R: A Hitchhikers Guide to Reproducible Research

- Hello

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University College Cork, Ireland

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School of Public Health

Reproducible or replicable

		Data	
		Same	Different
Analysis	Same	Reproducible	Replicable
	Different	Robust	Generalisable

Reproducible or replicable

		Data	
		Same	Different
Analysis	Same	Reproducible	Replicable
	Different	Robust	Generalisable

Reproducible or replicable

<table>
<tr><td colspan="2" rowspan="2"></td><th colspan="2">Data</th></tr>
<tr><th>Same</th><th>Different</th></tr>
<tr><th rowspan="2">Analysis</th><th>Same</th><td>Replicable</td><td>Reproducible</td></tr>
<tr><th>Different</th><td>Robust</td><td>Generalisable</td></tr>
</table>

COMMENTARY

Scientists behaving badly

To protect the integrity of science, we must look beyond falsification, fabrication and plagiarism, to a wider range of questionable research practices, argue **Brian C. Martinson, Melissa S. Anderson** and **Raymond de Vries**.

Table 1 | Percentage of scientists who say that they engaged in the behaviour listed within the previous three years (*n* = 3,247)

Top ten behaviours	All	Mid-career	Early-career
1. Falsifying or 'cooking' research data	0.3	0.2	0.5
2. Ignoring major aspects of human-subject requirements	0.3	0.3	0.4
3. Not properly disclosing involvement in firms whose products are based on one's own research	0.3	0.4	0.3
4. Relationships with students, research subjects or clients that may be interpreted as questionable	1.4	1.3	1.4
5. Using another's ideas without obtaining permission or giving due credit	1.4	1.7	1.0
6. Unauthorized use of confidential information in connection with one's own research	1.7	2.4	0.8 ***
7. Failing to present data that contradict one's own previous research	6.0	6.5	5.3
8. Circumventing certain minor aspects of human-subject requirements	7.6	9.0	6.0 **
9. Overlooking others' use of flawed data or questionable interpretation of data	12.5	12.2	12.8
10. Changing the design, methodology or results of a study in response to pressure from a funding source	15.5	20.6	9.5 ***
Other behaviours			
11. Publishing the same data or results in two or more publications	4.7	5.9	3.4 **
12. Inappropriately assigning authorship credit	10.0	12.3	7.4 ***
13. Withholding details of methodology or results in papers or proposals	10.8	12.4	8.9 **
14. Using inadequate or inappropriate research designs	13.5	14.6	12.2
15. Dropping observations or data points from analyses based on a gut feeling that they were inaccurate	15.3	14.3	16.5
16. Inadequate record keeping related to research projects	27.5	27.7	27.3

Standing on the shoulders of giants?

Research Article

Psychological Science
23(5) 524–532

DOI: 10.1177/0956797611430953
http://pss.sagepub.com
SAGE

Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling

Leslie K. John[1], George Loewenstein[2], and Drazen Prelec[3]
[1]Marketing Unit, Harvard Business School; [2]Department of Social & Decision Sciences, Carnegie Mellon University; and [3]Sloan School of Management and Departments of Economics and Brain & Cognitive Sciences, Massachusetts Institute of Technology

Abstract
Cases of clear scientific misconduct have received significant media attention recently, but less flagrantly questionable research practices may be more prevalent and, ultimately, more damaging to the academic enterprise. Using an anonymous elicitation format supplemented by incentives for honest reporting, we surveyed over 2,000 psychologists about their involvement in questionable research practices. The impact of truth-telling incentives on self-admissions of questionable research practices was positive, and this impact was greater for practices that respondents judged to be less defensible. Combining three different estimation methods, we found that the percentage of respondents who have engaged in questionable practices was surprisingly high. This finding suggests that some questionable practices may constitute the prevailing research norm.

