
# Open science and its advocacy

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# Outline of the session

- Introduction to open science
- Why be open?
- How to make your publications and data open
- Questions and discussion

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# WHAT IS OPEN SCIENCE?

Some definitions and clarifications

# What is open science?

"science carried out and communicated in a manner which allows others to contribute, collaborate and add to the research effort, with all kinds of data, results and protocols made freely available at different stages of the research process."

Research Information Network, Open Science case studies
www.rin.ac.uk/our-work/data-management-and-curation/open-science-case-studies

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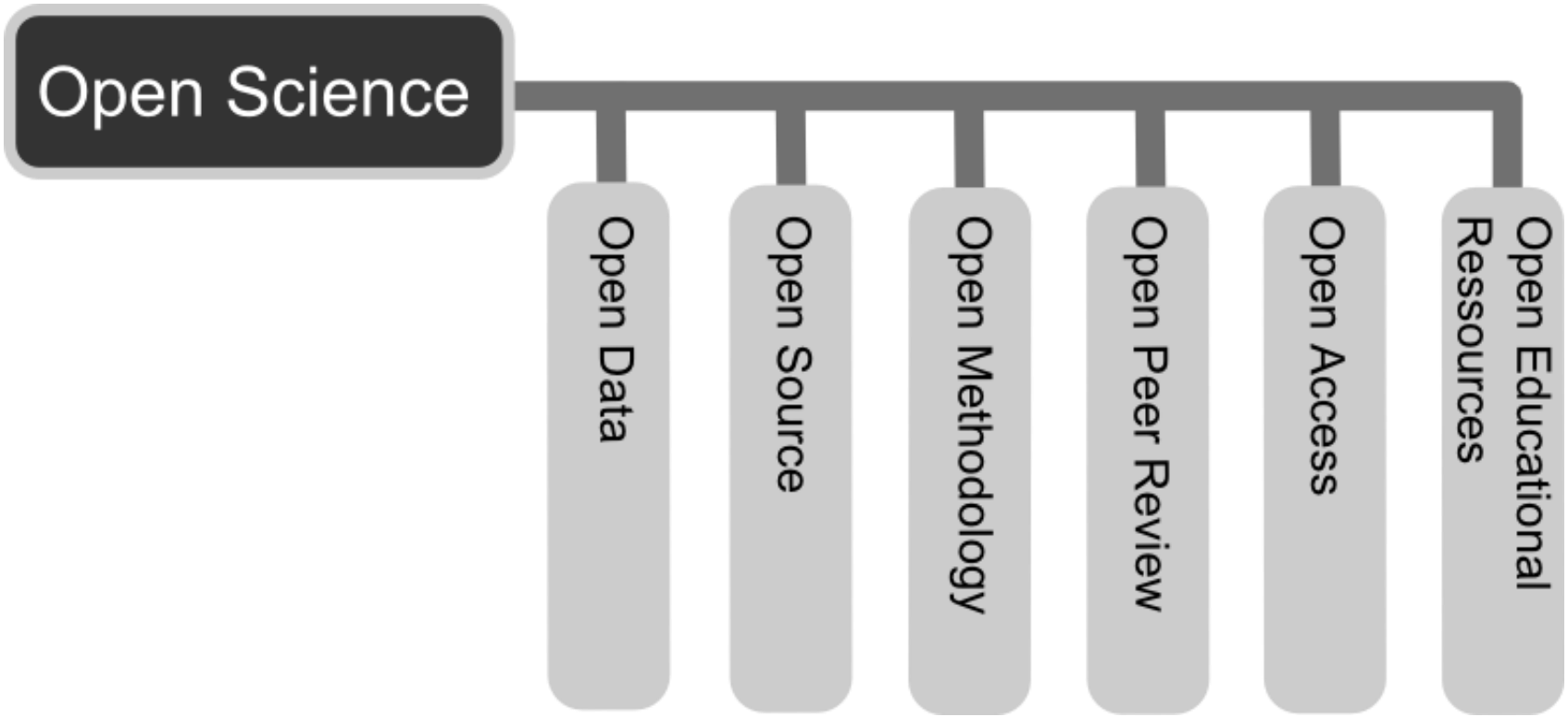
# More than open access publishing

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# Why open access?


Open Access Explained!
www.youtube.com/watch?v=L5rVH1KGBCY

# Open access to publications

- Free, immediate, online access to the results of research
- Free to reuse e.g. to build tools to mine the content
- Two routes to make sure anyone can access your papers
  - Gold route: paying APCs to ensure publishers makes copy open
  - Green route: self-archiving Open Access copy in repository
- Find out what your publisher allows on SHERPA RoMEO
  - www.sherpa.ac.uk/romeo

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# Open data

"Open data and content can be freely used, modified and shared by anyone for any purpose"

http://opendefinition.org

Tim Berners-Lee's proposal for five star open data - http://5stardata.info

- ★ make your stuff available on the Web (whatever format) under an open licence
- ★★ make it available as structured data (e.g. Excel instead of a scan of a table)
- ★★★ use non-proprietary formats (e.g. CSV instead of Excel)
- ★★★★ use URIs to denote things, so that people can point at your stuff
- ★★★★★ link your data to other data to provide context

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# Open methods

- Documenting and sharing workflows and methods
- Sharing code and tools to allow others to reproduce work
- Using web based tools to facilitate collaboration and interaction from the outside world
- *Open netbook science* – "when there is a URL to a laboratory notebook that is freely available and indexed on common search engines."
  http://drexel-coas-elearning.blogspot.co.uk/2006/09/open-notebook-science.html

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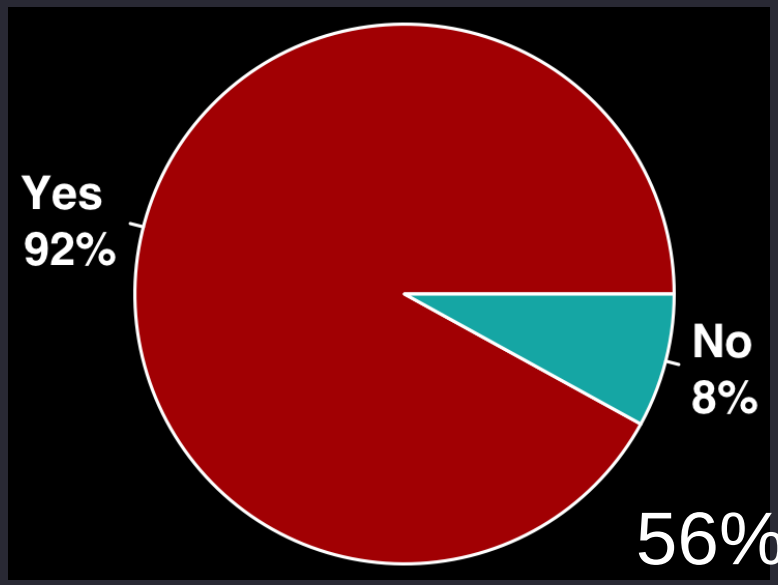
# Reliance on specialist research software

