FAIR and Open Data

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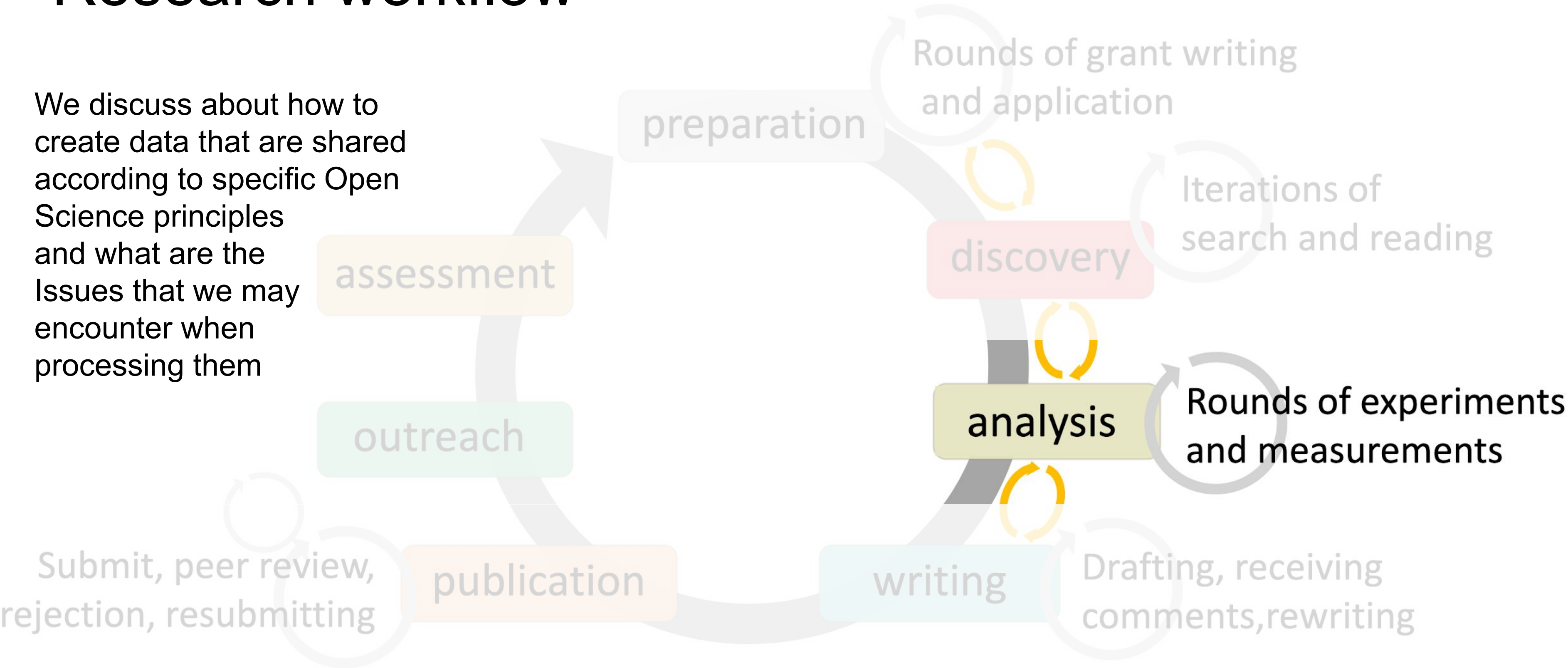
DIPARTIMENTO DI FILOLOGIA CLASSICA E ITALIANISTICA

Research workflow

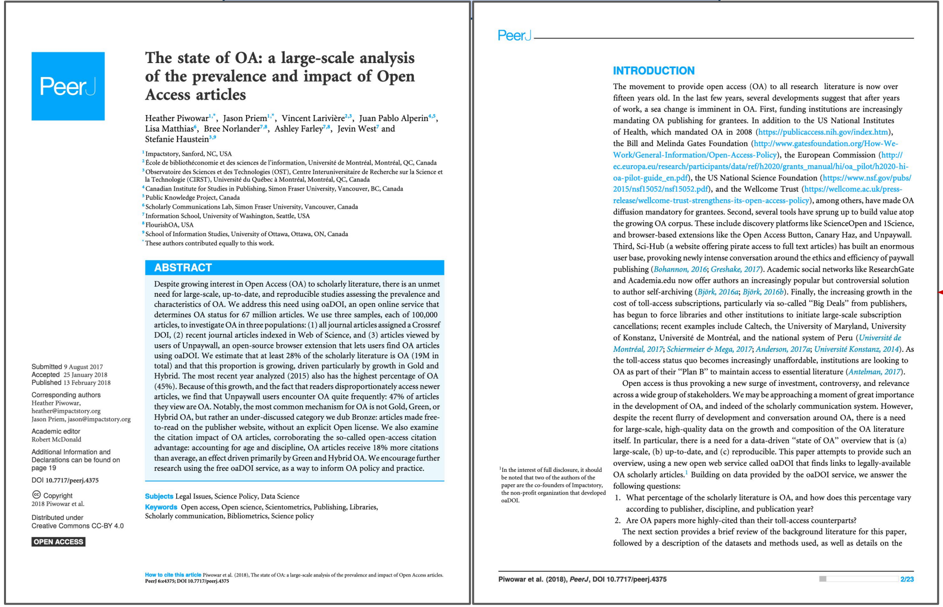
We discuss about how to create data that are shared according to specific Open Science principles
and what are the Issues that we may encounter when processing them


