

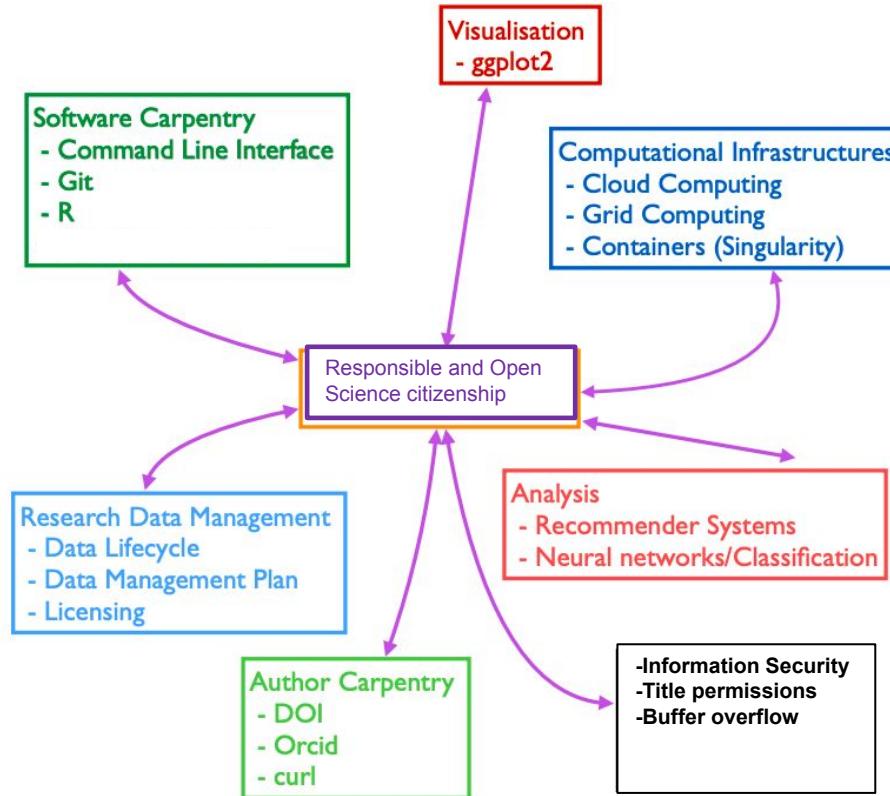


Data  
Schools

# Open and Responsible (Data) Science Citizenship

Material from Louise Bezuidenhout,  
presented by Nii Tawiah & Ayishih Bellew

# Our Curriculum



# Plan for the first part of the Morning

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1. Responsible conduct of research
2. Open science as a new way of being responsible
3. Being a responsible, open science citizen

*Our session will be highly interactive and involve discussion.  
There will be 5 min breaks after 20 mins of being in session.*

# Responsible Conduct of Research

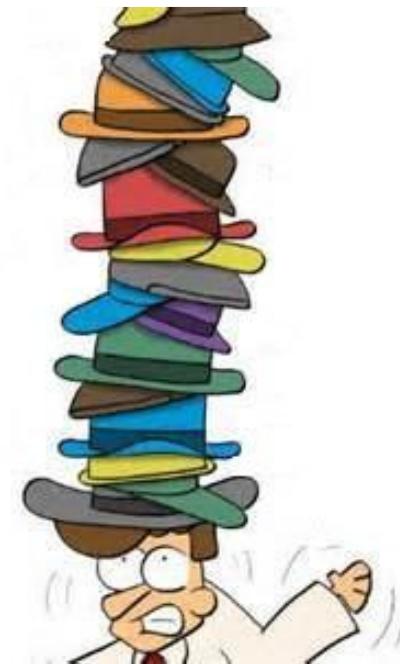
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- Not just about being
  - “good at your work”
  - producing data
  - getting on with your colleagues
- As knowledge producers, educators and recipients of public funds we have additional responsibilities as researchers

# Balancing Multiple Roles as a Researcher

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- Data producer
- Data user and/or collaborator
- Author
- Employee
- Teacher/mentor
- Recipient of public funds
- Recipient of public trust
- Citizen/legally-obligated individual
  - *How do all these roles fit together?*



# Responsibility as a Product of Integrity

- Practice of scientific investigation with integrity

**integrity**

/ɪn'teɡriti/

*noun*

1. the quality of being honest and having strong moral principles.

"a gentleman of complete integrity"

*synonyms:* honesty, uprightness, probity, rectitude, honour, honourableness, upstandingness, good character, principle(s), ethics, morals, righteousness, morality, nobility, high-mindedness, right-mindedness, noble-mindedness, virtue, decency, fairness, scrupulousness, sincerity, truthfulness, trustworthiness  
"I never doubted his integrity"

2. the state of being whole and undivided.

"upholding territorial integrity and national sovereignty"

*synonyms:* unity, unification, wholeness, coherence, cohesion, undividedness, togetherness, solidarity, coalition  
"internal racial unrest threatened the integrity of the federation"

# Key Ethical Norms

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- Responsible research involves the awareness and application of professional norms and ethical principles in all areas relating to research
- Beneficence (do good)
- Non-maleficence (cause no harm)
- Accountability
- Transparency
- Care/Equity
- Collegiality



# Codes of Conduct

- Ethics are often outlined in disciplinary codes of conduct
- Can be helpful ways of summarizing areas of activity to think about in relation to RCR

## ACM Code of Ethics and Professional Conduct

### 1. GENERAL ETHICAL PRINCIPLES.

1.1 Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing.

1.2 Avoid harm.

1.3 Be honest and trustworthy.

1.4 Be fair and take action not to discriminate.

1.5 Respect the work required to produce new ideas, inventions, creative works, and computing artifacts.

1.6 Respect privacy.

1.7 Honor confidentiality.

### 2. PROFESSIONAL RESPONSIBILITIES.

2.1 Strive to achieve high quality in both the processes and products of professional work.

2.2 Maintain high standards of professional competence, conduct, and ethical practice.

2.3 Know and respect existing rules pertaining to professional work.

2.4 Accept and provide appropriate professional review.

2.5 Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.

2.6 Perform work only in areas of competence.

2.7 Foster public awareness and understanding of computing, related technologies, and their consequences.

2.8 Access computing and communication resources only when authorized or when compelled by the public good.

2.9 Design and implement systems that are robustly and usably secure.

### 3. PROFESSIONAL LEADERSHIP PRINCIPLES.

3.1 Ensure that the public good is the central concern during all professional computing work.

3.2 Articulate, encourage acceptance of, and evaluate fulfillment of social responsibilities by members of the organization or group.

3.3 Manage personnel and resources to enhance the quality of working life.

3.4 Articulate, apply, and support policies and processes that reflect the principles of the Code.

3.5 Create opportunities for members of the organization or group to grow as professionals.

3.6 Use care when modifying or retiring systems.

3.7 Recognize and take special care of systems that become integrated into the infrastructure of society.

### 4. COMPLIANCE WITH THE CODE.

4.1 Uphold, promote, and respect the principles of the Code.

4.2 Treat violations of the Code as

<https://www.acm.org/code-of-ethics>

# RCR as a Collaborative Endeavour



# Institutional Responsibilities

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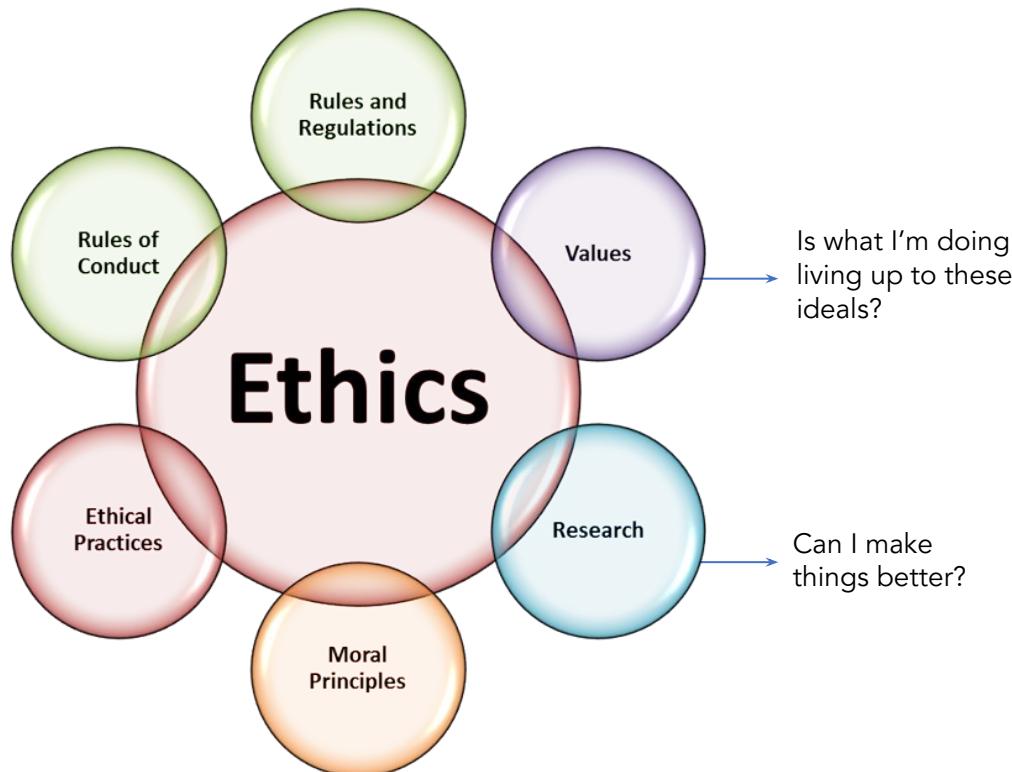
- Education
- Infrastructures that support responsible research
- Capacity for dealing with concerns/whistleblowing/misconduct
- Engagement and compliance with inter/national regulation

# RCR: Changing Practices and Environments

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- Understanding of responsible research, researchers and research contexts is changing
- Individual responsibility – expect compliance with regulations, active engagement with RCR behaviours
- Institutions/National/International systems – expect investment in RCR-supporting infrastructures, develop systems of educating, monitoring and mediating
- International science community – expect monitoring, support and capacity building