Slide from Neil Chue-Hong, Software Sustainability Institute

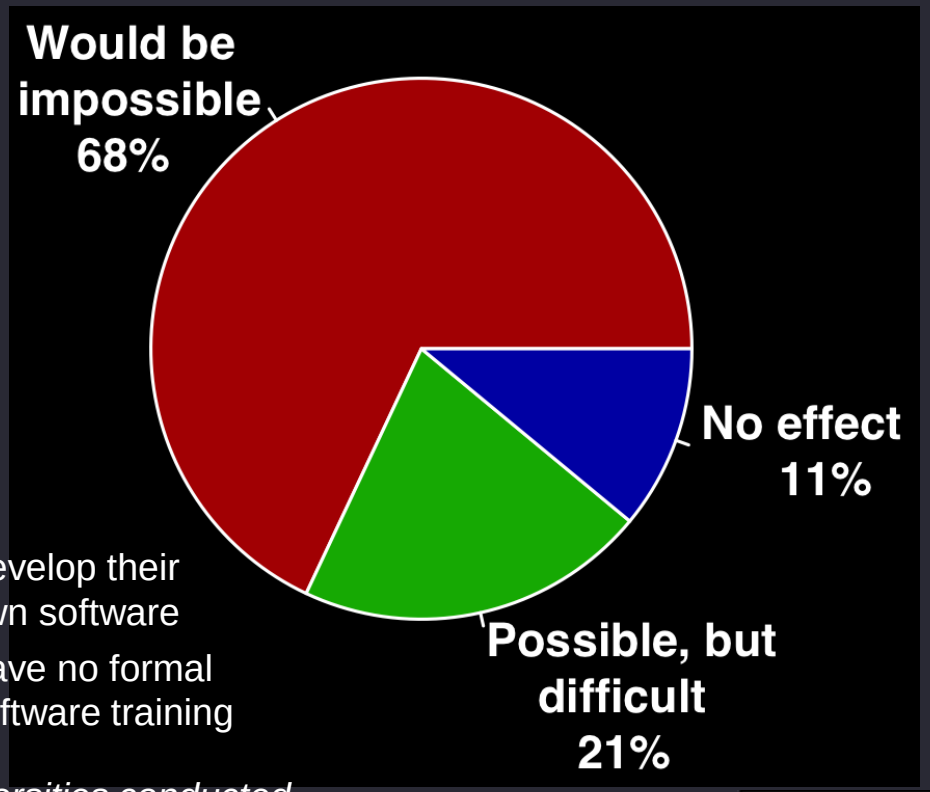
Do you use research software?




56% Develop their own software

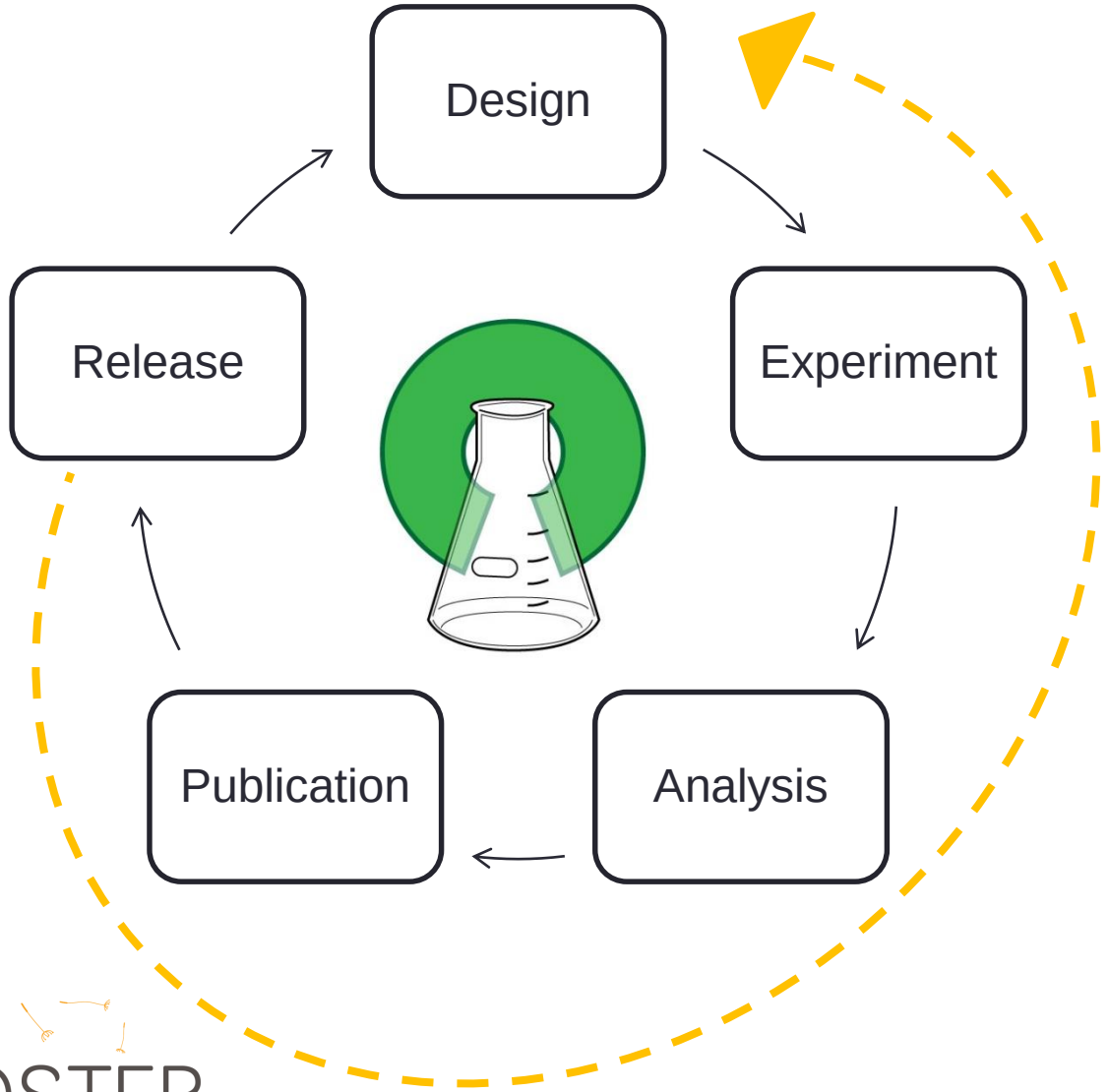
71% Have no formal software training

What would happen to your research without software




*Survey of researchers from 15 UK Russell Group universities conducted by SSI between August - October 2014. DOI: 10.5281/zenodo.14809*

# Openness at every stage




Change the typical lifecycle

Publish earlier and release more

Papers + Data + Methods + Code…

Support reproducibility

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# Degrees of openness

Five star open data

★★★★★

Unable to share
Under embargo

Open — Restricted — Closed

Content that can be freely used, modified and shared by anyone for any purpose

Limits on who can use the data, how or for what purpose

- Charges for use
- Data sharing agreements
- Restrictive licences
- Peer-to-peer exchange
- …


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# WHY PRACTICE OPEN SCIENCE?

