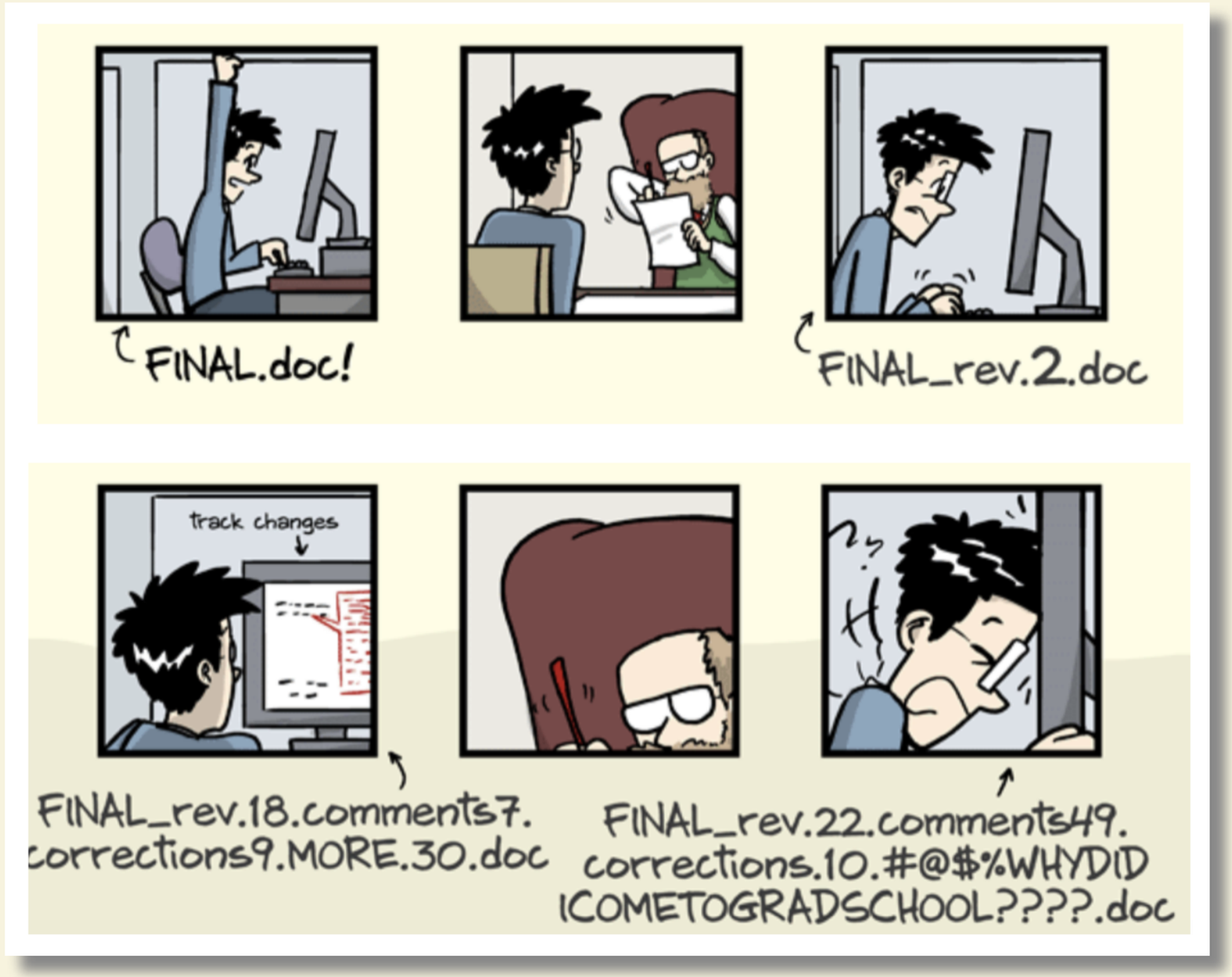

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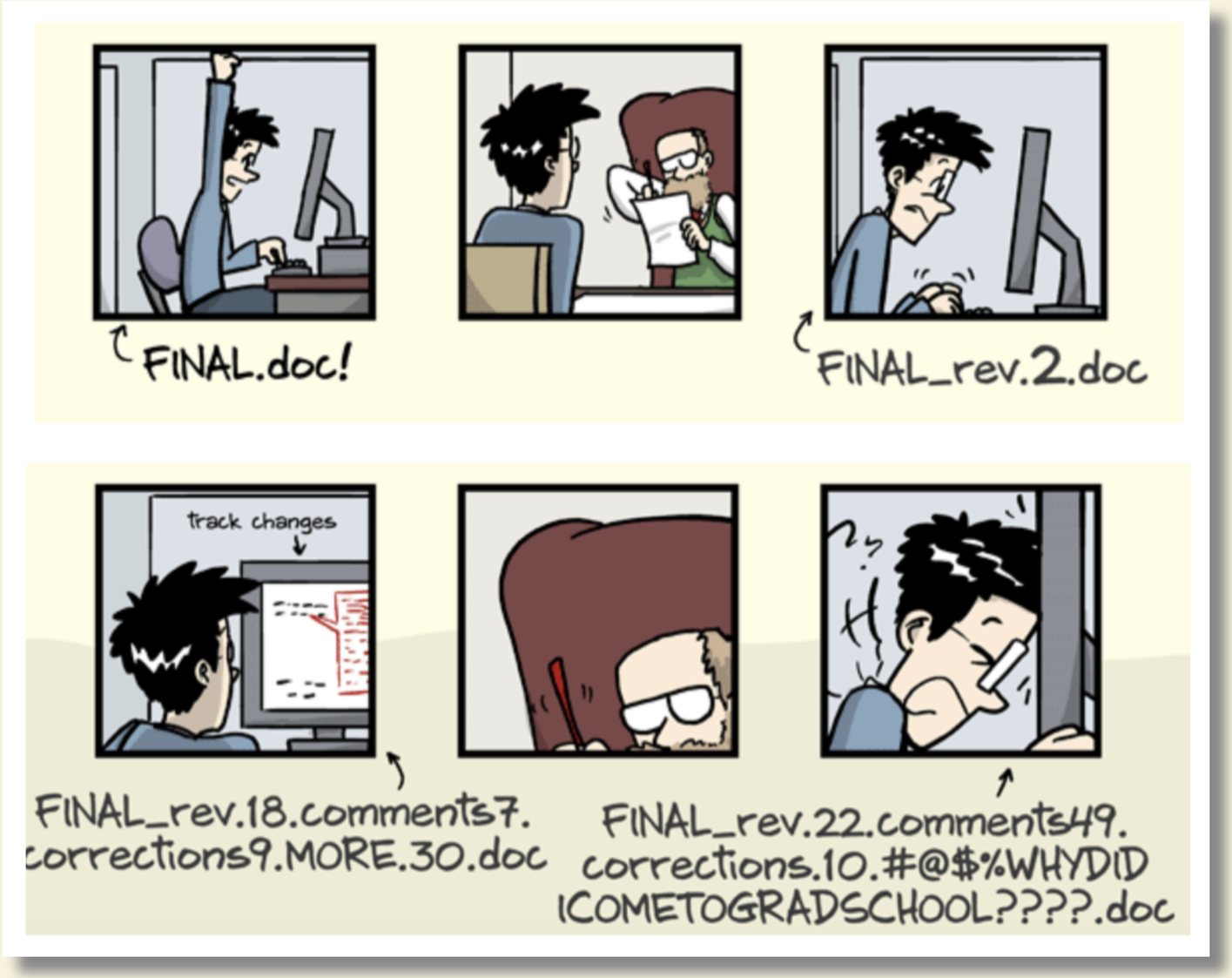
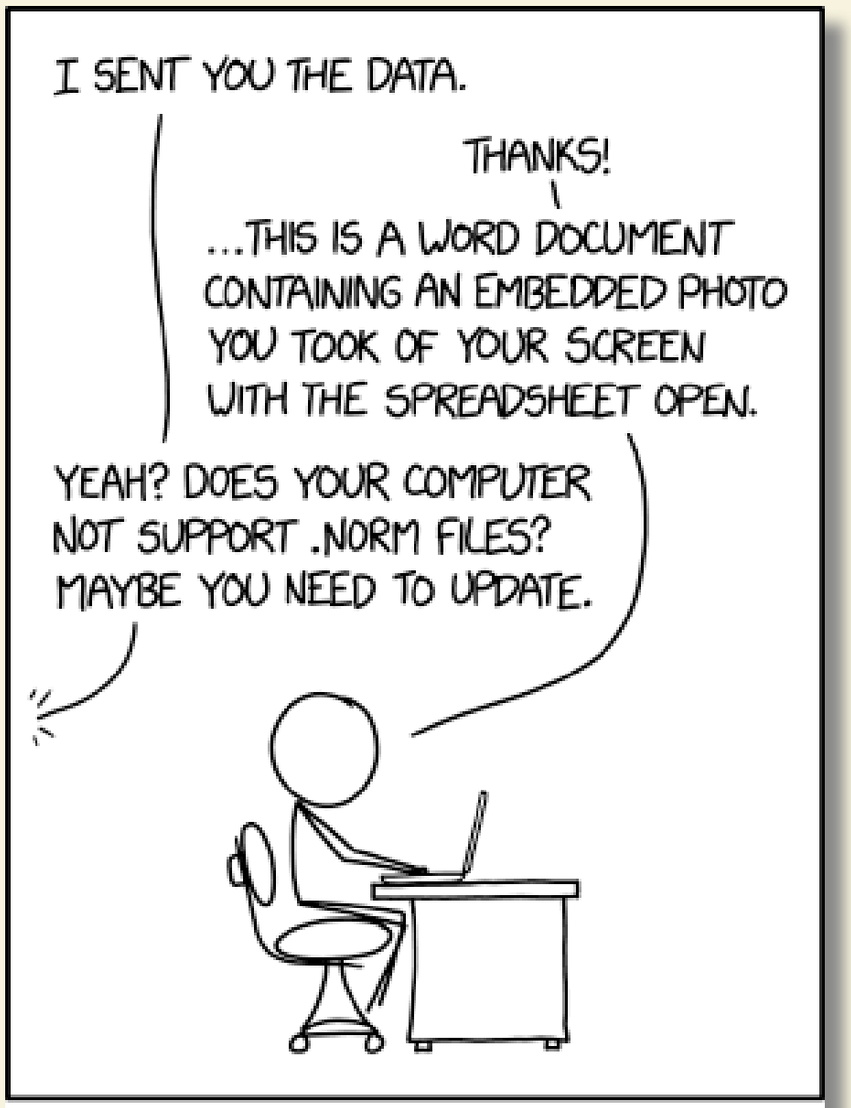


- keep things organized
- keep track of changes

WHY STANDARDS?