241 shades of grey

Contents lists available at SciVerse ScienceDirect

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

Full Length Articles

The secret lives of experiments: Methods reporting in the fMRI literature

Joshua Carp

University of Michigan, Department of Psychology, 530 Church Street, Ann Arbor, MI, 48109, USA

A R T I C L E I N F O

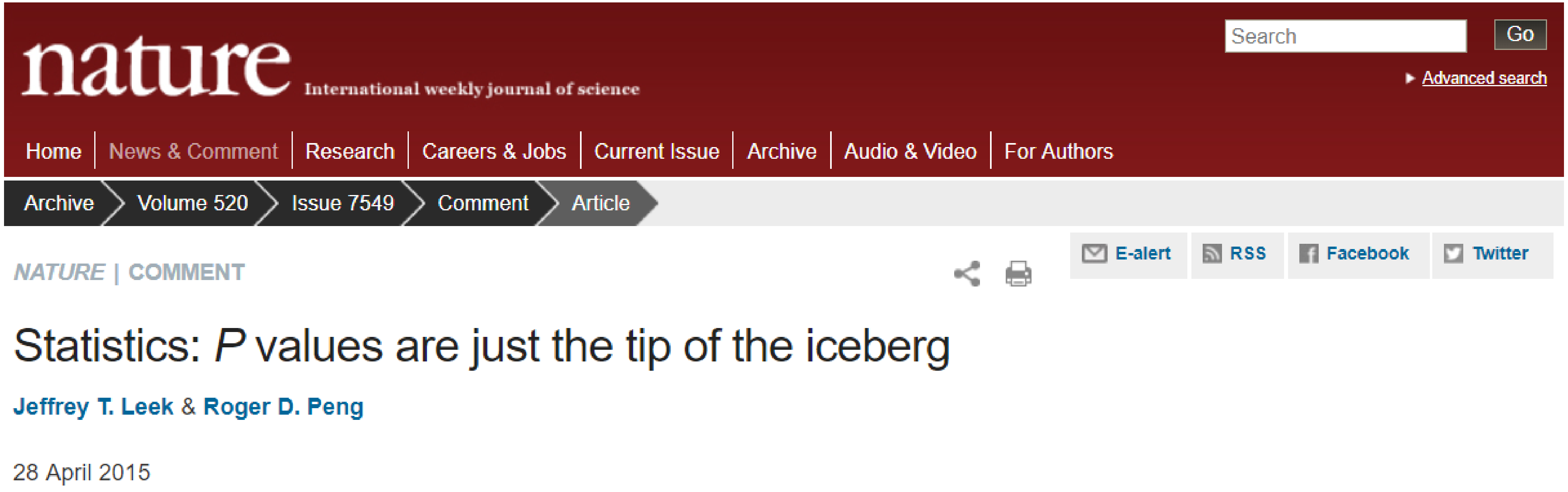
Article history:
Accepted 3 July 2012
Available online 10 July 2012

Keywords:
fMRI
Methods reporting
Reproducibility
Experimental design
Analysis methods
Statistical power

A B S T R A C T

Replication of research findings is critical to the progress of scientific understanding. Accordingly, most scientific journals require authors to report experimental procedures in sufficient detail for independent researchers to replicate their work. To what extent do research reports in the functional neuroimaging literature live up to this standard? The present study evaluated methods reporting and methodological choices across 241 recent fMRI articles. Many studies did not report critical methodological details with regard to experimental design, data acquisition, and analysis. Further, many studies were underpowered to detect any but the largest statistical effects. Finally, data collection and analysis methods were highly flexible across studies, with nearly as many unique analysis pipelines as there were studies in the sample. Because the rate of false positive results is thought to increase with the flexibility of experimental designs, the field of functional neuroimaging may be particularly vulnerable to false positives. In sum, the present study documented significant gaps in methods reporting among fMRI studies. Improved methodological descriptions in research reports would yield significant benefits for the field.