## Benefits and drivers

# It’s part of good research practice

"It was *never* acceptable to publish papers without making data available."

- Ewan Birney

#OpenData
#OpenScience

Original image via doi:10.1038/461145a. “Research cannot flourish if data are not preserved and made accessible. Data management should be woven into every course in science.” - *Nature* 461, 145

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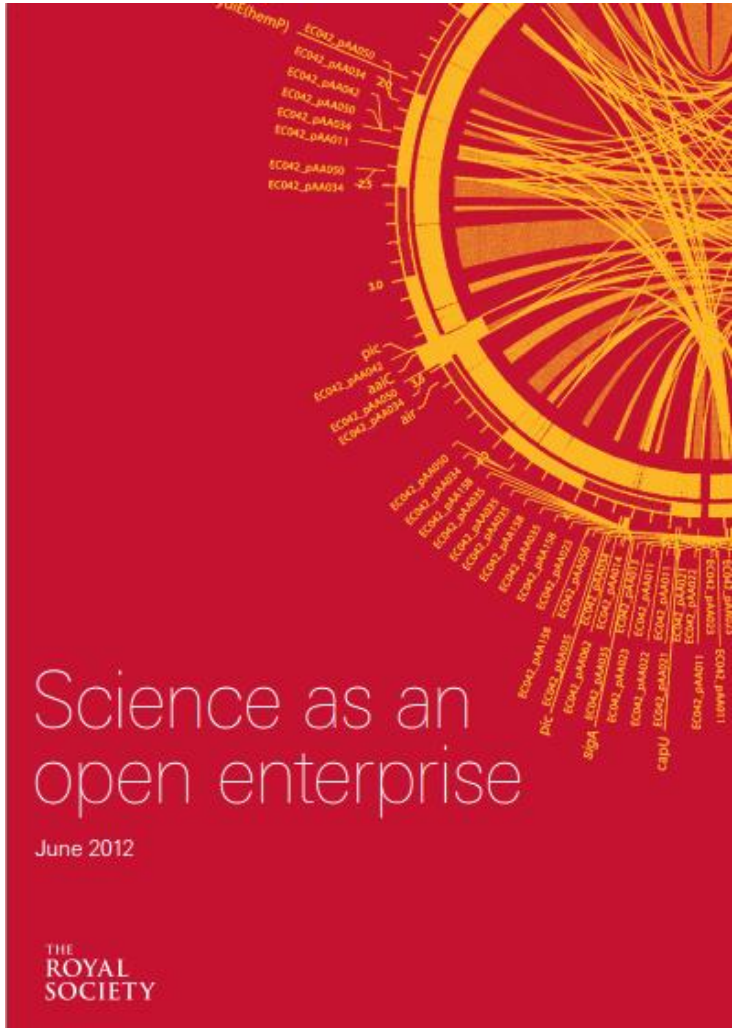
# Science as an open enterprise

*"Much of the remarkable growth of scientific understanding in recent centuries is due to open practices; open communication and deliberation sit at the heart of scientific practice."*

Royal Society report calls for 'intelligent openness' whereby data are accessible, intelligible, assessable and usable.

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https://royalsociety.org/policy/projects/science-public-enterprise/Report

# Some benefits of openness

- You can access relevant literature – not behind pay walls
- Ensures research is transparent and reproducible
- Increased visibility, usage and impact of your work
- New collaborations and research partnerships
- Ensure long-term access to your outputs
- Help increase the efficiency of research

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# Saving wasted time

OA helps to reduce time spent finding/accessing material:

"If around 60 minutes were characteristic for researchers (the average time spent trying to access the last research article they had difficulty accessing), then in the current environment the time spent dealing with research article access difficulties might be costing around DKK 540 million (EUR 72 million) per year among specialist researchers in Denmark alone."

Access to research and technical information in Denmark, Houghton, Swan & Brown (2011)
http://eprints.ecs.soton.ac.uk/22603

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# Cut down on academic fraud

nature International weekly journal of science

Login

nature news home | news archive | specials | opinion | features | news blog | nature journal

comments on this story

Stories by subject
- Brain and behaviour
- Lab life

Stories by keywords
- Deiderik Stapel
- Tilburg University
- Academic fraud
- Retractions
- Social psychology

This article elsewhere
- Blogs linking to this article
- Add to Digg
- Add to Facebook
- Add to Newsvine
- Add to Del.icio.us
- Add to Twitter

Published online 1 November 2011 | *Nature* **479**, 15 (2011) | doi:10.1038/479015a
Updated online: 1 November 2011
Updated online: 8 December 2011

News

## Report finds massive fraud at Dutch universities

**Investigation claims dozens of social-psychology papers contain faked data.**

Ewen Callaway

When colleagues called the work of Dutch psychologist Diederik Stapel too good to be true, they meant it as a compliment. But a preliminary investigative report (go.nature.com/tqmp5c) released on 31 October gives literal meaning to the phrase, detailing years of data manipulation and blatant fabrication by the prominent Tilburg University researcher.



Dutch psychologist Diederik Stapel.

*Persbureau van Eijndhoven*

"We have some 30 papers in peer-reviewed journals where we are actually sure that they are fake, and there are more to come," says Pim Levelt, chair of the committee that investigated Stapel's work at the university.

Stapel's eye-catching studies on aspects of social behaviour such as power and stereotyping garnered wide press coverage. For example, in a recent *Science* paper (which the investigation has not identified as fraudulent), Stapel reported that untidy environments encouraged discrimination (*Science* **332**, 251–253; 2011).

Related stories
- Seven days: 9–15 September 2011 — 14 September 2011
- Chaos promotes stereotyping — 07 April 2011

Naturejobs

Tenure-Track Faculty Positions (Assistant / Associate / Full Professor)Yale University, Department of Genetics
Yale University School of Medicine

Assistant Professor
Harvard Medical School

More science jobs

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external links
- Tilburg University
- Interim investigation report

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www.nature.com/news/2011/111101/full/479015a.html

# Validation of results

"It was a mistake in a spreadsheet that could have been easily overlooked: a few rows left out of an equation to average the values in a column.

The spreadsheet was used to draw the conclusion of an influential 2010 economics paper: that public debt of more than 90% of GDP slows down growth. This conclusion was later cited by the International Monetary Fund and the UK Treasury to justify programmes of austerity that have arguably led to riots, poverty and lost jobs."