# RCR as an Extended Form of Research Ethics



Fostering ethical excellence  
instead of avoidance of  
misconduct

# Extending the Reach of Ethics in Research

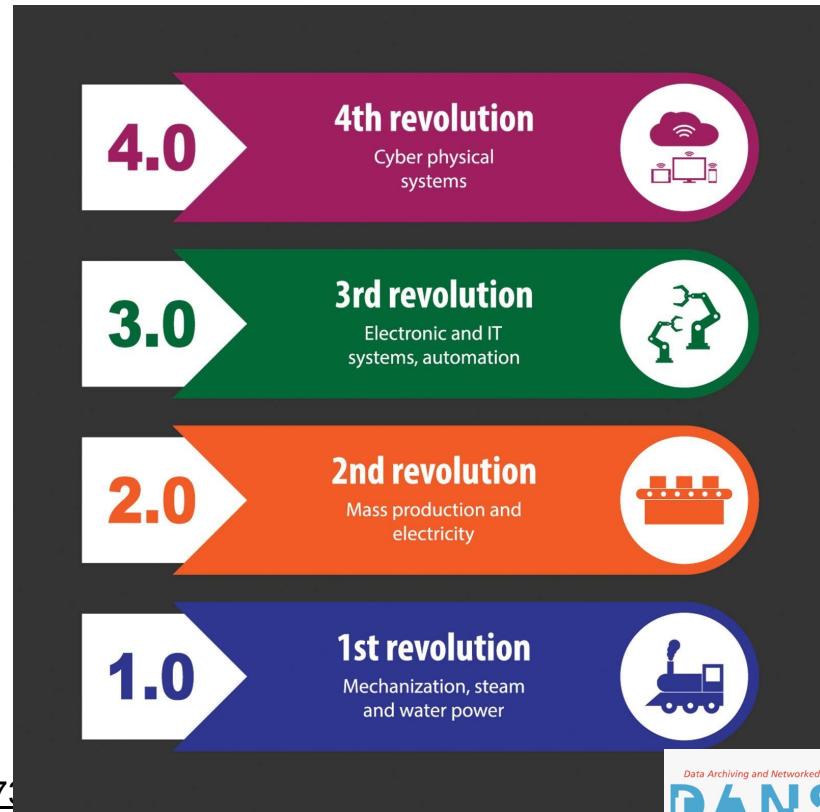
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- Produce verifiable and re-usable data
- Protect scientists and societies from harm
- Enable collaboration
- Ensure investments (financial, trust, time etc) are recompensed
- Embeds science within cultural/social priorities



# The Digital Revolution

- Data “deluge”
- Big Data
- AI
- Increasing opportunities and prioritization of interdisciplinary research



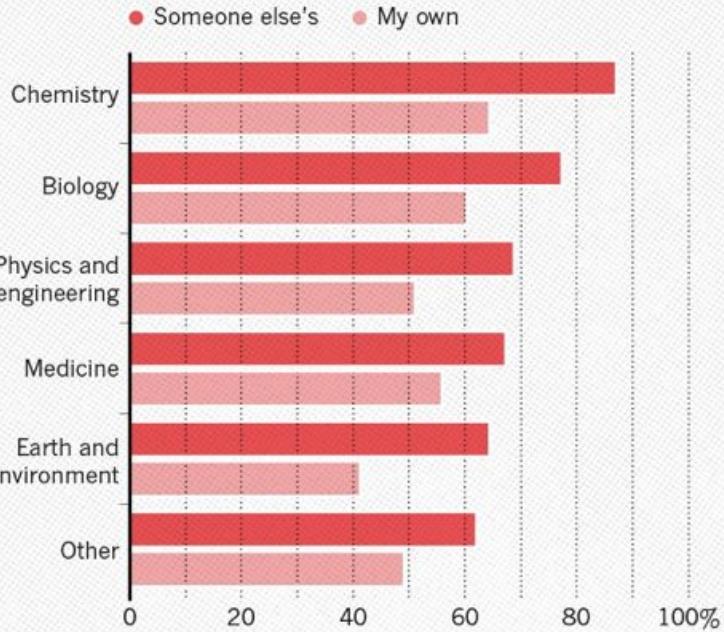
# The Digital Revolution: Coming at the Right Time?

- Advances in computing have not only changed research, but come at a time of significant change in research
- A number of issues are changing the way we think/talk/govern research
  - Reproducibility crisis
  - Increased scrutiny of public investment in research
  - Increased pressure for public access to research resources
  - Sustainable Development Goals (SDGs)
  - Blurred boundaries between academia, commerce and government
  - Citizen science movement
- Driving forward new models of research practice

# The Reproducibility Crisis in Research

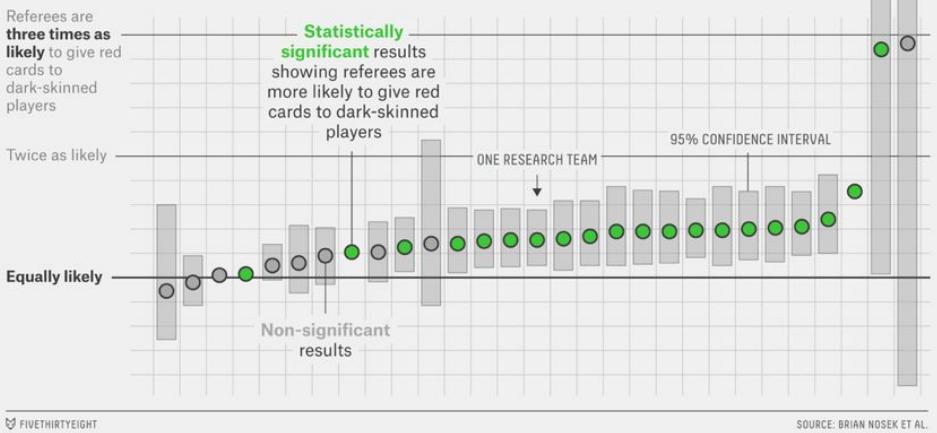
## HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?

Most scientists have experienced failure to reproduce results.



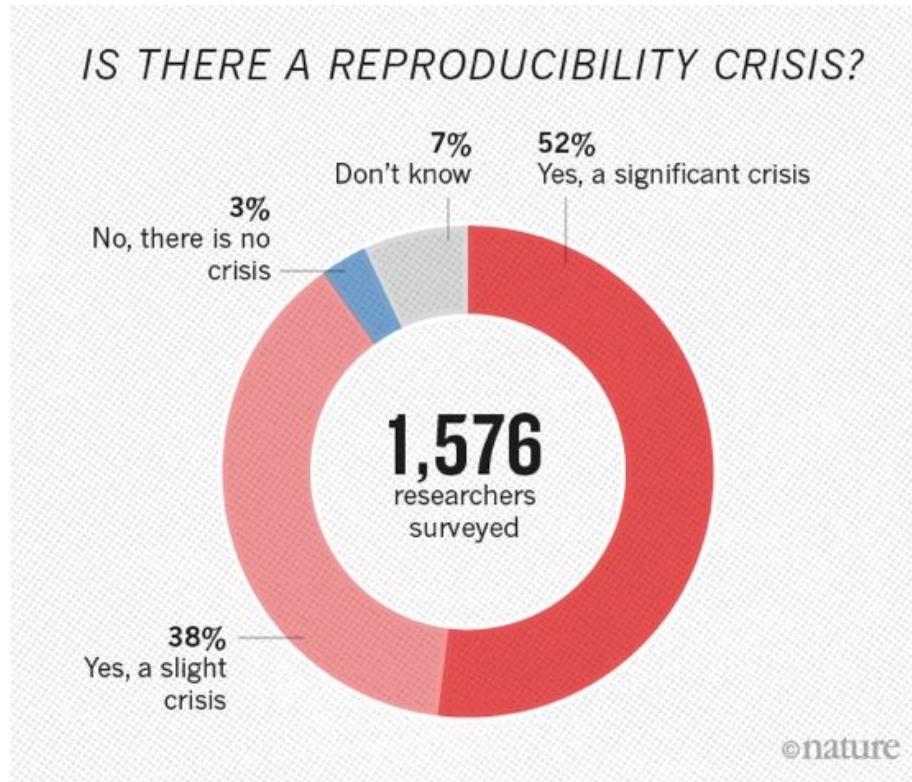
## Same Data, Different Conclusions

Twenty-nine research teams were given the same set of soccer data and asked to determine if referees are more likely to give red cards to dark-skinned players. Each team used a different statistical method, and each found a different relationship between skin color and red cards.



- Nature survey of 1,576 researchers (Baker et al 2016)
- <https://psyarxiv.com/qkwst/>

# A General Consensus on the Crisis



- Variability in analysis and methodology
- Incentives aligned towards publication not reproducibility
- Lack of transparency and access to data

Nature survey of 1,576 researchers  
(Baker et al 2016)

# SDGs, Research and Global Good



Increased support and funding for research that addresses SDGS and contributes to global development

## SUSTAINABLE DEVELOPMENT GOALS



# New Challenges for Responsible Research Models

- Expanding scope of responsibility (led by SDGs)
- Digital systems and distributed research making individual role responsibilities complicated
- Inclusion of non-researchers in research process raises concerns about ethical practice
- Urgent need to (efficiently) use and re-use volume of data being created raises concerns about
  - Opportunity to share vs loss of control
  - Increase benefits of research for public vs possible harms
  - (Un)Intended marginalizations
  - Data recombination and re-use

# New Challenges for Responsible Research Models

- How can the evolving power of digital technologies be harnessed to uphold the principles of responsible research and increase reproducibility?
- How can the culture of science be adapted to support this evolution?
- How can practices and structures of scientific research be adapted to ensure that research benefits the most number of people?

*Are you aware of any specific cases in which unethical research or falsified research occurred? Can you share an example and how you think this affects us today?*

# Dr. Andrew Wakefield, a British former gastroenterologist



[Indian J Psychiatry](#), 2011 Apr-Jun; 53(2): 95–96.  
doi: [10.4103/0019-5545.82529](https://doi.org/10.4103/0019-5545.82529)

PMCID: PMC3136032  
PMID: [21772639](https://pubmed.ncbi.nlm.nih.gov/21772639/)

## The MMR vaccine and autism: Sensation, refutation, retraction, and fraud

T. S. Sathyanarayana Rao and Chittaranjan Andrade<sup>1</sup>  
► Author information ► Copyright and License information ► [PMC Disclaimer](#)

In 1998, Andrew Wakefield and 12 of his colleagues<sup>[1]</sup> published a case series in the *Lancet*, which suggested that the measles, mumps, and rubella (MMR) vaccine may predispose to behavioral regression and pervasive developmental disorder in children. Despite the small sample size ( $n=12$ ), the uncontrolled design, and the speculative nature of the conclusions, the paper received wide publicity, and MMR vaccination rates began to drop because parents were concerned about the risk of autism after vaccination.<sup>[2]</sup>

Almost immediately afterward, epidemiological studies were conducted and published, refuting the posited link between MMR vaccination and autism.<sup>[3,4]</sup> The logic that the MMR vaccine may trigger autism was also questioned because a temporal link between the two is almost predestined: both events, by design (MMR vaccine) or definition (autism), occur in early childhood.