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

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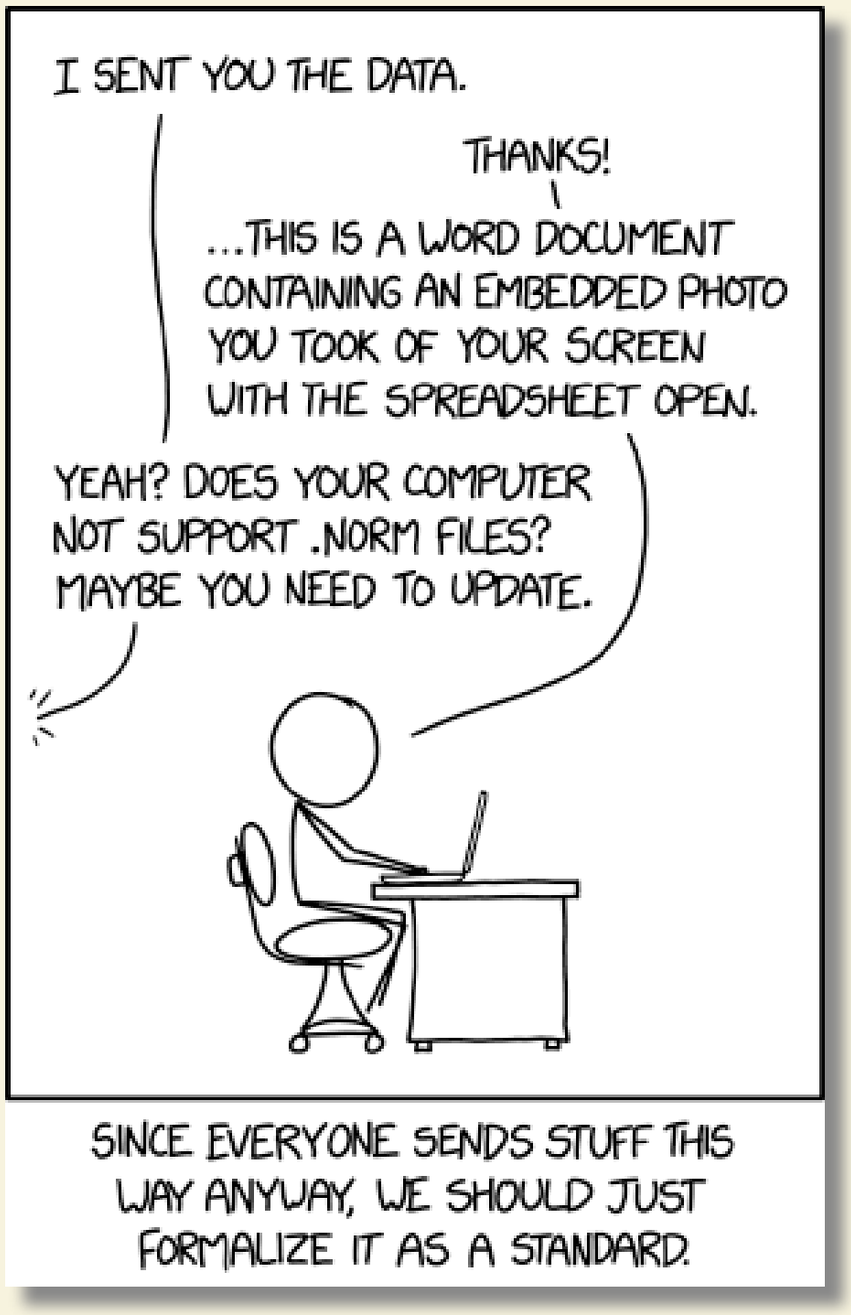
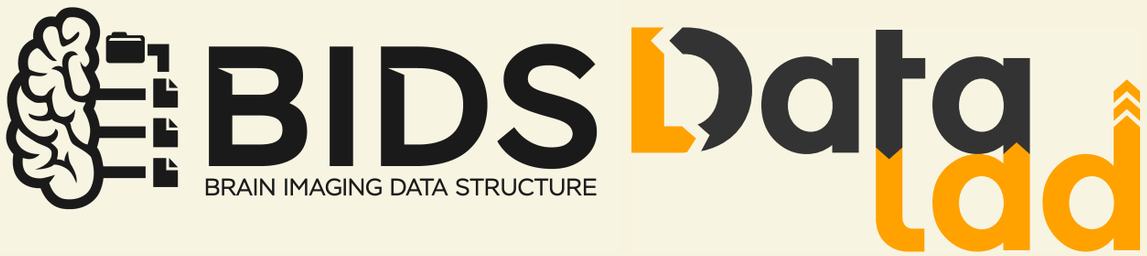


- reduce misunderstanding and rewriting/rearranging efforts


BIDS
BRAIN IMAGING DATA STRUCTURE


BIDS
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TOOLS THAT CAN HELP WITH DATA MANAGEMENT

BIDS
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Datalad

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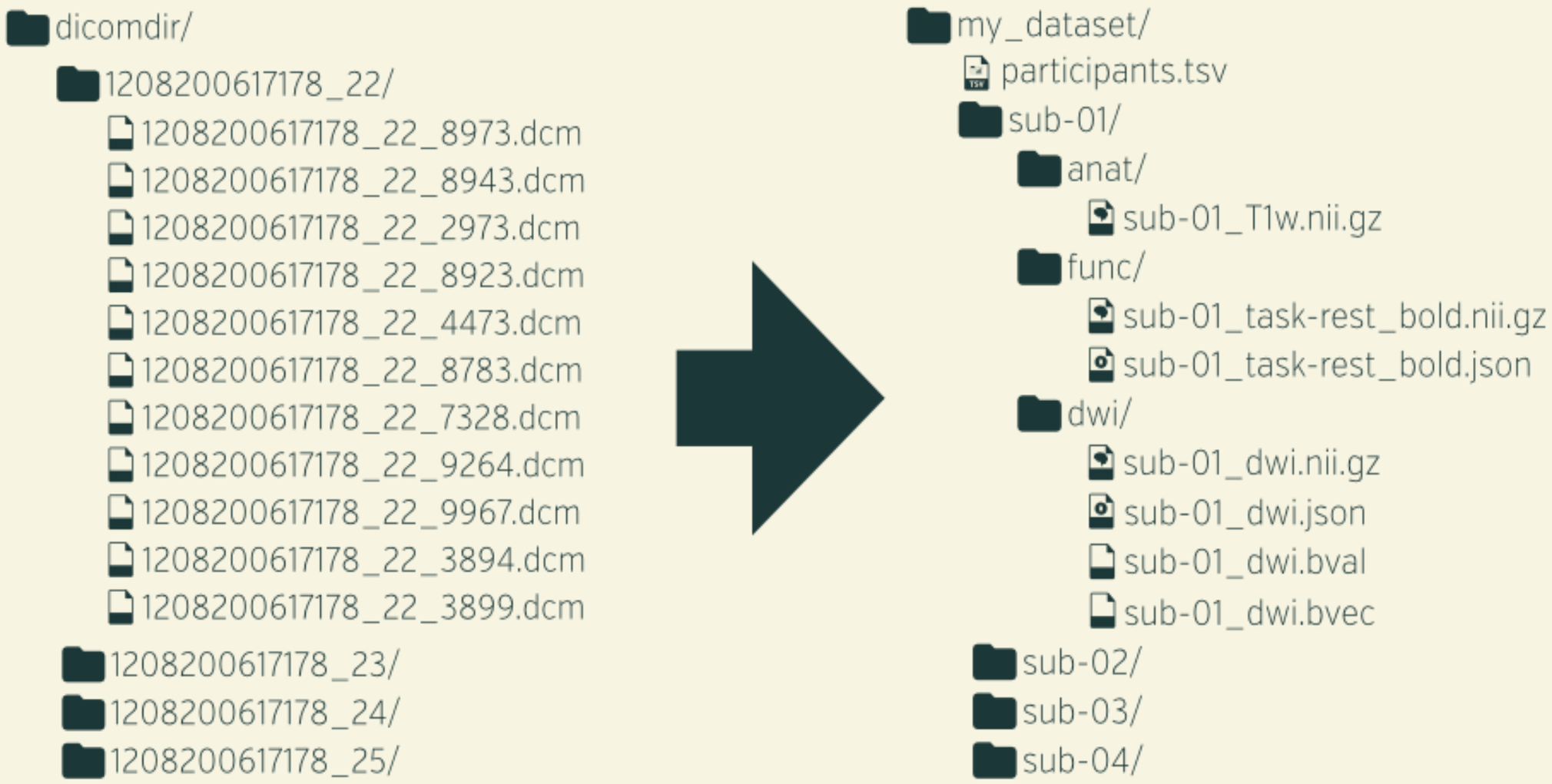