## The error that could subvert George Osborne's austerity programme

The theories on which the chancellor based his cuts policies have been shown to be based on an embarrassing mistake

**Charles Arthur** and **Phillip Inman**
The Guardian, Thursday 18 April 2013 21.10 BST


George Osborne says that Ken Rogoff, the man whose economic error has been uncovered, has strongly influenced his thinking. Photograph: Stefan Wermuth/PA

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www.guardian.co.uk/politics/2013/apr/18/uncovered-error-george-osborne-austerity

# Acceleration of the research process

*"As more papers are deposited and more scientists use the repository, the time between an article being deposited and being cited has been shrinking dramatically, year upon year. This is important for research uptake and progress, because it means that in this area of research, where articles are made available at – or frequently before – publication, the research cycle is accelerating."*

Open Access: Why should we have it? Alma Swan
www.keyperspectives.co.uk

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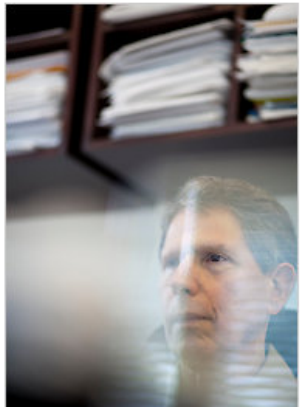
# More scientific breakthroughs

## Sharing of Data Leads to Progress on Alzheimer's

By GINA KOLATA
Published: August 12, 2010

In 2003, a group of scientists and executives from the National Institutes of Health, the Food and Drug Administration, the drug and medical-imaging industries, universities and nonprofit groups joined in a project that experts say had no precedent: a collaborative effort to find the biological markers that show the progression of Alzheimer's disease in the human brain.

Enlarge This Image



Now, the effort is bearing fruit with a wealth of recent scientific papers on the early diagnosis of Alzheimer's using methods like PET scans and tests of spinal fluid. More than 100 studies are under way to test drugs that might slow or stop the disease.

And the collaboration is already serving as a model for similar efforts against Parkinson's disease. A $40 million project to look for biomarkers for Parkinson's, sponsored by the Michael J. Fox Foundation, plans to enroll 600 study subjects in the United States and Europe.

*"It was unbelievable. Its not science the way most of us have practiced in our careers. But we all realised that we would never get biomarkers unless all of us parked our egos and intellectual property noses outside the door and agreed that all of our data would be public immediately."*

*Dr John Trojanowski, University of Pennsylvania*

www.nytimes.com/2010/08/13/health/research/13alzheimer.html?pagewanted=all&_r=0

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# Get a citation advantage

A study that analysed the citation counts of 10,555 papers on gene expression studies that created microarray data, showed:

"studies that made data available in a public repository received 9% more citations than similar studies for which the data was not made available"

Data reuse and the open data citation advantage,
Piwowar, H. & Vision, T. https://peerj.com/articles/175

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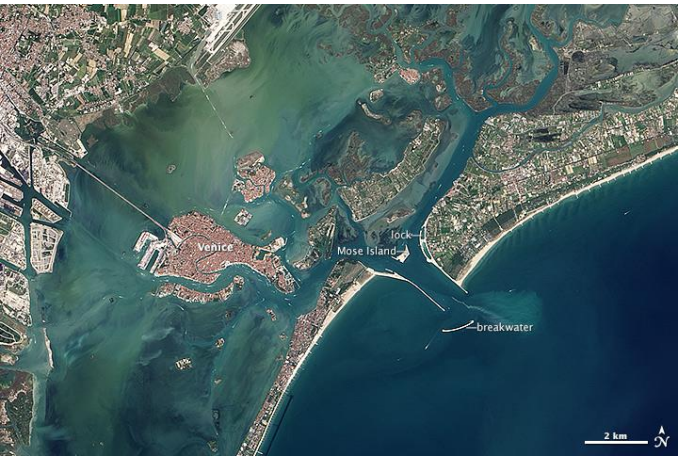
# Increased use and economic benefit

The case of NASA Landsat satellite imagery of the Earth's surface:

## Up to 2008

- Sold through the US Geological Survey for US$600 per scene
- Sales of 19,000 scenes per year
- Annual revenue of $11.4 million

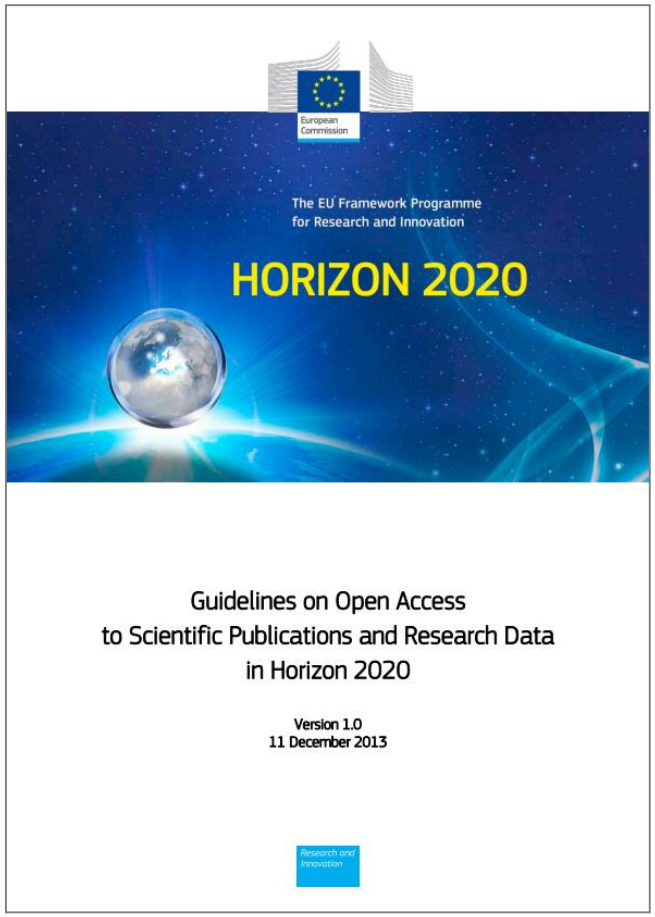



## Since 2009

- Freely available over the internet
- Google Earth now uses the images
- Transmission of 2,100,000 scenes per year.
- Estimated to have created value for the environmental management industry of $935 million, with direct benefit of more than $100 million per year to the US economy
- Has stimulated the development of applications from a large number of companies worldwide

http://earthobservatory.nasa.gov/IOTD/view.php?id=83394&src=ve

# Funder imperatives...




"The European Commission's vision is that information already paid for by the public purse should not be paid for again each time it is accessed or used, and that it should benefit European companies and citizens to the full."

http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf

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# But there are also opportunity costs

THE OPPORTUNITY COST OF MY #OPENSCIENCE WAS 35 HOURS + $690

By Emilio Bruna
http://brunalab.org/blog/2014/09/04/the-opportunity-cost-of-my-openscience-was-35-hours-690

For his most recent paper:

1. Double checking the main dataset and reformatting to submit to Dryad: **5 hours**
2. Creating complementary file and preparing metadata: **3 hours**
3. Submission of these two files and the metadata to Dryad: **45 minutes**
4. Preparing a map of the locations: **1 hour**
5. Submission of map to Figshare: **15 minutes**
6. Cleaning up and documenting the code, uploading it to GitHub: **25 hours**
7. Cost of archiving in Dryad: **US$90**
8. Page Charges: **$600**

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# So what needs to change?

