RN IT Italian Reproducibility Network

INTRODUCTORY TRAINING ON OPEN SCIENCE

Wednesday
1 February 2023

From 13:15 to 16:30

The event will be held in Polo Zanotto, Verona University, room T5 (Viale Università, 4, 37129 Verona VR)

THE EVENT WILL BE HELD ENTIRELY IN PRESENCE.

The reproducibility crisis in scientific research, a new research paradigm & ITRN presentation.
Carlo Miniussi, Center for Mind/Brain Sciences – CIMeC University of Trento

Open science practices: From registered reports to large-scale collaborative projects.
Marta Bortoletto, IRCCS Centro San Giovanni di Dio Fatebenefratelli, Brescia

Structuring experimental data: rethinking data acquisitions to enable replications.
Vittorio Iacovella, Center for Mind/Brain Sciences – CIMeC University of Trento

Multiverse analysis.
Michele Scandola, NPSY-Lab.VR, Department of Human Sciences, University of Verona

The reproducibility crisis in scientific research a new research paradigm & ITRN presentation

Carlo Miniussi

Center for Mind/Brain Sciences - CIMeC

Centre for Medical Sciences - CISMed

University of Trento, Rovereto (Trento), Italy

carlo.miniussi@unitn.it

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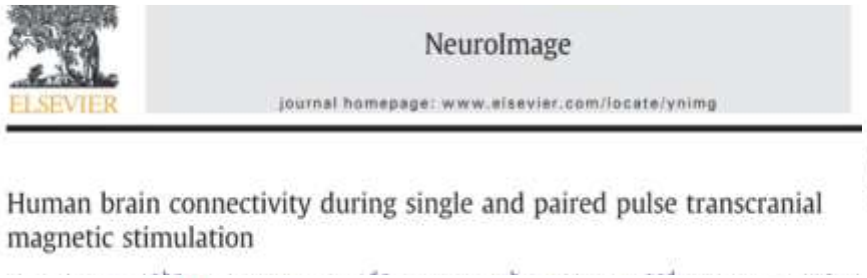
Presentation outline

- **The sustainability problem of science**
  e.g., questionable research practices
- **The principles and why of open science**
  e.g., FAIR
- **The benefits of collaborative culture**
  e.g., more efficient research processes, collaboration

Shifting from competition to collaboration

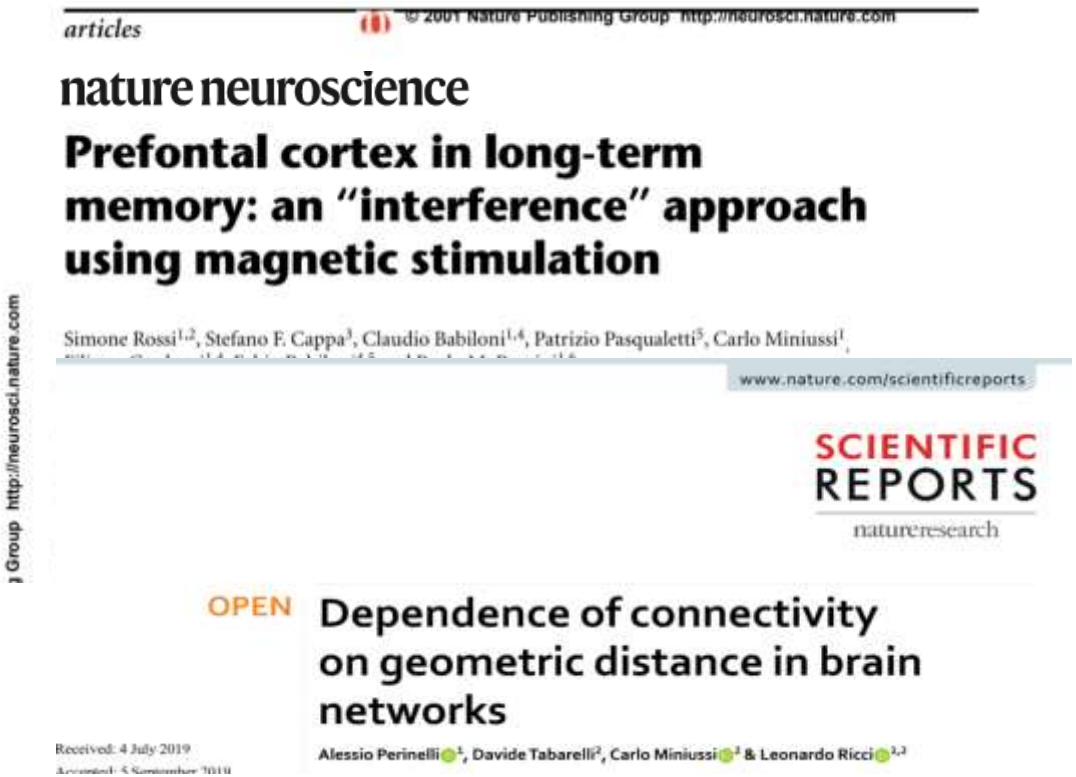
“Quantitative productivity” is this science or career?



