Radboud University

Karolinska Institutet

Introduction to Open Science

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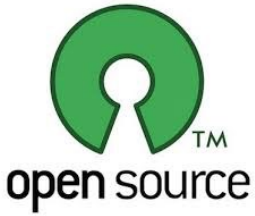
DONDERS INSTITUTE

NatMEG

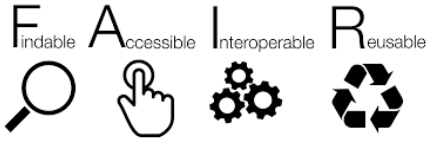
OPEN SCIENCE
OPEN ACCESS
OPEN DATA
OPEN SOURCE
OPEN MATERIALS
PREREGISTERED

My own active contributions to Open Science

FieldTrip toolbox for MEG/EEG analysis
The **EEGsynth** project for artistic neuro- and biofeedback



Human Connectome Project (**HCP**)
The Donders and Radboud **Data Repository**
Brain Imaging Data Structure (**BIDS**)

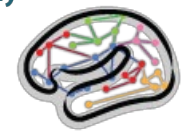


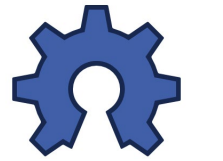
OHMB Open Science Room
BrainHack meetings

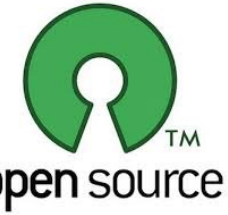
DIY projects with electronics and 3D printing

Open Science

- Open educational resources
- Open access publications
  - Open peer review
  - Pre-registration
  - Registered reports
- Open methodology
  - Open source
  - Open hardware
  - Open materials
- Open data
- …







Why do ~~Open~~ Better Science?