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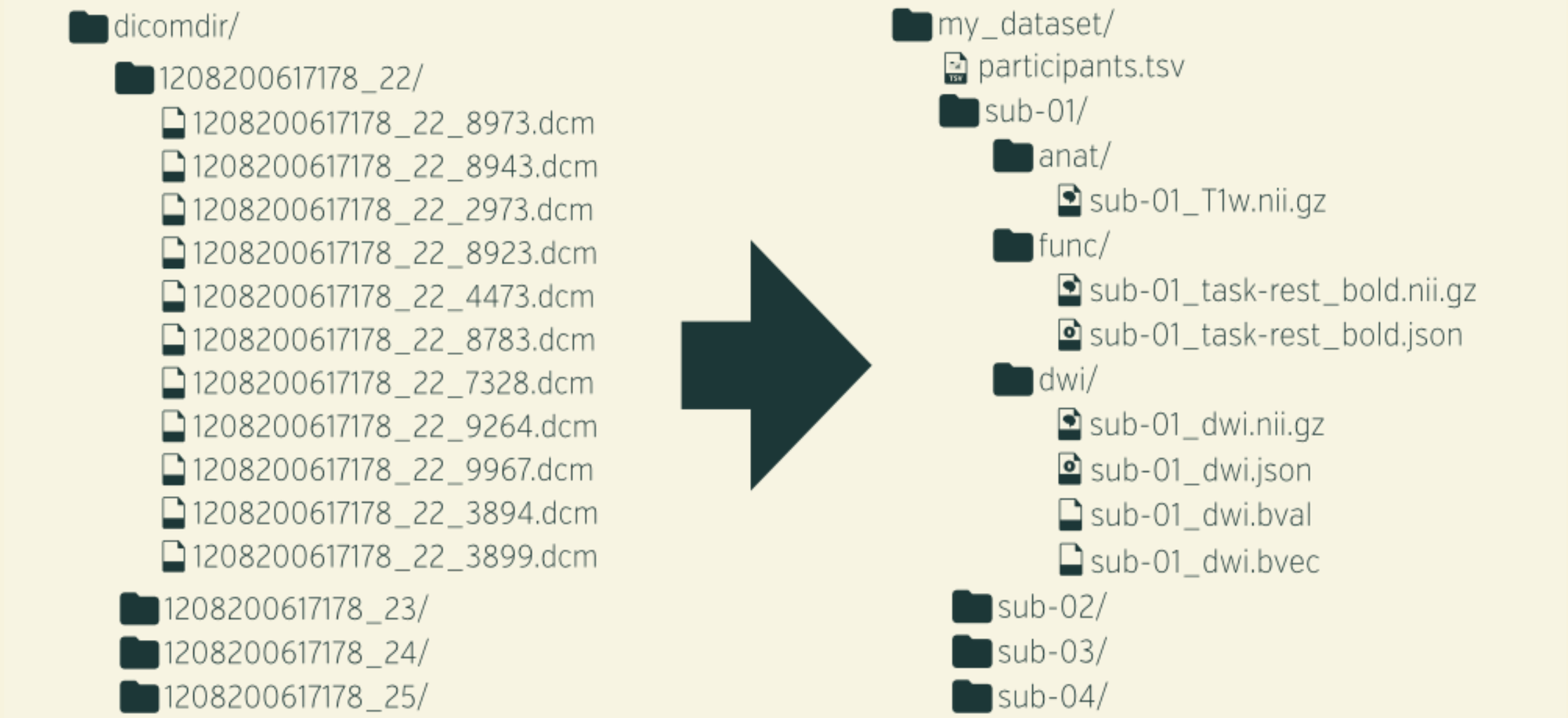

BIDS is a standard for a multitude of neuroimaging data (MRI, EEG, ...). It defines a data organization, naming schemes for files, and meta data descriptors.


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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

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.

DataLad 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...**
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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

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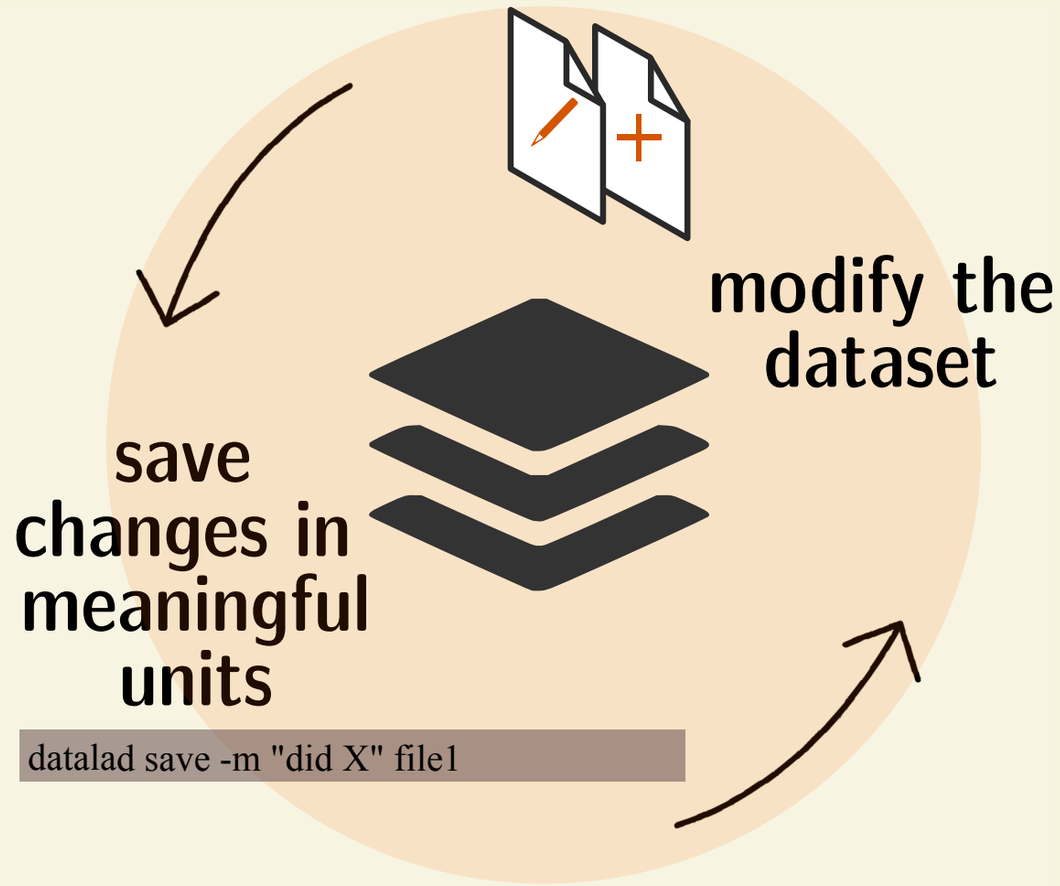

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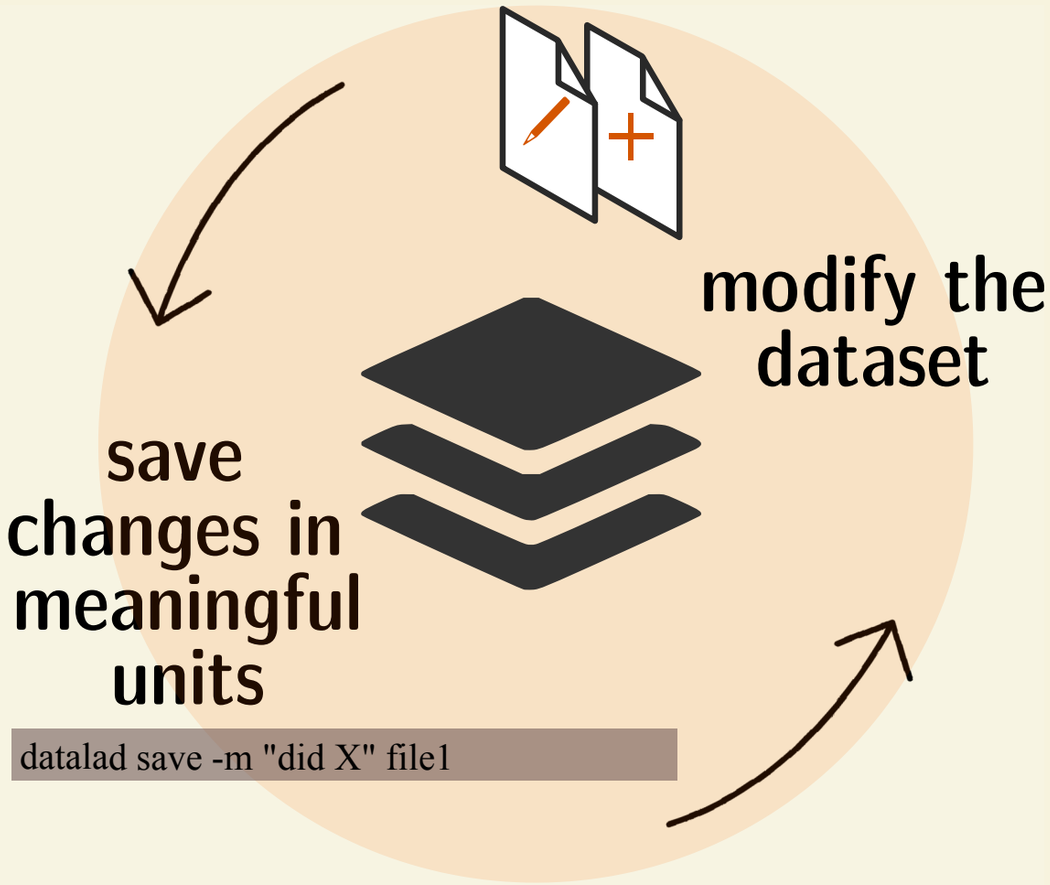

