

Open Science: with great data comes great responsibility

Nikola Stikov and Estrid Jakobsen

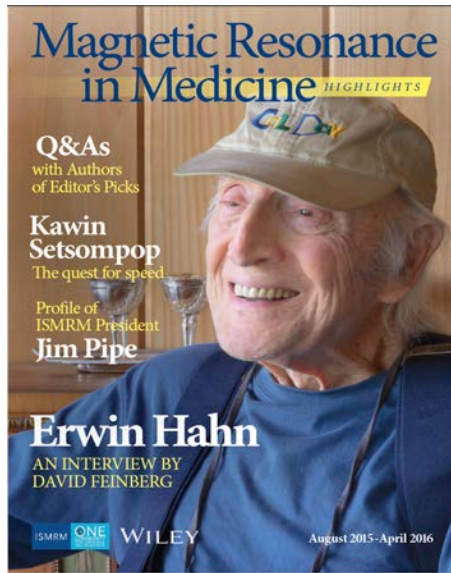


with Matthieu Dupuis and Catherine Duquette

My role in science communication



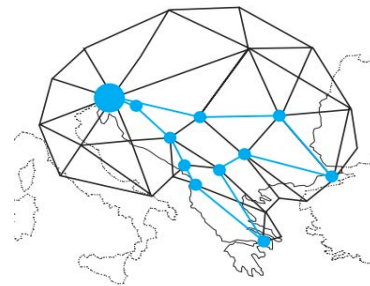
www.humanbrainmapping.org/blog



www.ismrm.org/mrm



blog.ismrm.org



WWW.MRBALKAN.ORG

**MAGNETIC RESONANCE
IN MEDICINE**

ISMRM **ONE**
COMMUNITY
FOR CLINICIANS
AND SCIENTISTS

Bridging the macro-micro gap: biophysical MR modeling of the central nervous system

Christine Tardif, PhD
Douglas Mental Health Research Institute
McGill University

Nikola Stikov, PhD
École Polytechnique / Montreal Heart Institute
University of Montreal



MR Imaging of Brain Microstructure

Guest Editors:

Prof. Bruce Pike [✉ bruce.pike@ucalgary.ca]

Prof. Daniel C. Alexander [✉ d.alexander@ucl.ac.uk]

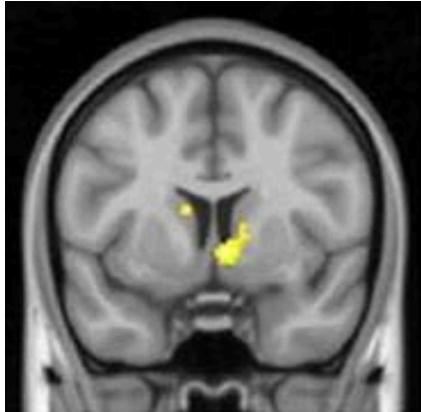
Prof. Nikola Stikov [✉ nikola.stikov@polymtl.ca]

My role in teaching



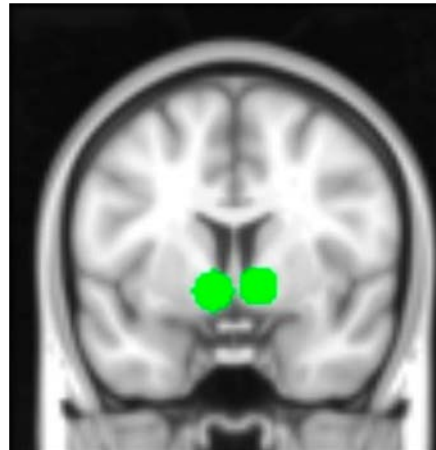
This is your brain on fMRI

This is your brain
on beer



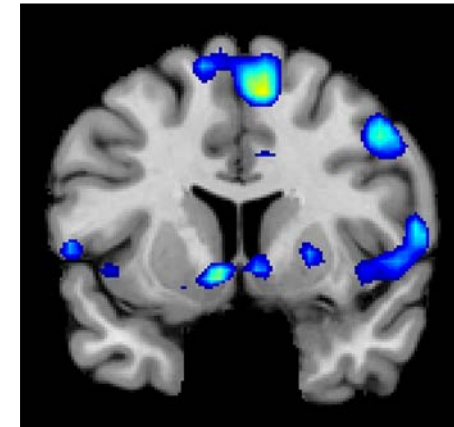
Oberlin et al.
Alcoholism: Clinical and Experimental
Research (2016)

This is your brain
on social media



Sherman et al.
Psychological Science (2016)

This is your brain
on God



Ferguson et al.
Social Neuroscience (2016)

What lay media says



EXPRESS Home of the Daily and Sunday Express

HOME NEWS SHOWBIZ & TV SPORT COMMENT FINANCE

UK WORLD POLITICS ROYAL SCIENCE WEATHER WEIRD NATURE SUNDAY

Home > News > UK

5 reasons car leasing might be better for you than buying a new...

Royal wedding 2019: FIRST PICTURES as bride Lady Gabriella...

REVEALED: Two EU countries could JOIN Britain by quitting the...

Religion lights up the 'same brain area as DRUGS and SEX'

FEELING God's spirit lights up the same areas of the brain as the more earthly desires of drugs, music, gambling and sex, scientists have revealed.

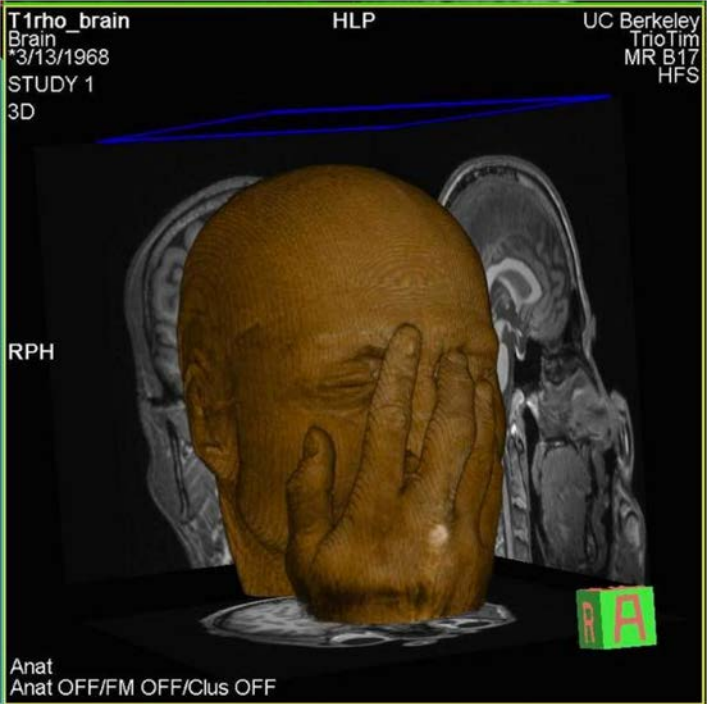
Do You Believe in God, or Is That a Software Glitch?

By KATE MURPHY AUG. 27, 2016



Yoshi Sodeoka

What the scientists say



@PractiCalfMRI

Scientific publishing

THE LONDON GAZETTE.

Published by Authority.

From Monday, September 3, to Monday, September 10, 1666.

Whitehall, Sept. 8.

THE ordinary course of this paper having been interrupted by a sad and lamentable accident of Fire lately happened in the City of London; it hath been thought fit to satisfy the minds of some of our Majesties good Subjects who must needs be concerned for the issue of an great assurance, to give this sheet, but soon Accomplish'd.

On the second part of, at one of the Clocks in the Morning, there happen'd a knock out, a fall in the Church Steeple in *Phildring Lane*, near *St. Dunstons*, which falling out at the hour of the night, and in a quarter of the Town, as close built with wooden houses spread itself as far before day, and set such distraction to the inhabitants that notwithstanding there were not taken for the timely preventing the further diffusion of it, by the blowing houses, as ought to have been so done, it became in a short time became too big to be moved by any Engines or working near it. It fell out most unhappily too, that a violent Faculty wind rained it, and kept it burning all that day and the night following, spreading itself by the *Grassmarket* and *Downward* from *Compass* to the *Water-side*, as far as the *Three Crosses in the Strand*.