Rounds of grant writing and application
preparation
Iterations of search and reading
discovery
analysis
Rounds of experiments and measurements
assessment
outreach
Submit, peer review, rejection, resubmitting
publication
writing
Drafting, receiving comments,rewriting

Kramer, B., & Bosman, J. (2015, June 18). The good, the efficient and the open—Changing research workflows and the need to move from Open Access to Open Science. CERN Workshop on Innovations in Scholarly Communication (OAI9), University of Geneva, Geneva, Switzerland. https://www.slideshare.net/bmkramer/the-good-the-efficient-and-the-open-oai9

What are the data?

Metadata about the publication



PeerJ

The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles

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ABSTRACT

Despite growing interest in Open Access (OA) to scholarly literature, there is an unmet need for large-scale, up-to-date, and reproducible studies assessing the prevalence and characteristics of OA. We address this need using oaDOI, an open online service that determines OA status for 67 million articles. We use three samples, each of 100,000 articles, to investigate OA in three populations: (1) all journal articles assigned a Crossref DOI, (2) recent journal articles indexed in Web of Science, and (3) articles viewed by users of Unpaywall, an open-source browser extension that lets users find OA articles using oaDOI. We estimate that at least 28% of the scholarly literature is OA (19M in total) and that this proportion is growing, driven particularly by growth in Gold and Hybrid. The most recent year analyzed (2015) also has the highest percentage of OA (45%). Because of this growth, and the fact that readers disproportionately access newer articles, we find that Unpaywall users encounter OA quite frequently: 47% of articles they view are OA. Notably, the most common mechanism for OA is not Gold, Green, or Hybrid OA, but rather an under-discussed category we dub Bronze: articles made free-to-read on the publisher website, without an explicit Open license. We also examine the citation impact of OA articles, corroborating the so-called open-access citation advantage: accounting for age and discipline, OA articles receive 18% more citations than average, an effect driven primarily by Green and Hybrid OA. We encourage further research using the free oaDOI service, as a way to inform OA policy and practice.

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Additional Information and Declarations can be found on page 19

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OPEN ACCESS

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Keywords Open access, Open science, Scientometrics, Publishing, Libraries, Scholarly communication, Bibliometrics, Science policy

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PeerJ

INTRODUCTION

The movement to provide open access (OA) to all research literature is now over fifteen years old. In the last few years, several developments suggest that after years of work, a sea change is imminent in OA. First, funding institutions are increasingly mandating OA publishing for grantees. In addition to the US National Institutes of Health, which mandated OA in 2008 (https://publicaccess.nih.gov/index.htm), the Bill and Melinda Gates Foundation (http://www.gatesfoundation.org/How-We-Work/General-Information/Open-Access-Policy), the European Commission (http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf), the US National Science Foundation (https://www.nsf.gov/pubs/2015/nsf15052/nsf15052.pdf), and the Wellcome Trust (https://wellcome.ac.uk/press-release/wellcome-trust-strengthens-its-open-access-policy), among others, have made OA diffusion mandatory for grantees. Second, several tools have sprung up to build value atop the growing OA corpus. These include discovery platforms like ScienceOpen and 1Science, and browser-based extensions like the Open Access Button, Canary Haz, and Unpaywall. Third, Sci-Hub (a website offering pirate access to full text articles) has built an enormous user base, provoking newly intense conversation around the ethics and efficiency of paywall publishing (*Bohannon, 2016*; *Greshake, 2017*). Academic social networks like ResearchGate and Academia.edu now offer authors an increasingly popular but controversial solution to author self-archiving (*Björk, 2016a*; *Björk, 2016b*). Finally, the increasing growth in the cost of toll-access subscriptions, particularly via so-called "Big Deals" from publishers, has begun to force libraries and other institutions to initiate large-scale subscription cancellations; recent examples include Caltech, the University of Maryland, University of Konstanz, Université de Montréal, and the national system of Peru (*Université de Montréal, 2017*; *Schiermeier & Mega, 2017*; *Anderson, 2017a*; *Université Konstanz, 2014*). As the toll-access status quo becomes increasingly unaffordable, institutions are looking to OA as part of their "Plan B" to maintain access to essential literature (*Antelman, 2017*).