# Time For A New Approach?



Increase trust in science, don't waste public resources



Get constructive feedback



Be international and inclusive

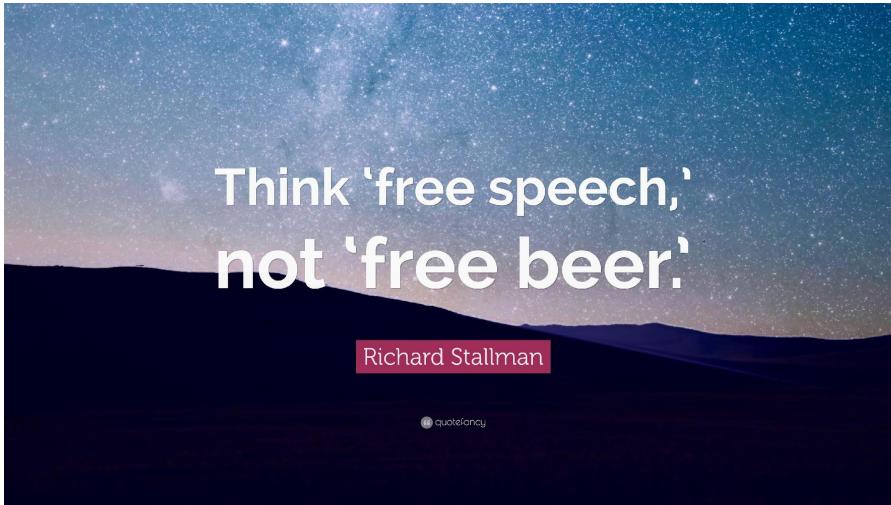


Disseminate findings to community

We need to start to effectively share

# Open Science

- The products of scientific research should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control



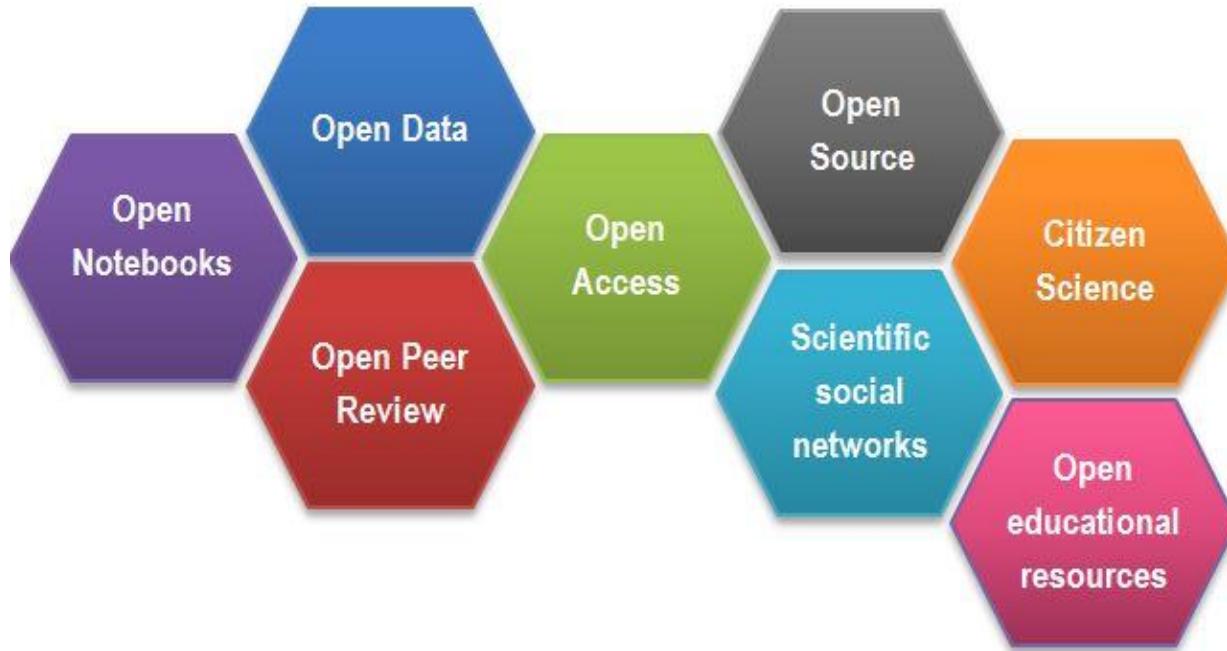
## Gratis versus Libre

"Free" means there is no cost, where libre means "at liberty", referring to the freedom to modify source code. Libre doesn't mean gratis. Libre can mean available. Libre can mean without restriction

# Open Science (contd.)

- The movement to make scientific research, data and dissemination accessible to all levels of an inquiring society
- Scope:
  - Transparency in experimental methodology, observation, and collection of data
  - Public availability and reusability of scientific data
  - Public accessibility and transparency of scientific communication
  - Using web-based tools to facilitate scientific collaboration

# Open Science: an Umbrella of Many Activities



# Open Science is Many Things

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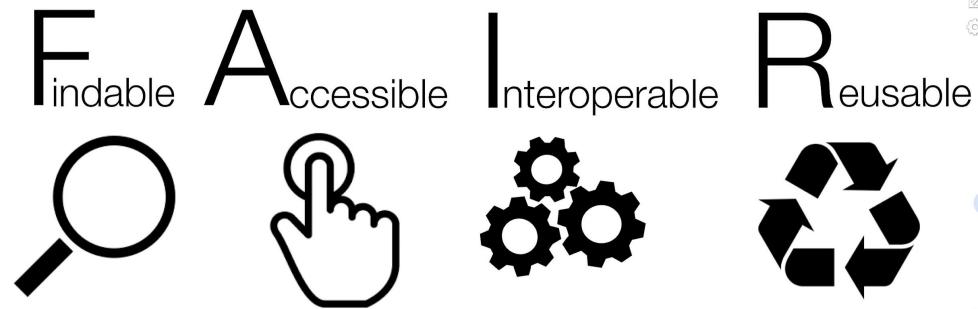
- Open Science includes activities that:
  - facilitate resource sharing
  - improve awareness of sharing
  - create linkages between resources
  - advocate for removal of financial barriers
  - advocate for just distribution of resources



# Openness as an Aspiration not an Absolute

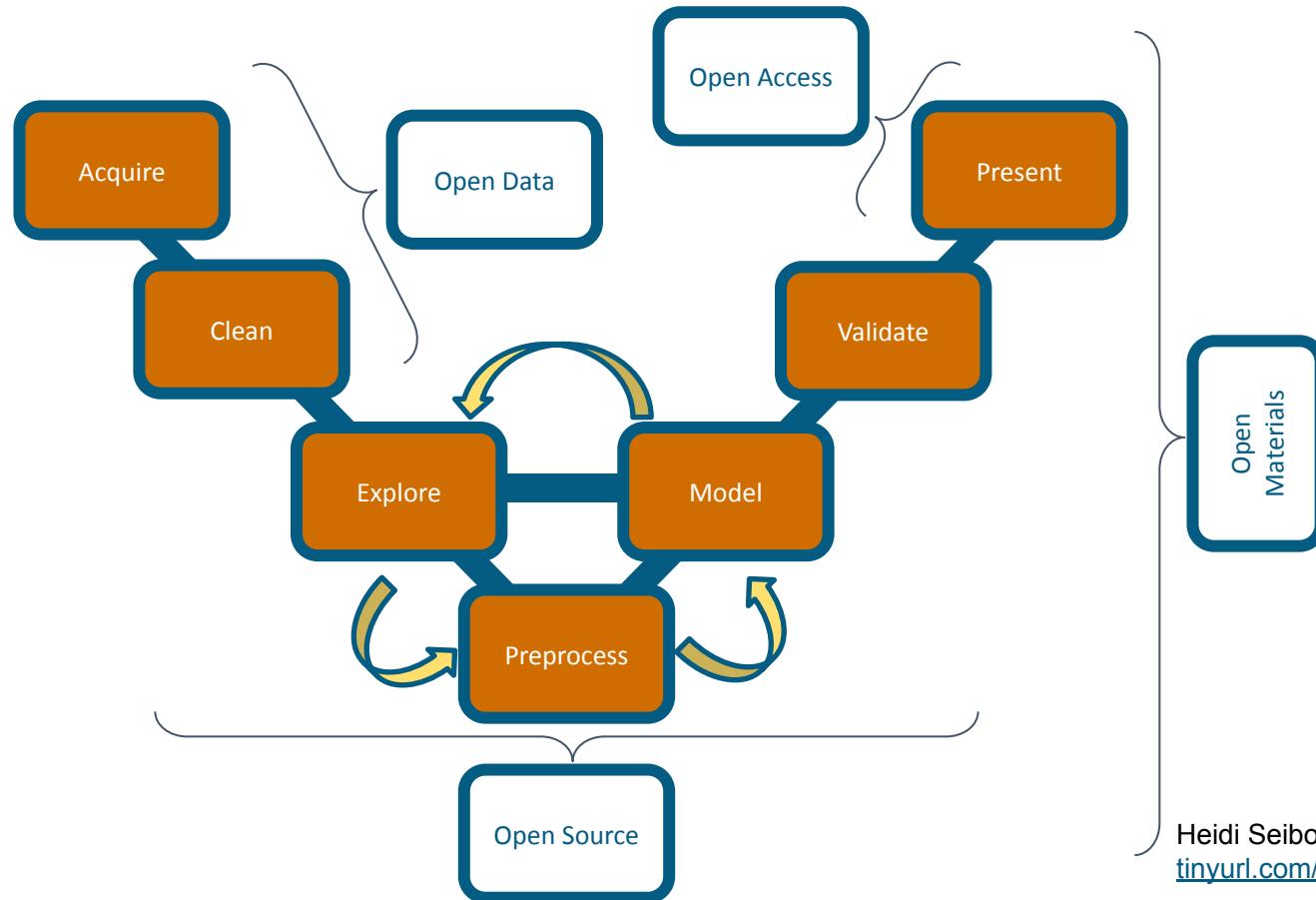
- Openness is not an absolute for research outputs – different research products require different solutions
  - Sensitive data
  - Commercial applications
  - National IP and traditional knowledge
- Open Science movement drives critical engagement in these areas to find solutions that are suitable
- Openness is not an absolute in the research process – different forms of openness foregrounded at different times