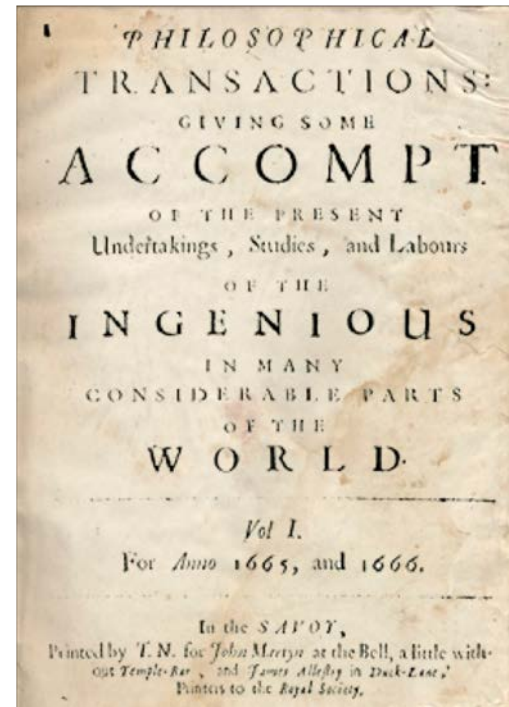
The people in all parts about it, distressed by the violence of it, and their particular care to every way their Goods, many attempts were made to prevent the spreading of it, by pulling down Houses and burning out the materials in which it first began, as the *Trincher* and *Killick*, and so continuing it yet even through those ways, and raze in a night down all *Monday* and *Tuesday*, yet notwithstanding His Majesties care, and His Royal Highness's indefatigable and personal pains to apply all possible remedies to prevent it, calling upon and helping the people with their Goods, and a great number of *Volunteers* and *Country* gentlemen assisting therein, for which they were requir'd with a thousand Blessings from the poor distressed people, by the favour of God, the Wind abated a little on *Tuesday* night, so the Flames ceasing with break holidays at the *Temple*, by the word of God it was thought to have been on the 5th day, to cast an Engine for trying it, we began to work with an Engine, but His Highness never desisted of watching his personal care, whereby he had that day assisted in some parts by the Lord of the Council before and behind it, that a stop was put to it at the *Temple*

Church, near *Holborn*, *St. Dunstons*, *Albion*, *Gravel Lane*, near the lower end of *Chancery Lane*, at the end of *the* *Chancery* by the *Gravel* at the upper end of *St. Dunstons* street and *Leadenhall* street, at the *Street* in *Chancery* at the church in *St. Dunstons* street, near *Chancery*, *St. Dunstons*, at the middle of *St. Dunstons*, and at the *Street* *St. Dunstons*.

On *Thursday* by the blessing of God it was wholly burnt down and extinguish'd. It so is that burning it principally burnt out again first at the *Temple*, by the falling of some sparks (as it is generally upon a pile of *Wooden* buildings; but His Royal Highness who watches them that night in *London*, by the great labours and diligent watch, and especially by applying Power to blow up the Houses about it, he had day most happily extinguish'd.

Divers *Strangers*, *Dutch* and *French* were, during the fire, apprehended upon suspicion that they contributed uncharitably to it, who are all imprisoned, and Informations prepar'd to make a severe Inquisition here upon by my Lord Chief Justice *Killegrew*, assisted by some of the Judges of the *King's Bench*; and some excellent Members of the City, who observing who's suspicion, the number of the burning all along to a *Temple*, and so blown towards it all its way by strong Winds, make to conclude the whole was an effect of an unhappy chance, or to speak better, the heavy hand of God made us for our sins, therefore the favour of His Judgment in this striking the Fire, and immediately came His Majesty's commandment to the City, to send forth a party to stay to it when we were in the last distress, and that all attempts for quenching it however industriously perform'd should be void. His Majesty's commandment in Council and ever since hath continued making orders, and the City had parts of it where the danger and mischief was greatest, till this morning that his Majesty's King the Duke of *Albany* was by the King called for to come with him in this great occasion, to put his happy and successful hand to the finishing this memorable calamity.

About the *Temple* the several efforts given for quenching down the Flames to stop at the *Temple* of *London* was more generally intended, they put down by the Wind, notwithstanding which it came almost to the very Gates of it. So as by this early prevention the general course of War halting in the Town was entirely saved, and we have further the intimate cause to give God thanks, that the Fire did not begin where



Gatekeeping (peer-review)

Dear Sir,

We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists before it is printed. I see no reason to address the — in any case erroneous — comments of your anonymous expert. On the basis of this incident I prefer to publish the paper elsewhere.

Respectfully,

Albert Einstein, 1936

Publishing

Lifecycle of Scholarly Communication



PMC full text: [Proc Natl Acad Sci U S A. 2014 Jul 1; 111\(26\): 9425–9430.](#)
 Published online 2014 Jun 16. doi: [10.1073/pnas.1403006111](#)
[Copyright/License](#) ▶ [Request permission to reuse](#)

Table 1.

Estimated 2009 mean bundle prices by Carnegie type

Publisher	Research 1, \$	Research 2, \$	Master's, \$
Elsevier	1,159,137	366,771	89,190
Springer	382,286	184,583	52,692
Wiley	329,535	94,072	30,726

Proc Natl Acad Sci U S A

How costs break down

An economic model shows how switching from subscription to open access changes the costs of publishing.

■ = US\$100

Subscription
PRINT & ONLINE
(\$4,871)



Cuts out costs
of typesetting
and printing

Subscription
ONLINE ONLY
(\$3,509)



Simplifies sales
administration
and user
management

Open access
ONLINE ONLY
(\$2,289)



▨ Voluntary peer review (not counted in price)
Additional cost if reviewers were paid for their time.

■ Article processing

Administering peer review (assuming average rejection rate of 50%); editing; proofreading; typesetting; graphics; quality assurance.

■ Other costs

Covers, indexes and editorial; rights management; sales and payments; printing and delivery; online user management; marketing and communications; helpdesk; online hosting.

