

4eu+

What is Open Science?

Richard Dennis, University of Copenhagen
Milan Janíček, Charles University Prague
Jochen Apel, Heidelberg University

Open Science for you - An Introduction Series to Open Science | 8 November 2021



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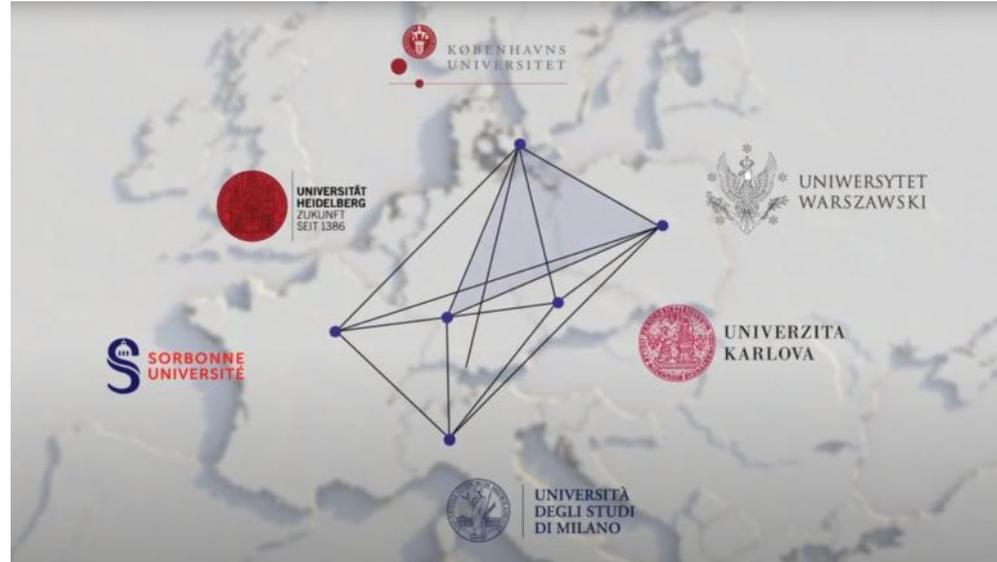
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4EU+ Alliance and Open Science

- 4EU+ is a transnational strategic university association.
- Aim: Strengthen the European vision of deepened cooperation and mutual enrichment in research and teaching
- Open Science is an integral part of this.
- Two 4EU+ projects currently work on Open Science.
- „Open for you – an Introduction Series to Open Science“ – 14 session on OS topics!



Agenda

- Open Science and the scientific method
- Open Access & Future of Scholarly Publishing
- FAIR Data Principles
- Education & Skills
- Research Integrity
- EOSC
- Citizen Science

Open Scholarship

How can research be carried out in a way...

- ... that its results are reliable, transparent and comprehensible?
- ... that it is understandable and accessible?
- ... that there is confidence in its results?
- ... that new insights can be found?
- ... ensuring that scientific progress takes place as quickly as possible?





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Karl Popper

- Public nature of scientific methods
- Individuals cannot do science, science is always social activity.
- Why? Only in this way something like objectivity can emerge.
- Individual researchers are in love with their models, methods and theories. They will stick to them with all their strength.
- Public control and criticism by third parties is a necessary condition for scientific activity.
- Institutions that make this kind of criticism possible: Laboratories, journals, congresses.
- How do these institutions change?

**OPEN SCIENCE:
JUST
SCIENCE
DONE RIGHT**

Open Science

- Open Access
- Open Research Data
- Open Source / Open Research Software
- Open Methodology
- Open Evaluation Practices
- Citizen Science
- Open Licenses



open science

“Open Science describes an on-going movement in the way research is performed, researchers collaborate, knowledge is shared, and science is organised. It affects the whole research cycle and its stakeholders, enhances science by facilitating more transparency, openness, networking and collaboration.

Open Science opens up scientific processes and products from all levels to everyone. As such it includes Open Access, Open Research Data, Open Methodology, Open Evaluation, Citizen Science.”

<https://www.openaire.eu/what-is-open-science>

Open Science and its role in universities: A roadmap for cultural change

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8 Dimension of Open Science

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2. FAIR Data Principles
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4. Education and Skills
5. Rewards and Incentives
6. Next-generation Metrics
7. Research Integrity
8. Citizen Science

<https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdf>

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Open Access

Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003)

“Open access contributions include original scientific research results, raw data and metadata, source materials, digital representations of pictorial and graphical materials and scholarly multimedia material. [...] The author(s) and right holder(s) of such contributions grant(s) to all users a **free, irrevocable, worldwide, right of access** to, and a license to **copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship.**“

https://openaccess.mpg.de/67605/berlin_declaration_engl.pdf

- These and other early declarations are the starting point for a multitude of OA policies at local, national, and international levels, up to the point that the European Commission and a series of other funding bodies have made OA the standard for research projects they fund.
Cf. <https://www.coalition-s.org/>

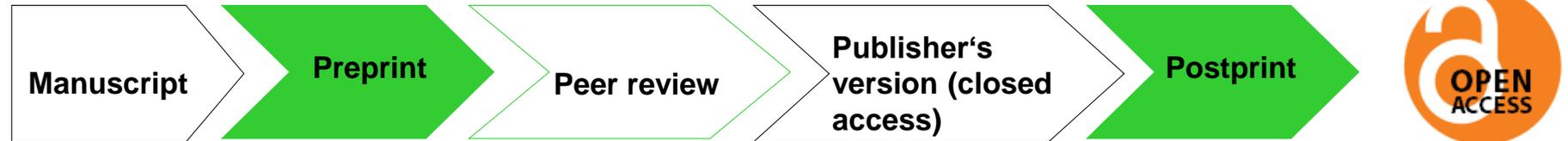
Golden Road

Primary publication is released open access



Green Road ("Self-Archiving")

Parallel publication of preprints, postprints or publisher's version on subject-specific or institutional repository



Green Open Access



Cornell University



arXiv is a free distribution service and an open-access archive for 1,955,942 scholarly articles in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics. Materials on this site are not peer-reviewed by arXiv.