Open access is thus provoking a new surge of investment, controversy, and relevance across a wide group of stakeholders. We may be approaching a moment of great importance in the development of OA, and indeed of the scholarly communication system. However, despite the recent flurry of development and conversation around OA, there is a need for large-scale, high-quality data on the growth and composition of the OA literature itself. In particular, there is a need for a data-driven "state of OA" overview that is (a) large-scale, (b) up-to-date, and (c) reproducible. This paper attempts to provide such an overview, using a new open web service called oaDOI that finds links to legally-available OA scholarly articles.[1] Building on data provided by the oaDOI service, we answer the following questions:

1. What percentage of the scholarly literature is OA, and how does this percentage vary according to publisher, discipline, and publication year?
2. Are OA papers more highly-cited than their toll-access counterparts?

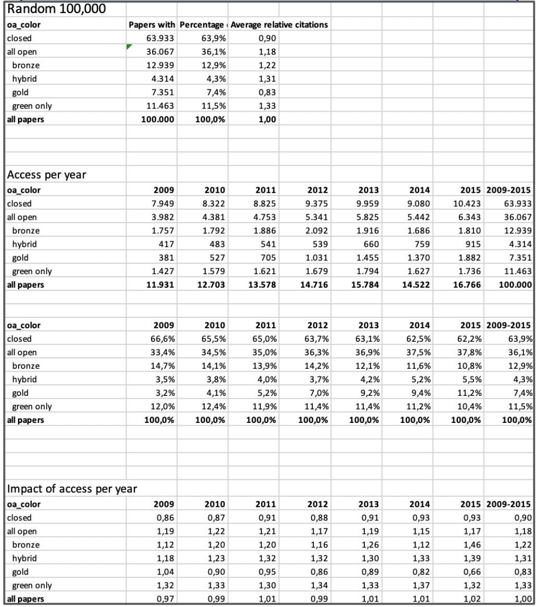
The next section provides a brief review of the background literature for this paper, followed by a description of the datasets and methods used, as well as details on the

[1] In the interest of full disclosure, it should be noted that two of the authors of the paper are the co-founders of Impactstory, the non-profit organization that developed oaDOI.

Piwowar et al. (2018), *PeerJ*, DOI 10.7717/peerj.4375 2/23

Used in

Metadata about the data



Random 100,000								
oa_color	**Papers with**	**Percentage (**	**Average relative citations**					
closed	63.933	63,9%	0,90					
all open	36.067	36,1%	1,18					
bronze	12.939	12,9%	1,22					
hybrid	4.314	4,3%	1,31					
gold	7.351	7,4%	0,83					
green only	11.463	11,5%	1,33					
all papers	**100.000**	**100,0%**	**1,00**					
Access per year								
oa_color	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2009-2015**
closed	7.949	8.322	8.825	9.375	9.959	9.080	10.423	63.933
all open	3.982	4.381	4.753	5.341	5.825	5.442	6.343	36.067
bronze	1.757	1.792	1.886	2.092	1.916	1.686	1.810	12.939
hybrid	417	483	541	539	660	759	915	4.314
gold	381	527	705	1.031	1.455	1.370	1.882	7.351
green only	1.427	1.579	1.621	1.679	1.794	1.627	1.736	11.463
all papers	**11.931**	**12.703**	**13.578**	**14.716**	**15.784**	**14.522**	**16.766**	**100.000**
oa_color	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2009-2015**
closed	66,6%	65,5%	65,0%	63,7%	63,1%	62,5%	62,2%	63,9%
all open	33,4%	34,5%	35,0%	36,3%	36,9%	37,5%	37,8%	36,1%
bronze	14,7%	14,1%	13,9%	14,2%	12,1%	11,6%	10,8%	12,9%
hybrid	3,5%	3,8%	4,0%	3,7%	4,2%	5,2%	5,5%	4,3%
gold	3,2%	4,1%	5,2%	7,0%	9,2%	9,4%	11,2%	7,4%
green only	12,0%	12,4%	11,9%	11,4%	11,4%	11,2%	10,4%	11,5%
all papers	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**
Impact of access per year								
oa_color	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2009-2015**
closed	0,86	0,87	0,91	0,88	0,91	0,93	0,93	0,90
all open	1,19	1,22	1,21	1,17	1,19	1,15	1,17	1,18
bronze	1,12	1,20	1,20	1,16	1,26	1,12	1,46	1,22
hybrid	1,18	1,23	1,32	1,32	1,30	1,33	1,39	1,31
gold	1,04	0,90	0,95	0,86	0,89	0,82	0,66	0,83
green only	1,32	1,33	1,30	1,34	1,33	1,37	1,32	1,33
all papers	0,97	0,99	1,01	0,99	1,01	1,01	1,02	1,00