p-values should not define a study



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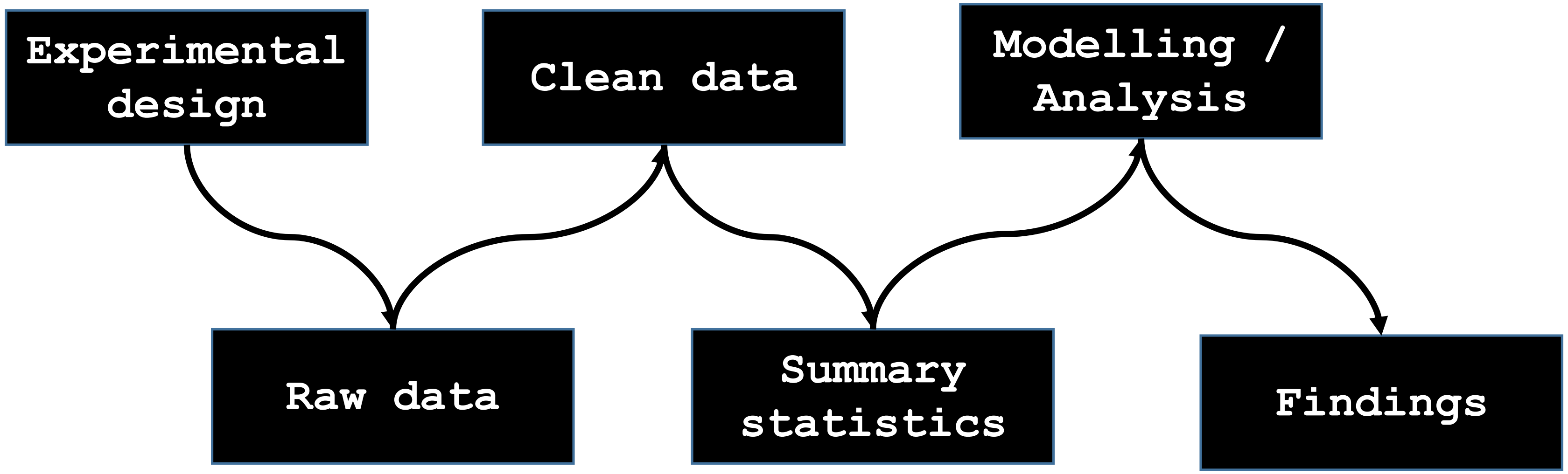
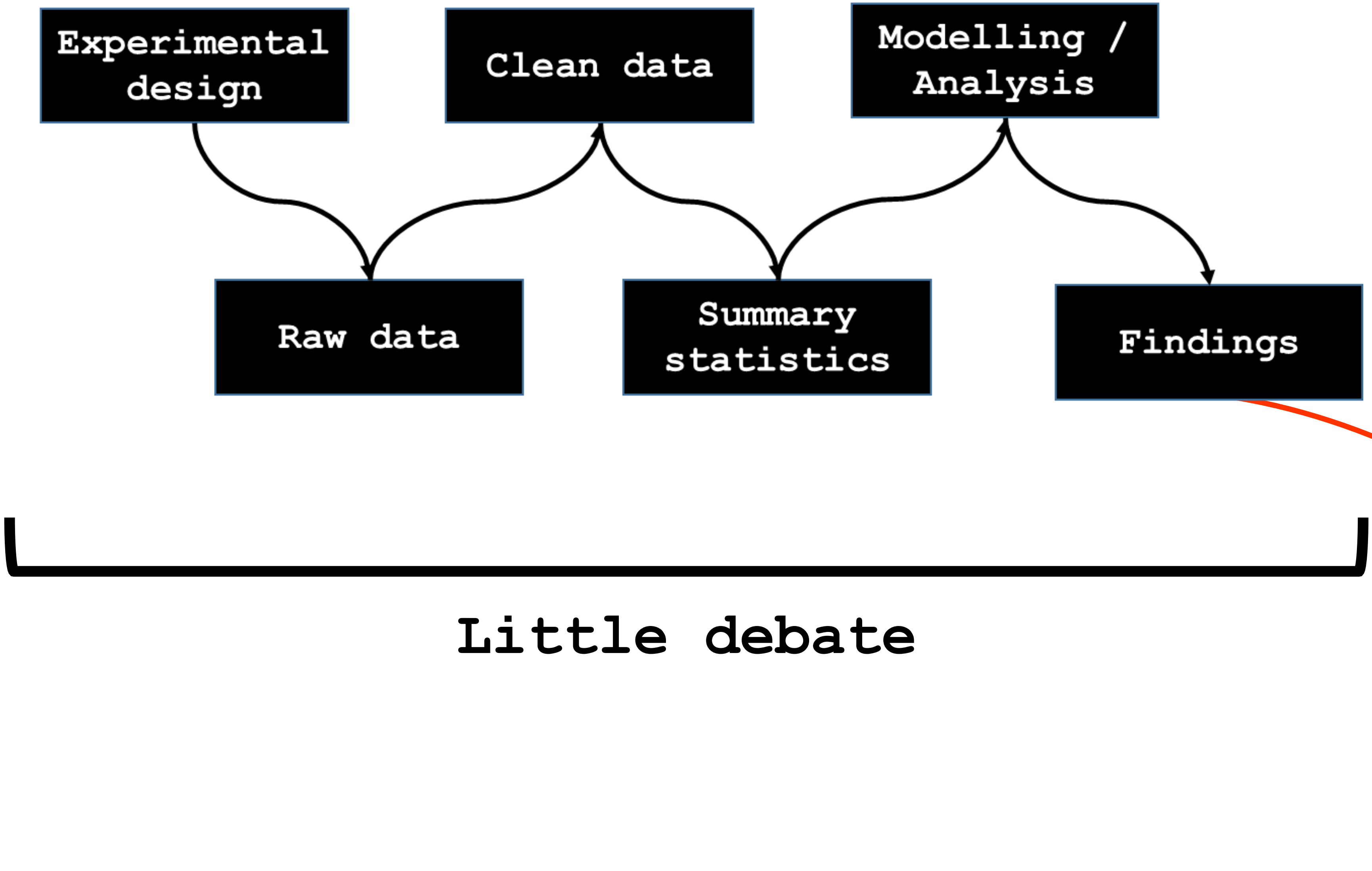
Statistics: *P* values are just the tip of the iceberg