Subject search and browse:

Physics

News

Celebrating [arXiv's 30th anniversary!](#) 1991-2021.

Read about recent news and updates on [arXiv's blog](#). (View the former "what's new" pages [here](#)). Read [robots beware](#) before attempting any automated download.



Physics

- [Astrophysics](#) ([astro-ph new](#), [recent](#), [search](#))
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Accueil Dépôt Consultation Recherche Documentation

Accueil

Coronavirus (COVID-19)

Consulter et télécharger toutes les publications disponibles dans HAL

[Accéder aux publications](#)

Archive ouverte HAL

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion d'articles scientifiques de niveau recherche, publiés ou non, et de thèses, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

À l'attention du déposant

- Le dépôt du texte intégral est effectué en accord avec les co-auteurs et dans le respect de la politique des éditeurs
- La mise en ligne est assujettie à une modération, la direction de HAL se réservant le droit de refuser les articles ne correspondant pas aux critères de l'archive

Gold Open Access

- Publishing fees (APC, BPC)
- Transformative agreements (transforming subscription budgets to central open access budgets)
- Membership models
- Pledging/crowdfunding
- Non-profit university presses



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Check your institution's website for information on local support through publication funds, discounts, or umbrella framework agreements covering publishing fees.

OPEN ACCESS

RESEARCH DATA

SUPPORT

FAQ

Discounts for CU authors

[AAAS - Science](#) | [ACS](#) | [IEEE](#) | [Karger](#) | [LWW](#) | [MDPI](#) | [RSC](#) | [SCOAP3](#) | [Taylor&Francis](#)

AAAS – Science

- Corresponding (or paying) authors of Charles University have the opportunity to gain a 15% discount on the price of the APC publication fee in [Science Advances](#) journal (ISSN 2375-2548). The discount is valid for all types of articles with a CC-BY or CC-BY-NC license.

American Chemical Society

- Thanks to the [ACS Publications](#) subscription, all Charles University authors are entitled to a discount of 250 USD on the APC basic price. Additional discount can be given to those authors who are also members of the [ACS Membership Program](#).
- For more information on publishing fee discounts, please visit [ACS Open Access website](#) ("Member discounts" section) or consult the official [price list](#).

Institute of Electrical and Electronics Engineers (IEEE)

- NOTICE: All vouchers for 2021 were exhausted.**

Elsevier agreement 2021-24

Det Kgl. Bibliotek's national licensing consortium has, on behalf of the Danish universities and other research institutions, entered into a four-year agreement with Elsevier from 2021 to 2024.



Istock

The agreement is the first in Denmark to ensure full reading access to Elsevier's journals and free and immediate access (Open Access) to the articles published by researchers at the institutions covered by the agreement.

University fund for APC

The professors, researchers, research fellows and PhD students of the University of Milan can submit a request for funding for publications in non-hybrid Gold Open Access journals according to the rules approved by academic bodies.

Please apply to apc@unimi.it, using the attached form, after the first step of the review process, when there is reasonable certainty that the article will be published.

 [Funding application form](#)

 [Rules issued by academic bodies](#)



OPEN ACCESS [Aiuto e guida](#)

Journals

ACME

Annali della Facoltà di Studi Umanistici dell'Università degli Studi di Milano.

[View Journal](#) | [Current Issue](#)



Altre Modernità

Altre Modernità (ISSN 2035-7680) is an electronic journal OJS of Literary and Cultural Studies promoted by the...

[View Journal](#) | [Current Issue](#)



AN-ICON. Studies in Environmental Images

The journal AN-ICON. Studies in Environmental Images is a peer-reviewed web-based academic journal,...

[View Journal](#) | [Current Issue](#)

Annals of Microbiology

Raccolta dei primi numeri digitalizzati della rivista Annals of Microbiology, dal 1940

[View Journal](#) | [Current Issue](#)



AOQU (Achilles Orlando Quixote Ulysses). Journal



AMSUM Archives of Medicine & Surgery University of Milan



Erscheint demnächst



Heidelberg University Publishing

ist ein Open-Access-Verlag für qualitätsgeprüfte wissenschaftliche Publikationen. Wir unterstützen Open Access als Publikationsmodell für die Verbreitung hervorragender Forschungsergebnisse und setzen Open-Source-Software für die gemeinsame Entwicklung der zugrunde liegenden Publikationstechnologien ein.

Aktuelles

03.01.17
heiUP
Frisch erschienen: Die neue Ausgabe von Online - Heidelberg Journal of Religions on the Internet
Themen dieser Ausgabe unter anderem: Konflikt- und Affektverhalten konservativer Christen auf Facebook, die Bedeutung von Web 2.0 für Dschihadistinnen sowie Judentum, Christentum und Buddhismus in der englischsprachigen Wikipedia.