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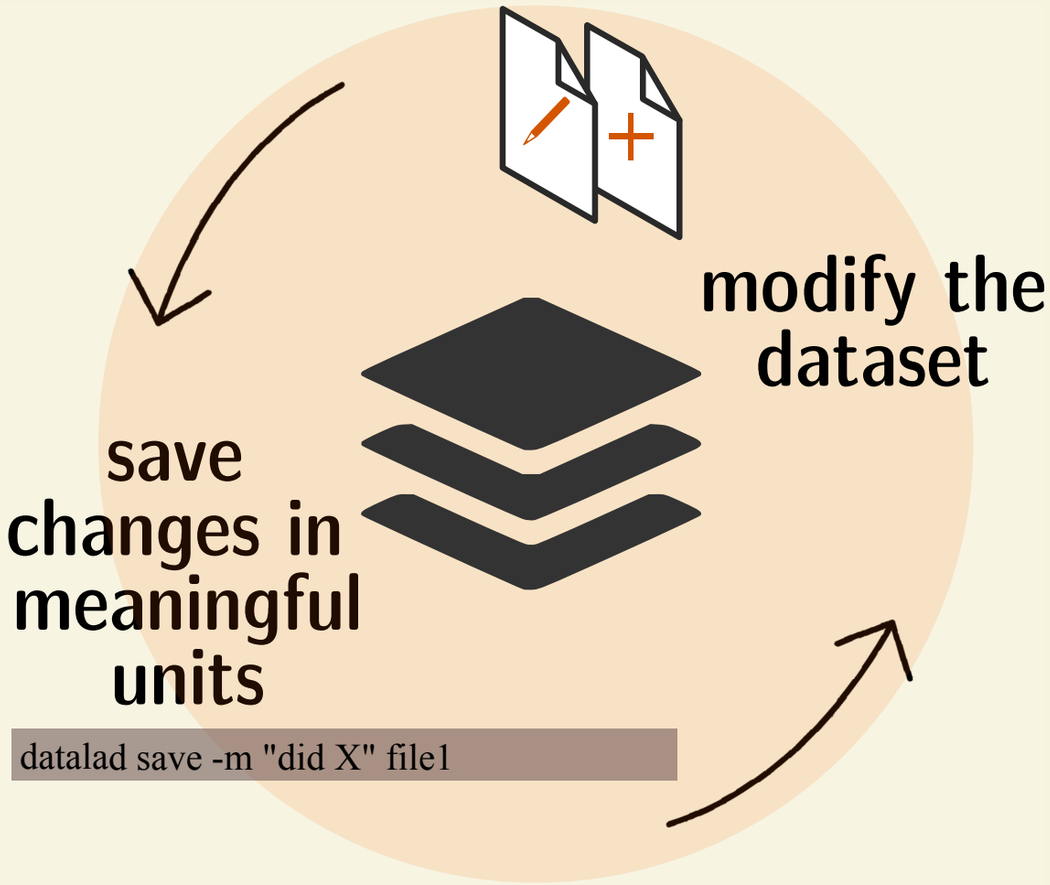

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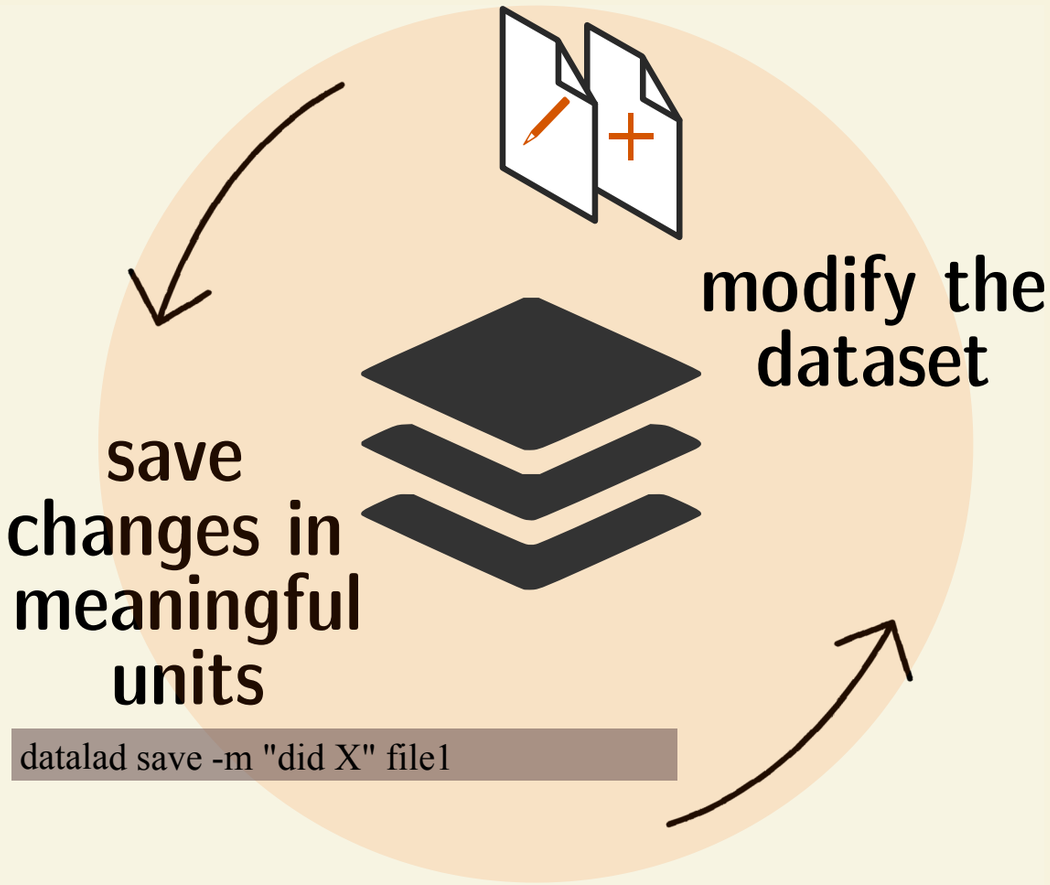

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A clean dataset status is good practice.

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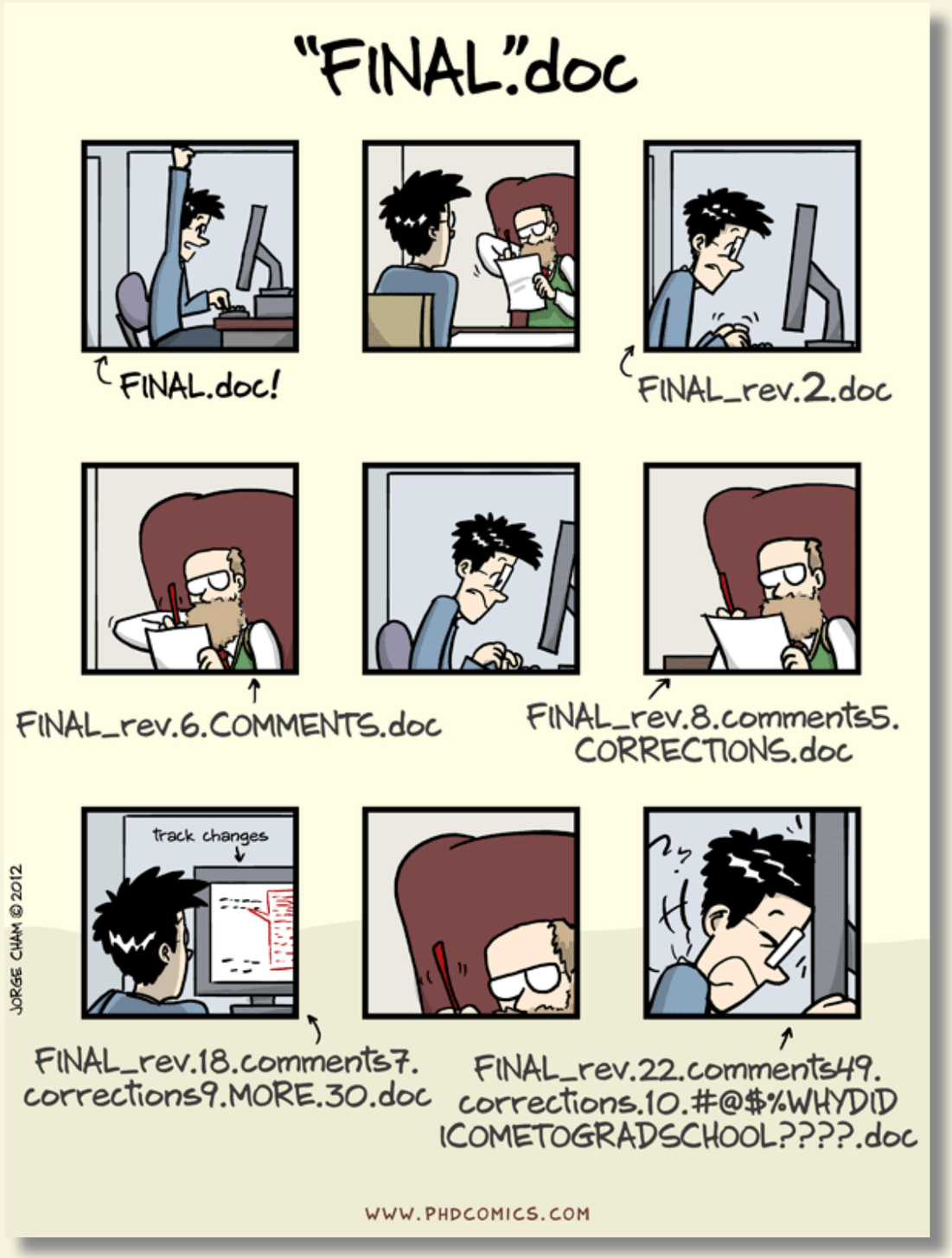