# As Open As Possible, As Closed As Necessary

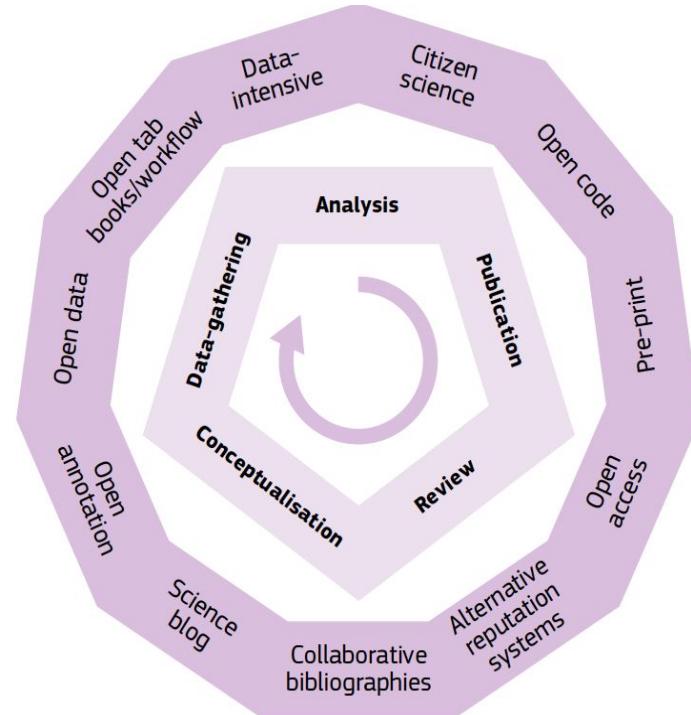
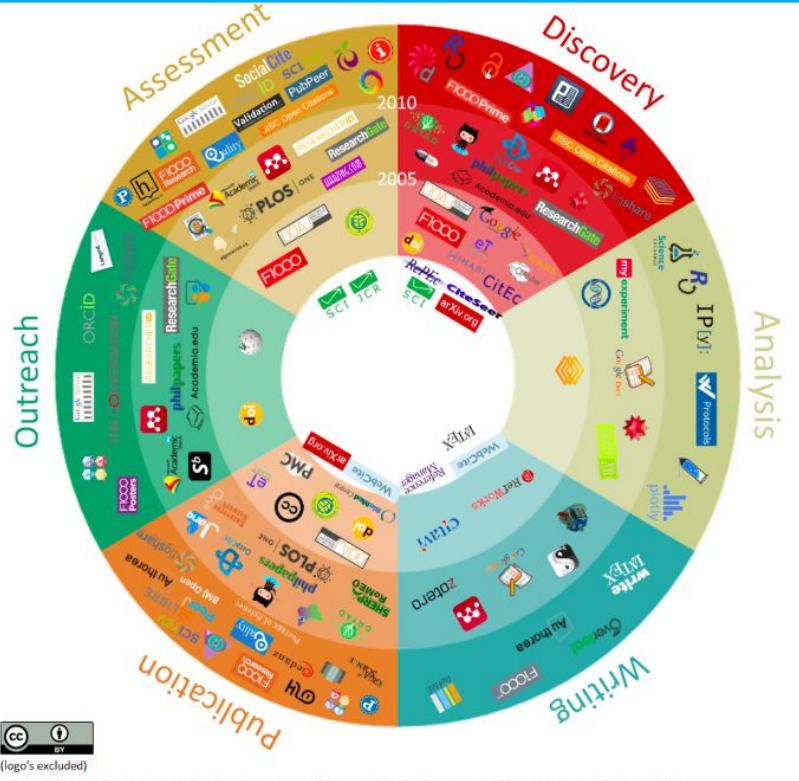


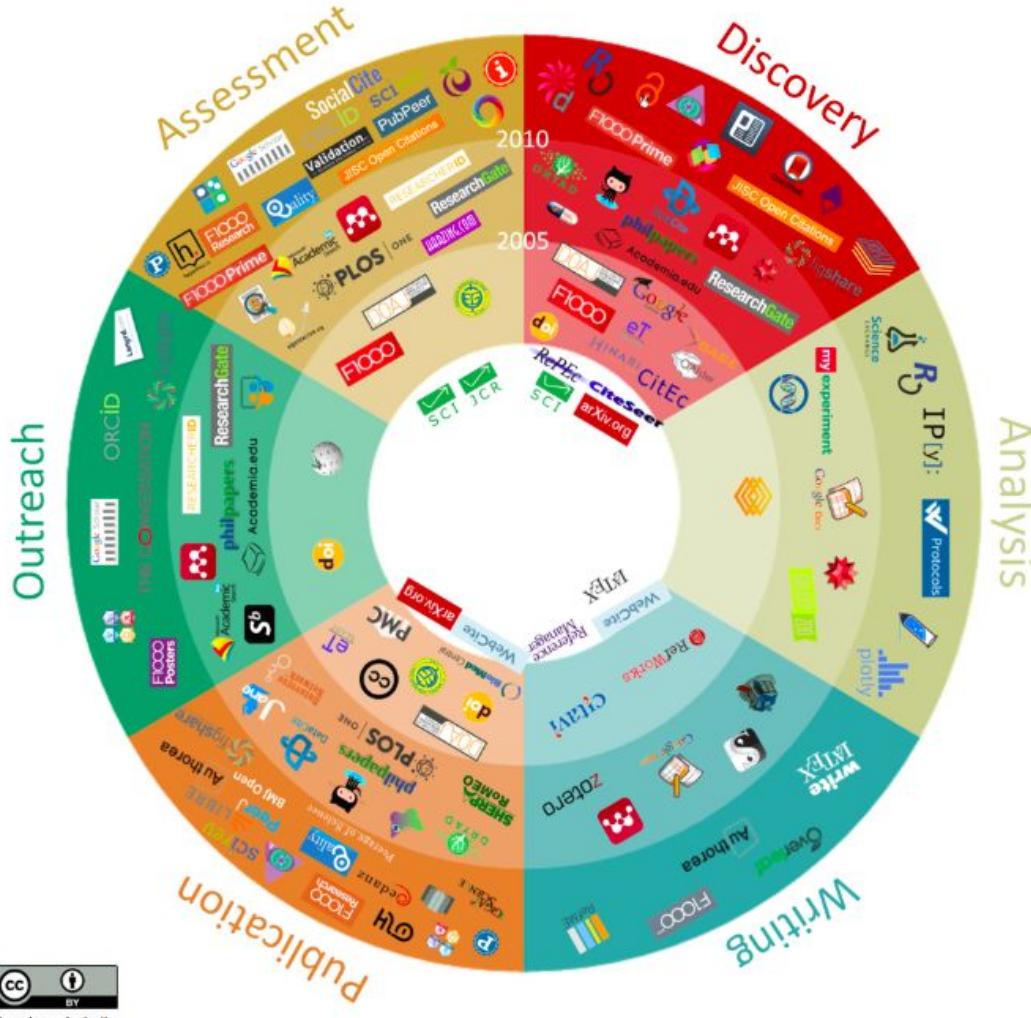
<https://www.timeshighereducation.com/blog/data-should-be-open-possible-and-closed-necessary>

# Openness Throughout The Research Lifecycle



# Open Science: Opening Up Research Potential





# Describe your workflows

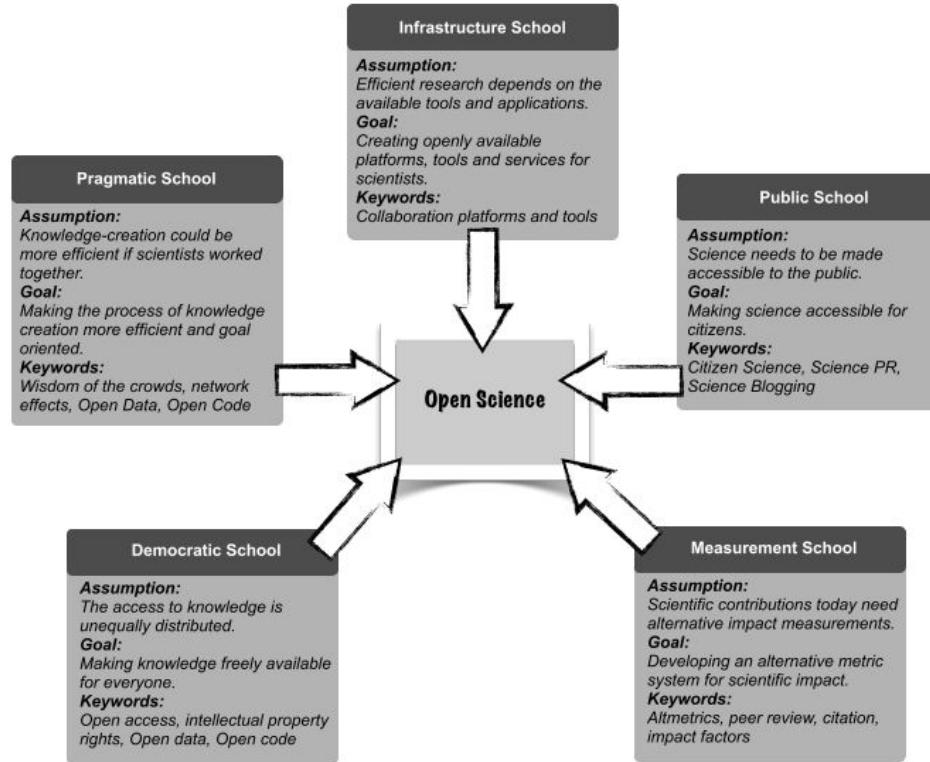
- Describe our workflow and then think in pairs how to make it more open.
- 5 minutes
- If you feel comfortable, share it here:  
<https://docs.google.com/document/d/1gfr5qUfOgcB6KUfYT6qFpNxHmrOgPAAdTWPWsyewZAw/edit?usp=sharing>

# A Way of Thinking And Doing

- An ideology as well as a set of practical actions
  - Commitment to equity, excellence, responsibility and justice
  - Practice of research practices such as collaboration, sharing of research data, lab notes and other research processes with no restriction, promote reuse, redistribution and reproduction of the research and its underlying data and methods
- Open Science = practice-based ethics
- Like all ethics, it requires motivation, buy-in and commitment
- Changing the way we think about responsible research



# Different Motivations, Same Response



(Fecher and Friesike, 2014)

# Openness in RCR

*Open Lab Books:*

Transparency in research practices

*Sharing and openness:*

enhance transmission of values

*Open Peer Review:*

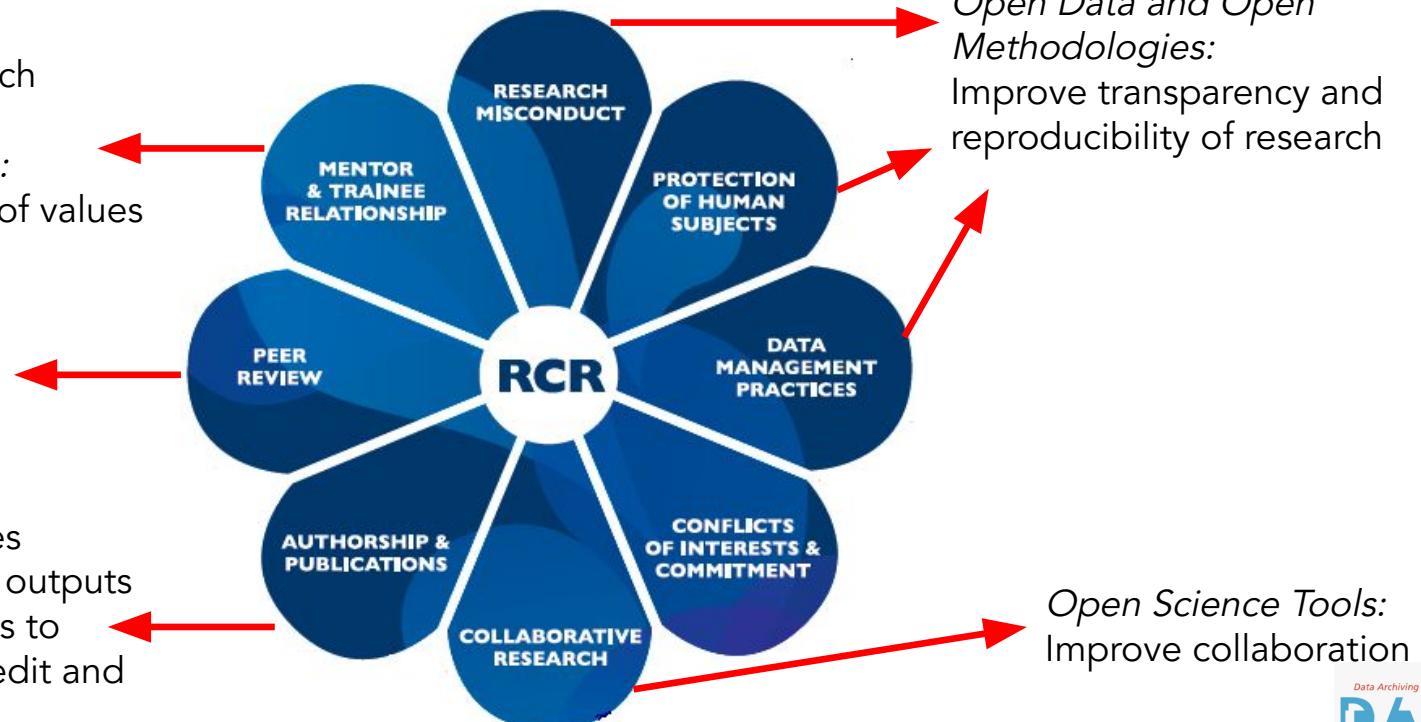
Transparency in peer review leads to better dialogue and collegial behaviour