A publication (https://doi.org/10.7717/peerj.4375) accepted in a journal

The related data on which the entire publication is based on

Piwowar, H., Priem, J., Larivière, V., Alperin, J. P., Matthias, L., Norlander, B., Farley, A., West, J., & Haustein, S. (2017). Data From: The State Of Oa: A Large-Scale Analysis Of The Prevalence And Impact Of Open Access Articles [Data set]. Zenodo. https://doi.org/10.5281/zenodo.837901

FAIR data principles

Findability, Accessibility, Interoperability, and Reusability: these four principles, proposed by the FORCE11 community, serve to guide data producers and publishers for helping them to maximize the added-value gained by contemporary, formal scholarly digital publishing

They represent goals and desiderata of good data management and stewardship

Even if they have been devised originally for data, they have been proposed considering all scholarly digital research objects in mind, since all components of the research process must be available to ensure transparency, reproducibility, and reusability

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J.-W., da Silva Santos, L. B., Bourne, P. E., Bouwman, J., Brookes, A. J., Clark, T., Crosas, M., Dillo, I., Dumon, O., … Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data, 3, 160018. https://doi.org/10.1038/sdata.2016.18

Findable

F1. (Meta)data are assigned a globally unique and persistent identifier

F2. Data are described with rich metadata (see also R1)

F3. Metadata clearly and explicitly include the identifier of the data they describe

F4. (Meta)data are registered or indexed in a searchable resource

GO FAIR. (2018). FAIR Principles. https://www.go-fair.org/fair-principles/

Accessible

A1. (Meta)data are retrievable by their identifier using a standardised communications protocol

- A1.1 The protocol is open, free, and universally implementable

- A1.2 The protocol allows for an authentication and authorisation procedure, where necessary

A2. Metadata are accessible, even when the data are no longer available

GO FAIR. (2018). FAIR Principles. https://www.go-fair.org/fair-principles/

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 to other (meta)data

GO FAIR. (2018). FAIR Principles. https://www.go-fair.org/fair-principles/

Reusable

R1. (Meta)data are richly described with 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 detailed provenance
- R1.3. (Meta)data meet domain-relevant community standards

GO FAIR. (2018). FAIR Principles. https://www.go-fair.org/fair-principles/

Different types of data

The agnosticism of generic principles like FAIR requires the various communities' specificities (i.e. proper to Informatics, Humanities, Medicine, Statistics, etc.) to be taken into account

General rule: within the FAIR framework, everything is data

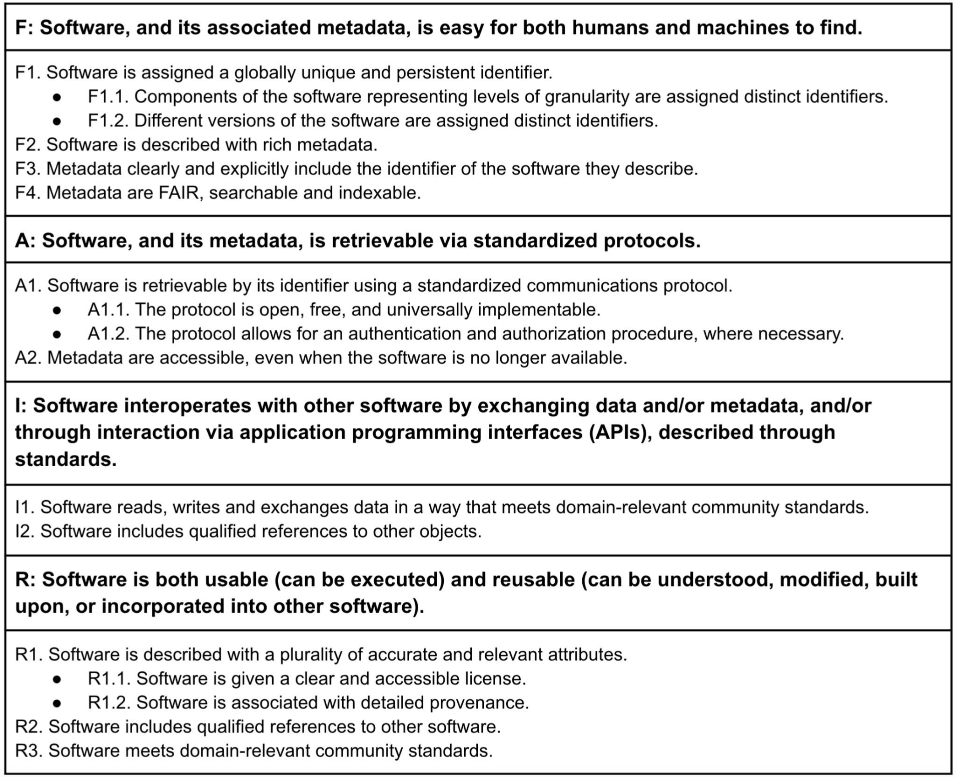
Data should be "intended to be as universal as possible, including datasets, publications, software, etc."