Conclusions from Emilio Bruna:

- Develop a better system of incentives from the community for archiving data and code
- Teach our students how to do this NOW - it's much easier if you develop good habits early
- Minimise the actual and opportunity costs

**We need to stop telling people "You should" and get better at telling people "Here's how"**

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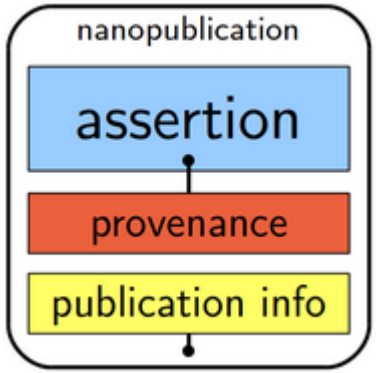
# HOW TO PRACTICE OPEN SCIENCE?

## Questions to consider

# Conduct science in the open

- Use open lab notebooks
- Share protocols
- Blog about your work
- Publish assertions to get ideas out sooner (nanopublication)





http://openwetware.org

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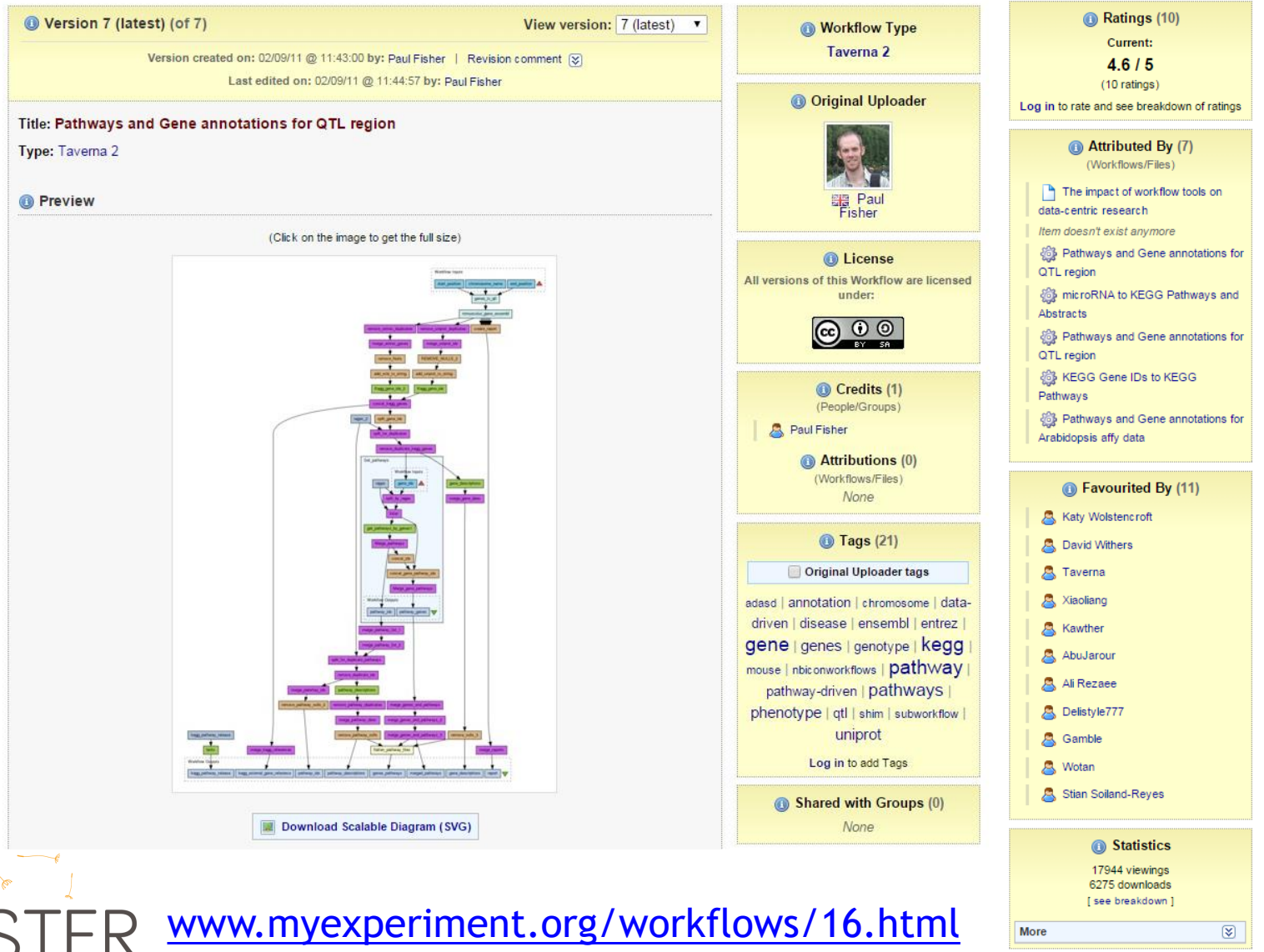
# Collaborate & share: MyExperiment

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www.myexperiment.org/workflows/16.html

# Routes to open access publication

Researcher **decides where to publish**

Check SHERPA RoMEO to see what OA and self-archiving options are available [www.sherpa.ac.uk/romeo](www.sherpa.ac.uk/romeo)

Publish in an **open access journal**

Pay Article Processing Charge (APC) - *if required*

Immediate open access (via publisher)

GOLD OA ROUTE

GREEN OA ROUTE

Publish in a **subscription-based journal**

**Search for a repository** [http://opendoar.org](http://opendoar.org)

**Self-archive in a repository**, based on publisher policy.

Immediate or delayed open access, depending on publisher's policy.