*Open Access:* Improves availability of research outputs

*Open publishing:* leads to improved citations, credit and collaboration

*Open Data and Open Methodologies:*

Improve transparency and reproducibility of research

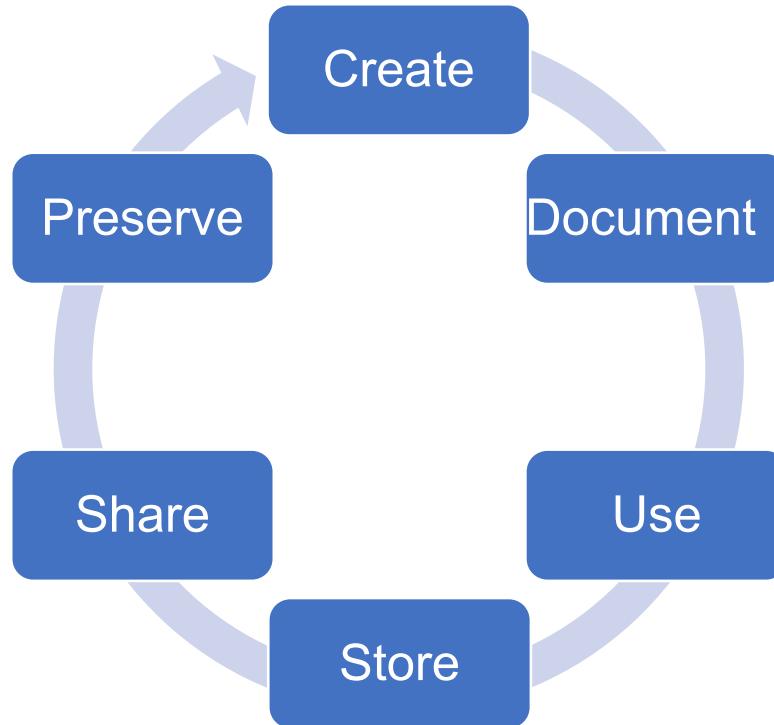


# Openness as a Continuum and a Journey

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- Open Science is both a cultural movement as well as a set of individual research decisions/practices
  - Commitment to openness is the start of a lifelong journey as an Open researcher – like anything, learning to be open takes time, motivation and mentorship/support
  - Individual researchers can show support for Open Science through the way they do their research
  - Can make changes to daily research practices to be more open in all aspects of research
- 
- *There is no “hard and fast” rule – openness must work for you within your specific work context and with your daily challenges*

# Different Actions at Different Stages



# Individual Openness: More Than Open Access

Share your data - the research data that underpins publications should also be accessible to support validation and facilitate reuse. In cases where data sensitivities won't allow open access, be sure to provide details on how someone could request authorised access.

Share your code - many researchers now develop bespoke bits of code to help them analyse and/or visualise the data they have collected. Having access to this code is essential for supporting the validation of your findings and to help others to build upon your work.

Share your workflows - without knowing what steps were taken to capture, process and analyse the data - and in what order - it can be virtually impossible to validate published findings. This has led to what some are calling the Reproducibility Crisis. Nature's special issue on Challenges in Irreproducible Research gives you a better sense of the scale of this problem.

# Pragmatic Openness

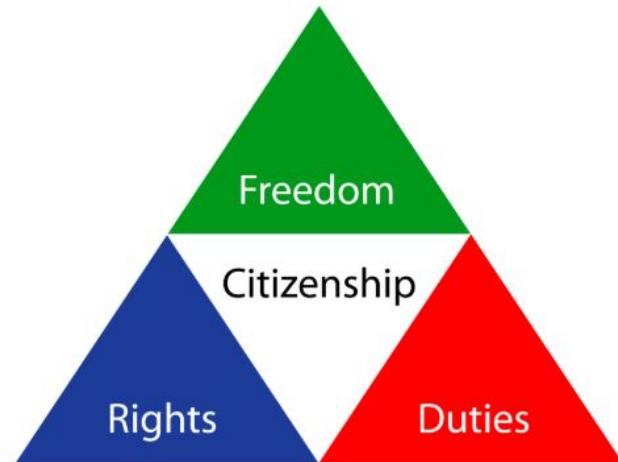
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- Openness in research is new ... And can be scary
  - It's ok to have concerns
  - It's ok to realize that not all the open practices will work for you
  - There can be legal, regulatory, ethical reasons not to share
- However, you benefit from the increasingly open research landscape (papers, data, software)
- So, how can one avoid "freeloading"?

# Responsible and Open Research as Citizenship

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- Citizenship:
  - ethical obligations arising out of social living
  - being part of a community requires the acceptance of civic responsibilities and contribution to the overall public good
- As a citizen you have duties and expected ways of acting
  - Follow rules
  - Participate in community activities
  - Protect the community and its resources from misuse



# Responsible and Open (Data) Science Citizenship

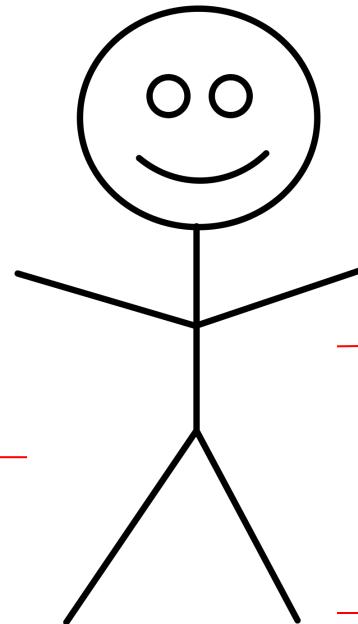
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- Research is a community endeavour
  - involves social actions such as resource sharing and communal practice
  - responsible researchers are “citizens” of the research community
- Citizenship is a give and take
  - Benefits to facilitate freedom of research
  - Structures to safeguard rights as researcher
  - Responsibilities to assume to protect culture
- Support and grow culture instead of just living in it

# Tools for Responsible, Open (Data) Science Citizenship

Data science

- Practical skills
- Norms and values
- Infraethics



Data management

- Norms and values (FAIR)
- Practical tools - RDM

Data use

- Finding and using data
- Data re-use and attribution

Authorship

- ORCID
- Journals and licensing

Openness, sharing, justice, beneficence

Ethics and responsibility

- Areas for activity

# Challenges of Being Open at Home

# Implementing Open and Responsible Practices in Your Own Research

- Challenges are common – everyone has them
- Physical, social and regulatory contexts influence perceptions of Open Science and ability to engage in Open Science activities

*SA1/3: I think it leads to better science*



*KY1/1: I won't release data unless I first of all publish*



# Experiencing Challenges is Normal

What specific challenges do you anticipate encountering when you return home in terms of your data work?

CHALLENGES OF OPEN+RESPONSIBLE RESEARCH AT HOME		
INSTITUTIONAL / CULTURAL	CHALLENGE	SOLUTIONS
	<ul style="list-style-type: none"><li>• lack of support from supervisor / peers</li><li>• peers not sharing</li><li>• ownership / IP concerns</li><li>• tradition of not being open</li><li>• lack of interest</li><li>• being naive about risks</li><li>• traditions of non-transparency</li><li>• lack of knowledge</li><li>• no oversight on ROM</li></ul>	<ul style="list-style-type: none"><li>• highlight that openness is not new</li><li>• draw attention to funding requirements</li><li>• openness = citations</li><li>• use international policy</li><li>• institutions (ie. cope)</li><li>• make (1) examples - ie. work flows</li><li>• engage multiple stakeholders</li><li>• incl. uni, admin, gov, undergrads</li><li>• talk about CAPE+FAIR</li><li>• engage with CONARE</li></ul>
INFRASTRUCTURE / RESOURCES	<ul style="list-style-type: none"><li>• time</li><li>• infrastructure</li><li>• availability of data</li><li>• repositories - access / lack</li><li>• lack of training + opportunities</li><li>• lack of ROM awareness</li><li>• knowing the laws</li><li>• processing power</li></ul>	<ul style="list-style-type: none"><li>• use OS tools online - ie/101 tools</li><li>• make use of available databases</li><li>• check restdatas</li><li>• ask for APC numbers</li><li>• check out lists of resources</li><li>• get involved in training - ie. Carpentries</li><li>• join communities - ie R/R/Python</li><li>• use support networks - ie AuthorAID</li><li>• get involved in OS discussions to reflect LINC perspective</li></ul>
PERSONAL CONCERN	<ul style="list-style-type: none"><li>• not sure how to share</li><li>• working with qual research</li><li>• lack of knowledge of tools</li><li>• not getting credit</li><li>• working multidisciplinarily - different approaches to ROM</li></ul>	<ul style="list-style-type: none"><li>• reach out to decision makers to raise concerns</li><li>• know your rights - Creative Commons license</li><li>• know community expected behavioural standards - ie codes of conduct</li><li>• "take it slowly" - increase openness incrementally in your own work</li><li>• find people to model your work practices on</li><li>• find trusted infrastructures</li><li>• open communication basis</li></ul>

# It's OK To Have Challenges

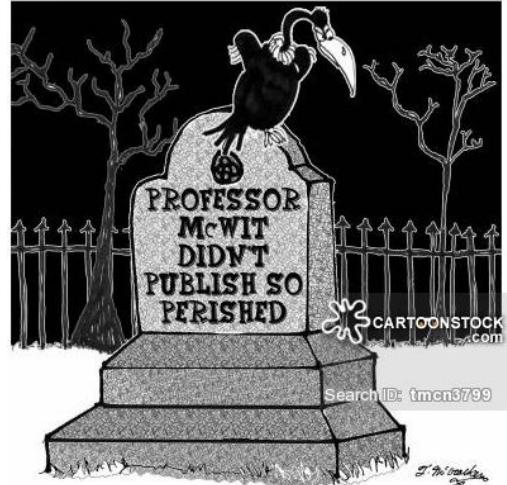
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- Challenges can be categorized into a number of different areas:
  1. Cultural resistance and lack of institutional/peer support
  2. Resource limitations
  3. Personal concerns
- Challenges are not insurmountable – many resources can help address them