■ Management and investment

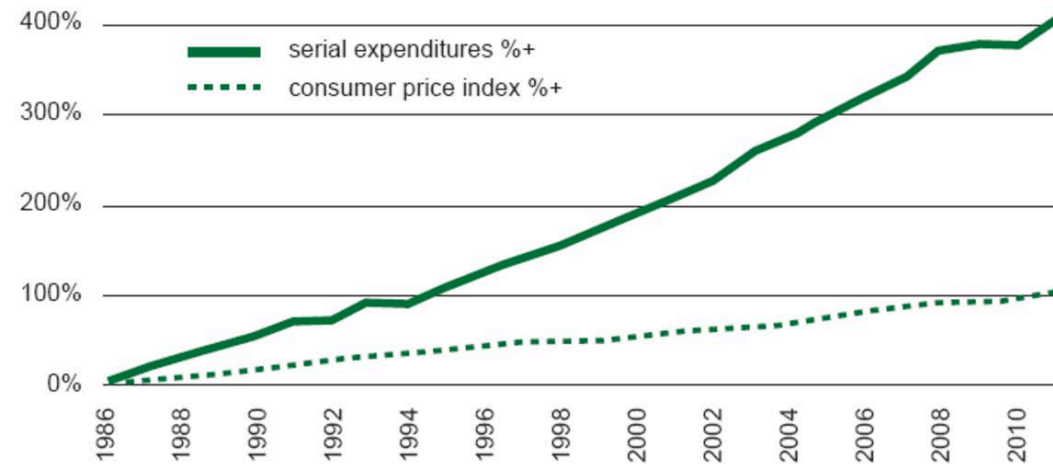
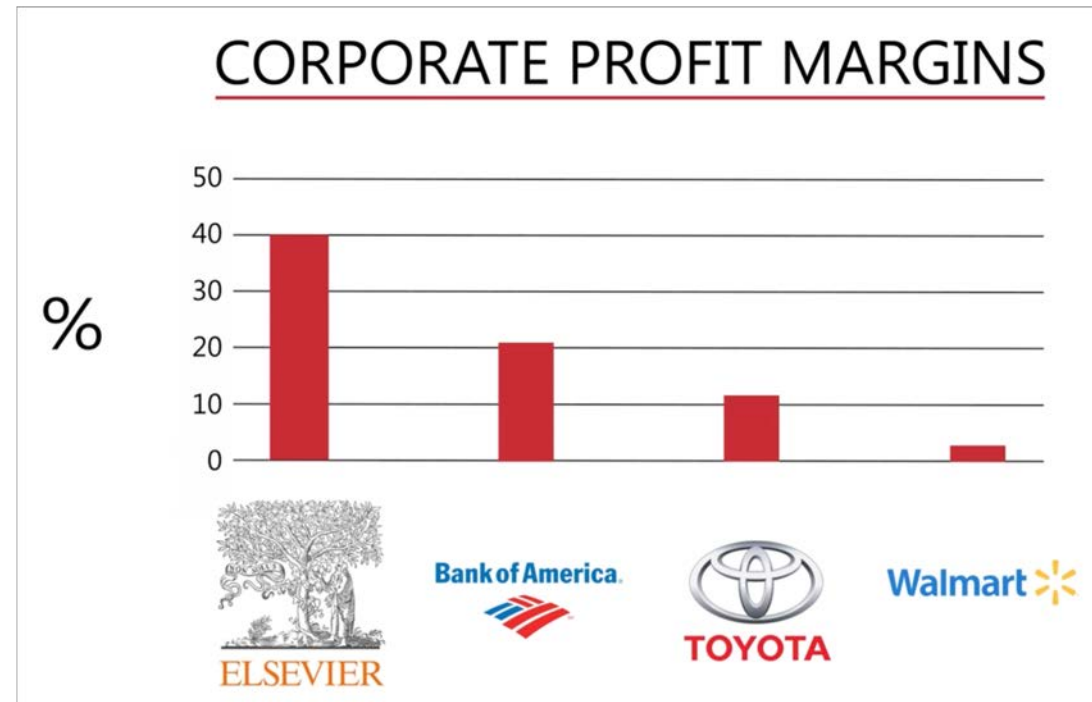
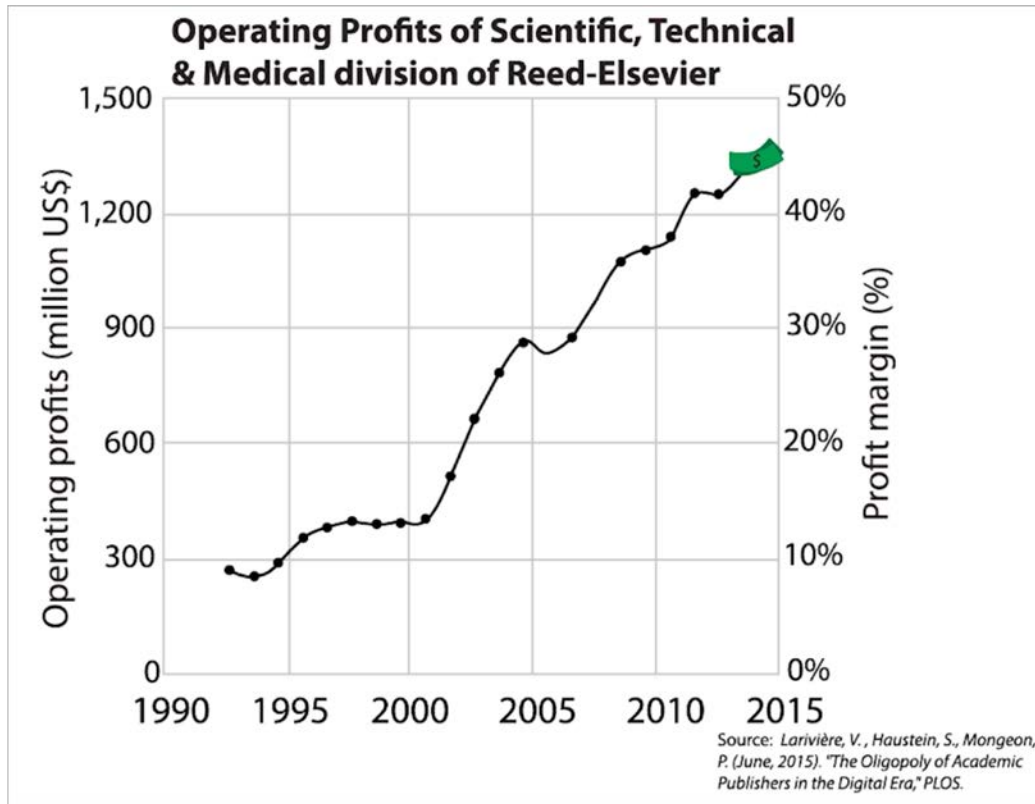
Includes cost to establish journal: assumed 20% subscription; 15% open access.

■ Margin

Assumed 20% subscription; 15% open access.

Data from J. Houghton et al. *Economic implications of alternative scholarly publishing models* (Joint Information Systems Committee, 2009); available at [go.nature.com/uqrxqw](#).

You pay for this!



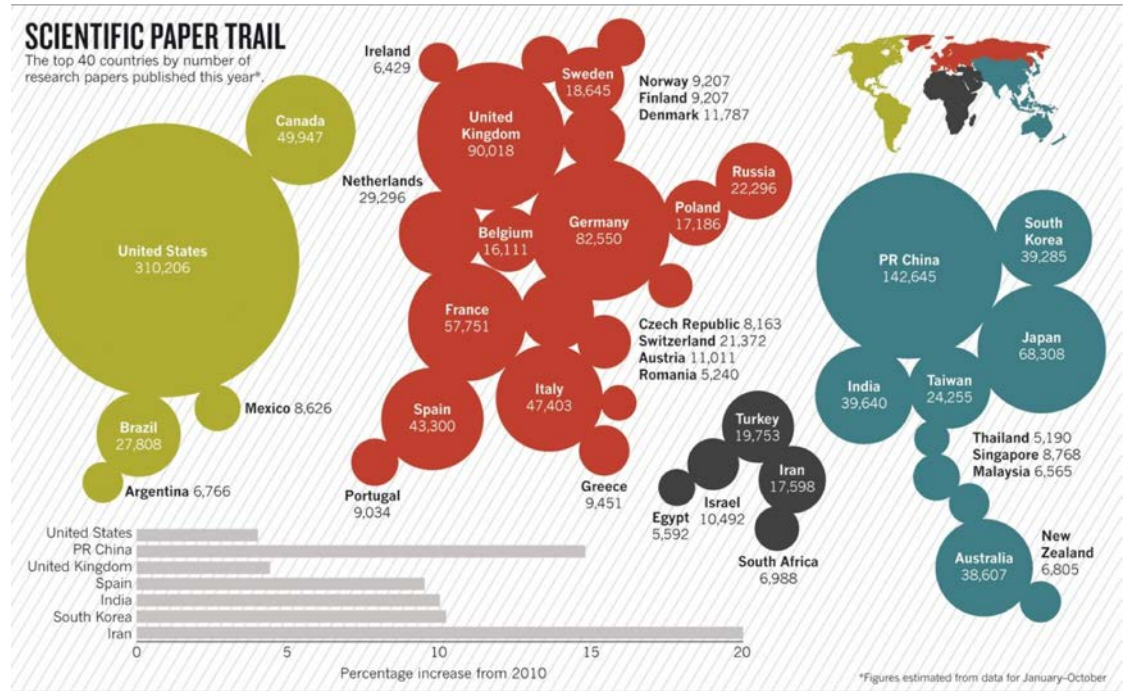
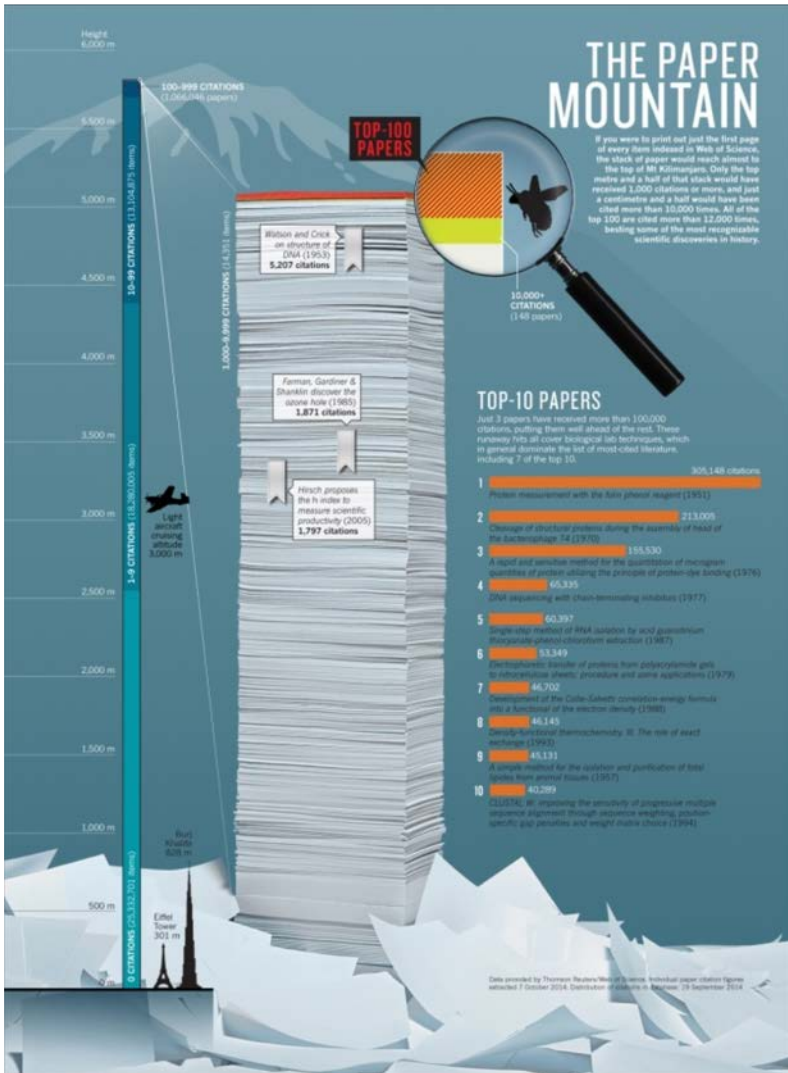


The long read

Is the staggeringly profitable business of scientific publishing bad for science?