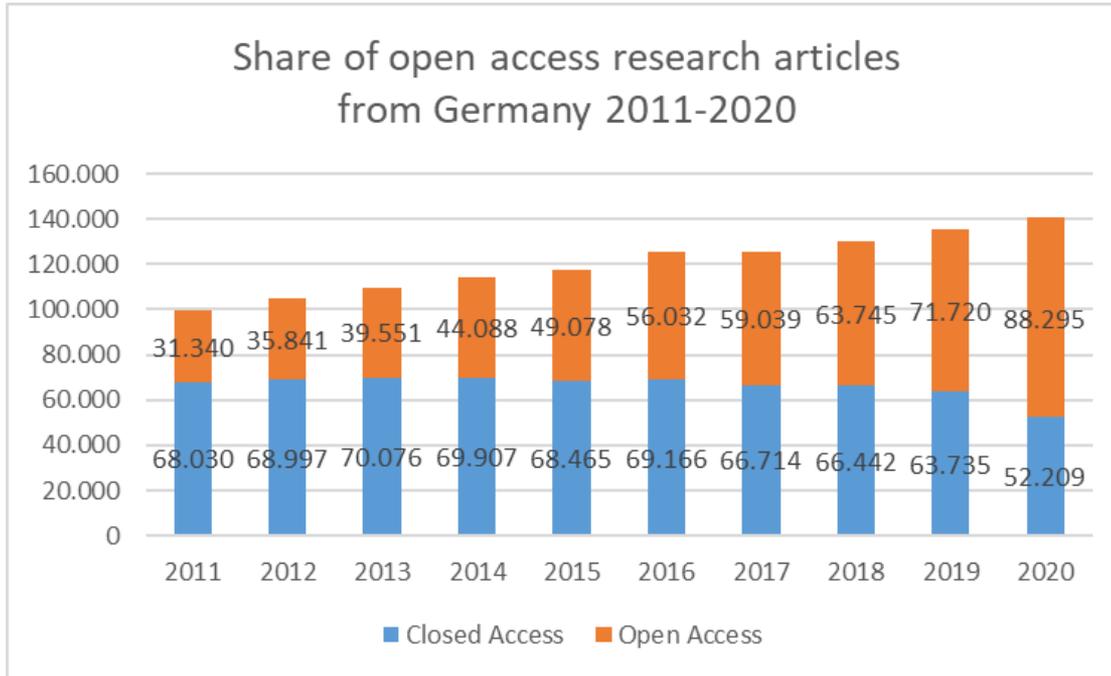
09.12.2016
heiUP
Neueste Ausgabe der "Ruperto Carola" ist online
STOP & GO, der Wechsel zwischen Stillstand und Bewegung, zwischen Beharren und Veränderung, ist das Thema der neuesten Ausgabe des *Manuale Diritto Penale* 70. Jahrgang der Universität Heidelberg.

Example: Heidelberg University Publishing

- ✔ E-Strategy: **Open Access** online version is the primary publication form, different digital formats (HTML, ePDF, EPUB)
- ✔ Professional Print on Demand with national and international availability
- ✔ Strict quality standards: Scientific advisory board and double blind peer review
- ✔ High quality copy-editing and layout
- ✔ **Enhanced publications: Integration of videos, animations and other multimedia assets, application of controlled vocabularies and authority data in the full text, cross-linking with open research data**
- ✔ Sustainability and high visibility
- ✔ <https://heiup.uni-heidelberg.de/>



Open Access uptake



Although the numbers may vary from country to country, open access is on its way to become the dominant publishing model for research articles.

Two decades after the Berlin Declaration, the question is no longer whether to publish in open access, but how to shape the open access publishing system.



Jussieu Call for Open science and bibliodiversity (2017)

„Open Access must be complemented by support for the diversity of those acting in scientific publishing – what we call bibliodiversity [...]”