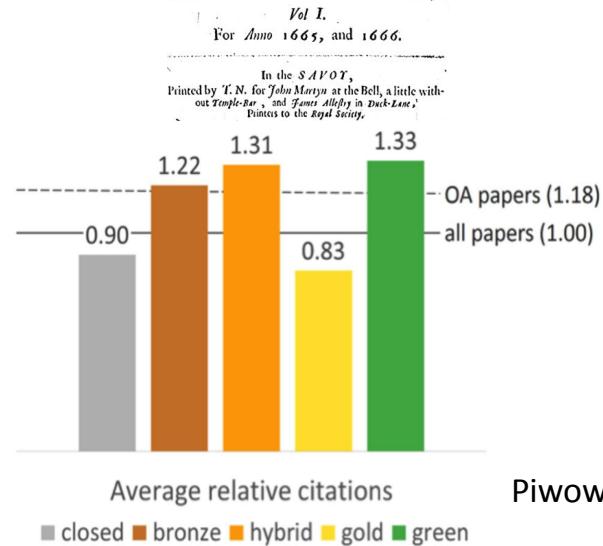
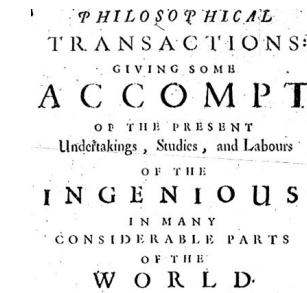
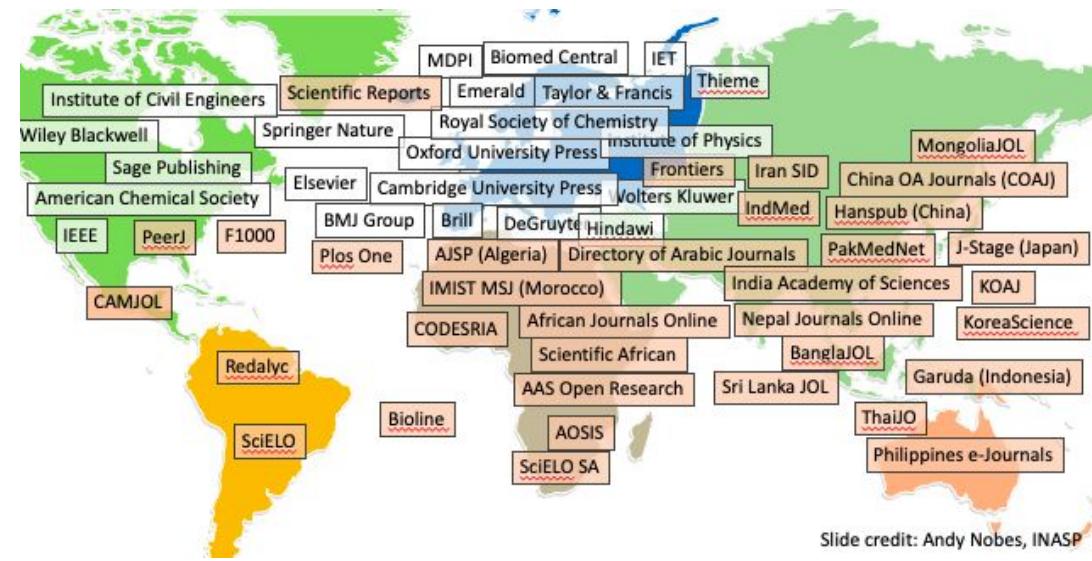


# Cultural Resistance and Lack of Support

- A quick background:
  - Inherited colonial academic systems
  - Historic lack of funding and resources limiting research scope
  - “Parachute research”
- Problems include
  - Lack of institutional support
  - Lack of regulations/guidance
  - Lack of trust



# Getting Your Institution On Board



Piwowar 2018

# Challenges Beyond the Research Context

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- technology affects communication, collaboration and knowledge exchange within scientific, work and home settings
- need to help people to use those innovations *more productively and safely*
- need to improve ways in which new technologies can be designed and developed to be *more responsive* to societal acceptability and desirability

*Not just about being open/closed. It's about making sure that you use openness as a tool to secure just futures.*

# Networking and Future Collaboration

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- Pair with someone in another organization and find out about their research interests.

5 min





Data  
Schools

# Enhancing Healthcare\_1

Presented by Nii Tawiah & Ayishih Bellew

# *Plan for the second part of the morning*

- AI/ML in Health
- Algorithmic Bias

*Our session will be highly interactive and involve discussion.*

*There will be 5 min breaks after 20 mins of session.*

# *What is health?*

*“Health is a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity.”*

*World Health Organization 1948*

# *Social drivers of health*



# *What is Public Health?*

*“Public health is what we, as a society, do collectively to assure the conditions in which (all) people can be healthy.”*

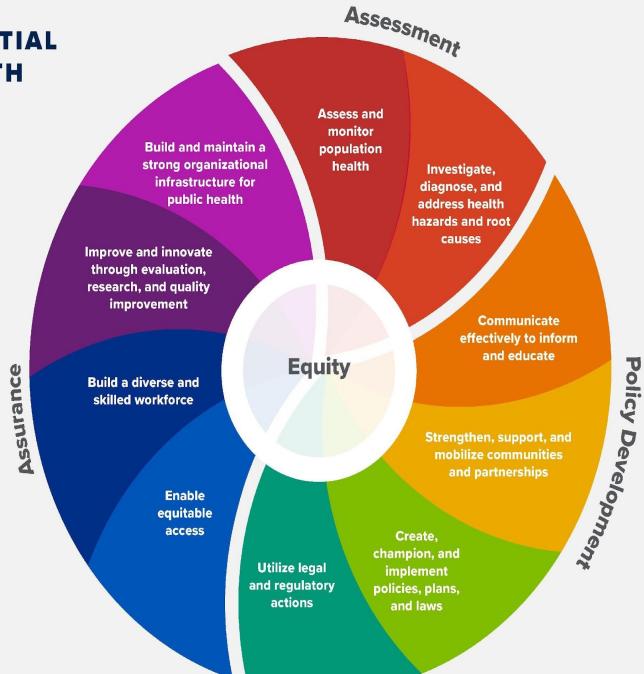
*Institute of Medicine (1988), Future of Public Health*

# *Factors that determine public health*

## **THE 10 ESSENTIAL PUBLIC HEALTH SERVICES**

*To protect and promote the health of all people in all communities*

The 10 Essential Public Health Services provide a framework for public health to protect and promote the health of all people in all communities. To achieve optimal health for all, the Essential Public Health Services actively promote policies, systems, and services that enable good health and seek to remove obstacles and systemic and structural barriers, such as poverty, racism, gender discrimination, and other forms of oppression, that have resulted in health inequities. Everyone should have a fair and just opportunity to achieve good health and well-being.



Created 2020

# *Health equity*

*The state in which everyone should have an equal opportunity to attain their highest level of health. Achieving this requires ongoing efforts to address past and present injustices, overcome barriers to healthcare, and eliminate preventable health disparities. A commitment to working towards a fair and just society where everyone can access the care and resources they need to live a healthy life.*

# *Health disparity*

*Health disparities are preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations.*

# *Health disparity versus health inequity*

*Health disparities refer to differences in health outcomes among different populations. It is important to note that these differences are not limited to one group.*

*Health inequities are disparities in health outcomes and the opportunities available to groups to achieve the best possible health. These differences are often caused by social and structural injustices that are avoidable and unfair.*

# *Total Diabetes*

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- 37.3 million people have diabetes—that's 11.3% of the US population.
- 28.7 million people have been diagnosed with diabetes.
- 8.5 million people who have diabetes have not been diagnosed and do not know they have it.



**1 in 5**

---

37.3 million Americans  
have diabetes, and 1 in 5  
don't know it.

# *Diabetes disparities by race and ethnicity*

Percentage of US Adults 18 or Older With Diagnosed Diabetes, by Race and Ethnicity,  
2018–2019

Race and Ethnicity	Percentage
American Indian or Alaska Native	14.5
Asian, non-Hispanic	9.5
Black, non-Hispanic	12.1
Hispanic, overall	11.8
White, non-Hispanic	7.4

# *Diabetes disparities by education level*

**Percentage of US Adults 18 or Older With Diagnosed Diabetes, by Education Level,  
2018-2019**

Education Level	Percentage
Less than high school	13.4
High school	9.2
More than high school	7.1

# ***Structural inequities***

*Structures or systems in society, such as finance, housing, transportation, education, and social opportunities, are designed to unfairly benefit one population, intentionally or not.*

# ***Equality versus equity versus disparity***

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- Equality is achieved when each person or group of people is given the same resources or opportunities.
- Equity is achieved when it is recognized that each person or group of people has different circumstances, and resources are allocated accordingly to reach an equal outcome.
- Disparity is a difference that is closely linked with social, economic, and/or environmental disadvantage.

<https://www.youtube.com/watch?v=MIXZyNtaoDM>

# Inequality

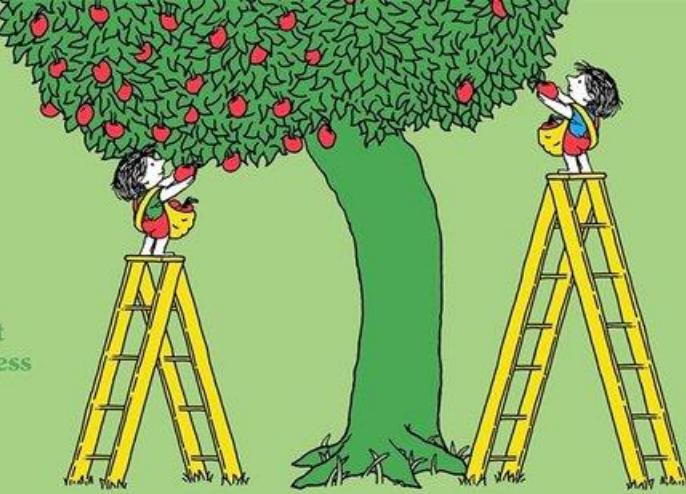
Unequal access to opportunities



With apologies to Shel Silverstein from @lunchbreath

# Equity

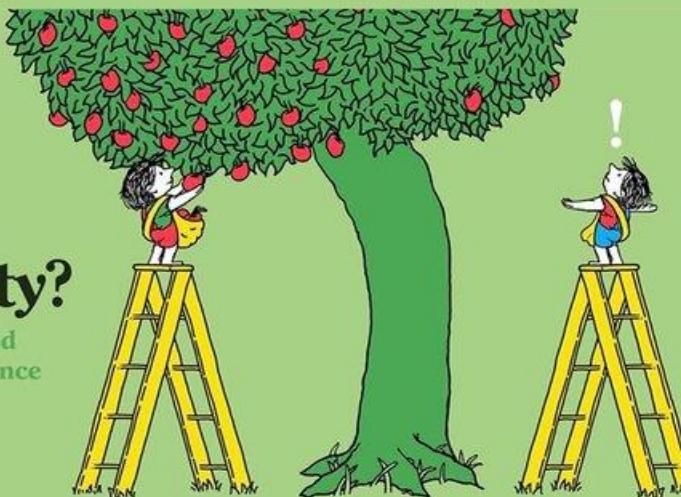
Custom tools that identify and address inequality