NeuroImage

journal homepage: www.elsevier.com/locate/ynimg

Human brain connectivity during single and paired pulse transcranial magnetic stimulation



articles

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nature neuroscience

Prefontal cortex in long-term memory: an “interference” approach using magnetic stimulation

Simone Rossi[1,2], Stefano F. Cappa[3], Claudio Babiloni[1,4], Patrizio Pasqualetti[5], Carlo Miniussi[1],

www.nature.com/scientificreports

SCIENTIFIC REPORTS

nature research

OPEN

Dependence of connectivity on geometric distance in brain networks

Received: 4 July 2019

Alessio Perinelli[1], Davide Tabarelli[2], Carlo Miniussi[2,3] & Leonardo Ricci[2,3]

ELSEVIER

Neurology

COGNITIVE NEUROSCIENCE AND NEUROPSYCHOLOGY

NEUROREPORT

Available online at www.sciencedirect.com

SCIENCE DIRECT

Cognitive Brain Research 19 (2004) 259–268

COGNITIVE BRAIN RESEARCH

www.elsevier.com/locate/cogbrainres

Research report

Sub-second “temporal attention” modulates alpha rhythms. A high-resolution EEG study

Claudio Babiloni[a,b,c,*], Carlo Miniussi[b], Fabio Babiloni[a], Filippo Carducci[a,b,c], Febo Cincotti[a], Claudio Del Percio[a], Giulia Sirello[a], Claudia Fracassi[b], Anna C. Nobre[d], Paolo Maria Rossini[b,c,e]

[a]Dipartimento di Fisiologia Umana e Farmacologia, Università La Sapienza, Rome, Italy
[b]IRCCS S Giovanni di Dio Fatebenefratelli, Brescia, Italy
[c]AFaR-Dip. di Neuroscienze, S. Giovanni Calibita, Fatebenefratelli Isola Tiberina, Rome, Italy
[d]Department of Experimental Psychology, University of Oxford, Oxford, UK
[e]Neurologia, Università Campus Biomedico, Rome, Italy

Accepted 2 December 2003

right dorsolateral prefrontal sual change awareness

[A], Marco Sandrini[1,2] and Carlo Miniussi[1]

f Trento, Via Matteo del Ben 5, 38068 Rovereto, TN, Rovereto; [1]Cognitive Neuroscience Unit, rtment of Neurological and Vision Sciences, University of Verona, Verona, Italy

ponding Author: massimo.turatto@unitn.it

5 August 2004; accepted 18 September 2004

change blind- led that con- ed activity in nd right dor- of repetitive e causal role en rTMS was as compared

to left DLPF rTMS and sham stimulation. This result is important as it shows, for the first time, that conscious change perception is associated with normal activity in the right DLPF cortex. Our findings are in agreement with a recent view emphasizing the role of frontal areas, in addition to classical ventral and dorsal pathways, in visual awareness. NeuroReport 15:2549–2552 © 2004 Lippincott Williams & Wilkins.

words: Conscious perception; Change awareness; Prefrontal cortex; rTMS

Neuroscience 143 (2006) 793–803

CONVERSION FROM MILD COGNITIVE IMPAIRMENT TO ALZHEIMER'S DISEASE IS PREDICTED BY SOURCES AND COHERENCE OF BRAIN ELECTROENCEPHALOGRAPHY RHYTHMS

P. M. ROSSINI,[a,b,c*] C. DEL PERCIO,[a,d] P. PASQUALETTI,[b] E. CASSETTA,[b] G. BINETTI,[a] G. DAL FORNO,[c] F. FERRERI,[b,c] G. FRISONI,[a,b] P. CHIOVENDA,[b,c] C. MINIUSSI,[a,e] L. PARISI,[c] M. TOMBINI,[c] F. VECCHIO[b,d] AND C. BABILONI[a,b,d]

[a]IRCCS “Centro S. Giovanni di Dio-F.B.F.,” Brescia, Italy
[b]A. Fa.R., Dip. Neurosci. Osp. FBF, Isola Tiberina, Rome, Italy
[c]Clinica Neurologica University “Campus Biomedico” Rome, Italy
[d]Dip. Fisiologia Umana e Farmacologia, University “La Sapienza,” Rome, Italy
[e]Dip. Scienze Biomediche e Biotecnologia, University of Brescia, Brescia, Italy

Mild cognitive impairment (MCI) is a state of the elderly brain intermediate between normal cognition and dementia, being mainly characterized by objective evidence of memory impairment not yet encompassing the definition of dementia (Petersen et al., 1995, 2001).

There is a growing consensus on the idea that MCI is a precursor of Alzheimer's disease (AD) (Scheltens et al., 2002) based on the high rate of progression from this state to AD (Petersen et al., 2001). Indeed, in normal aging population annual conversion rate to AD ranges from 0.17% to 3.86% (Petersen et al., 2001; Frisoni et al., 2004), while in MCI it is remarkably higher ranging between 6 and 40% in the different series (Petersen et al.,

Integrity & Reliability

Nowadays it becomes extremely difficult to know whether what is reported in an article is a transparent and valid account of what was actually done and found.

“Most scientific publications are utterly redundant, mere quantitative productivity” Gerhard Fröhlich

How do we identify, read and evaluate new information of interest in this “sea” of ~~research~~ papers?