<https://jussieucall.org/>

Open Science and its role in universities: A roadmap for cultural change

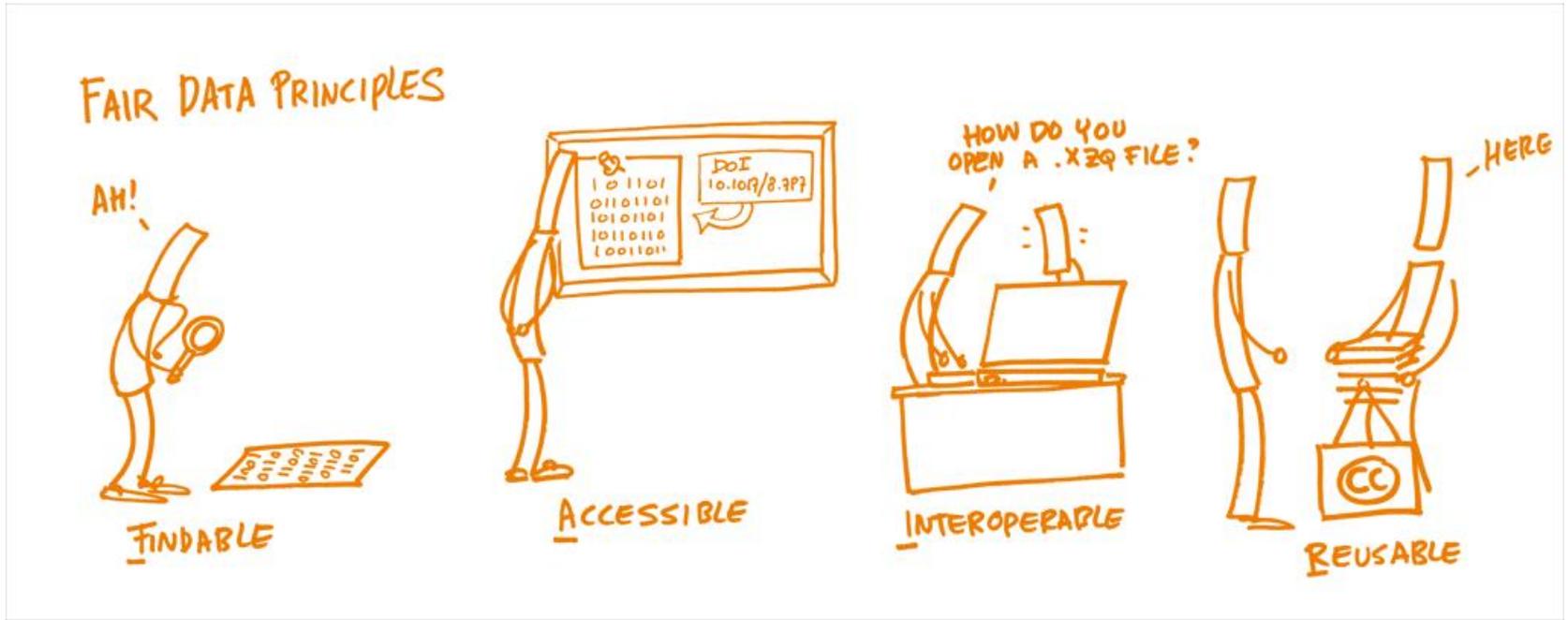
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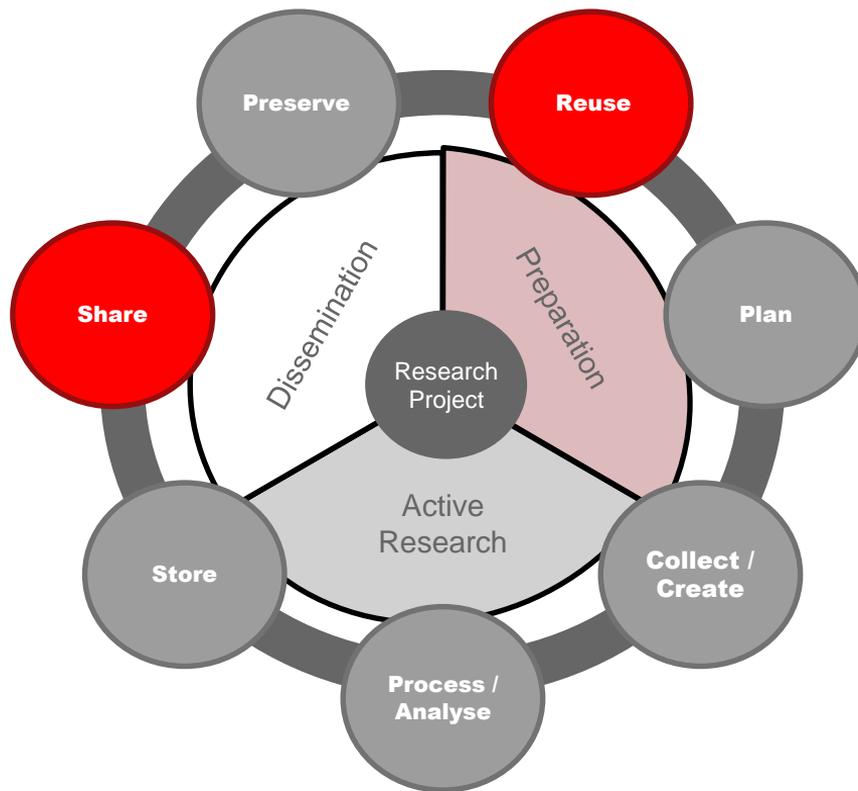


A day in the life of a scientist with FAIR data.

CAN I ATTEND THIS SEMINAR?

SORRY, WE HAVE A NEW POLICY

- YOU FIRST NEED TO DONATE SOME OPEN DATA



FAIR Data Principles

In 2016, the 'FAIR Guiding Principles for scientific data management and stewardship' were published in *Scientific Data*, and since then they have gone on to become a touchstone for the long-term management of research data of all kinds. The FAIR authors intended to provide guidelines to improve the **Findability**, **Accessibility**, **Interoperability**, and **Reusability** of digital assets.

These principles emphasize machine-actionability (i.e. the ability of automated computational systems to find, access, interoperate, and reuse data with minimal or no human intervention) as humans increasingly rely on computational means to discover and work with data as a result of the increase in volume, complexity, and creation speed of data.

FAIR Data Principles



Findable

Data and materials enriched with metadata assigned with a unique identifier



Accessible

Data and metadata stored in a trusted repository with an open and free protocol. Accessible by machines and humans



Interoperable

Using vocabularies and public domain ontologies the metadata can be referenced and linked



Reusable

Additional documentation and protocols describing the acquisition of the data, licensed with a detailed provenance

F**To Be Findable:**

- F1 - (meta)data are assigned a globally unique and eternally persistent identifier.
- F2 - data are described with rich metadata
- F3 - (meta)data are registered or indexed in a searchable resource.
- F4 - (meta)data specify the data identifier.