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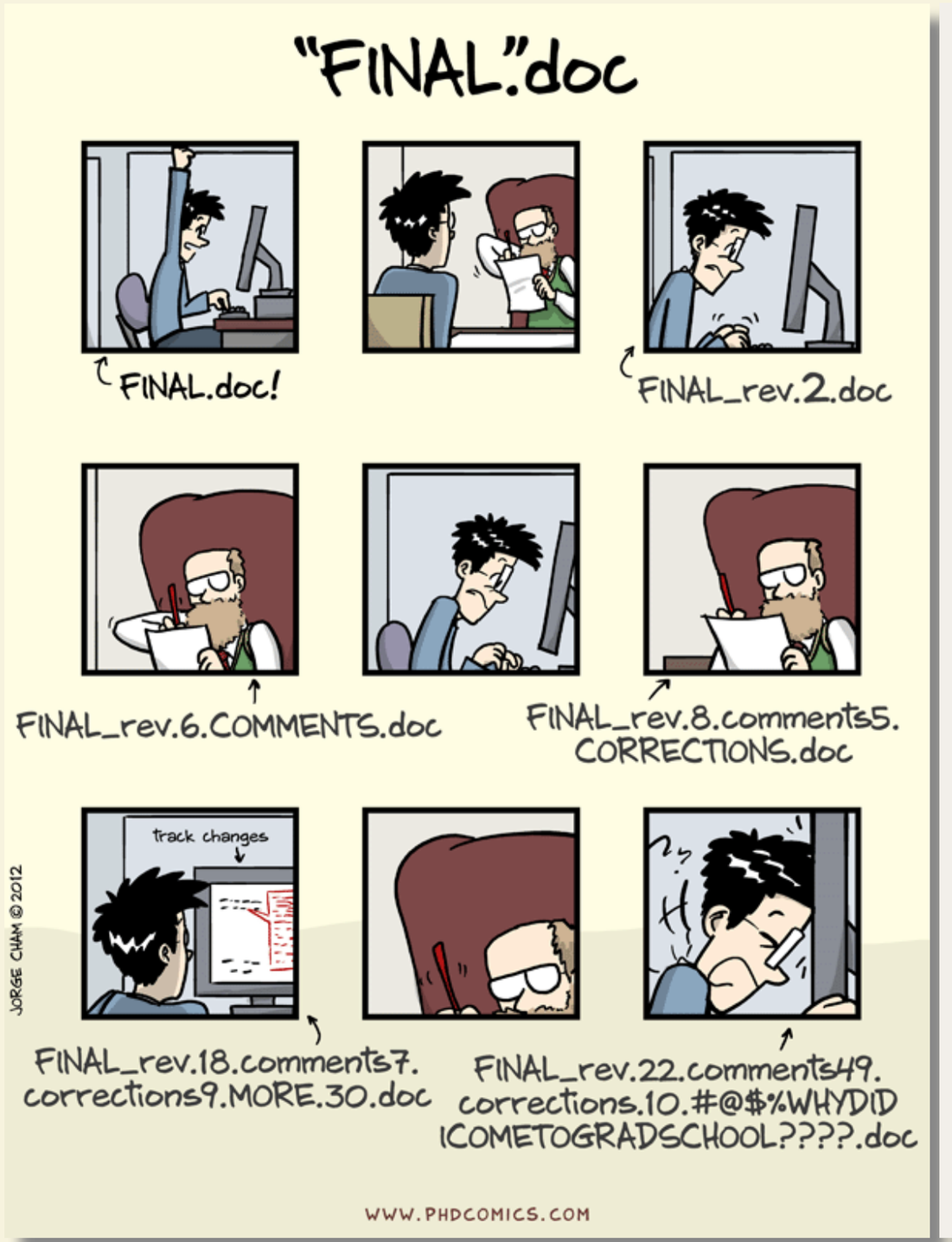

Image credit: www.phdcomics.com www.linode.com

FROM HERE

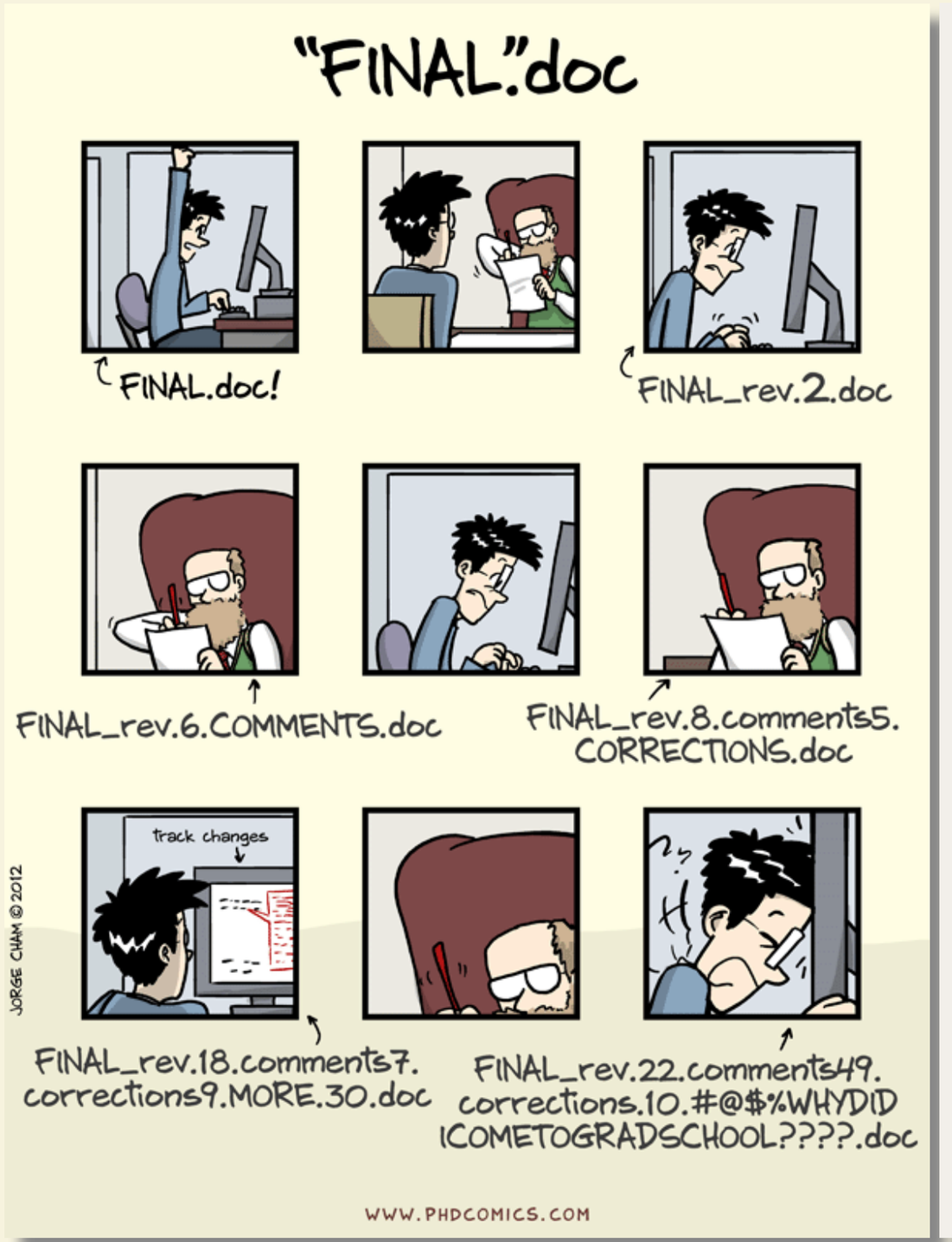

Image credit: www.phdcomics.com www.linode.com

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

> ! *Dataset structure is fully flexible to be able to accommodate domain standards or personal preferences.*

> ! *A dataset can be populated with any type of files, and these files can be saved to the dataset.*

> ! *Published repositories can be installed as subdatasets. This nesting can be arbitrily deep. Datasets can be installed from a path, URL., or data collection.*

> ! *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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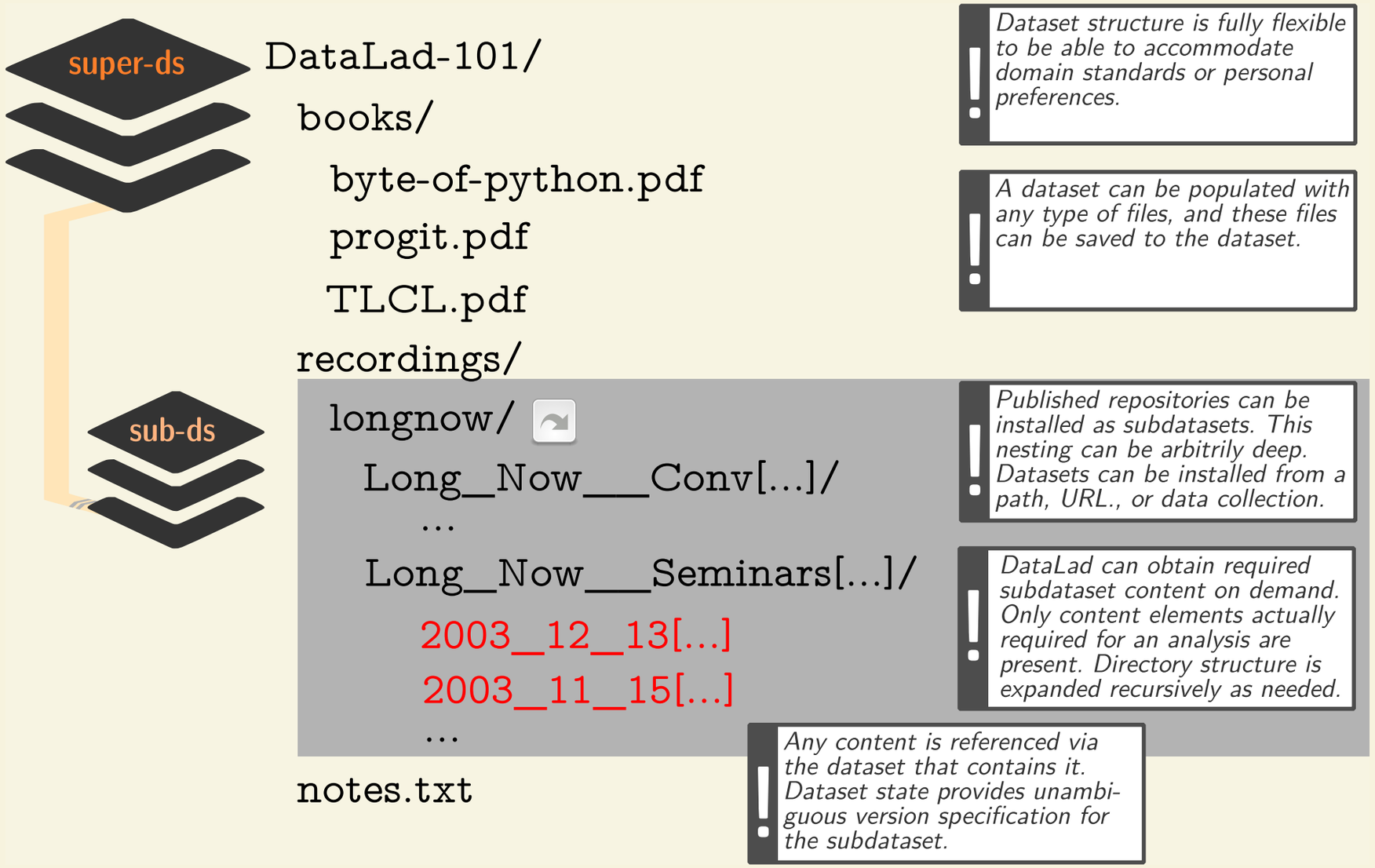

- Datasets are light-weight: Upon installation, only small files and meta data about file availability are retrieved.