Democratic

everyone should be able to contribute

Pragmatic

it is more efficient to collaborate

Infrastructure

it results in better tools

Public

results should be accessible to all

Measurement

results can be better quantified

But also …

to tackle the lack of trust

to address poor reproducibility

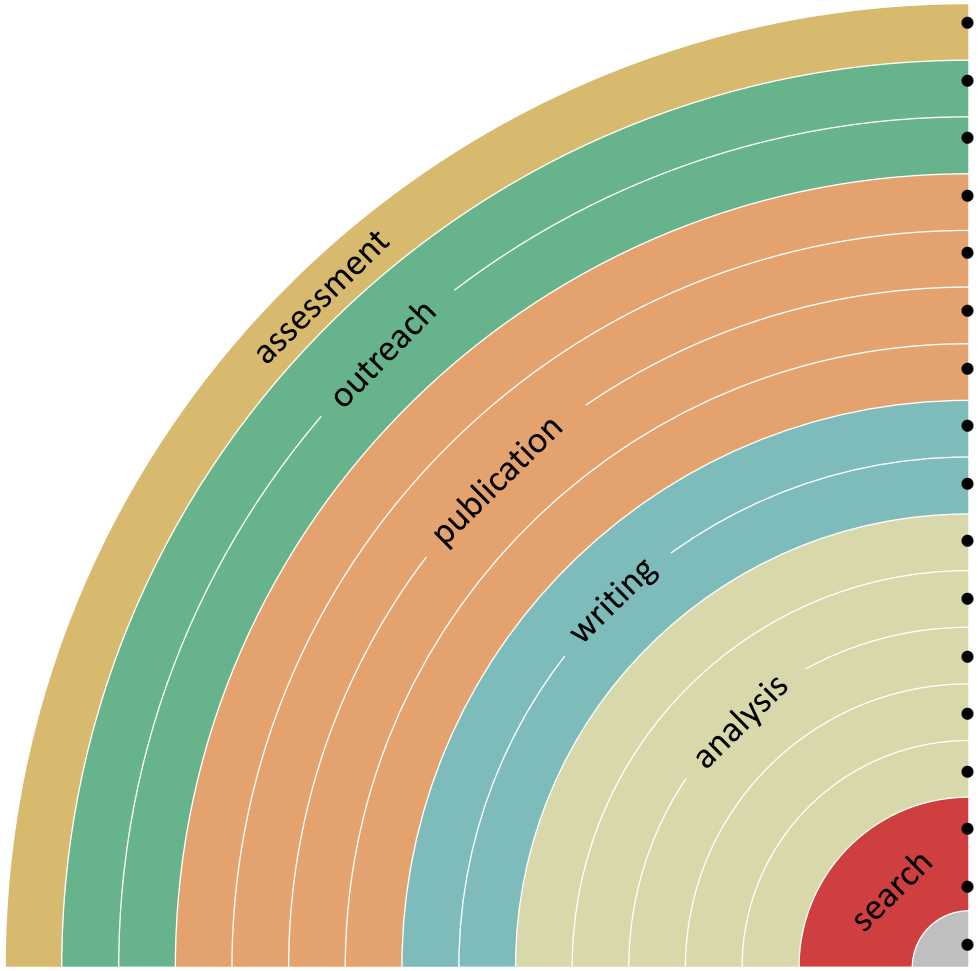
to improve quality

because it is the right thing to do

Research cycle

Research Data Lifecycle by LMA Research Data Management Working Group, CC-BY-NC-4.0

You can make this cycle more open by …



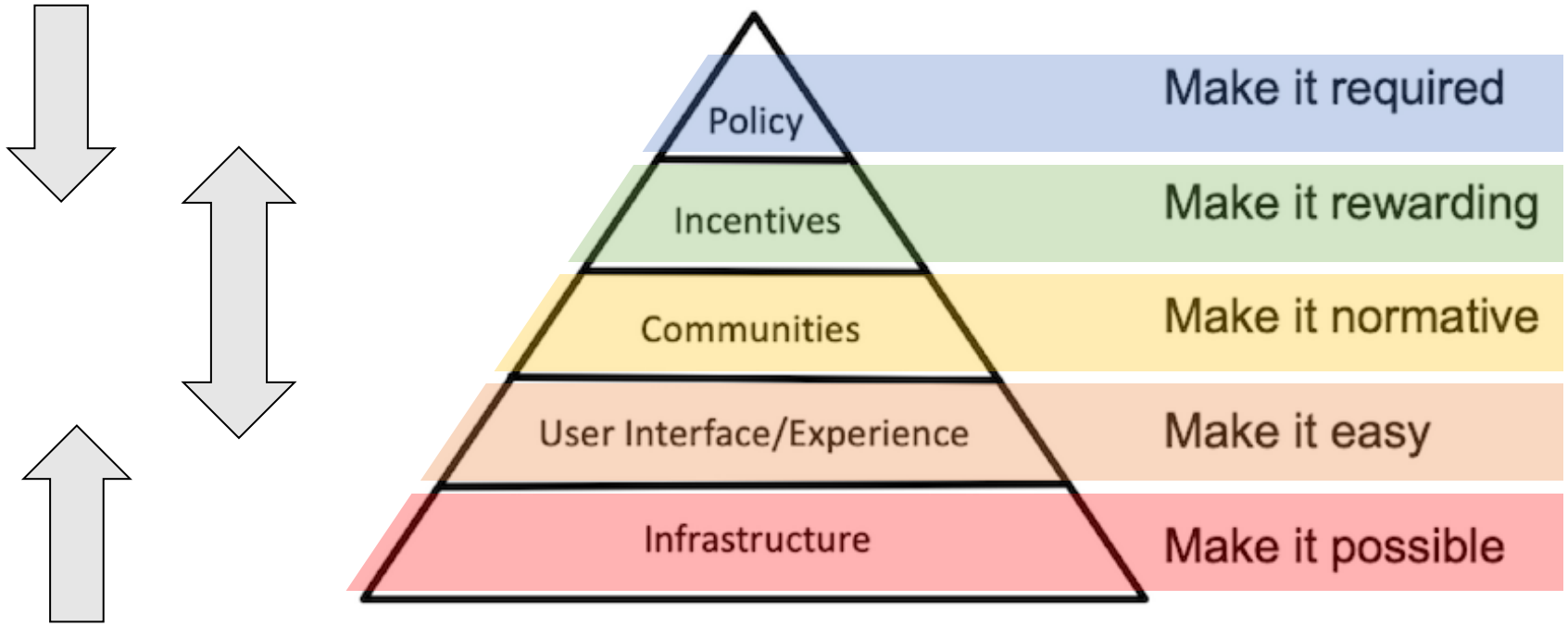
- adding alternative evaluation, e.g. with altmetrics
- communicating through social media, e.g. Twitter
- sharing posters & presentations, e.g. at FigShare
- using open licenses, e.g. CC0 or CC-BY
- publishing open access, ‘green’ or ‘gold’
- using open peer review, e.g. at journals or PubPeer
- sharing preprints, e.g. at OSF, arXiv or bioRxiv
- using actionable formats, e.g. with Jupyter or CoCalc
- open XML-drafting, e.g. at Overleaf or Authorea
- sharing protocols & workfl., e.g. at Protocols.io
- sharing notebooks, e.g. at OpenNotebookScience
- sharing code, e.g. at GitHub with GNU/MIT license
- sharing data, e.g. at Dryad, Zenodo or Dataverse
- pre-registering, e.g. at OSF or AsPredicted
- commenting openly, e.g. with Hypothes.is
- using shared reference libraries, e.g. with Zotero
- sharing (grant) proposals, e.g. at RIO