A**To be Accessible:**

- A1 - (meta)data are retrievable by their identifier using a standardized communications protocol
 - A1.1. - the protocol is open, free and universally implementable.
 - A1.2. - the protocol allows for an authentication and authorization procedure where necessary
- A2 - metadata are accessible, even when the data are no longer available

I**To be Interoperable:**

- I1 - (meta)data use a formal, accessible, shared and broadly applicable language for knowledge representation.
- I2 - (meta)data use vocabularies that follow FAIR principles
- I3 - (meta)data include qualified references in other (meta)data

R**To be Reusable:**

- R1 - (meta)data have a plurality of accurate and relevant attributes
 - R1.1. - (meta)data are released with a clear and accessible data usage license
 - R1.2. - (meta)data are associated with their provenance.
 - R1.3 - (meta)data meet domain-relevant community standards

FAIR Data Principles

In order to properly understand FAIR, you should keep four things in mind:

Both humans and machines are intended as digesters of data.

This will lead to **the creation of an ecosystem** that is fast to respond to change and automatically adapts to new findings or changes: **the Internet of FAIR Data and Services.**

This is the reason for focusing on standards for data, identification mechanisms, data availability, etc.

The FAIR principles apply to both data and metadata.

Where **metadata are descriptions of or records about data.**

This is why the term “(meta)data” is stated in the principles.

The principles are not necessarily about open data.

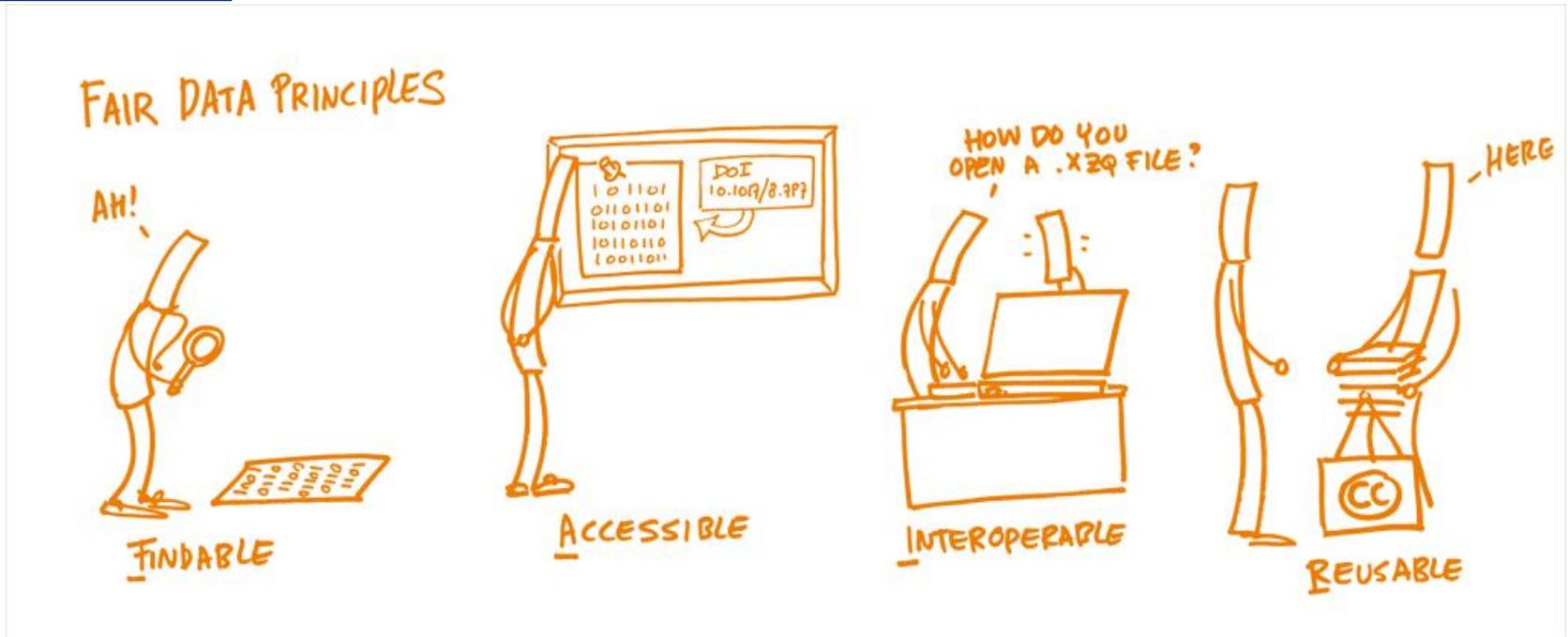
You can **work in a FAIR manner with data that is not intended for public availability.**

The FAIR principles are not rules or standards.

The FAIR principles must not be mistaken for rules or standards that you can use to evaluate tools, data, policies, etc. This would soon make the principles out-of-date and inapplicable across research disciplines.

Adopting the FAIR principles will often be a gradual adaptation of work routines – but it could also be a huge leap, where you replace one type of infrastructure with another. It will be up to the different research areas and research communities to make the FAIR principles work in their respective contexts.