<https://www.theguardian.com/science/2017/jun/27/profitable-business-scientific-publishing-bad-for-science>

A paper is a 17th century artifact

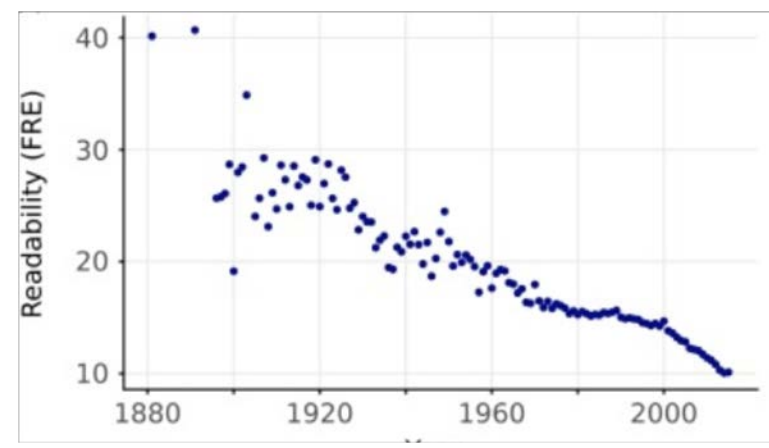
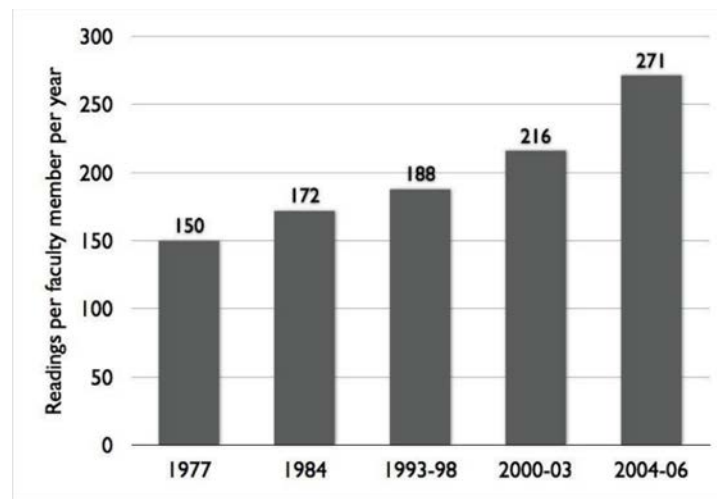
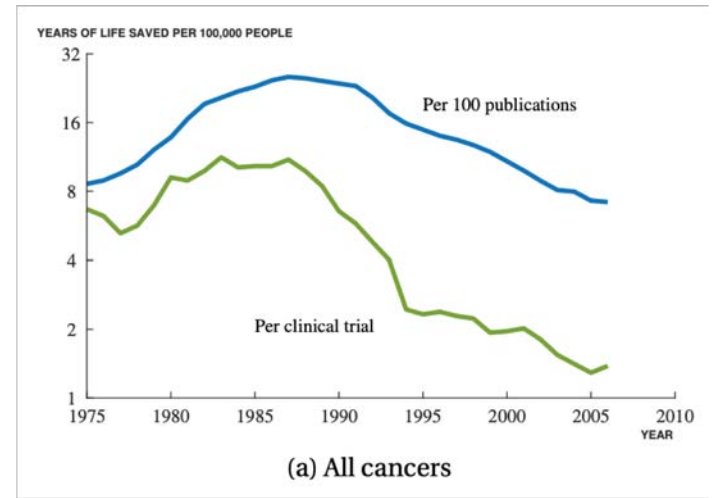
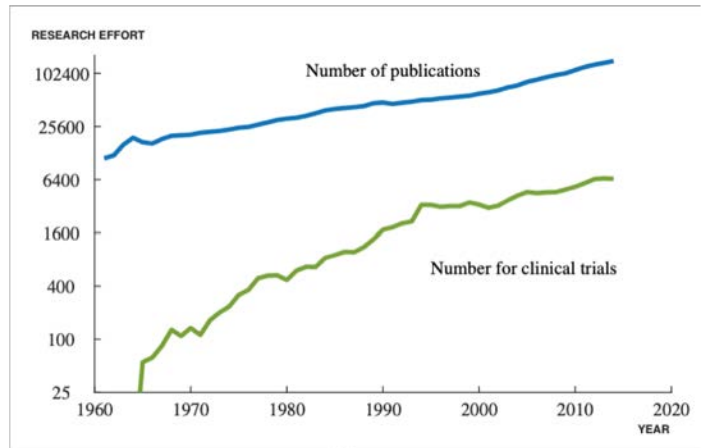
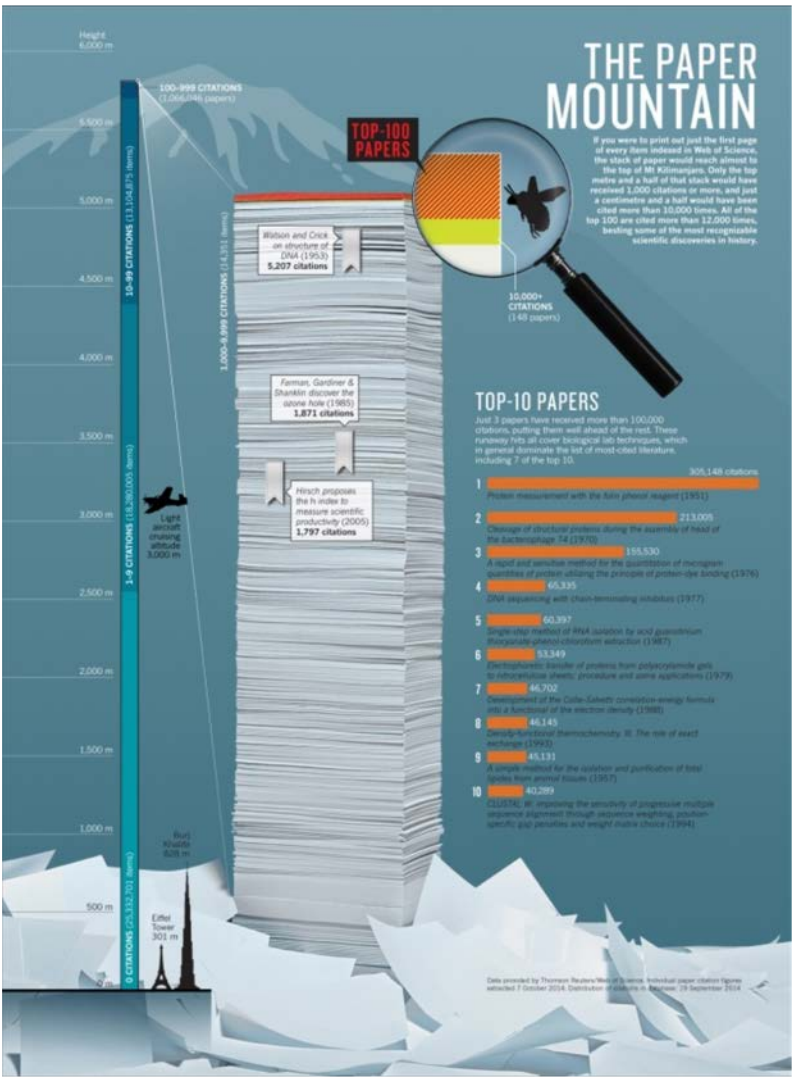


"Today I wouldn't get an academic job. It's as simple as that. I don't think I would be regarded as productive enough."

Peter Higgs, 2014

<https://www.nature.com/news/the-top-100-papers-1.16224>

The PDF crisis





What we've got here is a
FAILURE TO COMMUNICATE

Paradigm shift

Scientific revolution is the phase in which the underlying assumptions of the field are reexamined and a new paradigm is established.