With apologies to Shel Silverstein from @lunchbreath

# Equality?

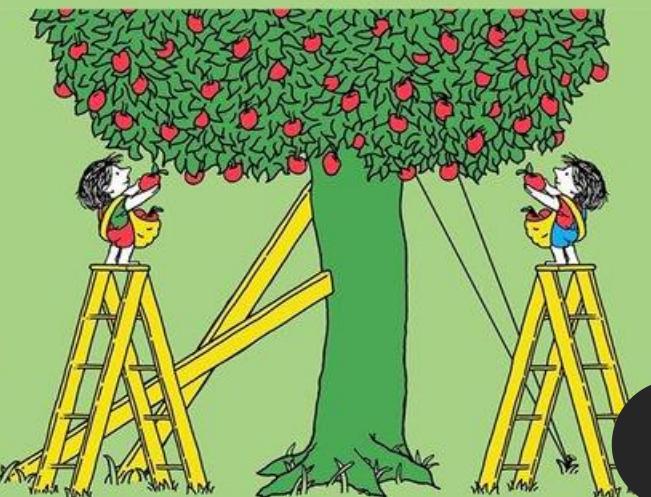
Evenly distributed tools and assistance



With apologies to Shel Silverstein from @lunchbreath

# Justice

Fixing the system to offer equal access to both tools and opportunities



With apologies to Shel Silverstein from @lunchbreath

2019 Design In Tech Report | Addressing Imbalance



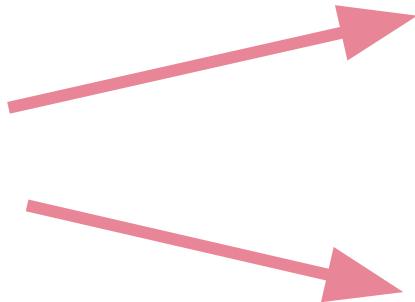
# Data Schools

## Enhancing healthcare with AI\_2

### Presented by Nii Tawiah & Ayishih Bellew

# *What is Artificial Intelligence?*

Artificial Intelligence (AI): A term that addresses machine behavior and function that exhibits the intelligence and behavior of humans.



Rules-based: Algorithms programmed to use (generally clinically accepted) rules to guide decision-making.

Machine-learning (ML): Algorithm that uses data to create relationships without explicitly being programmed.

## Figure 1: AI Building Blocks in Global Health

**Artificial Intelligence:** Use of computers for automated decision-making to perform tasks that normally require human intelligence, specific examples include:

DATA	PROCESSING	ACTION
 <b>Computer vision</b> Automated methods used to conduct image-based inspection and analysis	 <b>Information processing (in AI)</b> Processing of digitized data in ways parallel to human brain functions	 <b>Image generation</b> Automated creation of images using AI
 <b>Speech recognition</b> Computerized identification and response to sounds produced in human speech	 <b>Machine learning</b> Pattern recognition that learns and improves from experience without being programmed	 <b>Speech generation</b> Automated generation of human-like speech using AI
<b>ABCDE</b> <b>FGHIJK</b> <b>LMNOP</b>	 <b>Natural language processing</b> Processing and analysis of large amounts of data written in natural language (eg. narrative)	 <b>Planning &amp; exploring agents</b> Use of AI for strategies or action sequences by agents, robots, or unmanned vehicles

 Most relevant to global health

Source: AI@BCG, Encyclopedia Britannica, Oxford Dictionary

# AI in Health

**Figure 2:** Framework of all AI Use Cases in Healthcare

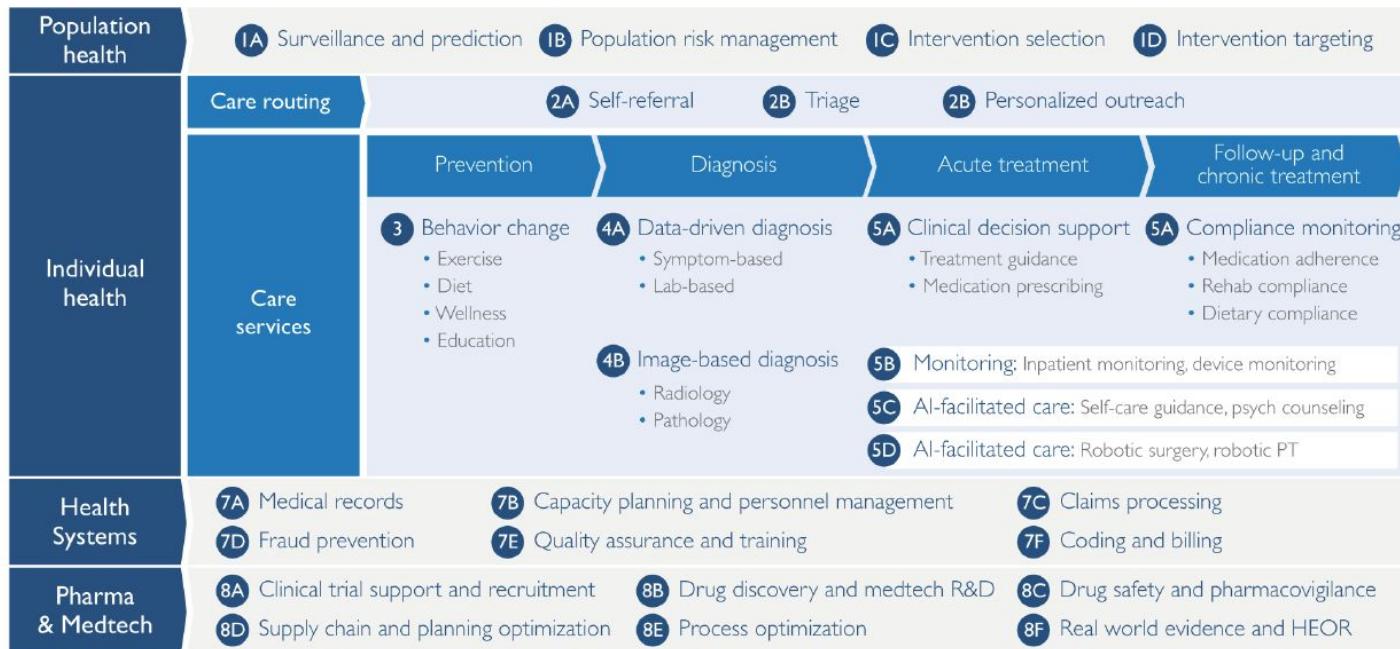


Figure from USAID's "Artificial Intelligence in Global Health: Defining a Collective Path Forward" <https://www.usaid.gov/cii/ai-in-global-health>

# Bias

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## Bias

Inclination or prejudice (perjudicar) for or against one person or group, especially in a way considered to be unfair.

## Discrimination

Unequal treatment of persons on the basis of 'protected characteristics' such as race, sexual identity etc.

## Bias in algorithms

Unjustified and/or unintended deviation in the distribution of algorithm outputs, with respect to one or more of its parameter dimensions

# What Causes Bias?

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*.... among the major factors that contribute to bias in the results that [systems] produce is because there is bias in the data. So you actually have to look at the data as far as the performance is concerned, to make sure you have a representative sample of the population you are trying to model* (Mittelstadt, Allo, Taddeo, Wachter, Floridi, 2016)

Bias in data selection

Use of unrepresentative datasets in algorithm development

# *Bias in both types of AI*

**nature**

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NEWS | 24 October 2019 | Update [26 October 2019](#)

## **Millions of black people affected by racial bias in health-care algorithms**

**Study reveals rampant racism in decision-making software used by US hospitals – and highlights ways to correct it.**

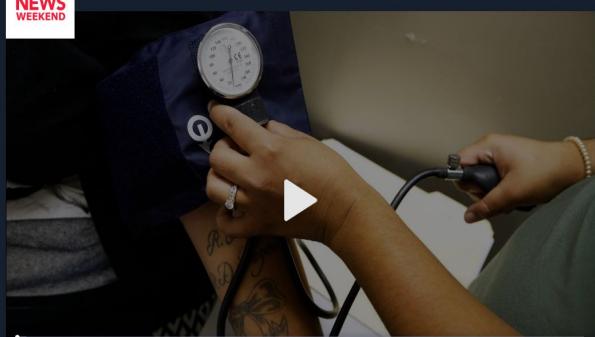
Heidi Ledford

An algorithm widely used in US hospitals to allocate health care to patients has been systematically discriminating against black people, a sweeping analysis has found.

PBS NEWS WEEKEND

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### How racial biases in medical algorithms lead to inequities in care

Dec 17, 2022 5:35 PM EDT

# Current Challenges

Google search results for "did the holocaust happen":

- did the holocaust happen
- did the holocaust happen
- did the holocaust happen during ww2
- did the holocaust really happen yahoo
- did the holy grail exist

Top 10 reasons why the holocaust didn't happen. - Stormfront  
<https://www.stormfront.org> • General > History & Revisionism ▾  
19 Dec 2008 - 10 posts - 8 authors.  
The Holocaust Lie more than anything else keeps us down. The twin ... You can believe what you want, but I believe the holocaust did happen.

Holocaust denial - Wikipedia  
[https://en.wikipedia.org/wiki/Holocaust\\_denial](https://en.wikipedia.org/wiki/Holocaust_denial) \*

Holocaust denial is the act of denying the genocide of Jews and other groups in the Holocaust ... denial movement bases its approach on the predetermined idea that the Holocaust, as understood by mainstream historiography, did not occur.

11:01 PM • 19 Mar 2016 • 17%  
unprofessional hairstyles for work

D | E.T.P.  
[hoax-it-never-happened/](#) require force of law to ... are "undeniable"

**Bonnie Kamona** @BonKamona

I saw a tweet saying "Google unprofessional hairstyles for work". I did. Then I checked the 'professional' ones 😂😂😂

10:04 PM - Apr 5, 2016

234 12,620 8,039

INTERVIEW THE COUNTRY'S SUBURBAN THUMBS UP: 100,230 U.S. VOTES

## Why Google Search Results Favor Democrats

It's not because the company is biased—the search is more complicated.

By Michael J. Kinsley, with Michael O'Halloran

BERNIE SANDERS, 2016 Democratic presidential candidate, speaks at a campaign rally in Milwaukee, Wisconsin.