IF OPTION EXISTS
e.g. a **'hybrid' journal**
(*a subscription-based journal that has a paid open access option*)

Pay Article Processing Charge (APC)

Immediate open access (via publisher)

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# Sherpah RoMEO

## Search again?

Journal titles or ISSNs  Publisher names

nature

Exact title  starts with  contains  ISSN

Advanced Search  Search  Reset

)836, ESSN: 1476-4687)

| | |
|---|---|
| RoMEO: | This is a RoMEO **yellow** journal |
| Paid OA: | This journal is not in the list for the paid open access option. |
| Author's Pre-print: | ✓ author **can** archive pre-print (ie pre-refereeing) |
| Author's Post-print: | **subject to Restrictions below** author **can** archive post-print (ie final draft post-refereeing) |
| Restrictions: | • 6 months embargo |
| Publisher's Version/PDF: | ✗ author **cannot** archive publisher's version/PDF |
| General Conditions: | • Authors retain copyright<br>• Published source must be acknowledged and DOI cited<br>• Must link to publisher version<br>• Publisher's version/PDF cannot be used<br>• On author's personal website and institutional repository<br>• If funding agency rules apply, authors may post authors version to their relevant funding body's archive, 6 months |
| Mandated OA: | Compliance data is available for 28 funders |
| Paid Open Access: | Open Access Hybrid Model - Selected Titles Only |
| Copyright: | Pre-publication policy - License to Publish - Manuscript Deposition Service |
| Updated: | 06-Mar-2013 - Suggest an update for this record |
| Link to this page: | http://www.sherpa.ac.uk/romeo/issn/0028-0836/ |
| Published by: | Nature Publishing Group - *Yellow Policies in RoMEO* |

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# Deposit in your local repository!

- Speak to the library and deposit in your IR
- Consider other relevant repositories for your field too e.g. Arxiv - http://arxiv.org
- Deposit in Zenodo (catch-all repository) http://zenodo.org
- Check OpenDOAR for examples - http://www.opendoar.org

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# OpenAIRE

Open Access Infrastructure for research in Europe

- aggregates data on OA publications
- mines & enriches it content by linking thing together
- provides services & APIs e.g. to generate publication lists

www.openaire.eu


http://vimeo.com/108790101

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# Open access button


The Open Access Button helps you get the research you want right now (without paying for it), and adds papers you still need to your wishlist.

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https://openaccessbutton.org

# How to make data open?


https://okfn.org

1. Choose your dataset(s)
   - What can you may open? You may need to revisit this step if you encounter problems later.
2. Apply an open license
   - Determine what IP exists. Apply a suitable licence e.g. CC-BY
3. Make the data available
   - Provide the data in a suitable format. Use repositories.
4. Make it discoverable
   - Post on the web, register in catalogues…

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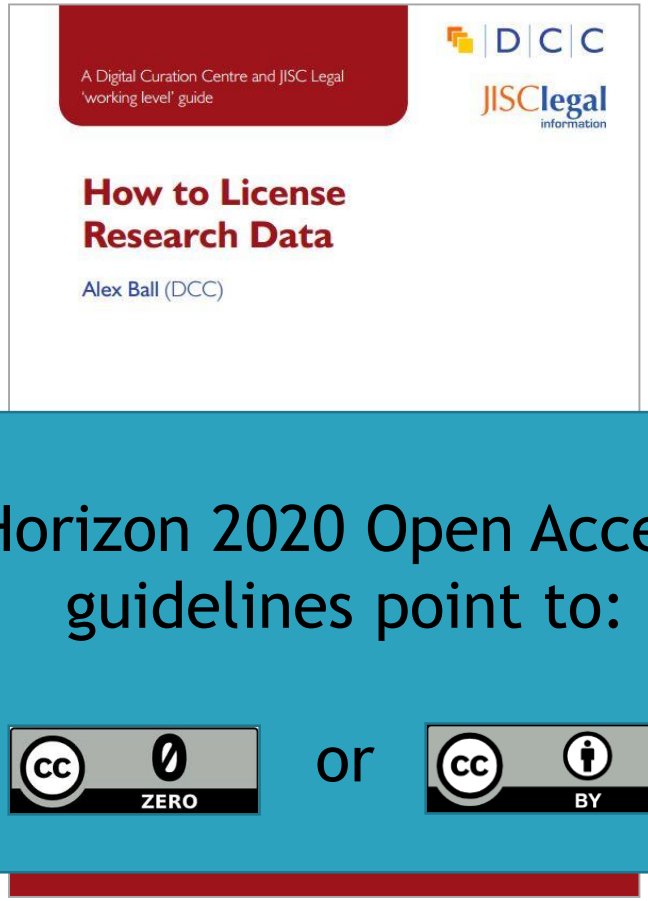
# Licensing research data openly




This DCC guide outlines the pros and cons of each approach and gives practical advice on how to implement your licence

Horizon 2020 Open Access guidelines point to:

CC 0 ZERO or CC BY

CREATIVE COMMONS LIMITATIONS

NC Non-Commercial
What counts as commercial?

SA Share Alike
Reduces interoperability

ND No Derivatives
Severely restricts use

**These clauses are not open licenses**

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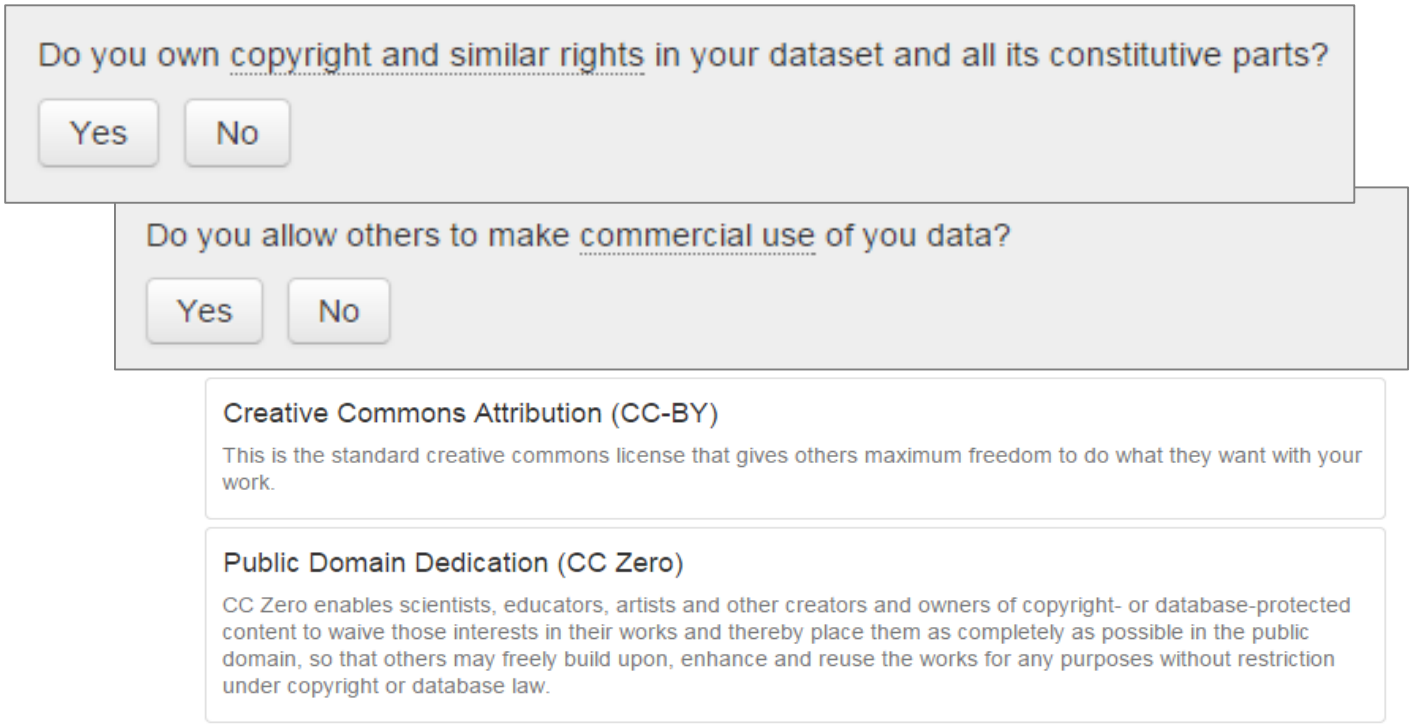
www.dcc.ac.uk/resources/how-guides/license-research-data