Jeffrey T. Leek & Roger D. Peng

28 April 2015




Experimental design
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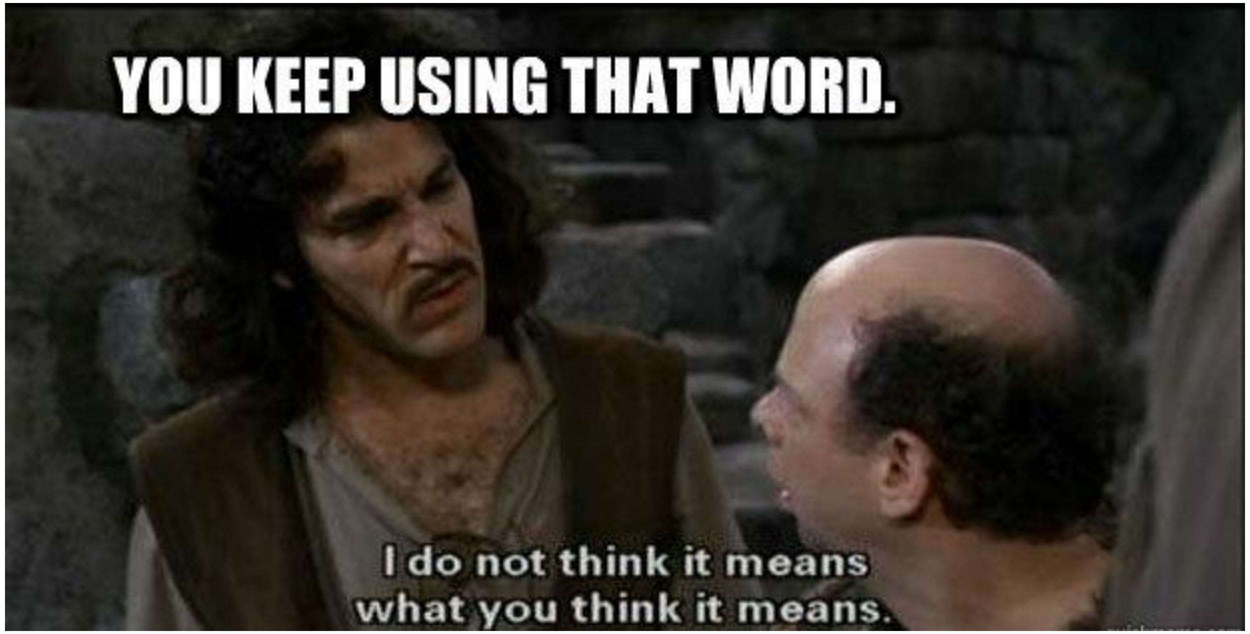
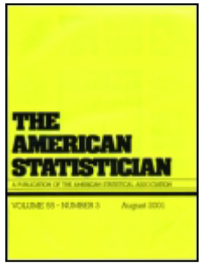
Modelling / Analysis
Raw data
Summary statistics
Findings
Little debate