## Women less likely to be shown ads for high-paid jobs on Google, study shows

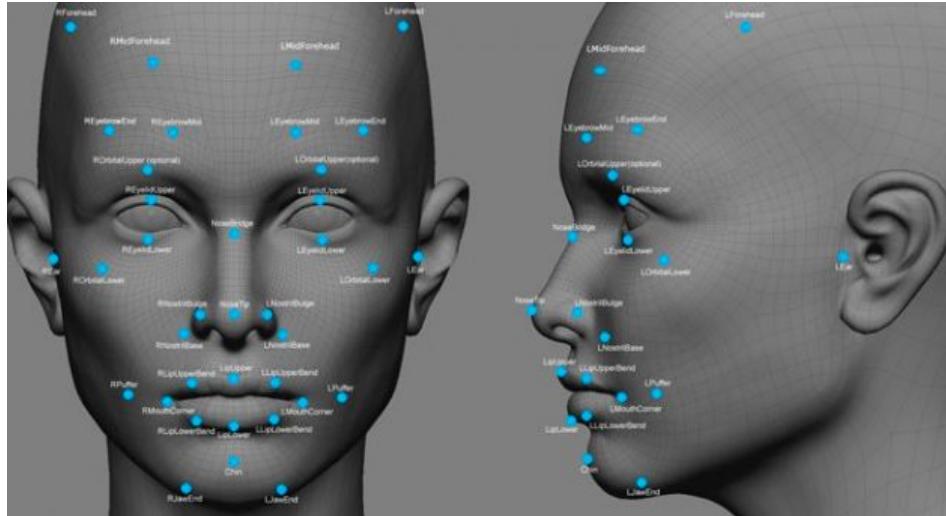
Automated testing and analysis of company's advertising system reveals male job seekers are shown far more adverts for high-paying executive jobs



# Facial Recognition Software

Joy Buolamwini (MIT)

- Software created by brand-name tech firms such as Amazon uncovered much higher error rates in classifying the gender of darker-skinned women than for lighter-skinned men.
- Other problems – unable to reliably detect Asian eyes
- Location of software companies and demographics = non-representative datasets used in algorithm development



# Significant Harms From Deployment of Algorithms

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- Called on Amazon to stop selling its facial recognition software to police.
- Caution about the fast-moving adoption of facial recognition by police, government agencies and businesses from stores to apartment complexes
- Computer vision systems that enable self-driving cars to “see” the road shows they have a harder time detecting pedestrians with darker skin tones.

## Courts use risk algorithms to set bail: A step toward a more just system?

**PROGRESS WATCH** Court systems in more than two dozen US cities and states are using algorithms that assess flight risk without considering race, gender, or socioeconomic status, in an attempt to remove implicit bias from the equation.

By Gretel Kauffman Staff | AUGUST 3, 2016



## Example 1: Algorithmic Decisions on Bail

The screenshot shows the header of a ProPublica article. At the top left is the ProPublica logo. To its right is a small image of a man. Next to the image are social media sharing icons for Facebook, Twitter, and LinkedIn, followed by a 'Donate' button. The main title 'Machine Bias' is prominently displayed in large white letters against a dark background. Below the title is a subtitle: 'There's software used across the country to predict future criminals. And it's biased against blacks.' The author's name, 'by Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, ProPublica', and the date, 'May 23, 2016', are listed at the bottom of the article header.

## Northpointe and COMPAS

In 2014, then U.S. Attorney General Eric Holder warned that the risk scores might be injecting bias into the courts. He called for the U.S. Sentencing Commission to study their use. "Although these measures were crafted with the best of intentions, I am concerned that they inadvertently undermine our efforts to ensure individualized and equal justice," he said, adding, "they may exacerbate unwarranted and unjust disparities that are already far too common in our criminal justice system and in our society."

The sentencing commission did not, however, launch a study of risk scores. So ProPublica did, as

# Value Laden Nature of Algorithmic Design

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"Algorithms are inescapably value-laden. Operational parameters are specified by developers and configured by users with desired outcomes in mind that privilege some values and interests over others...[O]peration within accepted parameters does not guarantee ethically acceptable behavior... for example, profiling algorithms that discriminate against marginalized populations"

(Mittelstadt, Allo, Taddeo, Wachter, Floridi, 2016)

# *What is an algorithm bias?*

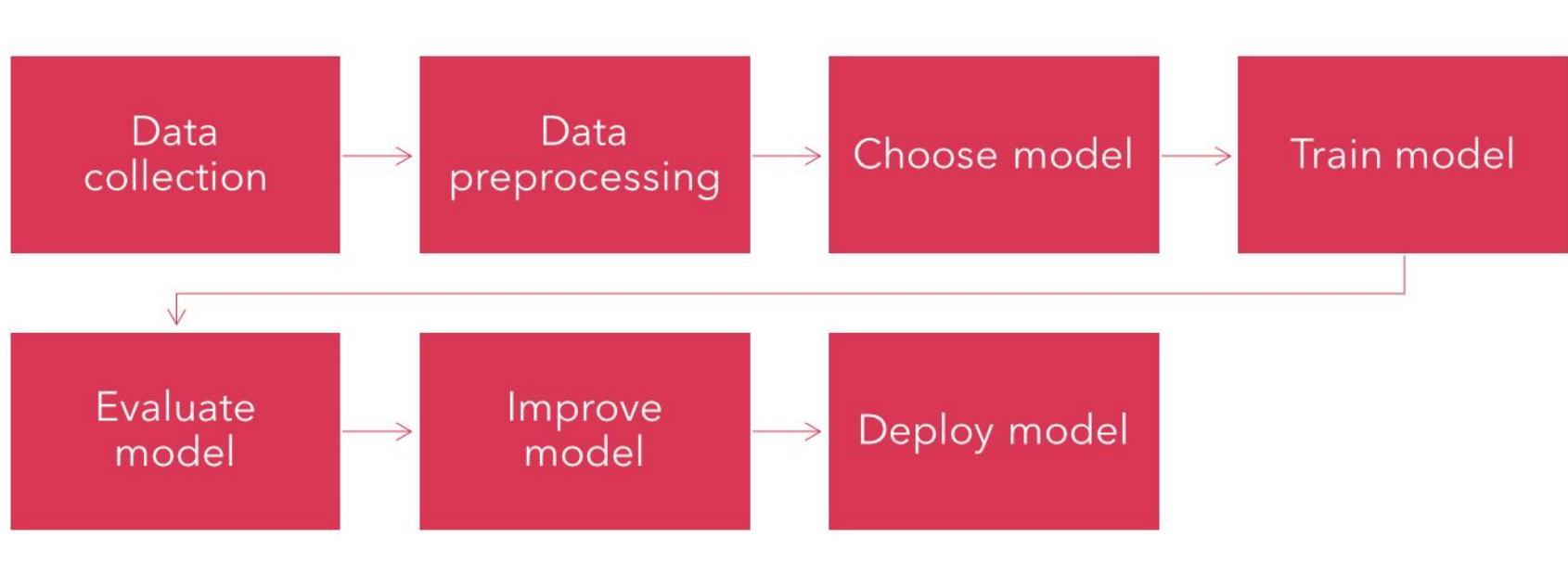
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Is an algorithm that demonstrates significantly different performance in a subgroup of the population of interest:

- *Demographic (racial, ethnicity, age, sex, gender, etc.) Socioeconomic (income, insurance status, etc.)*
- *Geographic (rural vs urban)*
- *Health system (community hospital, academic health center) Comorbidities*

An algorithm could be biased along one dimension or a combination of dimensions

# *How are machine learning algorithms made?*



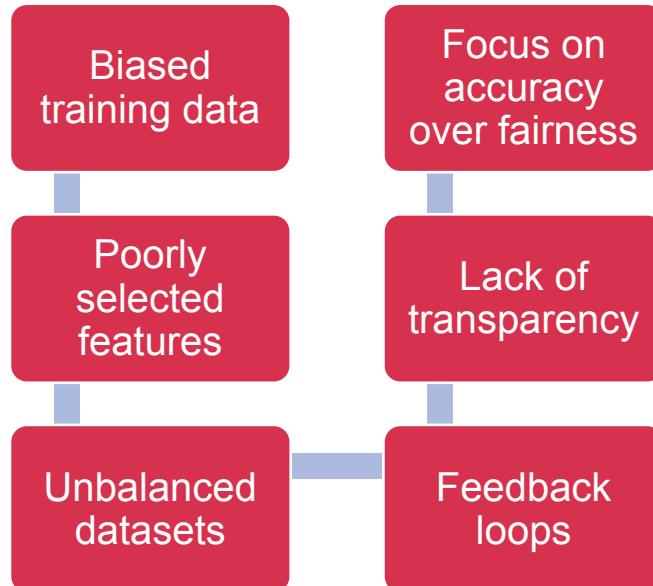
# *Different data types*

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- Testing data is the data used to test algorithmic performance after a system is trained.
- Operational data is used to make a prediction once the algorithm is in use (e.g., a patient's HER and sensor data used to determine a risk score for a patient).
- Clinical study/performance data are the results of evaluations of the algorithm
- Training data is used to initially teach the algorithm; learning algorithms use the data to find relationships between the data and the label/annotation(supervised machine learning) to make predictions.

# How does AI become biased or unfair?

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# The Difficult Nature of Identifying Biases

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- Only 20% of those predicted to commit a violent crime had gone on to do so
- Of those deemed likely to re-offend, 61% went on to be arrested, when misdemeanours such as driving with an expired license were included;
- Black people were almost twice as likely to be falsely labelled as at risk of future offending than white people;
- White people were mislabelled as low risk more often than black people;
- Even when statistical tests were run to isolate the effect of race from criminal history, recidivism, age and gender, black people were:
  - 77% more likely to be labelled as at risk of committing a future violent crime than white people
  - 45% more likely to be labelled as at risk of committing any kind of crime

# On Correcting for 'Real World' Bias

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*algorithms are inherently politicised [as connected to social policy and political power]... and reflect our current world view, our current social policy ... If we are not explicit about that as well, if we are not transparent about that, that we value equality between men and women, then we are again creating bias at another level of the system (Jirotka 2016)*

# Eliminating Human Bias?

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- In the early 2000s the US criminal justice system began using risk assessments to assist decision-making.
- Assessments are based on algorithmic calculations to predict, for instance, how likely an individual is to re-offend or fail to attend court for sentencing.
- Used to determine whether an individual should be granted bail or how long their sentence should be
- ‘Low risk’ offenders given shorter sentences and perhaps even kept out of jail entirely.
- Overcome human bias, or ...?

# A Vision for Algorithmic Design

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*We want our algorithms in a sense to follow a higher values, moral values that we think are more important than giving an exact reflection of the world. And that I think is a very interesting, but also in a sense very shady area in which, are we going to use the data as it is? Or are we going to change the data, or not change but adapt the way we look at the data to serve our purpose of being non-discriminatory...*

# Federal efforts to address bias and fairness in AI

## U.S. Food and Drug Administration (FDA)

- Good Machine Learning Practice for Medical Device Development: Guiding Principles (October 2021)
- Artificial Intelligence and Machine Learning (AI/ML) Software as a Medical Device Action Plan (January 2021)

## Federal Trade Commission (FTC)

- FTC Blog “*Aiming for truth, fairness, and equity in your company’s use of AI*” (April 2021)
  - Test for discriminatory outcomes, embrace transparency and independent evaluation, “do more good than harm”

## National Institute of Standards and Technology (NIST)

- A Proposal for Identifying and Managing Bias in Artificial Intelligence (June 2021)

## Office of the National Coordinator for Health Information Technology (ONC)

- ONC Artificial Intelligence Showcase - Seizing the Opportunities and Managing the Risks of Use of AI in Health IT (January 2022)

## Office of Science and Technology Policy (OSTP)

- OSTP Blog: “*Americans Need a Bill of Rights for an AI-Powered World*” (October 2021)

# How do you promote Data and AI literacy?

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- Get independent researchers to check your code/data selection/results to expose biases
- Always critically examine the decisions you're making in your research and ask "why do I think that way"?
- Be critical of the code and results you're using – how did they get to the point they did?
- Think about how other cultures will respond to your decisions

Do the data/coding choices you made contribute to just present and futures? Are you upholding the moral values of societies?

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# Thank You

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Please feel free to contact us with any further questions!

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