- ✓ Publish searchable information online
- ✓ Link and cite published datasets
- ✓ Manage access to files in published datasets

- ✓ Define rights for reuse of your data
- ✓ Describe your research data
- ✓ Use open file formats

F_{indable} A_{ccessible} I_{nteroperable} R_{eusable}



Why is FAIR important?

Publication, outreach and impact are increased by making data FAIR and the possibility of researchers and machines discovering data relevant to their research. For example, there is evidence that articles with Open and FAIR data available receive more citations (SPARC Europe report) **. Moreover, FAIR practices also have a high economic return in the long term and open the door to citizen science, which is an increasingly important policy objective (Collins et al. 2018).

FAIR Data Principles

Possible way forward suggested by principle: *Open as possible, closed as necessary**



Principle articulated in "Guidelines on FAIR Data Management in Horizon 2020", EU Horizon 2020 programme

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<https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdf>

Education and skills

- open science brings new opportunities, but also some challenges
- it is important to be ready to solve them
- new skills on both personal and institutional level
 - get new skills yourself (as a researcher)
 - get support from your university

Groups of open science skills

- Skills related to open access publishing
- Skills related to data management and open data
- Skills enabling professional research conduct
- Citizen science skills

Skills related to open access publishing

- where to publish
- how to auto-archive
- how to improve societal impact
- contracts with publishers
- new publishing methods
- licensing and copyright
- bibliometrics and research impact reporting

Skills related to data management

- domain specific formats, standards and tools
- data management (including planning)
 - FAIR data
- data analysis
 - including reproducibility
- data description (metadata)
- institution specific workflows
 - data protection, availability policies etc
- data citation impact

Skills enabling professional research conduct

- research management
- legal skills
 - licensing, intellectual property (both as users and as creators)
- research integrity and ethical skills
 - avoiding plagiarism
 - sensitive data management
 - ((most cases are cases of neglect rather than fabrication, falsification or fraud))

Citizen science skills

- research design
- citizens engagement & communication
- relationships & trust

Training or support?

- Everyone can't be expert on everything
 - eg Data Stewards can help with keeping the data FAIR
- what to do?
 - **be aware** of new requirements
 - check **support** provided by your university in all areas mentioned
 - be ready to undertake **training** in some areas ;-)

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Research Integrity – 4 principles

- **Reliability** *in ensuring the quality of research, reflected in the design, the methodology, the analysis and the use of resources.*
- **Honesty** *in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way.*
- **Respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment.
- **Accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

Reproducibility crisis?

- significant portion of research outputs not reproducible?
 - many studies in recent years
- are data for this research available / do they even exist??
- possible reasons
 - too complex experimental design – difficult to recreate
 - human related reasons - accidental or malicious

Reproducibility & Open Science

- open science promotes
 - sharing methodology
 - sharing research data
 - including raw data
 - FAIR principles (!)
 - principle “as open as possible, as closed as necessary”
 - sharing research software
 - licensing (as open as possible)
 - open peer review process
 - creating of rewards and incentives regarding:
 - creating reproducible research
 - testing reproducibility of existing research

What to do?

- keep research integrity & reproducibility in your mind when conducting your research
 - provide all relevant data and documentation
- create and provide FAIR data
 - use proper research data management during the research – it is very difficult/impossible to fix it at the end

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EOSC – What is it?



**EUROPEAN OPEN
SCIENCE CLOUD**

EOSC – What is it?

- The **European Open Science Cloud (EOSC)** is a European Commission initiative aimed at developing a federated infrastructure providing its users with services promoting Open Science practices
- Aims to **develop a trusted, virtual, federated environment that cuts across borders** and scientific disciplines to store, share, process, and re-use research digital objects (like publications, data, and software) following FAIR Data principles.
- **Brings together institutional, national and European stakeholders, initiatives, and data infrastructures** to develop an inclusive open science ecosystem in Europe.

This is expected to lead towards:

- **new insights and innovations**
- **higher research productivity and**
- **improved reproducibility in science.**

EOSC Portal – What is it?

- The **EOSC Portal** is a gateway to information and resources in EOSC. It is also part of the EOSC implementation roadmap as one of the expected “federating core” (set of services providing the means to discover, share, access and re-use data and services) services contributing to the implementation of the “Access and interface” action line. It has been conceived to provide European delivery channel connecting the demand-side and the supply-side of the EOSC and all its stakeholders.
- The **EOSC Catalogue & Marketplace** acts as an entry point to the multitude of services and resources for researchers.