Science sustainability

Research misconduct as

“not only fabrication, falsification, or plagiarism …”

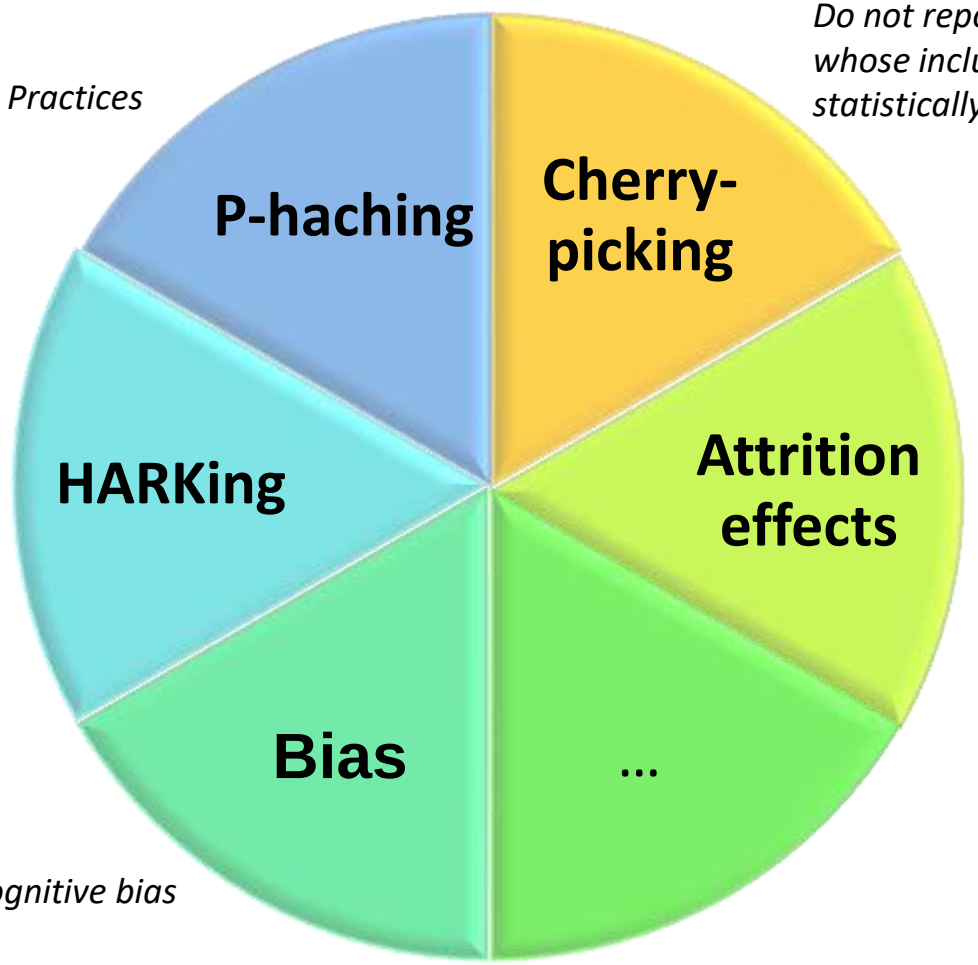
“questionable research practices occur in 72% of published science” Fanelli 2009

Origins of redaction bias

Questionable Research Practices that undermine the credibility of research finding and bias the scientific literature: exclusion or manipulation of data that are not consistent (with research hypotheses)

Questionable Statistical Practices

Do not report variables /conditions/treatments whose inclusions does not lead to interesting or statistically significant results (Franco et al 2016)



A posteriori approach

Specific subset of the experimental cohort has been removed relative to the control

Cognitive bias

“we need to report changes in statistical approaches, report all the information on what we have done… ”

Grimes DR, Heathers J. 2021

Inappropriate Research Practices

Questionable Research Practices

P-hacking

- Finish collecting data earlier than expected if the result are statistical significant (Le Bel et al., 2013)
- Deciding to collect more data after checking for statistical significance
- Chose to exclude individual data after checking if they affect statistical significance
- Use “analyses approaches” that make $p < .05$

But see also: select the analyses after looking at the data (Gelman & Loken 2014)

HARKing (Hypothesizing After Results are Know)

- Present unexpected results as if they were foreseen from the start
- Report results congruent with the hypotheses (Fanelli 2010)
- Exploratory analyses are reported as confirmatory (Wagenmakers et al., 2012)

Questionable Research Practices

Pertinent examples of this range from:

the fraudulent research that deviously and **wrongly linked the measles-mumps-rubella vaccine to autism**

- Godlee F. 2011 The fraud behind the MMR scare. Br. Med. J. 342, d22. (doi:10.1136/bmj.d22)
- Grimes DR. 2019 A dangerous balancing act: on matters of science, a well-meaning desire to present all views equally can be an Trojan horse for damaging falsehoods. EMBO Rep. 20, e48706. (doi:10.15252/embr.201948706)

to the substandard trials that gave the false impression **ivermectin was a viable COVID treatment**