CC BY
Bianca Kramer & Jeroen Bosman https://101innovations.wordpress.com

DOI: 10.5281/zenodo.1147025

We can all benefit of it …
and we can all contribute to it

Contributing to a Culture Change

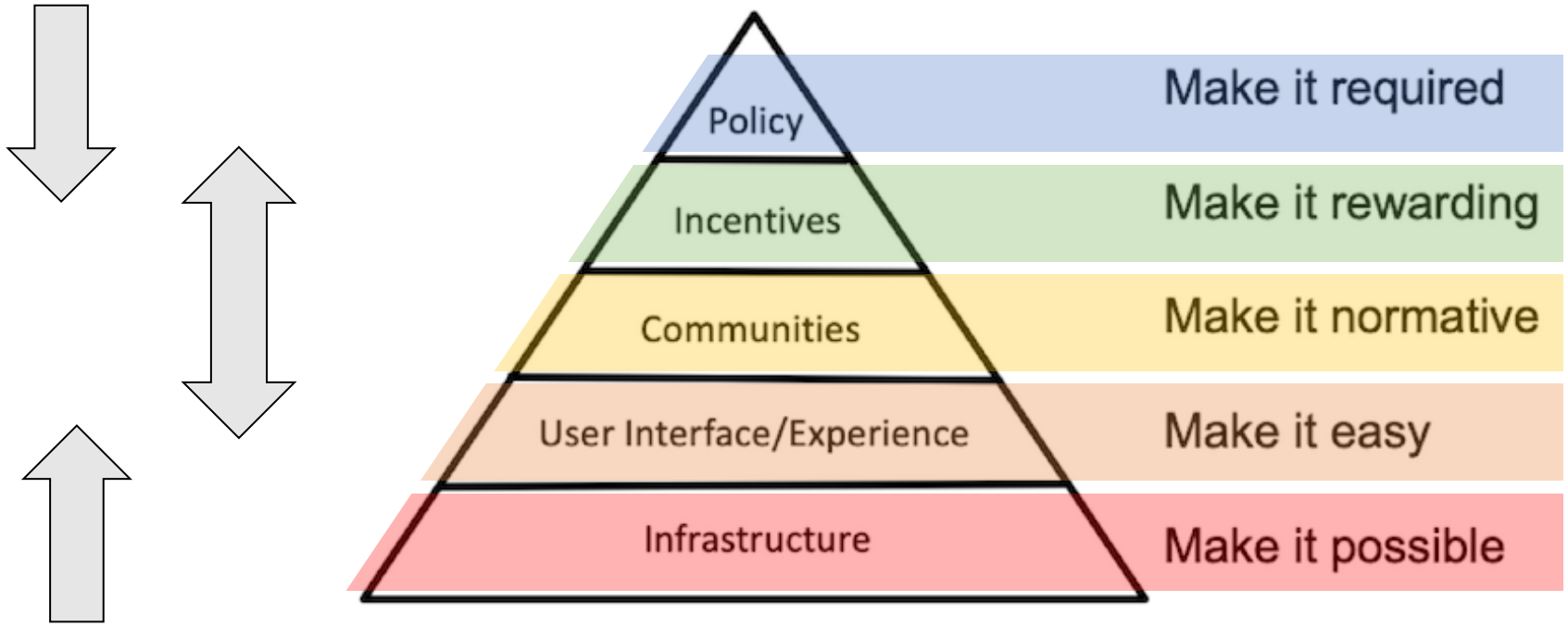


Not everyone can do everything.

Change requires both personal and organisational investments.