Avanço, K., Balula, A., Błaszczyńska, M., Buchner, A., … Wieneke, L. (2021). Future of Scholarly Communication—Forging an inclusive and innovative research infrastructure for scholarly communication in Social Sciences and Humanities (p. 46). Digital Humanities Centre at the Institute of Literary Research of the Polish Academy of Sciences. https://doi.org/10.5281/zenodo.5017705

Some examples: what is data in Informatics?

A number of research communities and groups have been considering how to apply aspects of FAIR to research software since 2017

The adoption of FAIR principles enables the transparency, reproducibility, and reusability of research – and part of this story applies also to software that needs to be well-described (i.e. metadata), inspectable, documented and appropriately structured so that it can be executed, replicated, built-upon, combined, reinterpreted, reimplemented, and/or used in different settings



F: Software, and its associated metadata, is easy for both humans and machines to find.

F1. Software is assigned a globally unique and persistent identifier.
- F1.1. Components of the software representing levels of granularity are assigned distinct identifiers.
- F1.2. Different versions of the software are assigned distinct identifiers.

F2. Software is described with rich metadata.
F3. Metadata clearly and explicitly include the identifier of the software they describe.
F4. Metadata are FAIR, searchable and indexable.

A: Software, and its metadata, is retrievable via standardized protocols.

A1. Software is retrievable by its 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 software is no longer available.

I: Software interoperates with other software by exchanging data and/or metadata, and/or through interaction via application programming interfaces (APIs), described through standards.

I1. Software reads, writes and exchanges data in a way that meets domain-relevant community standards.
I2. Software includes qualified references to other objects.

R: Software is both usable (can be executed) and reusable (can be understood, modified, built upon, or incorporated into other software).

R1. Software is described with a plurality of accurate and relevant attributes.
- R1.1. Software is given a clear and accessible license.
- R1.2. Software is associated with detailed provenance.

R2. Software includes qualified references to other software.
R3. Software meets domain-relevant community standards.

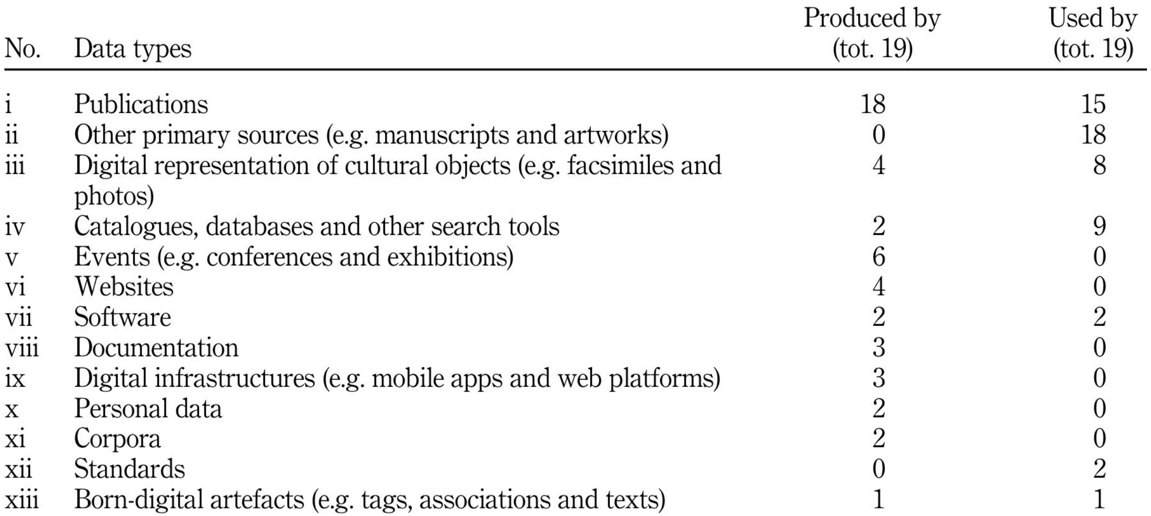
Chue Hong, N. P., Katz, D. S., Barker, M., Lamprecht, A.-L., Martinez, C., Psomopoulos, F. E., Harrow, J., Castro, L. J., Gruenpeter, M., Martinez, P. A., & Honeyman, T. (2022). FAIR Principles for Research Software (FAIR4RS Principles) [Recommendations with RDA Endorsement in Process]. Research Data Alliance. https://doi.org/10.15497/RDA00068