EOSC Catalogue & Marketplace



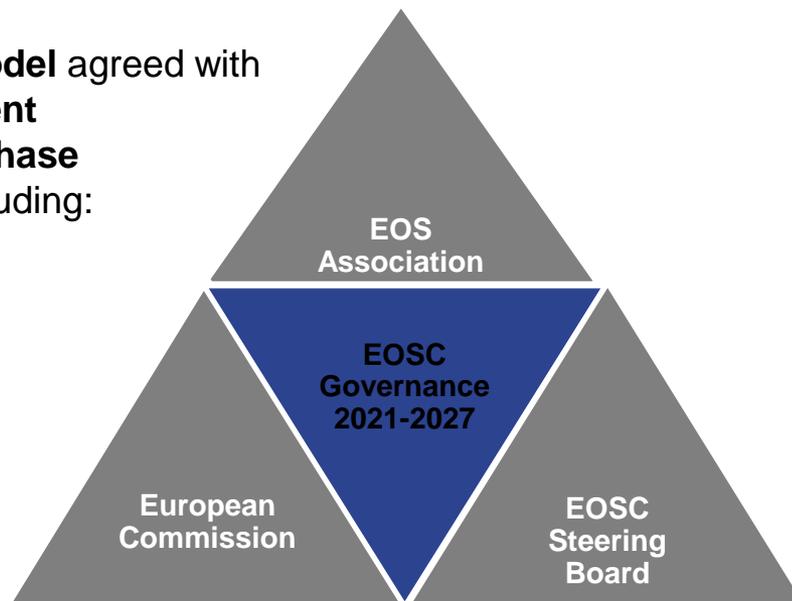
**LET'S TAKE A
TOUR!**

New tour of the EOSC
Catalogue and Marketplace



EOSC – Governance 2021 - 2027

- EU countries and countries associated with Horizon 2020, represented in the EOSC Governance Board, agreed unanimously to **run the EOSC as a co-programmed European Partnership under Horizon Europe from 2021**.
- **The new governance model** agreed with EU countries for the **current EOSC implementation phase after 2020** is tripartite including:



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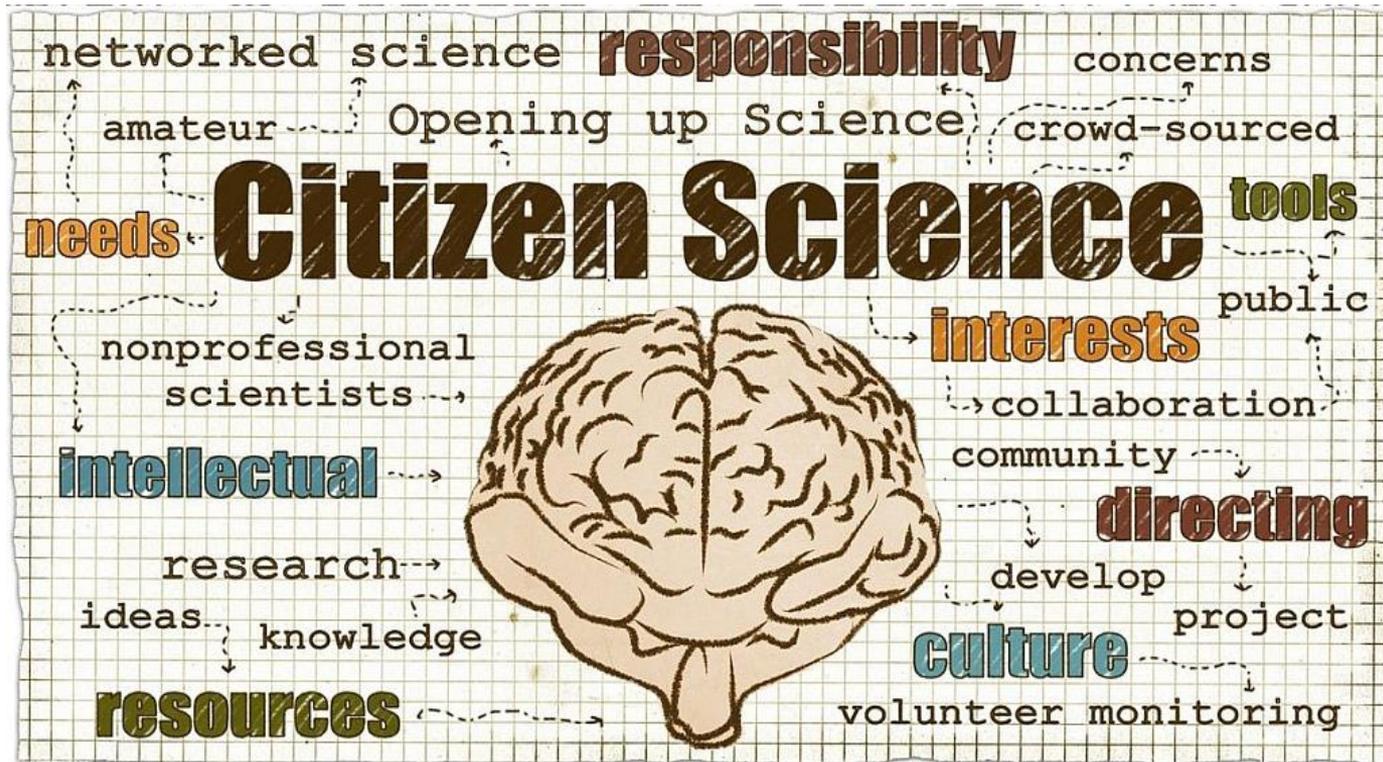
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Citizen Science



Citizen Science: What is Citizen Science?

Citizen science can be described as the **voluntary participation of non-professional scientists in research and innovation** at different stages of the process and at **different levels of engagement**, from shaping research agendas and policies, to gathering, processing and analyzing data, and assessing the outcomes of research. In very simplified terms, in citizen science, **scientific projects are carried out with the assistance or completely by interested amateurs** [lat. amator "lover"].

The **Citizen Scientists** formulate research questions, report observations, carry out measurements, evaluate data and/or write publications. Compliance with scientific criteria is a prerequisite.

This not only makes new scientific projects and new findings possible, but also **enables a dialogue between science and society** that is otherwise impossible or very difficult.