Kuhn, 1962

The Structure of Scientific Revolutions

Open science

The movement to make scientific research and data accessible to all

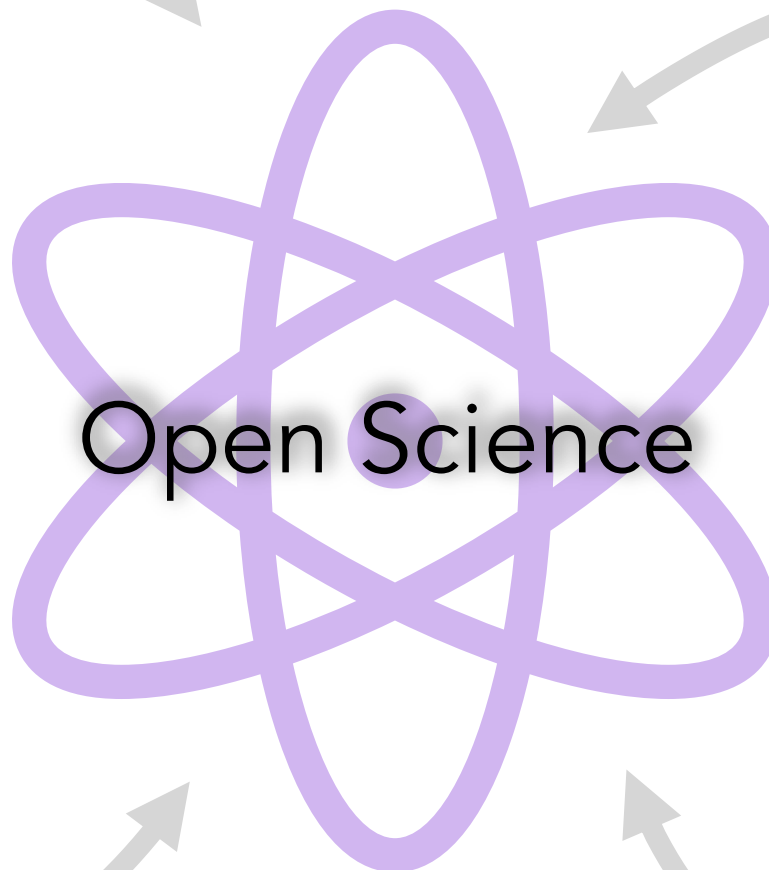
Wait - isn't that already how science works?

No - most research is publicly funded, but not accessible to all taxpayers





Open Datasets



Open Science

Open
Peer-Review



Open Source Software
/ Code

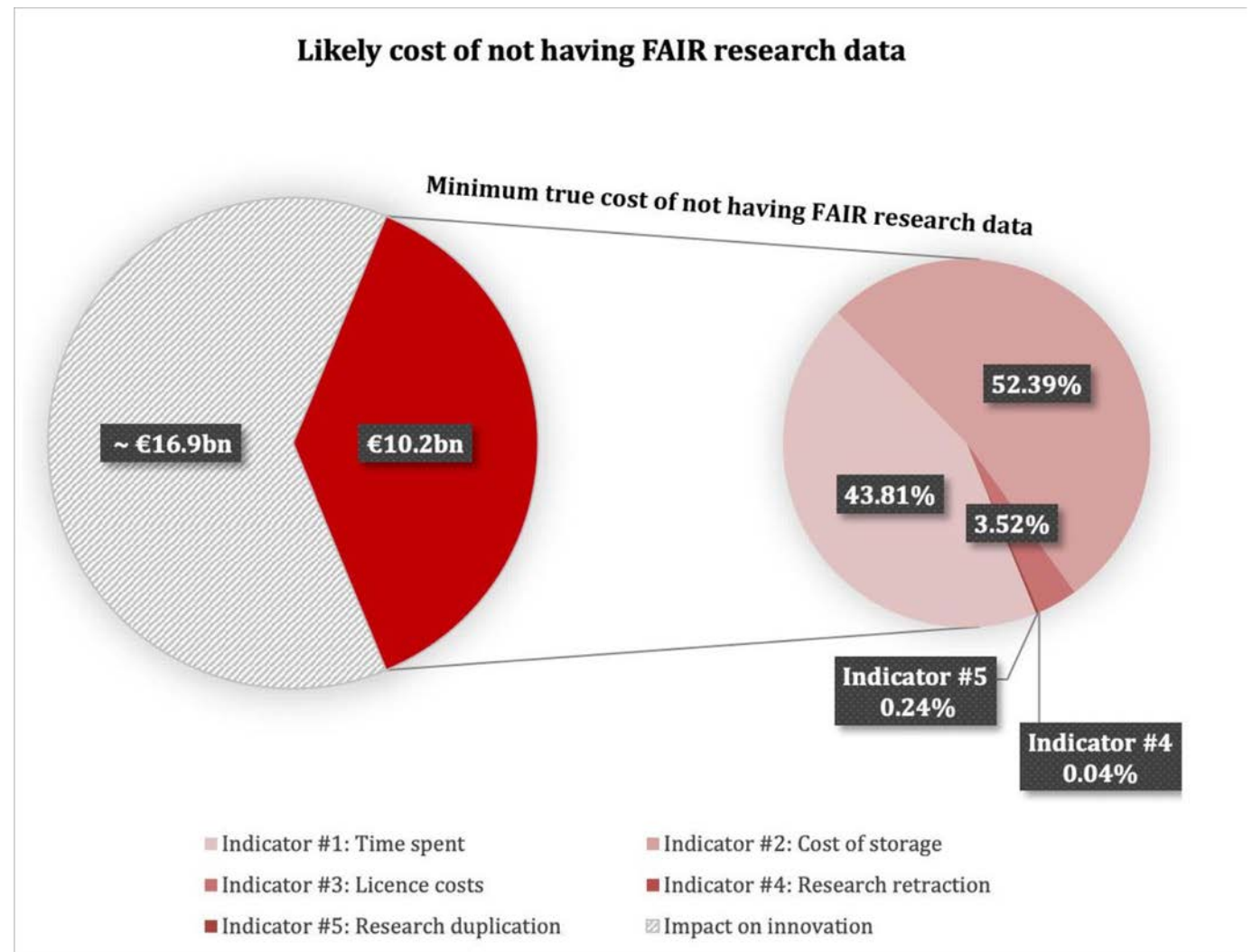


Open Access
Publishing

F.A.I.R. Principles

Data should be

- Findable
- Accessible
- Inter-operable
- Re-usable



<https://publications.europa.eu/en/publication-detail/-/publication/d375368c-1a0a-11e9-8d04-01aa75ed71a1/language-en>

Canadian/Quebec initiatives

- Canadian Open Neuroscience Platform



- Neurolibre



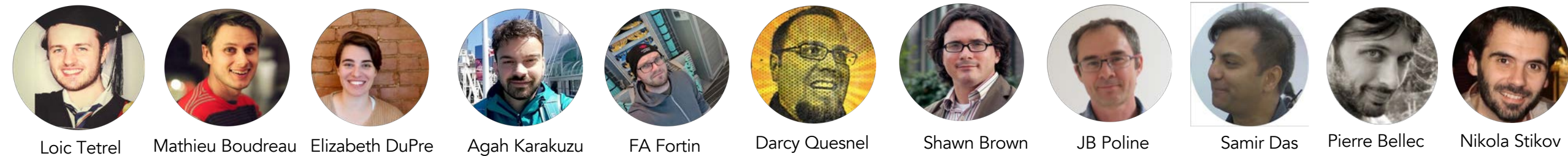
- Tanenbaum Open Science Institute



- Recently released PREVENT-AD dataset

- Data from a large sample (~400) of cognitively healthy individuals at high risk of developing Alzheimer's
- MRI, amyloid and tau CSF samples, blood markers, genetic info, and longitudinal cognitive data





Introducing neurolibre.conp.ca

Neurolibre is a curated repository of interactive neuroscience notebooks, seamlessly integrating data, text, code and figures. Notebooks can be freely modified and re-executed through the web, offering a fully reproducible, “libre” path from data to figures. Neurolibre is powered by the [Binder](#) project, with computational resources provided by [CONP](#), [CBRAIN](#) and [Compute Canada](#).