# EUDAT licensing tool

Answer questions to determine which licence(s) are appropriate to use

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http://ufal.github.io/lindat-license-selector

# Metadata standards to use

Use relevant standards for interoperability

Search by Discipline

Biology

Earth Science

General Research Data

Physical Science

Social Science & Humanities

RDA

RESEARCH DATA ALLIANCE

www.dcc.ac.uk/resources/metadata-standards

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# Choosing appropriate file formats

If you want your data to be re-used and sustainable in the long-term, you typically want to opt for open, non-proprietary formats.

| Type | Recommended | Avoid for data sharing |
|---|---|---|
| Tabular data | CSV, TSV, SPSS portable | Excel |
| Text | Plain text, HTML, RTF<br>PDF/A only if layout matters | Word |
| Media | Container: MP4, Ogg<br>Codec: Theora, Dirac, FLAC | Quicktime<br>H264 |
| Images | TIFF, JPEG2000, PNG | GIF, JPG |
| Structured data | XML, RDF | RDBMS |

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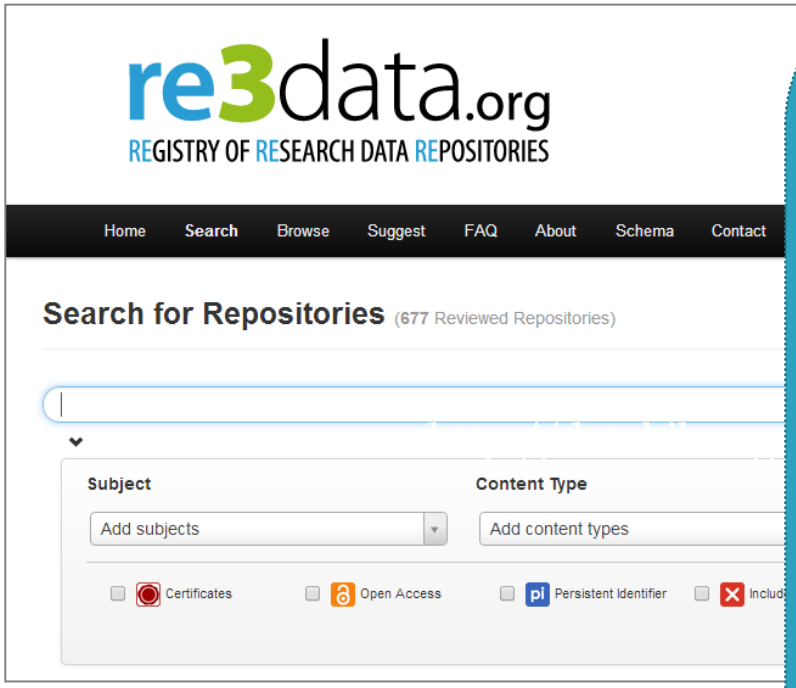
Further examples:
www.data-archive.ac.uk/create-manage/format/formats-table

# Data repositories

- Does your publisher or funder suggest a repository?
- Are there data centres or community databases for your discipline?
- Does your university offer support for long-term preservation?




http://service.re3data.org/search

## Zenodo

- OpenAIRE-CERN joint effort
- Multidisciplinary repository
- Multiple data types
  - Publications
  - Long tail of research data
- Citable data (DOI)
- Links funding, publications, data & software

www.zenodo.org

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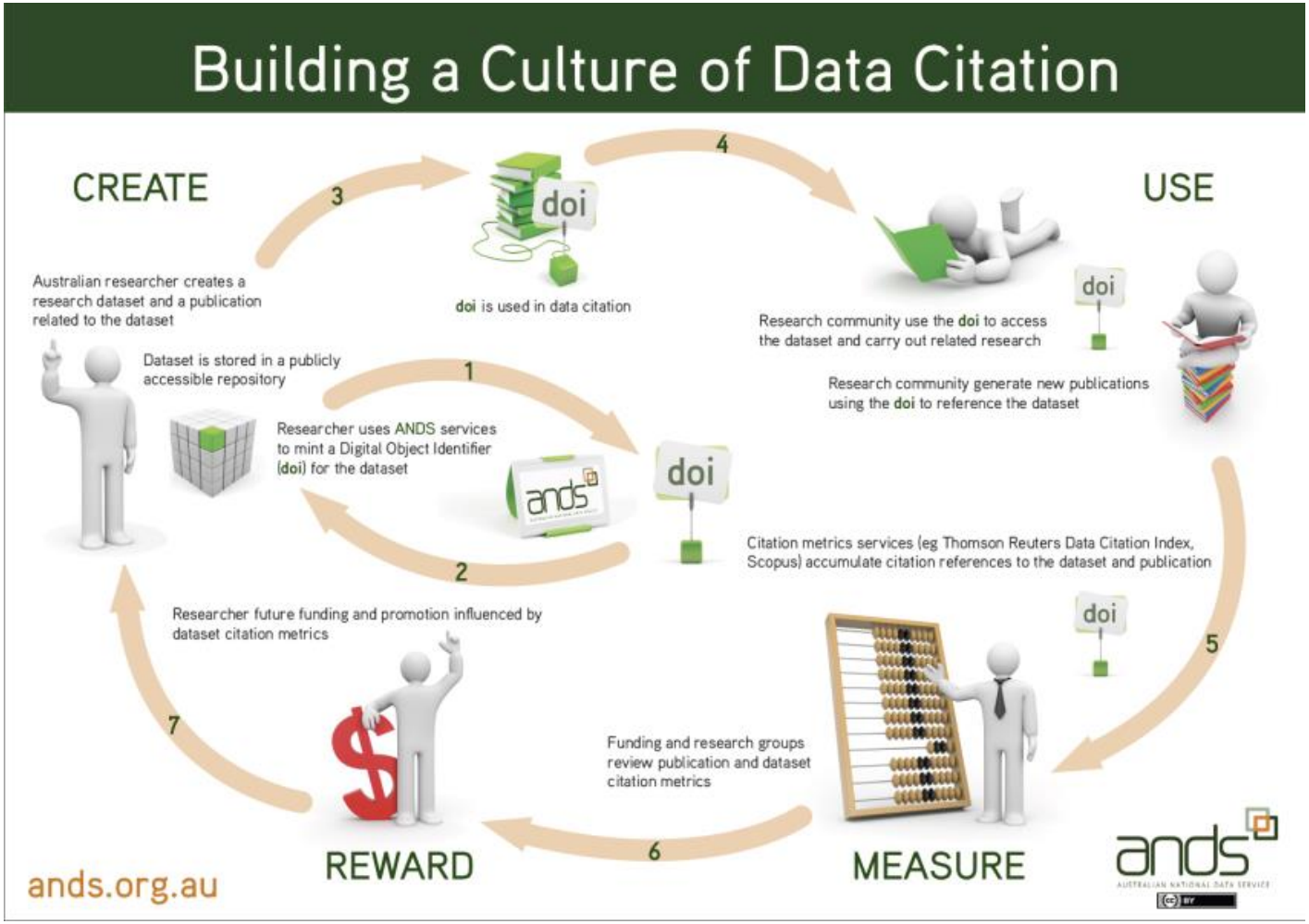
# Citing research data: why?