Some examples: what is data in the Humanities?

Humanities (at least, those related to studies in philology, literary criticism, language, linguistics, history of art and archival and library studies) uses and/or produces several kinds of data

Probably, one of the most surprisingly data types is events, meaning “any one-off gathering of people organised as a result of a research project, to share ideas, offer training, or present something to the public”, including:

- Conferences
- Exhibitions
- Webinars
- Guided tours
- Teacher training



No.	Data types	Produced by (tot. 19)	Used by (tot. 19)
i	Publications	18	15
ii	Other primary sources (e.g. manuscripts and artworks)	0	18
iii	Digital representation of cultural objects (e.g. facsimiles and photos)	4	8
iv	Catalogues, databases and other search tools	2	9
v	Events (e.g. conferences and exhibitions)	6	0
vi	Websites	4	0
vii	Software	2	2
viii	Documentation	3	0
ix	Digital infrastructures (e.g. mobile apps and web platforms)	3	0
x	Personal data	2	0
xi	Corpora	2	0
xii	Standards	0	2
xiii	Born-digital artefacts (e.g. tags, associations and texts)	1	1

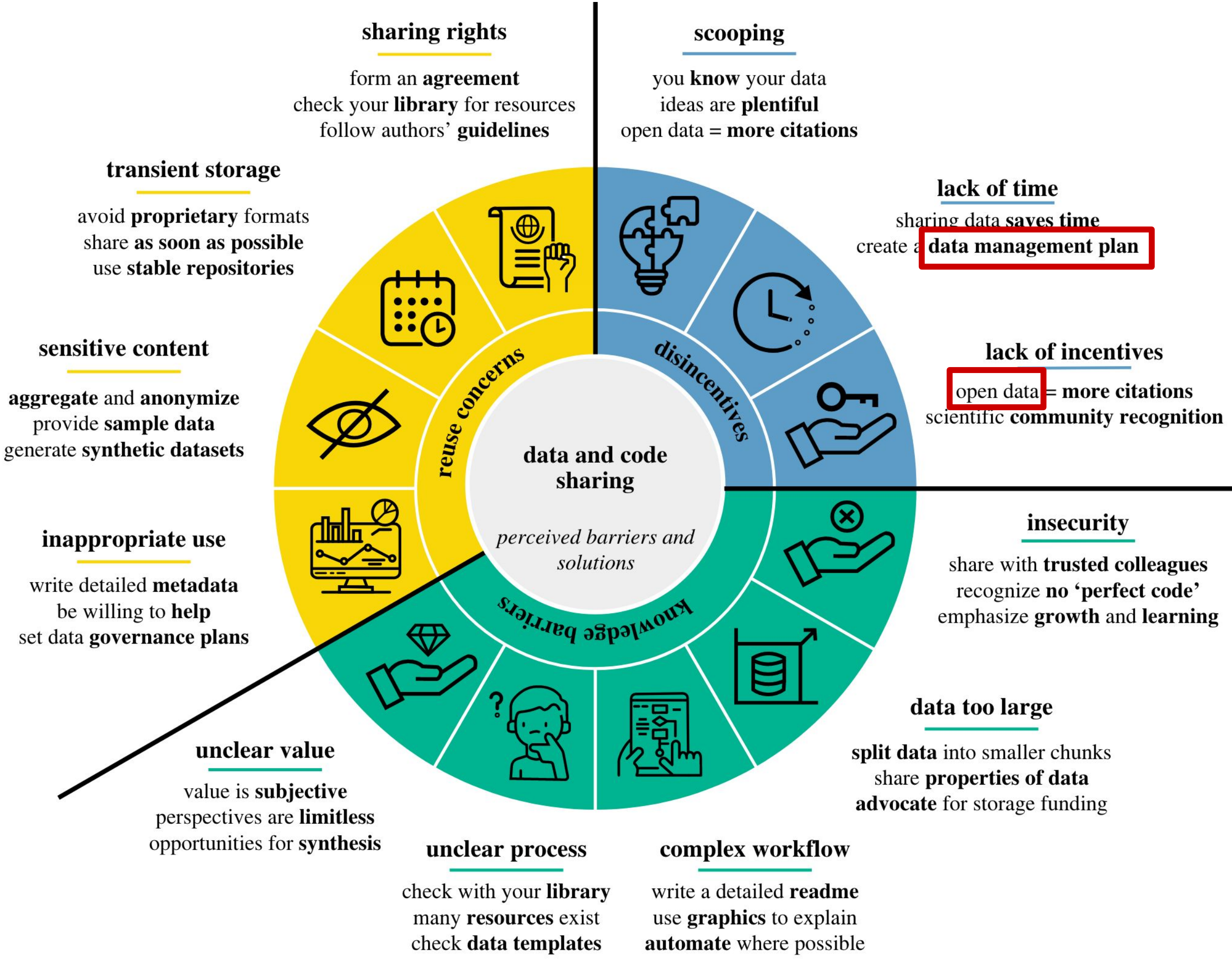
Gualandi, B., Pareschi, L., & Peroni, S. (2022). What do we mean by «data»? A proposed classification of data types in the arts and humanities. Journal of Documentation.
https://doi.org/10.1108/JD-07-2022-0146