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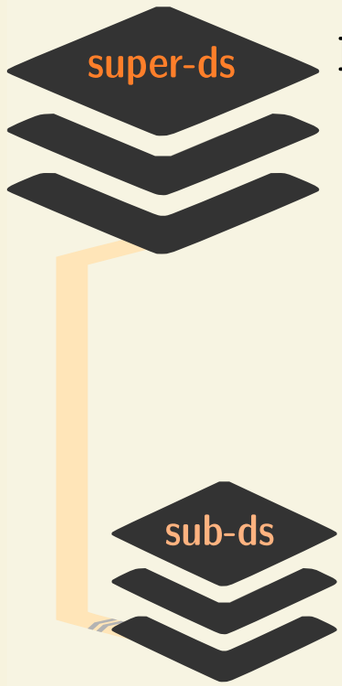

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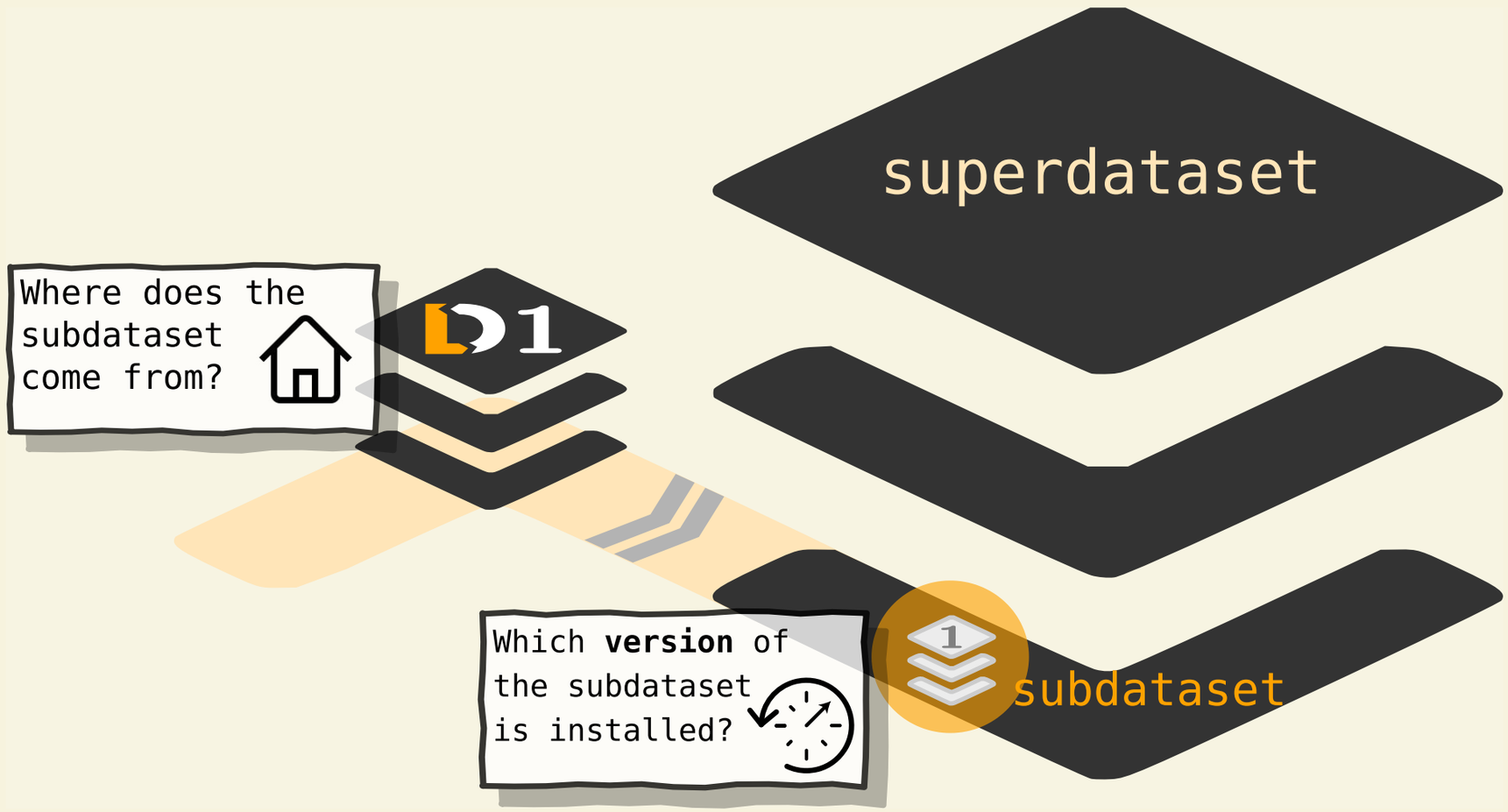
DATASET NESTING



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Datasets preserve their history.

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

REPRODUCIBLE DATA ANALYSIS

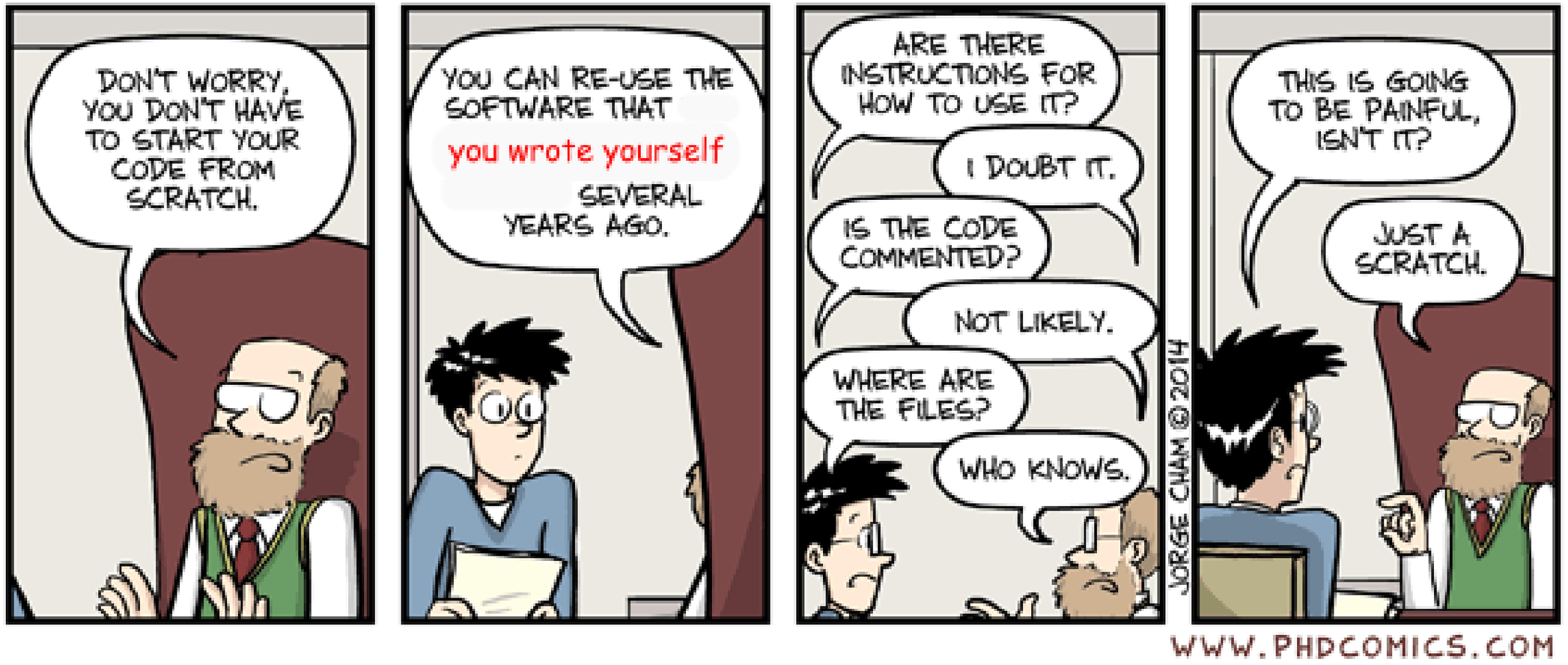

Image credit: Full comic at http://phdcomics.com/comics.php?f=1979

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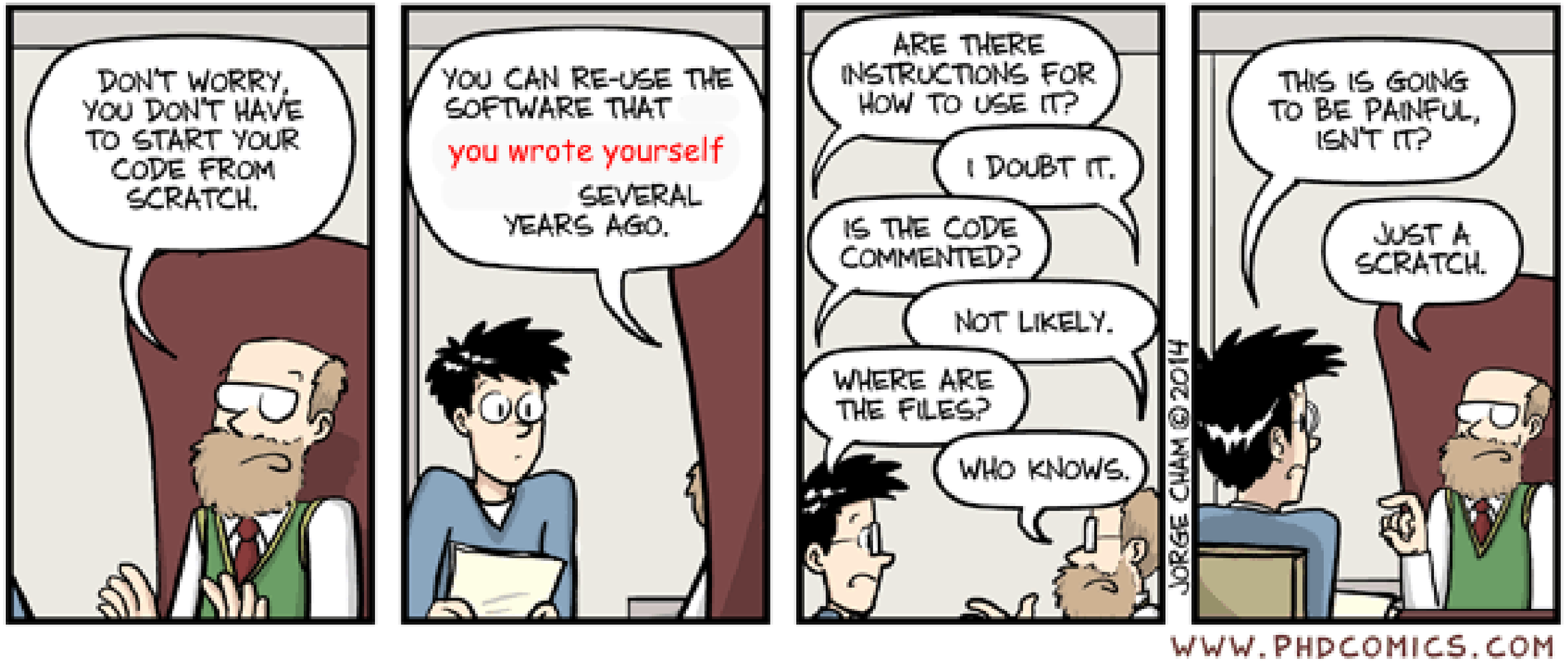