Citizen Science: 10 Principles of Citizen Science

Citizen science is a flexible concept which can be adapted and applied within diverse situations and disciplines.

The statements were developed by the 'Sharing best practice and building capacity' working group of the European Citizen Science Association, led by the Natural History Museum London with input from many members of the Association, to set out some of the key principles which as a community we believe underlie good practice in citizen science.

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1. Citizen science projects actively involve citizens in scientific endeavor that generates new knowledge or understanding. Citizens may act as contributors, collaborators, or as project leader and have a meaningful role in the project.
2. Citizen science projects have a genuine science outcome. For example, answering a research question or informing conservation action, management decisions or environmental policy
3. Both the professional scientists and the citizen scientists benefit from taking part. Benefits may include the publication of research outputs, learning opportunities, personal enjoyment, social benefits, satisfaction through contributing to scientific evidence e.g. to address local, national and international issues, and through that, the potential to influence policy.
4. Citizen scientists may, if they wish, participate in multiple stages of the scientific process. This may include developing the research question, designing the method, gathering and analyzing data, and communicating the results.

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5. Citizen scientists receive feedback from the project. For example, how their data are being used and what the research, policy or societal outcomes are.
6. Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled for. However, unlike traditional research approaches, citizen science provides opportunity for greater public engagement and democratization of science.
7. Citizen science project data and meta-data are made publicly available and where possible; results are published in an open access format. Data sharing may occur during or after the project, unless there are security or privacy concerns that prevent this.

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8. Citizen scientists are acknowledged in project results and publications.

9. Citizen science programs are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact.

10. The leaders of citizen science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activities.

Citizen Science: Why it is important?

Active engagement with citizens and society has the potential to improve research and its outcomes and reinforce societal trust in science. It can increase.

relevance and **effectiveness** by ensuring that R&I aligns with needs, expectations and values of society

creativity and **quality** by enlarging the collective capabilities, the scope of research and the quantity and quality of data

transparency, science literacy and **confidence of the public in research**

Citizen Science: Examples of Citizen Science

Galaxy Zoo' (<https://www.galaxyzoo.org/>) is one of the best-recognized global citizen science projects. Launched in July 2007, it asks participants to participate in astronomy research by classifying images of galaxies online. Originally, the images came solely from the Sloan Digital Sky Survey, an astronomical survey covering a quarter of the sky and over 930,000 galaxies (SDSS, 2013). Now, images from the Cosmic Assembly Near-Infrared Deep Extragalactic Legacy Survey (CANDELS) are also used. Following publicity via BBC radio and the BBC website, tens of thousands of volunteers registered to take part within the first week and by April 2009, more than 100 million galaxy classifications had been. Each galaxy is classified by more than one volunteer, helping to increase confidence in the results. Tens of scientific papers have been published based on data from the Galaxy Zoo project. Volunteers have helped astronomers to make numerous discoveries, such as the first planet with four stars.

Citizen Science: Examples of Citizen Science

The **'Big Butterfly Count'** (www.bigbutterflycount.org) is a national level citizen science project that takes place in the UK since 2010 between July and August each year and asks members of the public to get involved in monitoring butterfly populations in their area. Volunteers spend 15 minutes recording the numbers of butterflies they see in parks, school grounds, gardens, fields or forests. Butterfly Conservation, an NGO, provides an identification chart to help volunteers to recognize species of interest and they submit their results online via the project's website, or via a smartphone app (introduced in 2013). The project has several celebrity backers including Sir David Attenborough. Around 27,000 people took part in the 2012 survey, recording over 24,000 counts and more than 223,000 individual butterflies and moths from 21 target species. The results showed several species of butterfly declining by 50% or more since 2011, probably due to poor summer weather. Butterfly Conservation uses the data collected by volunteers across various schemes to assess the effectiveness of ongoing conservation work and direct its future conservation efforts. It also claims that data gathered in its monitoring schemes are used by the UK government to indicate the health of the environment.

Citizen Science: Examples of Citizen Science

An early example of local citizen science is that of **Lake Kirkkojärvi near Kangsala in Finland**. It was recognized as an important habitat for birds and became part of the EU's Natura 2000 network of protected sites. However, the lake was in a poor condition due to eutrophication and unpleasant odors from algae, which were affecting local citizens. In 2002, the regional environmental authorities organized a public discussion event addressing the future of the lake. However, following the meeting it was concluded that no action could be taken due to lack of funding and the lake's protected status. In 2004, local citizens became frustrated with the lack of action and contacted a local environmental official proposing to use an 'effective micro-organisms' (EM) solution to purify the water in the lake. The environmental official gave permission without informing the relevant authorities, assuming that the solution would be harmless but ineffective. The citizens' activity was then covered by local media, after which the regional environmental authorities banned further use of the EM solution in the lake. By 2006, the condition of the water in the lake had markedly improved, but the environmental authorities did not want to acknowledge any connection to the EM solution due to lack of scientific evidence, and offered alternative explanations. In media coverage, citizens were unconvinced by the authorities' explanations. Interviews with those involved suggest that the authorities felt they were bound to defend norms and regulations, and did not have the resources to nurture the growing interests and activities of local citizens. Citizens viewed the authorities as being inflexible and their expertise as questionable. The case demonstrates the potentially complex nature of interactions between citizens and local authorities.

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Thank you!

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