Layer 1:

A PDF compatible document

The steady-state longitudinal magnetization of an inversion recovery experiment can be derived from the Bloch equations for the pulse sequence $\{\theta_{180} - TI - \theta_{90} - (TR-TI)\}$, and is given by:

$$M_z(TI) = M_0 \frac{1 - \cos(\theta_{180})e^{-\frac{TR}{T_1}} - [1 - \cos(\theta_{180})]e^{-\frac{TI}{T_1}}}{1 - \cos(\theta_{180}) \cos(\theta_{90})e^{-\frac{TR}{T_1}}} \quad (1)$$

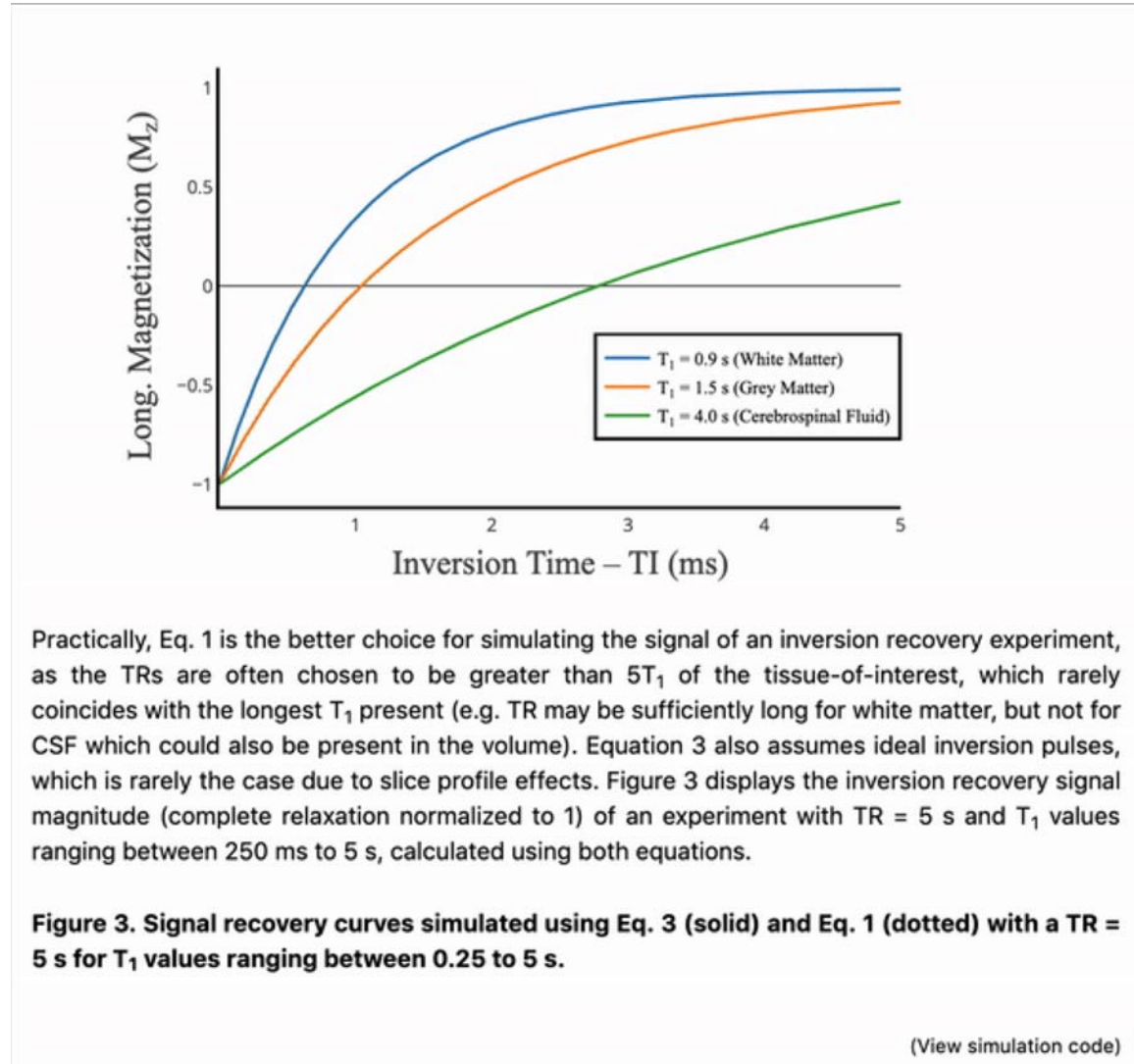
where M_z is the longitudinal magnetization prior to the θ_{90} pulse. If the in-phase real signal is desired, it can be calculated by multiplying Eq. 1 by $k \sin(\theta_{90})e^{-TE/T_2}$, where k is a constant. This general equation can be simplified by grouping together the constants for each measurements regardless of their values (i.e. at each TI, same TE and θ_{90} are used) and assuming an ideal inversion pulse:

$$M_z(TI) = C(1 - 2e^{-\frac{TI}{T_1}} + e^{-\frac{TR}{T_1}}) \quad (2)$$

where the first three terms and the denominator of Eq. 1 have been grouped together into the constant C. If the experiment is designed such that TR is long enough to allow for full relaxation of the magnetization ($TR > 5T_1$), we can do an additional approximation by dropping the last term in Eq. 2:



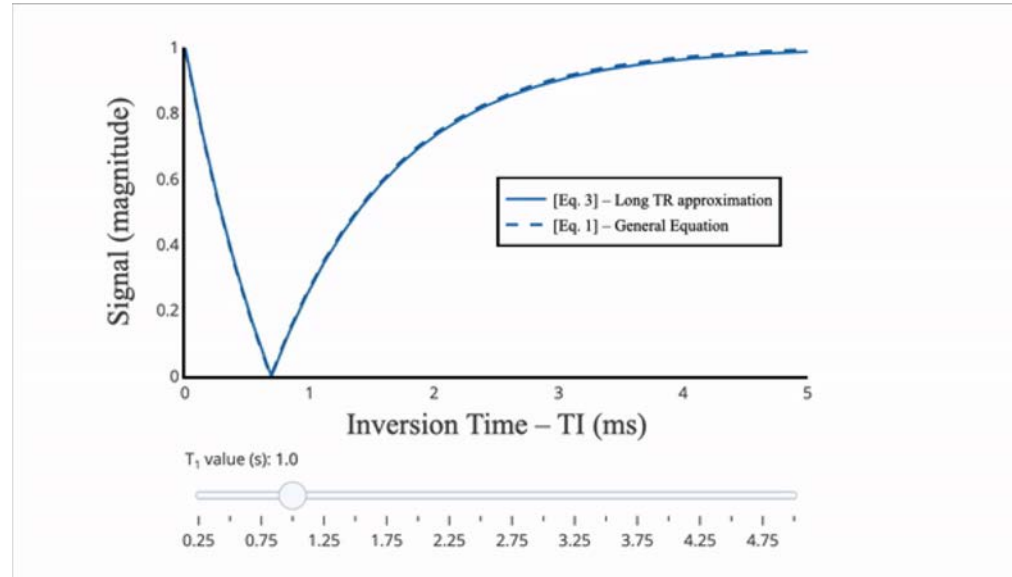
Layer 2: Dynamic figures



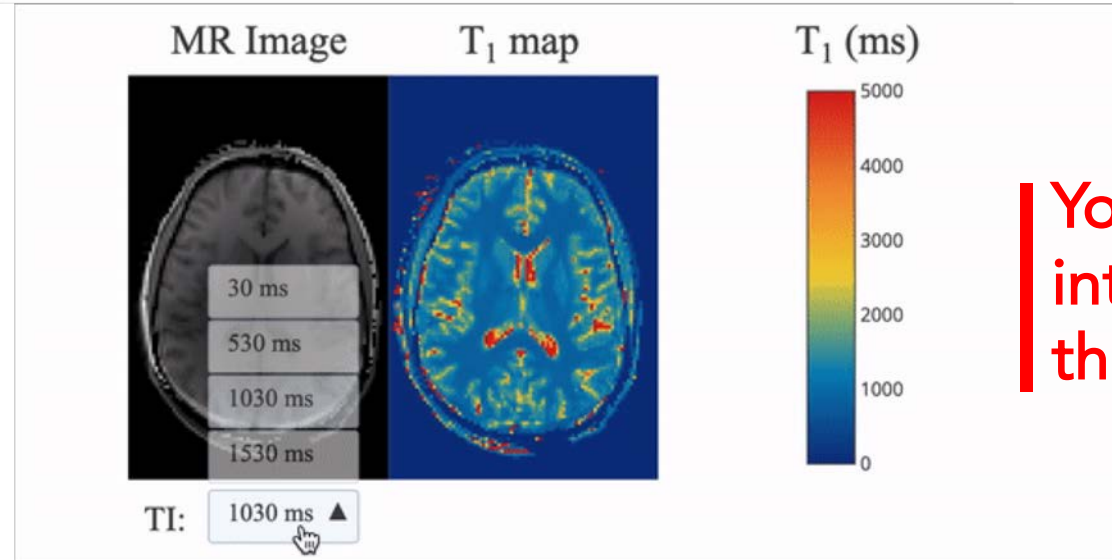
You can
observe the
actual data points



Layer 3: Interactivity



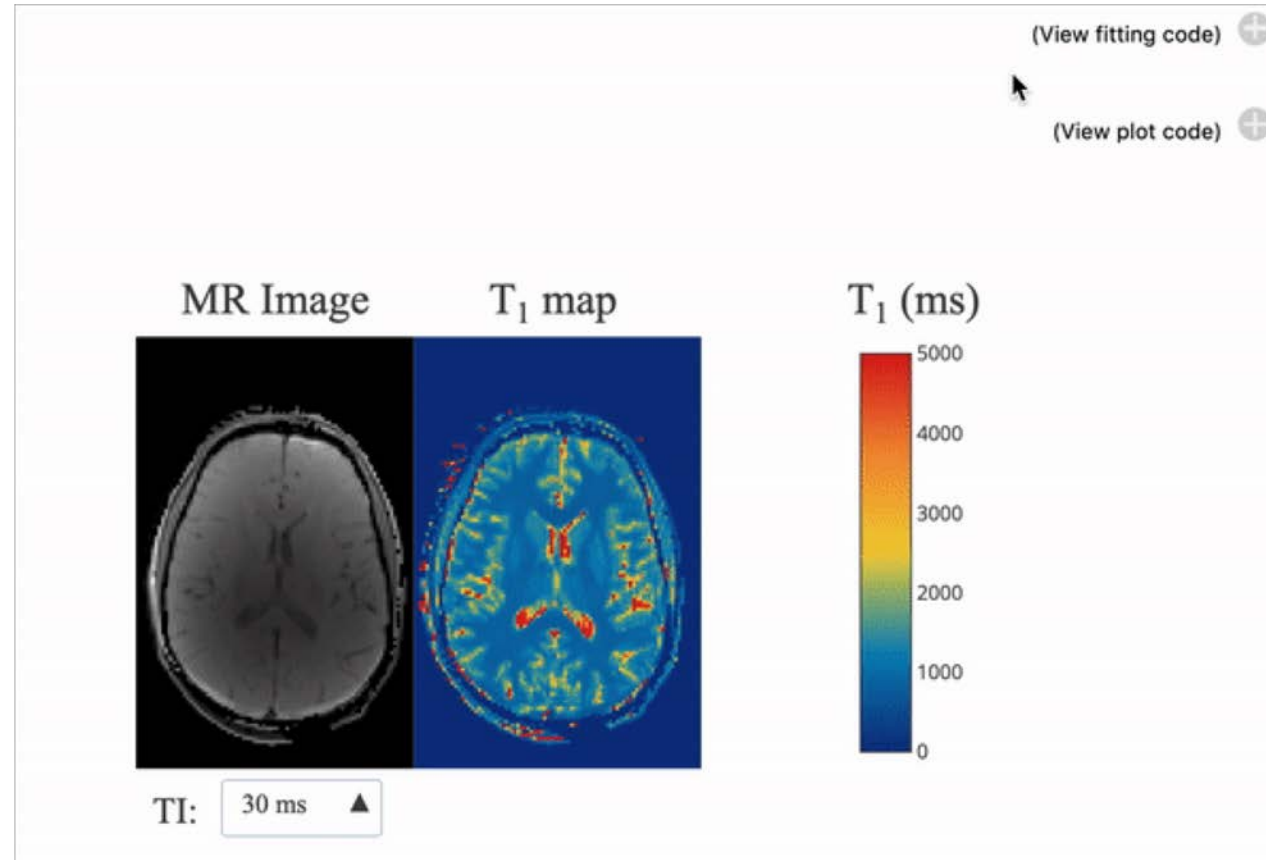
You can explore the phenomenon.



You can interact with the real-world data.



Layer 4: Transparency



You can SEE THE CODE that generates the outputs.



Layer 5:

Reproducibility

(View plot code) +

Practically, Eq. 1 is the better choice for simulating the signal of an inversion recovery experiment, as the TRs are often chosen to be greater than $5T_1$ of the tissue-of-interest, which rarely coincides with the longest T_1 present (e.g. TR may be sufficiently long for white matter, but not for CSF which could also be present in the volume). Equation 3 also assumes ideal inversion pulses, which is rarely the case due to slice profile effects. Figure 3 displays the inversion recovery signal magnitude (complete relaxation normalized to 1) of an experiment with TR = 5 s and T_1 values ranging between 250 ms to 5 s, calculated using both equations.

Figure 3. Signal recovery curves simulated using Eq. 3 (solid) and Eq. 1 (dotted) with a TR = 5 s for T_1 values ranging between 0.25 to 5 s.

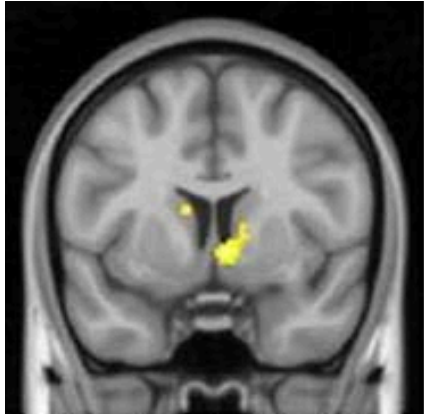
```
%use octave
% Verbosity level 0 overrides the disp function and supresses warnings.
% Once executed, they cannot be restored in this session
% (kernel needs to be restarted or a new notebook opened.)
VERBOSITY_LEVEL = 0;

if VERBOSITY_LEVEL==0
```

You can **RUN** the code that generates the outputs.

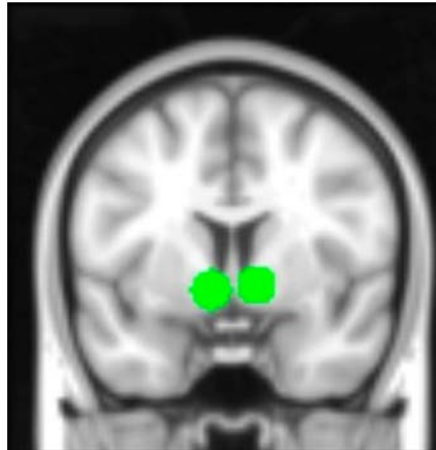
What if this was all free and transparent?

This is your brain
on beer



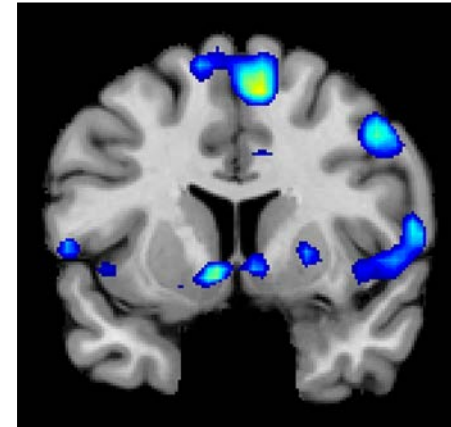
Oberlin et al.
Alcoholism: Clinical and Experimental
Research (2016)

This is your brain
on social media



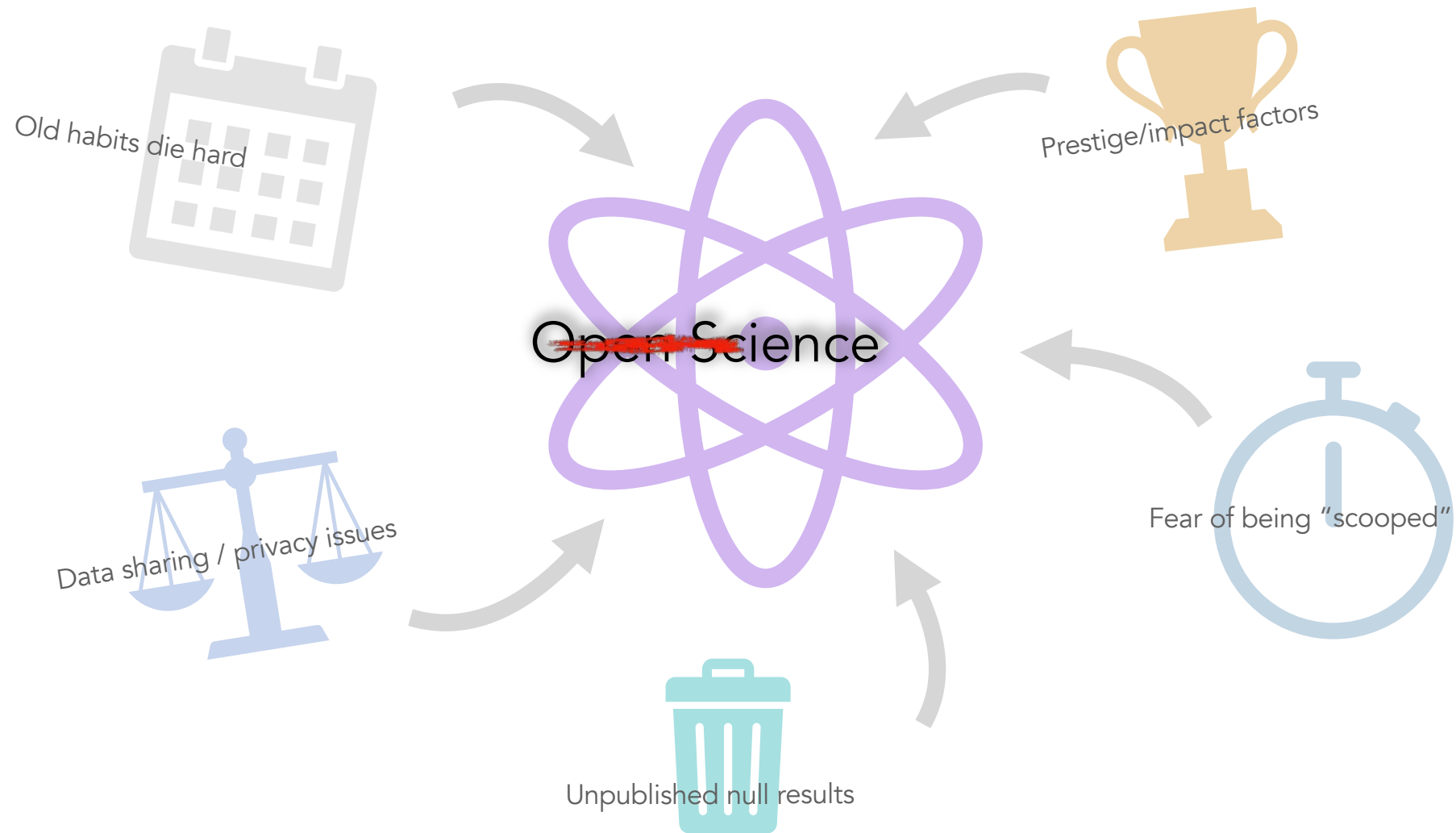
Sherman et al.
Psychological Science (2016)