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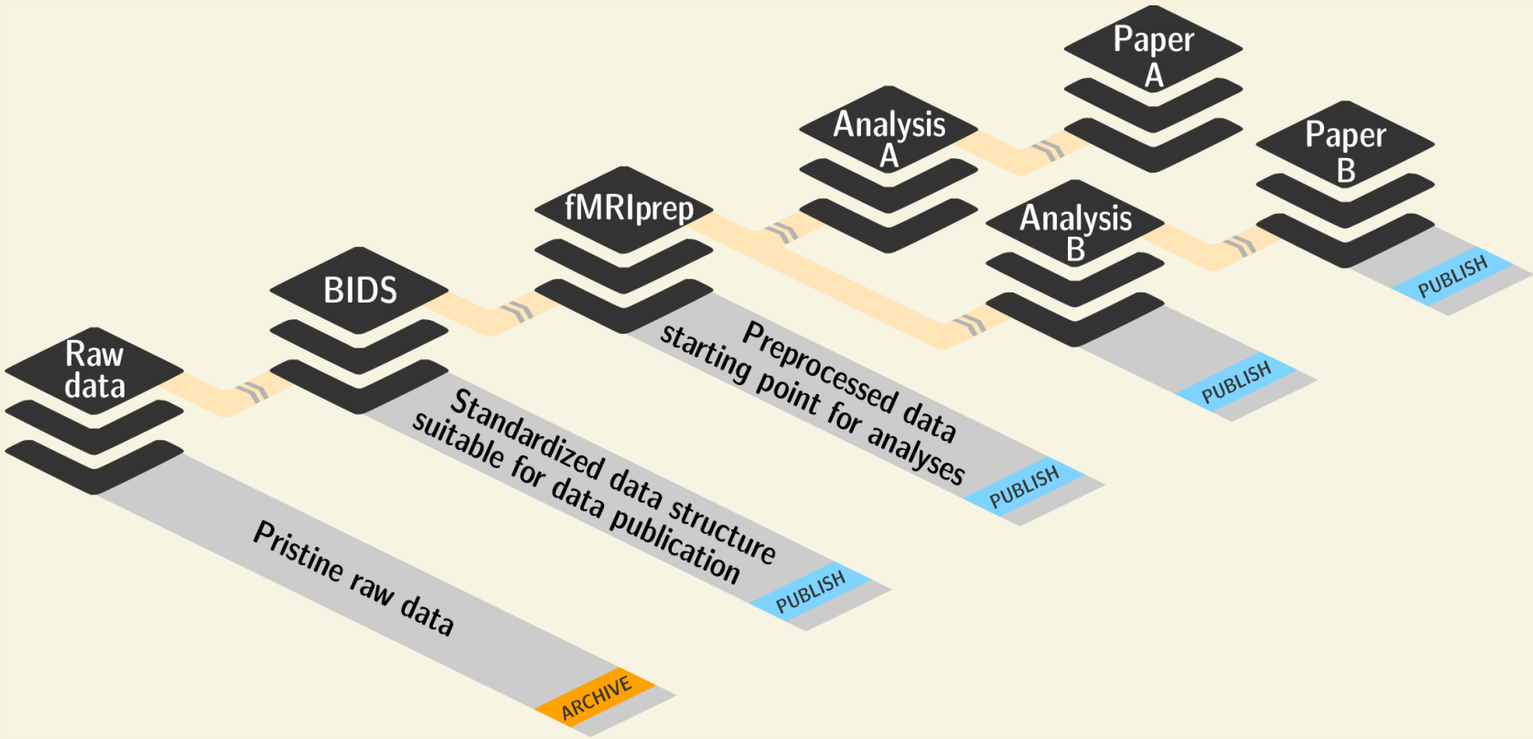
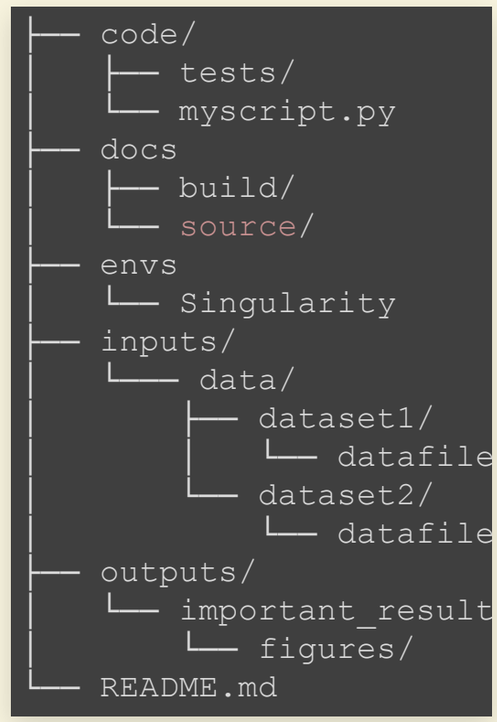
Code to follow along:
http://handbook.datalad.org/en/latest/code_from_chapters/10_yoda_code.html

BASIC ORGANIZATIONAL PRINCIPLES FOR DATASETS

Keep everything clean and modular

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



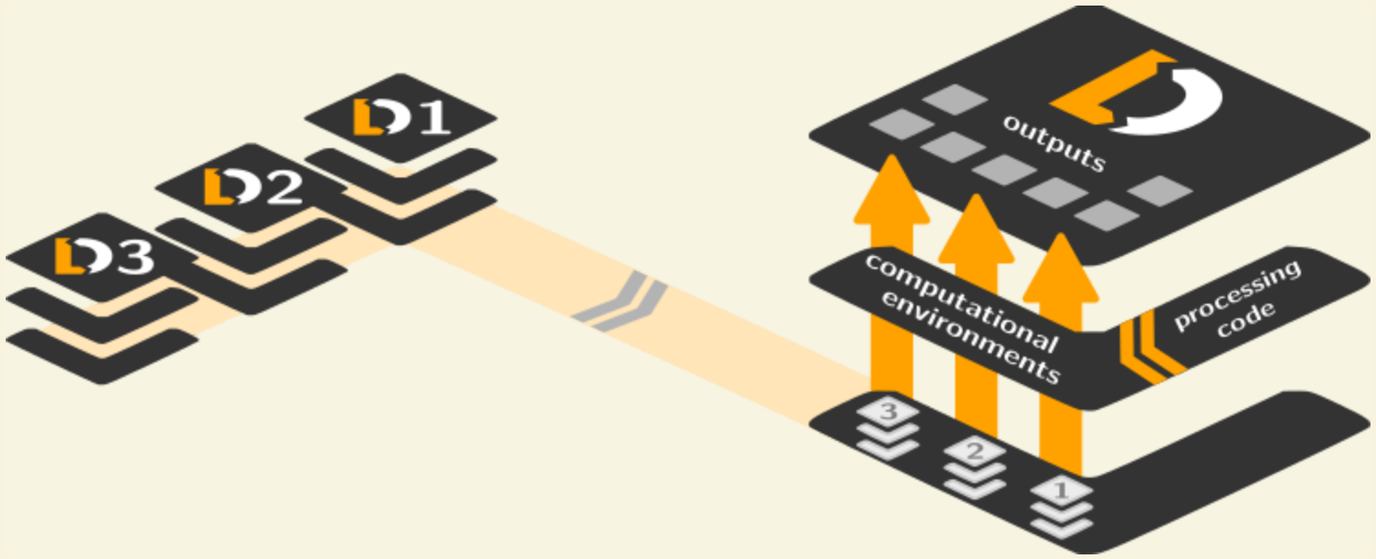


- do not touch/modify raw data: save any results/computations *outside* of input datasets
- Keep a superdataset self-contained: Scripts reference subdatasets or files with *relative paths*