- Lawrence JM, Meyerowitz-Katz G, Heathers JA, Brown NJ, Sheldrick KA. 2021 The lesson of ivermectin: meta-analyses based on summary data alone are inherently unreliable. Nat. Med. 27, 1853–1854. (doi:10.1038/s41591-021-01535-y)
- Reardon S. 2021 Flawed ivermectin preprint highlights challenges of COVID drug studies. Nature 596, 173–174. (doi:10.1038/d41586-021-02081-w)

Mars & Pareidolia

Trends in Cognitive Sciences
Research Culture and Reproducibility CellPress REVIEWS

Marcus R. Munafò,[1,2,*]
Christopher D. Chambers,[3]
Alexandra M. Collins,[4]
Laura Fortunato,[5,6] and
Malcolm R. Macleod[7]

February 2020, Vol. 24, No. 2

Citation bias

Misemer et al. Trials (2016) 17:473
DOI 10.1186/s13063-016-1595-7

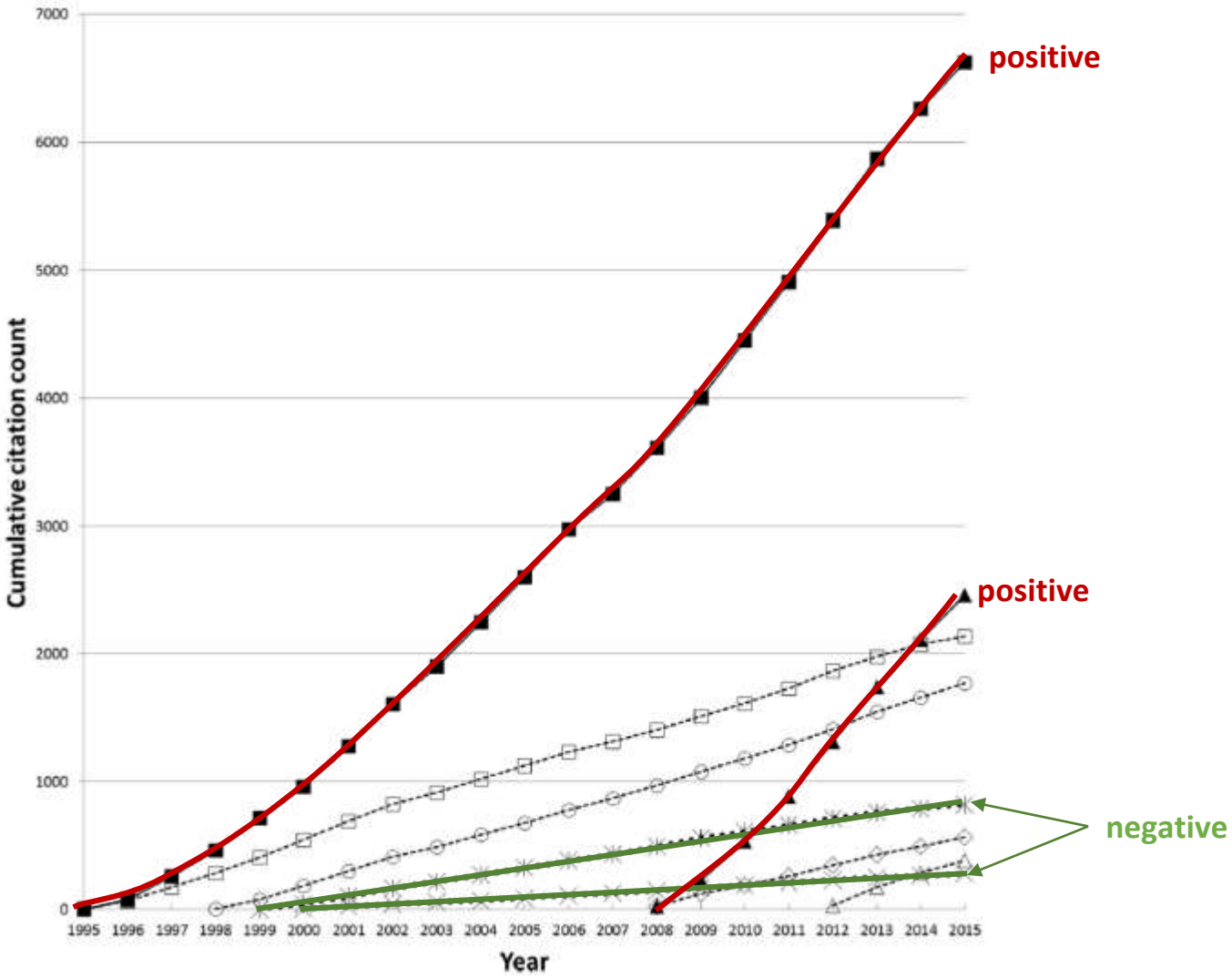
Trials
RESEARCH Open Access

Citation bias favoring positive clinical trials of thrombolytics for acute ischemic stroke: a cross-sectional analysis

Benjamin S. Misemer[1], Timothy F. Platts-Mills[2] and Christopher W. Jones[1*]

"when positive trials involving a medical intervention receive more citations than neutral or negative trials of similar quality"

"Cumulative citation counts over time for:
2 **positive** (solid lines),
4 **neutral** (dashed lines), and
2 **negative** (dotted lines)…"