Sharing:
some guidelines

Many researchers do not share their data simply because they do not know how

Data should be published alongside detailed metadata

Data sharing will increase opportunities for collaboration



sharing rights
form an **agreement**
check your **library** for resources
follow authors' **guidelines**

scooping
you **know** your data
ideas are **plentiful**
open data = **more citations**

transient storage
avoid **proprietary** formats
share **as soon as possible**
use **stable repositories**

lack of time
sharing data **saves time**
create a **data management plan**

sensitive content
aggregate and **anonymize**
provide **sample data**
generate **synthetic datasets**

lack of incentives
open data = **more citations**
scientific **community recognition**

reuse concerns

disincentives

data and code sharing

perceived barriers and solutions

knowledge barriers

inappropriate use
write detailed **metadata**
be willing to **help**
set data **governance plans**

insecurity
share with **trusted colleagues**
recognize **no 'perfect code'**
emphasize **growth** and **learning**

data too large
split data into smaller chunks
share **properties of data**
advocate for storage funding

unclear value
value is **subjective**
perspectives are **limitless**
opportunities for **synthesis**

unclear process
check with your **library**
many **resources** exist
check **data templates**

complex workflow
write a detailed **readme**
use **graphics** to explain
automate where possible

Gomes, D. G. E., Pottier, P., Crystal-Ornelas, R., Hudgins, E. J., Foroughirad, V., …, & Gaynor, K. M. (2022). Why don't we share data and code? Perceived barriers and benefits to public archiving practices. Proceedings of the Royal Society B: Biological Sciences, 289(1987), 20221113. https://doi.org/10.1098/rspb.2022.1113

What about Open?

Warning: FAIR data does not imply Open Data

Open as defined in the Open Definition:

> "Open means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness)"

License	Attribution (i.e. preserving provenance)	Forcing openness
Creative Commons Attribution (CC-BY)	yes	no
Creative Commons Attribution - Share-Alike (CC-BY-SA)	yes	yes
Creative Commons CCZero (CC0)	no	no
Open Data Commons Public Domain Dedication and Licence (PDDL)	no	no
Open Data Commons Attribution License (ODC-BY)	yes	no
Open Data Commons Open Database License (ODbL)	yes	yes

Open Knowledge Foundation. (2015). Open Definition 2.1. https://opendefinition.org/od/2.1/en/

Issues to the path towards the Open: personal data

GDPR is a regulation in EU law which concerns data protection and privacy, with particular regard to the gathering and processing of personal data of individuals

As stated in the Article 4 of the GDPR, personal data is any information that enable the identification of a natural person (i.e. the data subject), in particular by reference to an identifier such as a name, an identification number, etc.

Personal data can be gathered under specific conditions and cannot be published as Open Data – derogation to the this rule may exist, e.g. personal data in bibliographic information (authors' names, ORCIDs, etc.)