Brian Nosek, CoS (2019) https://www.cos.io/blog/strategy-for-culture-change

Contributing to a Culture Change



Each of us is from our position only capable of limited influence:

- policy makers from the top downwards
- engineers and other staff supporting from bottom-up
- many of us in between

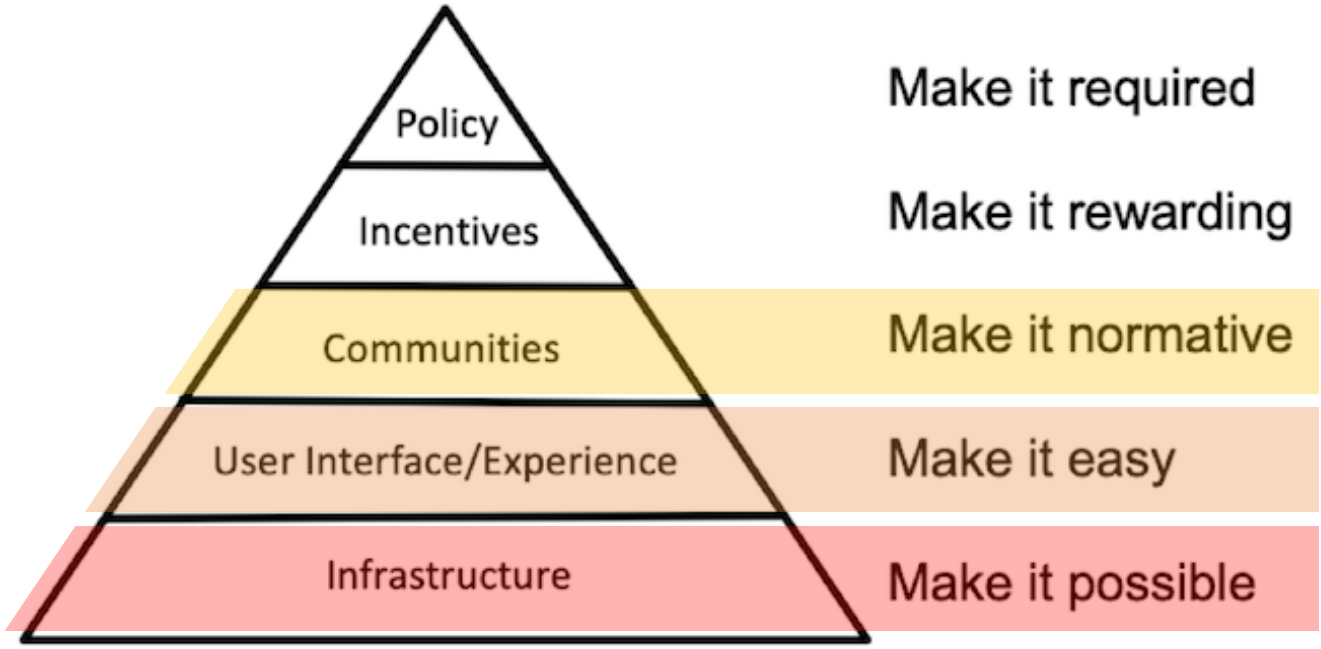
Personal experiences with Open Science

FieldTrip

HUMAN Connectome PROJECT

BIDS
BRAIN IMAGING DATA STRUCTURE

re3data.org
REGISTRY OF RESEARCH DATA REPOSITORIES
http://doi.org/10.17616/R31NJMZR
Radboud Data Repository



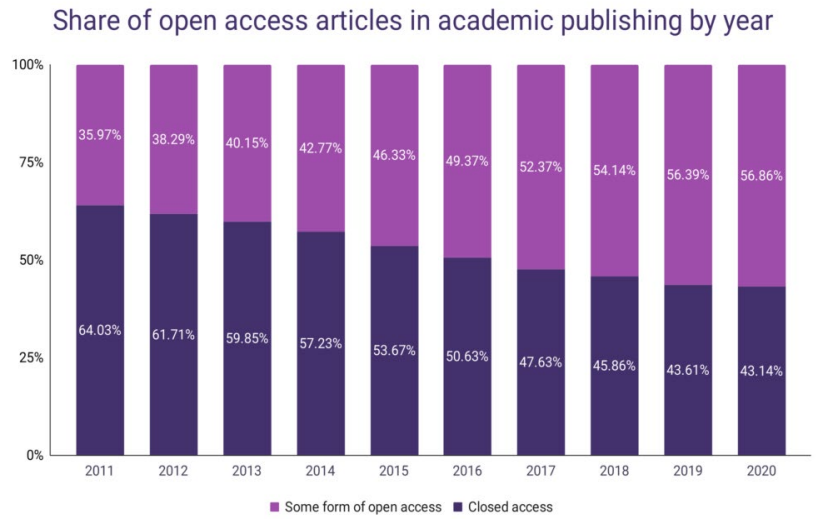
Where is Open Science successful?