Trials registered in ClinicalTrials.gov

RESEARCH ARTICLE PLOS ONE | DOI:10.1371/journal.pone.0132382 August 5, 2015

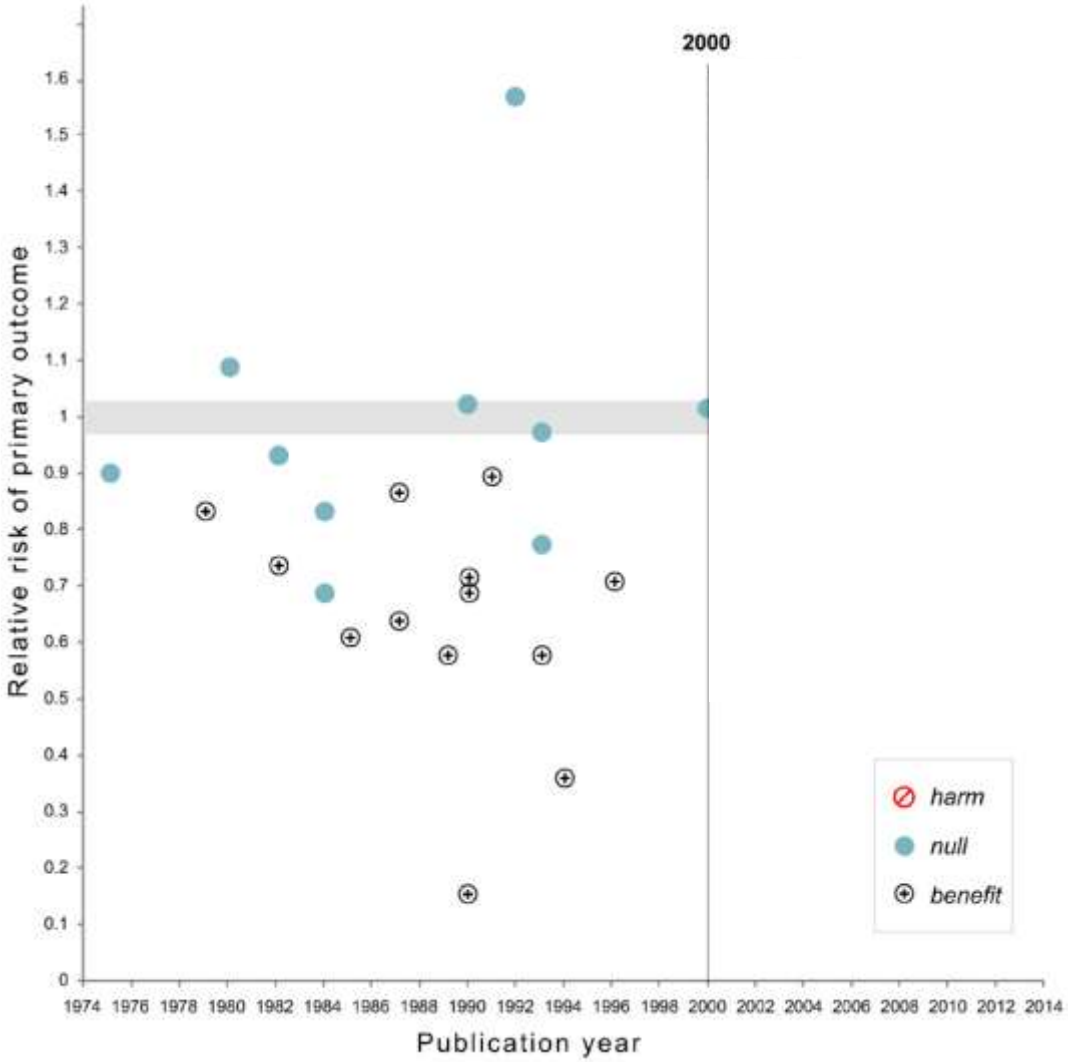
Likelihood of Null Effects of Large NHLBI Clinical Trials Has Increased over Time

Robert M. Kaplan[1]*, Veronica L. Irvin[2]

"Prior to 2000 when trials were not registered in clinical trials.gov, there was substantial variability in outcome.

Following the imposition of the requirement that trials preregister in clinical trials.gov the relative risk on primary outcomes showed considerably less variability around 1.0."

ClinicalTrials.gov PRS
Protocol Registration and Results System



"Relative risk of showing benefit or harm of treatment by year of publication for large National Heart Lung, and Blood Institute trials on pharmaceutical and dietary supplement interventions. "

What is the Primary Purpose of Open Science Practices?