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

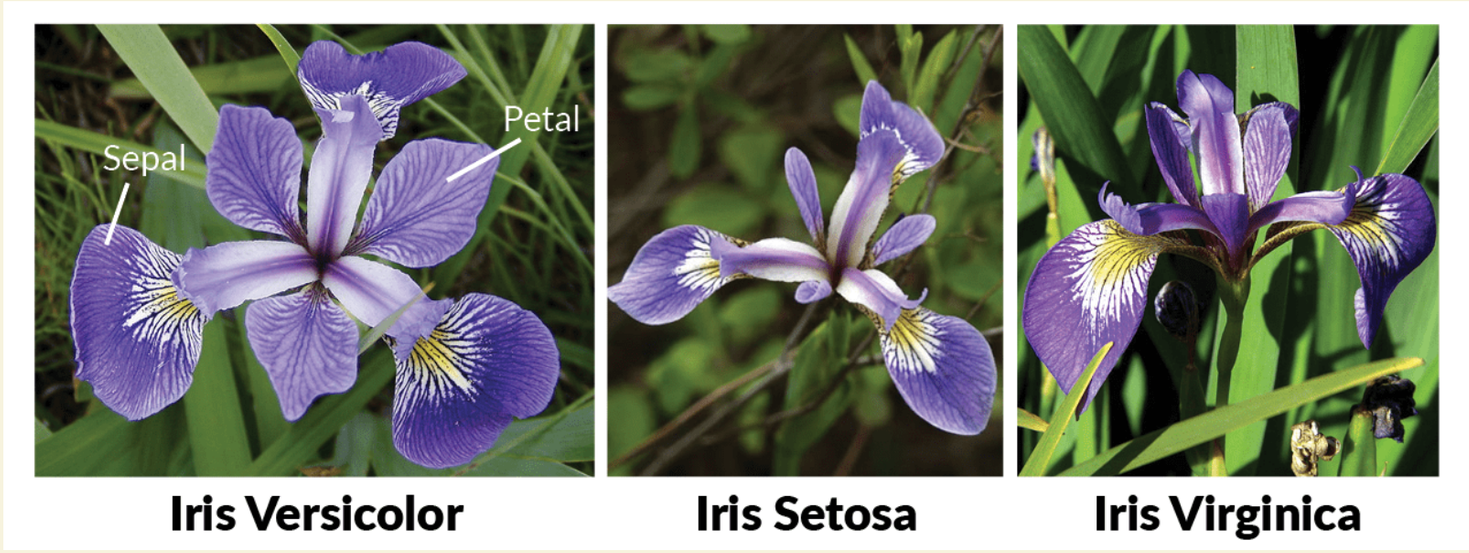


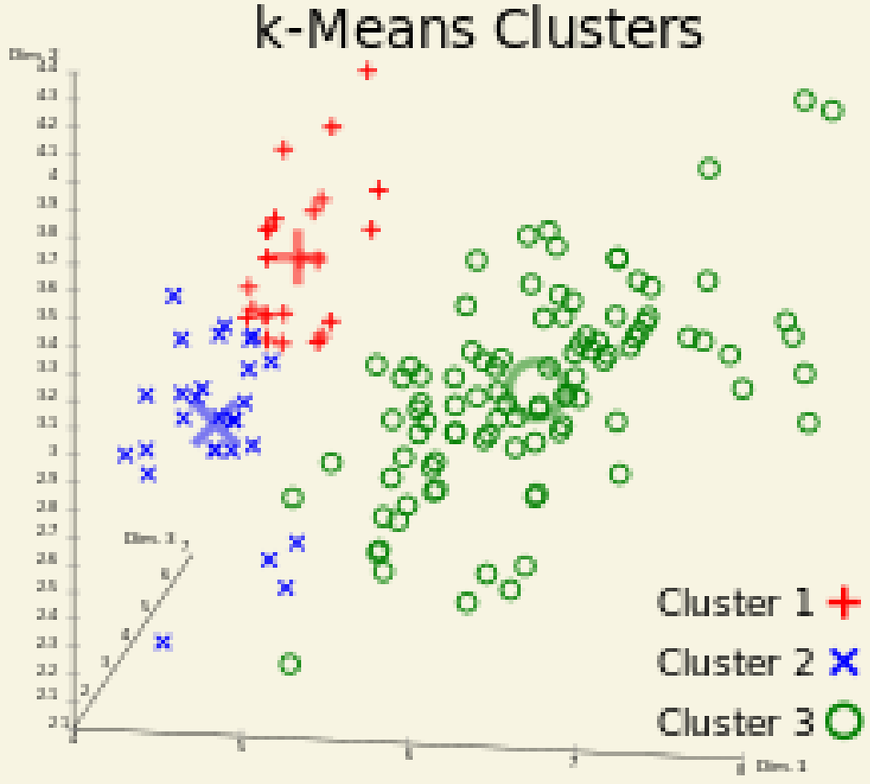
Document everything:

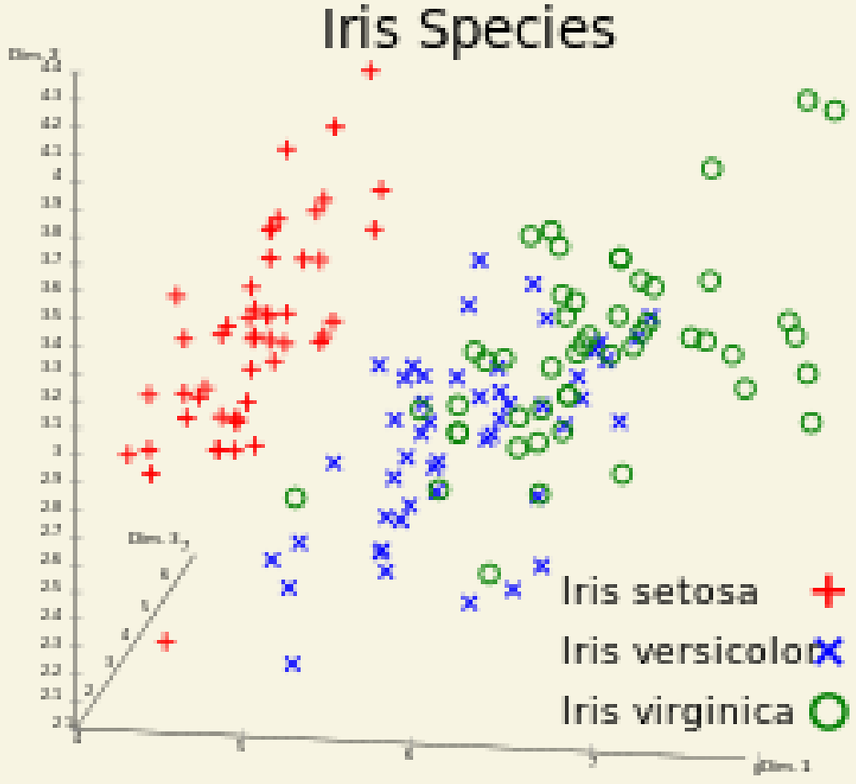
- Which script produced which output? From which data? In which software environment? ...

Find out more about organizational principles in the YODA principles!

A CLASSIFICATION ANALYSIS ON THE IRIS FLOWER DATASET







REPRODUCIBLE EXECUTION & PROVENANCE CAPTURE

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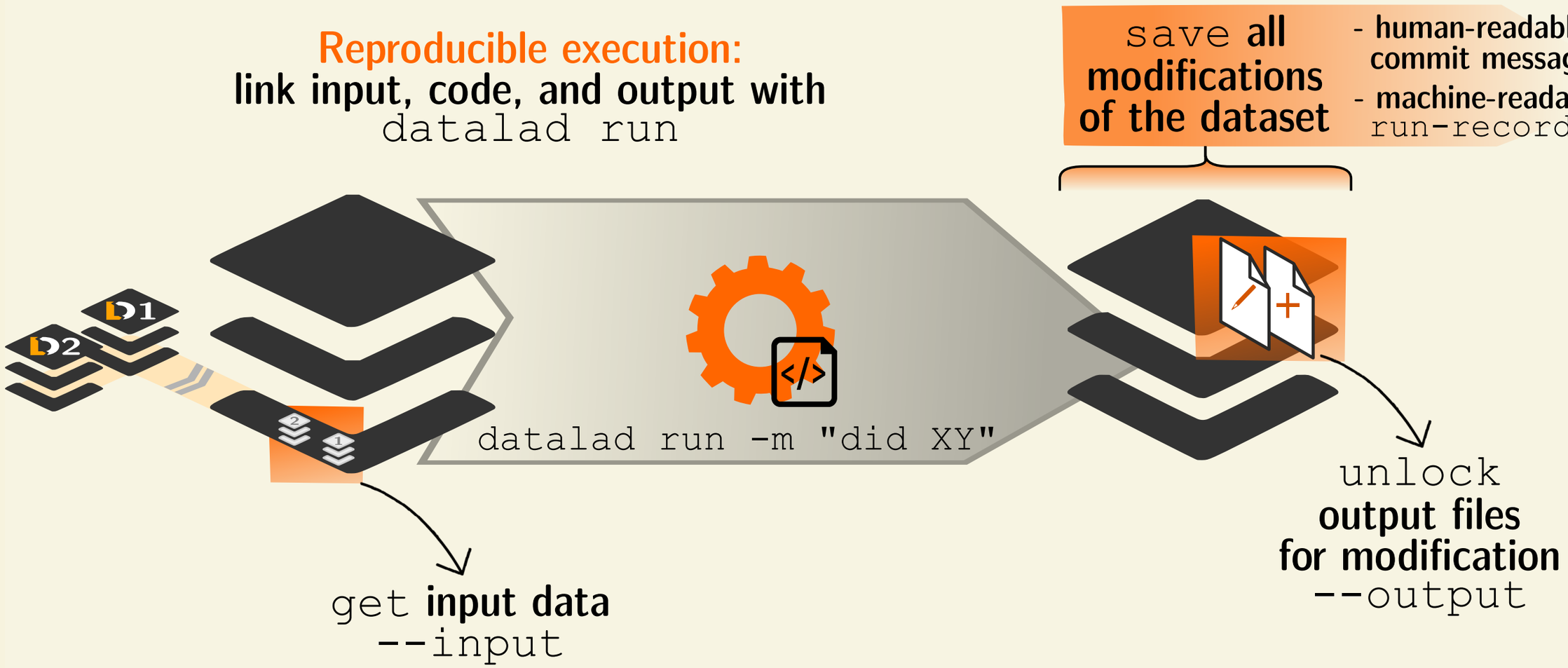

HOW TO GET STARTED WITH BIDS AND DATALAD

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[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
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Read the DataLad handbook

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Read the DataLad handbook

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

ACKNOWLEDGEMENTS

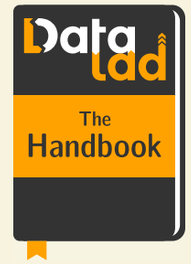
The BIDS standard

- Chris Gorgolewski
- Russ Poldrack
- 100(0?)+ additional contributors

- Michael Hanke
- Yaroslav Halchenko
- Joey Hess (git-annex)
- Benjamin Poldrack
- Kyle Meyer
- 22+ additional contributors

The DataLad Handbook

- Laura Waite
- Michael Hanke
- 11+ additional contributors



THANK YOU!

QUESTIONS?