Open Access publication

More than 18.000 open access publishers, including Elsevier, Springer, etc.

20% - 54% of all papers are open access (Simard et al. 2022).

However, large article processing charges make it hard for some researchers to publish in high-impact (expensive) journals.



open

closed

https://wordsrated.com/open-access-publishing-statistics/ (retrieved 21-11-2023)

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Open Source analysis software

Widely used in many research fields (R, Python, Julia, JASP, REDCap, FieldTrip).

However, challenging relation between open source and commercial models.

Open Data

Standard for many national and EU-level funding schemes.

However, privacy considerations and inconsistent interpretation of GDPR.

Tension between Open Source/Open Data and commercial interests

Academic software development, support and maintenance requires long-term efforts, but Research Software Engineers (RSEs) are rare.

FieldTrip is an Open Source MATLAB toolbox, but MATLAB is commercial, so FieldTrip is Free-as-in-speech (Libre 💬) but not Free-as-in-beer (Gratis 🍺).

Note: the English language does not distinguish "free 💬" from "free 🍺".

Companies like Google (Colab) and Microsoft (Github) are actively trying to bind Open Source software projects into their ecosystems on the premise of their services being free (🍺).

Companies like FaceBook and Google are funding Open Source development conditional on it being licensed under MIT/BSD(🍺), not GPL (💬).

Data platforms like OpenNeuro and DataDryad use CC0 ("anything goes") rather than CC-SA ("share alike").

Different goals of stakeholders

Not as simple as free-as-in-speech (libre 💬) versus free-as-in-beer (gratis 🍺).

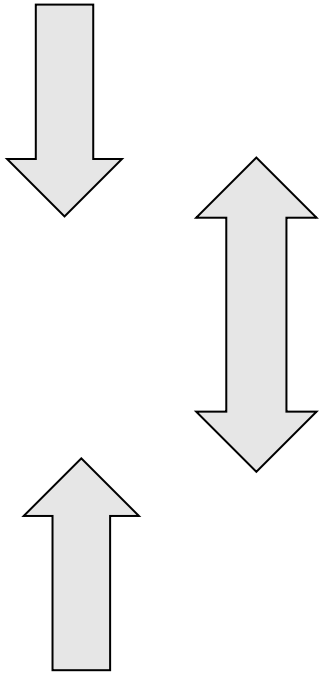
Academic researcher's work need incentives and reward.

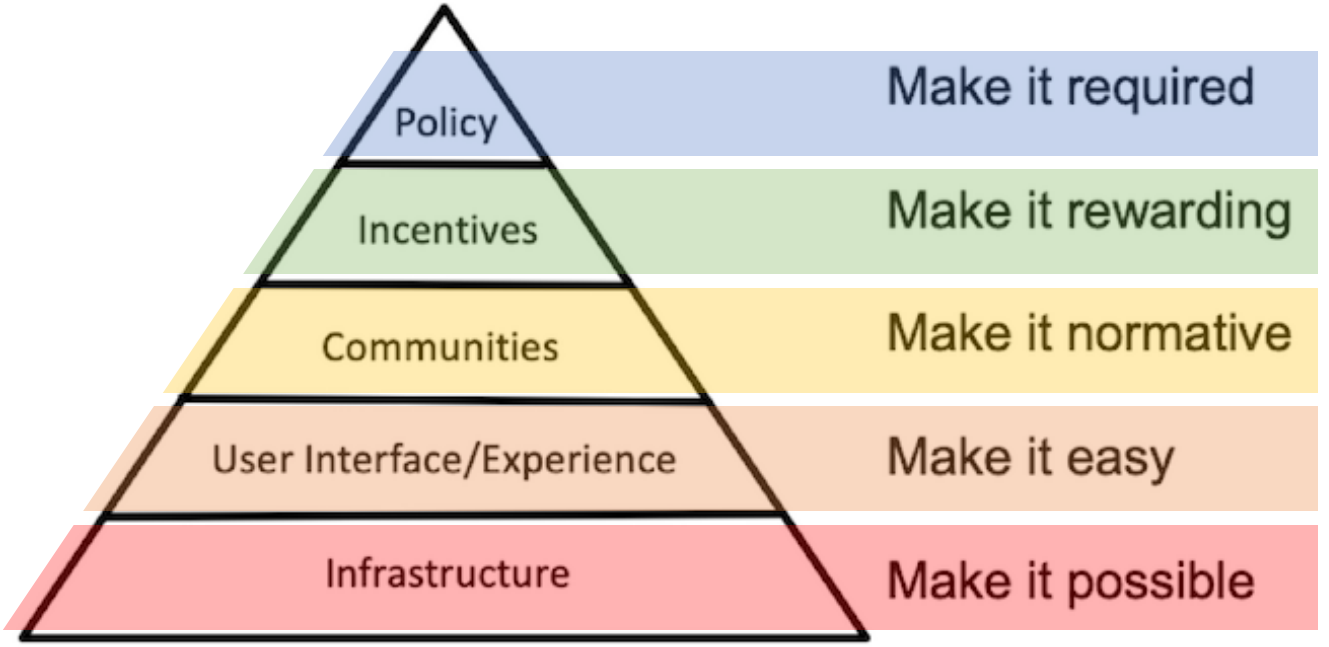
Interest of the **society and community** in developing products based on academic research, and bringing those to market.