This is your brain
on God



Ferguson et al.
Social Neuroscience (2016)

Incentives that work against open science practices



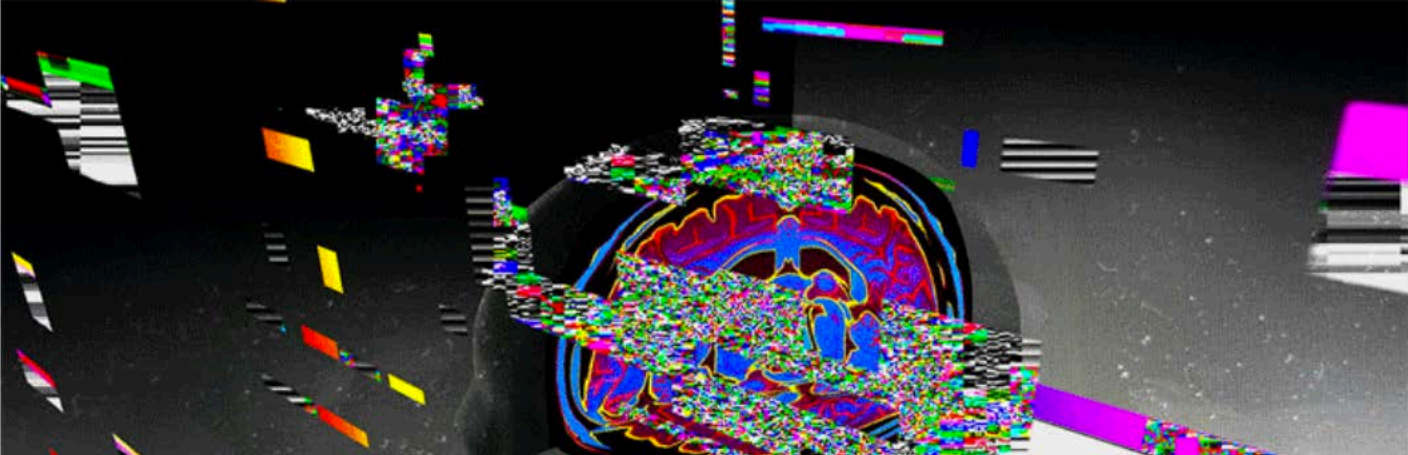
Consensus



☰ ORGANIZATION FOR HUMAN BRAIN MAPPING

Do You Believe in God, or Is That a Software Glitch?

By KATE MURPHY AUG. 27, 2016



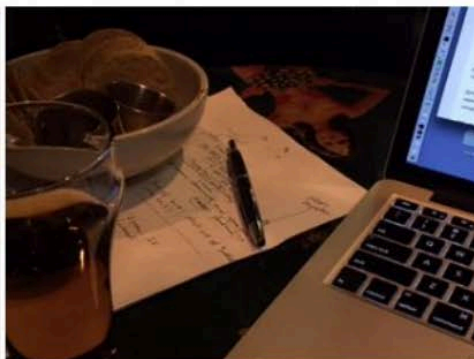
This cued a chorus of “I told you so!” from critics who have long said fM.R.I. is nothing more than high-tech phrenology. Brain-imaging researchers protested that the software problems were not as bad nor as widespread as the study suggested. The dust-up has caused

<http://www.ohbmbrianmappingblog.com/blog/keep-calm-and-scan-on>

Outreach

Oct 11 – Dec 20, 2017

[Show More](#)

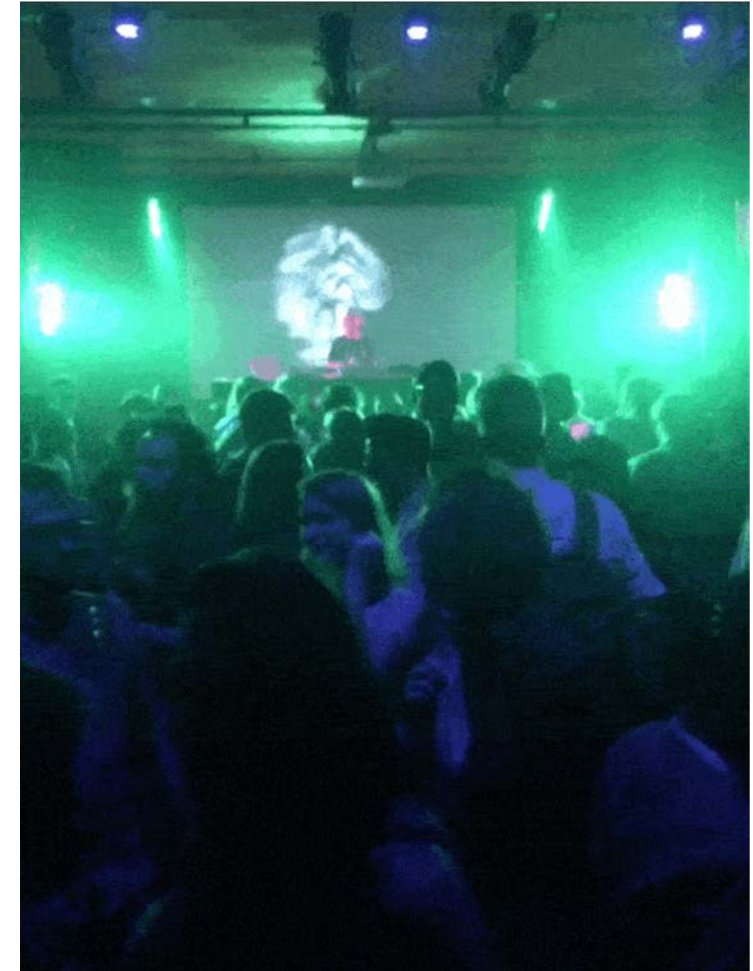


Community



Thomson House 2018

Centre Phi 2019



Post-revolution

Post-Revolution, the new paradigm's dominance is established and so scientists return to normal science, solving puzzles within the new paradigm.

Kuhn, 1962
The Structure of Scientific Revolutions

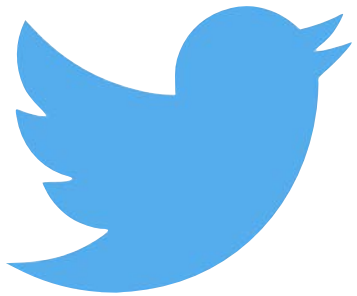
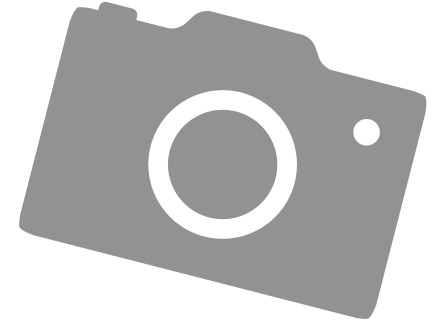
[E-mail: stikov@gmail.com](mailto:stikov@gmail.com)

Twitter: @Stikov



Want to learn more?

- Listen to the CONP podcast series: conp.ca/tag/podcasts/
- Follow QBIN: https://www.rbiq-qbin.qc.ca/General_Public
- If you ever hit a paywall, try this: unpaywall.org, or this: <http://bit.do/eSYzb>
- Engage with us on Twitter:



@NeuroLibre
@QBIN_RBIQ