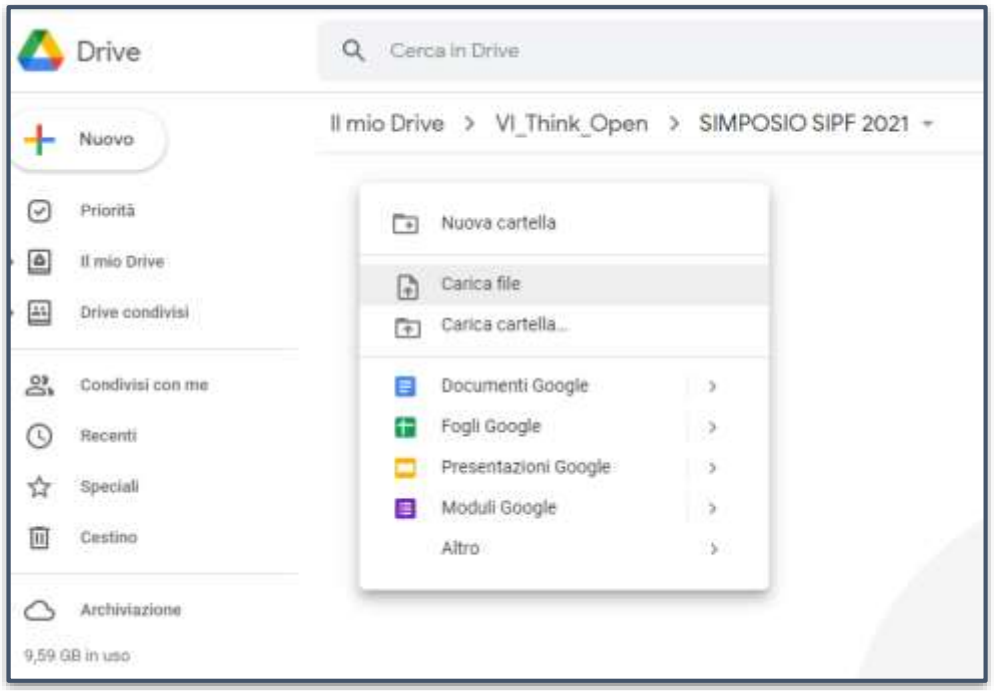
"… purposes of open science practices is **to improve the openness, integrity, and reproducibility of research** by preventing research misconduct or **reducing questionable research and/or reporting practices**"

Banks, G.C., Field, J.G., Oswald, F.L. et al.. J Bus Psychol 34, 257–270 (2019). https://doi.org/10.1007/s10869-018-9547-8