Many Open-Science-minded **companies** would not mind becoming the next Elsevier or Novo Nordisk, and companies want to leverage Open Science to their advantage.

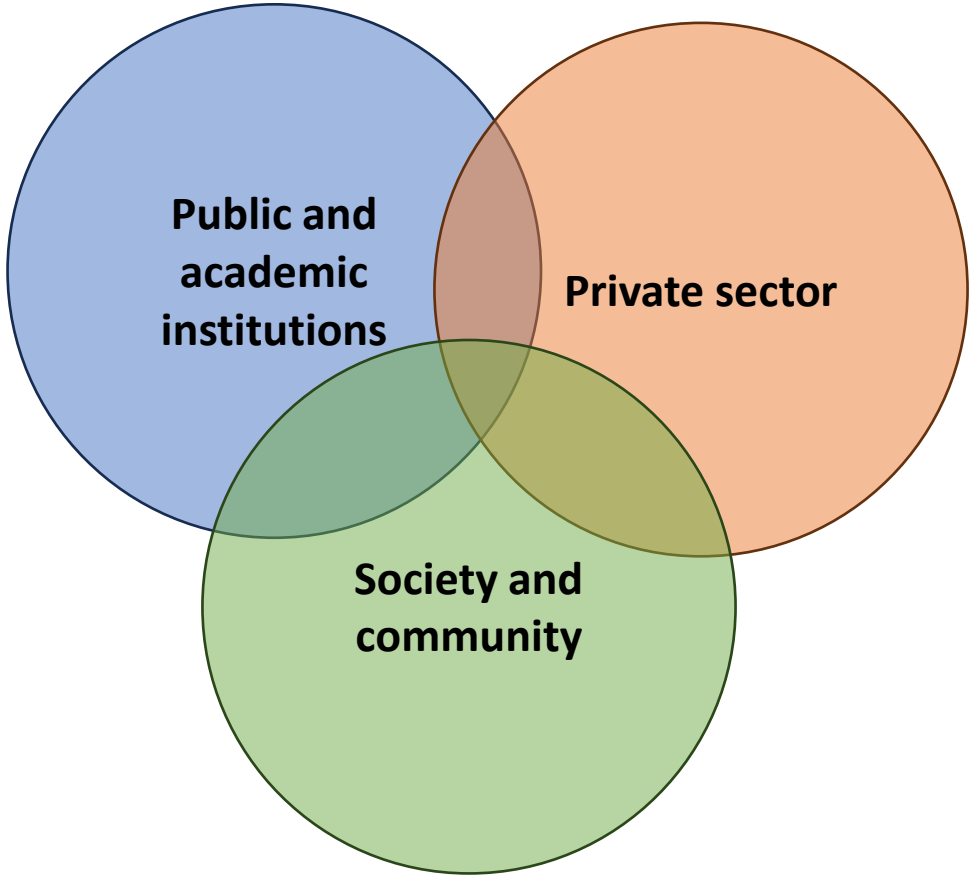
Very different responsibilities and (sometimes personal) stakes of academic researchers, research engineers, librarians, data stewards, privacy officers, institutional management, ...

Changing towards an Open Science culture *inside academia*





Changing towards an Open Science culture *together with the private sector and society*



Take home message

- Open Science consists of many aspects
- Open Science is better science
- Open Science still requires a lot of change in our culture
- Open Science is not only for academics
- Open Science needs to be sustainable to have a long-term impact

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