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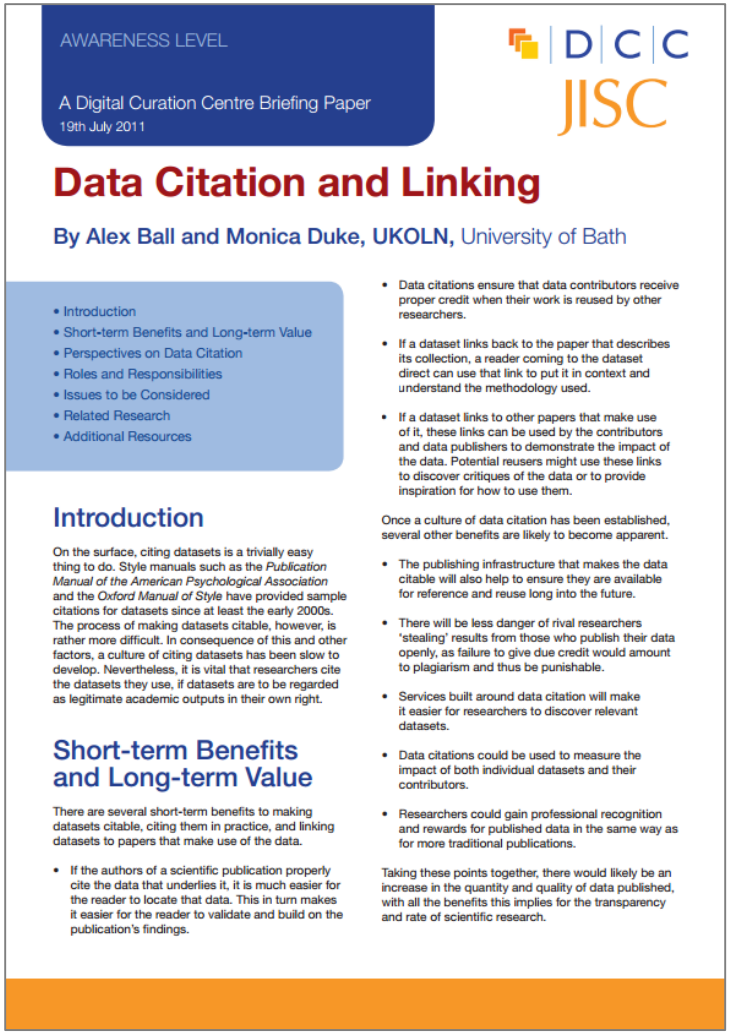
http://ands.org.au/cite-data

# How to cite data

Key citation elements

- Author
- Publication date
- Title
- Location (= identifier)
- Funder (if applicable)



AWARENESS LEVEL

A Digital Curation Centre Briefing Paper
19th July 2011

DCC JISC

## Data Citation and Linking

By Alex Ball and Monica Duke, UKOLN, University of Bath

- Introduction
- Short-term Benefits and Long-term Value
- Perspectives on Data Citation
- Roles and Responsibilities
- Issues to be Considered
- Related Research
- Additional Resources

### Introduction

On the surface, citing datasets is a trivially easy thing to do. Style manuals such as the *Publication Manual of the American Psychological Association* and the *Oxford Manual of Style* have provided sample citations for datasets since at least the early 2000s. The process of making datasets citable, however, is rather more difficult. In consequence of this and other factors, a culture of citing datasets has been slow to develop. Nevertheless, it is vital that researchers cite the datasets they use, if datasets are to be regarded as legitimate academic outputs in their own right.

### Short-term Benefits and Long-term Value

There are several short-term benefits to making datasets citable, citing them in practice, and linking datasets to papers that make use of the data.

- If the authors of a scientific publication properly cite the data that underlies it, it is much easier for the reader to locate that data. This in turn makes it easier for the reader to validate and build on the publication's findings.
- Data citations ensure that data contributors receive proper credit when their work is reused by other researchers.
- If a dataset links back to the paper that describes its collection, a reader coming to the dataset direct can use that link to put it in context and understand the methodology used.
- If a dataset links to other papers that make use of it, these links can be used by the contributors and data publishers to demonstrate the impact of the data. Potential reusers might use these links to discover critiques of the data or to provide inspiration for how to use them.

Once a culture of data citation has been established, several other benefits are likely to become apparent.

- The publishing infrastructure that makes the data citable will also help to ensure they are available for reference and reuse long into the future.
- There will be less danger of rival researchers 'stealing' results from those who publish their data openly, as failure to give due credit would amount to plagiarism and thus be punishable.
- Services built around data citation will make it easier for researchers to discover relevant datasets.
- Data citations could be used to measure the impact of both individual datasets and their contributors.
- Researchers could gain professional recognition and rewards for published data in the same way as for more traditional publications.

Taking these points together, there would likely be an increase in the quantity and quality of data published, with all the benefits this implies for the transparency and rate of scientific research.

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www.dcc.ac.uk/resources/briefing-papers/introduction-curation/data-citation-and-linking

# Plan for openness from the outset

**Many decisions taken early on in the project will affect whether the data can be made openly available**

- Think about where you want to publish and include APCs in grant applications if needed
- Ensure consent agreements also include permission to archive and share data for reuse by others
- Seek permissions for more than just the primary project purpose if signing licences to reuse third-party data. Derivative data may not be able to be shared if it includes somebody else's IP
- Explore the potential for openness when drafting agreements with commercial partners

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# Thanks – any questions

- DCC resources on Research Data Management
  www.dcc.ac.uk/resources

- FOSTER materials on Open Science
  www.fosteropenscience.eu

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