Shifting from competition to collaboration

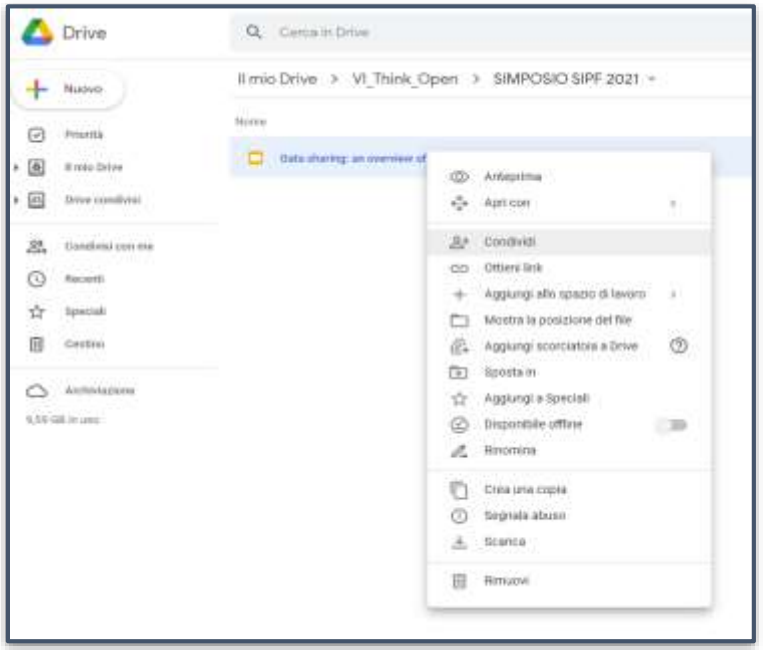
Data sharing

Not just



uploading information

and granting access to someone else



FAIR Principles for sharing

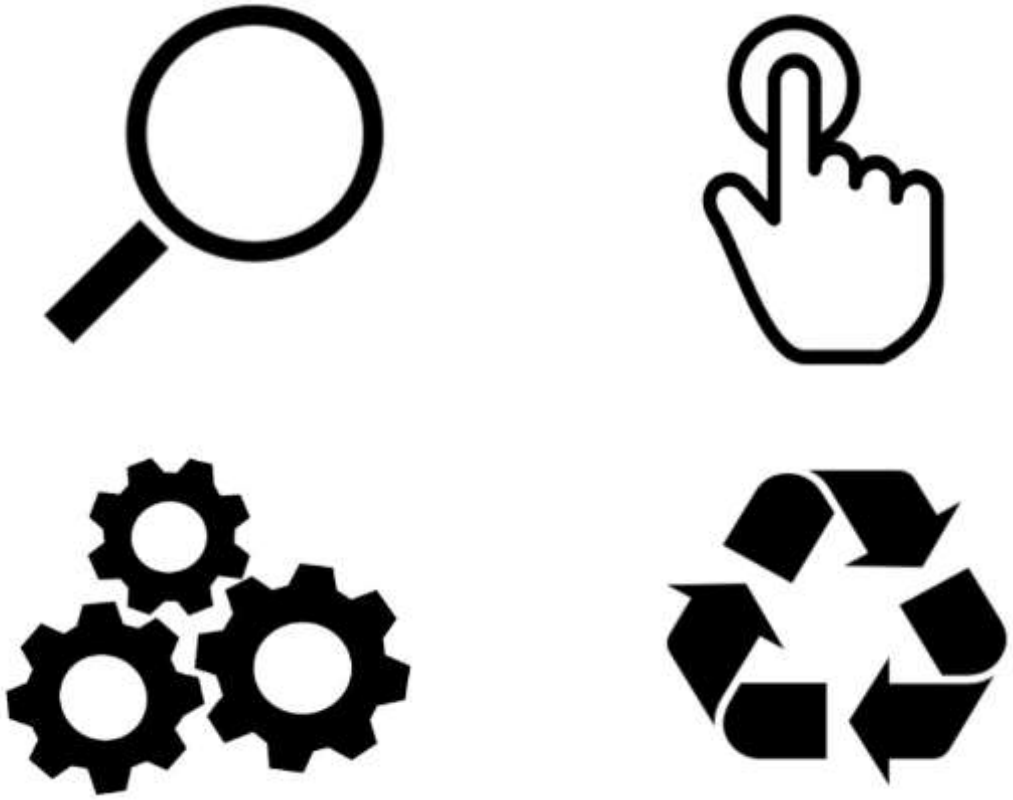
data available upon reasonable request

FAIR Principles for sharing: the pillars of open science

Guidelines to improve the Findability, Accessibility, Interoperability, and Reuse of digital assets

Findable

Accessible



Interoperable

Reusable

Wilkinson et al. Sci Data 3, 160018 (2016).
https://doi.org/10.1038/sdata.2016.18

Initiative https://force11.org/

FAIR Principles for sharing: the pillars of open science

Findable

(Meta-) data are assigned a globally unique identifier and indexed in a searchable resource.

Digital object identifier 10.1016/j.neuroimage.2021.118272

https://orcid.org/
0000-0002-5436-4745

ORCID
stands for
Open Researcher and Contributor ID

http://toolbox.google.com/datasetsearch

FAIR Principles for sharing: the pillars of open science

Accessible

GIN

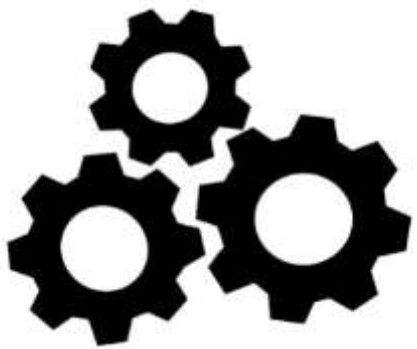
https://gin.g-node.org/

gin.g-node.org/CIMeC/TMS-EEG_brain_connectivity_BIDS

From https://www.go-fair.org/fair-principles/metadata-retrievable-identifier-standardised-communication-protocol/

FAIR Principles for sharing: the pillars of open science

(Meta-) data use a formal, accessible, shared, and broadly applicable language for knowledge representation.



Interoperable

From https://www.go-fair.org/fair-principles/i1-metadata-use-formal-accessible-shared-broadly-applicable-language-knowledge-representation/

FAIR Principles for sharing: the pillars of open science

(Meta-) data are richly described with relevant attributes, released with a clear and accessible data usage license.

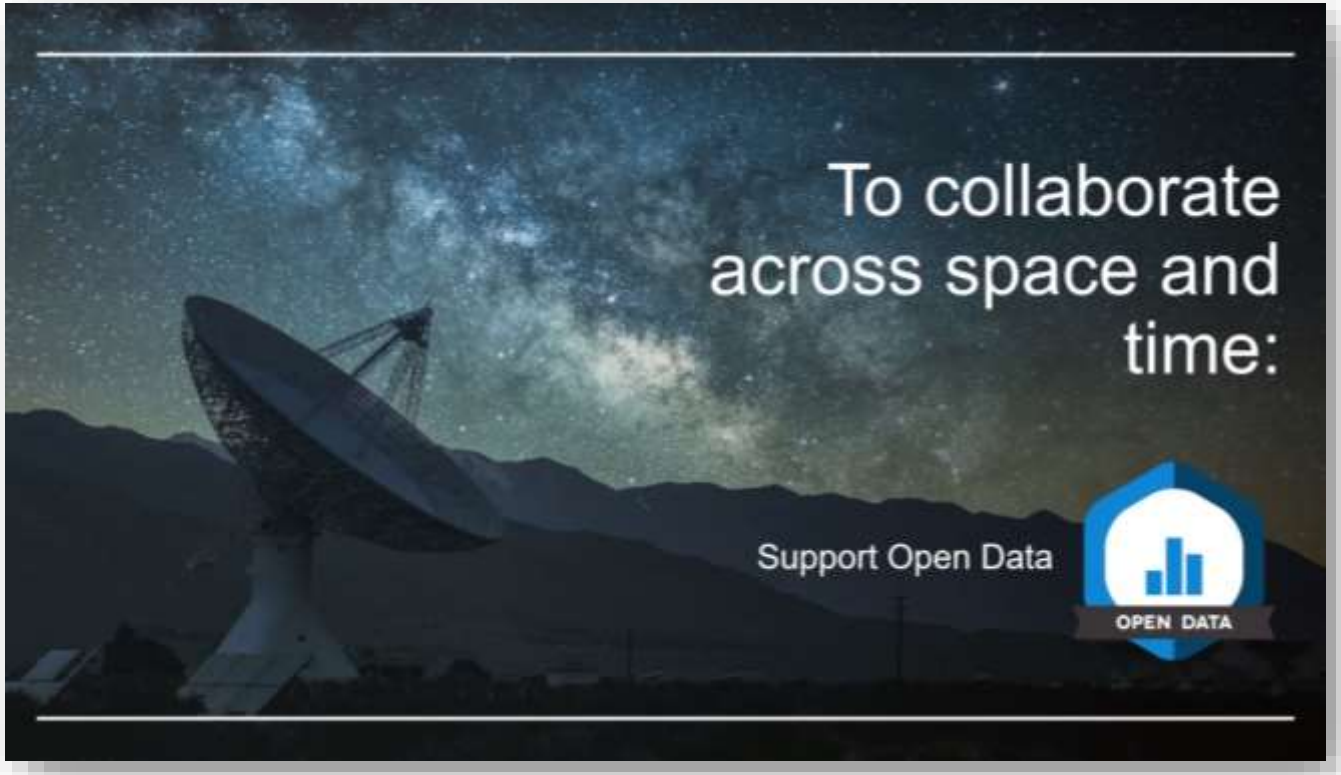
https://creativecommons.org/about/cclicenses/