Note: the principles of data protection do not apply to anonymous information

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), no. L119, Official Journal of the European Union (2016). http://data.europa.eu/eli/reg/2016/679/oj

Anonymisation and pseudonymisation

It is possible to publish personal data if they are somehow changed in a way that do not allow the identification of a natural person anymore

Two ways:

1. Anonymisation – rendering personal data anonymous in such a manner that the data subject is not or no longer identifiable (there exists tools that try to semi-automate this activity, such as OpenAIRE Amnesia)
2. Pseudonymisation – rendering personal data in such a manner that they can no longer be attributed to a specific data subject without the use of additional information, provided that such additional information is kept separately and is subject to technical and organisational measures to ensure that the personal data are not attributed to an identified or identifiable natural person

Applying one of these approaches enable one to publish Open Data also when the original gathering of such data included personal data

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), no. L119, Official Journal of the European Union (2016). http://data.europa.eu/eli/reg/2016/679/oj

How to publish data

Generally speaking, data should be published as open as possible, as closed as necessary

In choosing the license, in particular if considering or not the attribution clause, one has to think about the final goal to reach – that, within the Open Science ecosystem, should be fostering maximum reuse

Recently, the European Union has provided a clear guideline to follow for what it concerns the publication of data:

> “raw data, metadata or other documents of comparable nature may alternatively be distributed under the provisions of the Creative Commons Universal Public Domain Dedication deed (CC0 1.0)”

Landi, A., Thompson, M., Giannuzzi, V., Bonifazi, F., Labastida, I., da Silva Santos, L. O. B., & Roos, M. (2020). The “A” of FAIR – As Open as Possible, as Closed as Necessary. Data Intelligence, 2(1–2), 47–55. https://doi.org/10.1162/dint_a_00027

The (senseless) scholars’ fear

Misconception: *I want to share my data, but it is important to me that I’m cited when people use it. I prefer CC BY to CC0 because this kind of attribution is what I care about most*

If the issue is to be cited and acknowledged for a work, problem solved: citation practices are built around ethical norms, not around legal requirements

Using and not citing and acknowledging an existing work relates to plagiarism, and this act has a legal consequence independently from the license used to protect the data

Thus, the general rule for sharing data compliantly with Open Science practices is to use CC0 license instead of CC BY to foster maximum reuse

Wolfe, M. (2017, August 9). CC0 and Data Citation. https://www.library.ucdavis.edu/news/cc0-and-data-citation/

Trustworthy data

Provenance is a record that describes the people, institutions, entities, and activities involved in producing, influencing, or delivering data, and it is crucial in deciding whether information is to be trusted, how it should be integrated with other diverse information sources, and how to give credit to its originators when reusing it

Provenance can help to make trust judgements about a piece of data, since it , which can be used to form assessments about its quality, reliability or trustworthiness

Minimal provenance information:

- When a piece of data has been created and/or invalidated
- Who created a piece of data
- What is the source that has been used to create a piece of data

Belhajjame, K., B'Far, R., Cheney, J., Coppens, S., Cresswell, S., Gil, Y., Groth, P., Klyne, G., Lebo, T., McCusker, J., Miles, S., Myers, J., Sahoo, S., & Tilmes, C. (2013). PROV-DM: The PROV Data Model (L. Moreau & P. Missier, Eds.). World Wide Web Consortium. https://www.w3.org/TR/prov-dm/

Trustworthy long-term preservation of data

Guaranteeing that the data one publish are reusable by humans and machines, i.e. FAIR, is not enough, since a good part of the story concerns also to think ways to trustworthily preserve such data in the long term

You should take into consideration such digital repositories which are compliant with the TRUST principles:

- Transparency – repository services and data holdings are publicly verifiable
- Responsibility – authenticity+integrity of data and reliability+persistence of services
- User Focus – meet norms and expectations of target user communities
- Sustainability – preserve data and services for the long-term
- Technology – support secure, persistent, and reliable services

Lin, D., Crabtree, J., Dillo, I., Downs, R. R., Edmunds, R., Giaretta, D., De Giusti, M., L'Hours, H., Hugo, W., Jenkyns, R., Khodiyar, V., Martone, M. E., Mokrane, M., Navale, V., Petters, J., Sierman, B., Sokolova, D. V., Stockhause, M., & Westbrook, J. (2020). The TRUST Principles for digital repositories. Scientific Data, 7(1), 144. https://doi.org/10.1038/s41597-020-0486-7

Data Management Plan

A data management plan (DMP) is the tool one has to use to ensure that all the aspects introduced in the previous slides will be addressed appropriately – i.e. before one starts to gather the data

A DMP is a document that describes how you will treat your data during a project and what happens with the data after the project ends

What it is covered in a DMP:

- data discovery, collection and organization
- quality assurance/quality control
- documentation
- data preservation and sharing

Michener, W. K. (2015). Ten Simple Rules for Creating a Good Data Management Plan. PLOS Computational Biology, 11(10), e1004525. https://doi.org/10.1371/journal.pcbi.1004525

End

FAIR and Open Data

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