Reusable

From https://www.go-fair.org/fair-principles/r1-1-metadata-released-clear-accessible-data-usage-license/

Shifting from competition to collaboration

Collaborative projects – to grant reliability



- Consortium of researchers interested in one “subject” of research
- Radically collaborative, horizontal framework (everyone can lead and contribute)
- Large scale conceptual, consensus-based replication of seminal findings
- Identify sources of variability
- Experimental “best practices” in a given field of research

i.e., fewer original designs but more reliable studies

Shifting from competition to collaboration

Open data vs. data protection

- Opening data is indispensable for scientific progress and can benefit the entire community in terms of an improved knowledge (e.g., public health)
  - Open Science Paradigm

- The use of personal health data for **scientific research purposes** shall comply with the data protection framework to safeguard fundamental rights and freedoms of the data subjects
  - European and national rules to be taken into account

Think Open

- Open data include and grantees **integrity** of research (i.e., reliability, rigor, and replicability). This is a relevant issue to define the international reputation of a research center. Reliability is becoming essential in science.

- For Open data we will reduce costs and increase reputation, for cost **optimisation**.

- Putting big data to good use in neuroscience, will increase collaboration and integration with other centers/groups **implementing relevant discoveries** accelerates research, heightens the quality of results.

What is the Primary Purpose of Open Science Practices?

"Open science is a very broad term that **refers to many different concepts**, ranging from scientific philosophies and cultural norms, such as the ownership of scientific methods (i.e., communality) and the **principle that scientific output should be evaluated on its merit** (i.e., universalism) (Anderson, Martinson, & De Vries, 2007"

"This is a great opportunity to improve the "scientific" world."

Open Science - ITRN

ITALIAN REPRODUCIBILITY NETWORK

https://www.itrn.org

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https://www.itrn.org

MISSION

The Italian Reproducibility Network (ITRN) is a peer-led consortium that aims to

disseminate the factors that contribute to robust research within the Italian scientific community.

This is achieved by *promoting initiatives and offering a hub for scientists to get in touch, exchange ideas and good practices, and promote collective learning*.

ITRN seeks collaboration with **scientists in several disciplines**, **technical experts** in relevant fields and **stakeholders**, so as to connect the widest possible spectrum of skills and knowledge.

ITALIAN REPRODUCIBILITY NETWORK

IT Italian Reproducibility Network

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Australian Reproducibility Network

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Swiss Reproducibility Network

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https://www.itrn.org

ITALIAN REPRODUCIBILITY NETWORK

The IT Reproducibility Network is supporting several initiatives at various levels across the Italian research system, promoting training activities, disseminating best practice, and working to ensure coordination of efforts across the sectors.

- **Promote Open Research Working Groups**

These are set up by researchers at their institution, and seek to make the processes and products of research as transparent, accessible, and reproducible as possible.

- **International Seminars for PhD on Open Science**

The framework aims to support the teaching of open and reproducible research practices by organizing a cycle of seminars that captures the aspects of open and reproducible research.

- **ReproCofee**

An initiative developed by early-career researchers that aims is to build a community of researchers interested in open and reproducible research.

- Promote **Collaborative projects** – to grant reliability: Co-development and co-production of scientific research (i.e., fewer original designs but more reliable studies)

- **Tutors "hands-on" meetings**

Join the Italian Reproducibility Network

https://www.itrn.org

The presentation is available @
or by writing to carlo.miniussi@unitn.it

Thank you for your attention

"Transparent and impartial reporting of clinical trial results will ultimately identify the treatments most likely to maximize benefit and reduce harm." Kaplan & Irvin 2015

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CIMeC Center for Mind/Brain Sciences

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