Extreme scrutiny

Significant





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The American Statistician

ISSN: 0003-1305 (Print) 1537-2731 (Online) Journal homepage: http://amstat.tandfonline.com/loi/utas20

The ASA's Statement on *p*-Values: Context, Process, and Purpose

Ronald L. Wasserstein & Nicole A. Lazar

Eur J Epidemiol (2016) 31:337–350
DOI 10.1007/s10654-016-0149-3

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ESSAY

Statistical tests, *P* values, confidence intervals, and power: a guide to misinterpretations

Sander Greenland[1] · Stephen J. Senn[2] · Kenneth J. Rothman[3] · John B. Carlin[4] · Charles Poole[5] · Steven N. Goodman[6] · Douglas G. Altman[7]

Received: 9 April 2016 / Accepted: 9 April 2016 / Published online: 21 May 2016

Abstract Misinterpretation and abuse of statistical tests, confidence intervals, and statistical power have been decried for decades, yet remain rampant. A key problem is that there are no interpretations of these concepts that are at once simple, intuitive, correct, and foolproof. Instead, correct use and interpretation of these statistics requires an attention to detail which seems to tax the patience of working scientists. This high cognitive demand has led to an epidemic of shortcut definitions and interpretations that are simply wrong, sometimes disastrously so—and yet these misinterpretations dominate much of the scientific literature. In light of this problem, we provide definitions and a discussion of basic statistics that are more general and critical than typically found in traditional introductory expositions. Our goal is to provide a resource for instructors, researchers, and consumers of statistics whose knowledge of statistical theory and technique may be limited but who wish to avoid and spot misinterpretations. We emphasize how violation of often unstated analysis protocols (such as selecting analyses for presentation based on the *P* values they produce) can lead to small *P* values even if the declared test hypothesis is correct, and can lead to large *P* values even if that hypothesis is incorrect. We then provide an explanatory list of 25 misinterpretations of *P* values, confidence intervals, and power. We conclude with guidelines for improving statistical interpretation and reporting.

Editor's note This article has been published online as supplementary material with an article of Wasserstein RL, Lazar NA. The ASA's statement on p-values: context, process and purpose. The American Statistician 2016.

Albert Hofman, Editor-in-Chief EJE.

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Use of positive and negative words in scientific PubMed abstracts between 1974 and 2014: retrospective analysis

BMJ 2015 ; 351 doi: https://doi.org/10.1136/bmj.h6467 (Published 14 December 2015)
Cite this as: *BMJ* 2015;351:h6467

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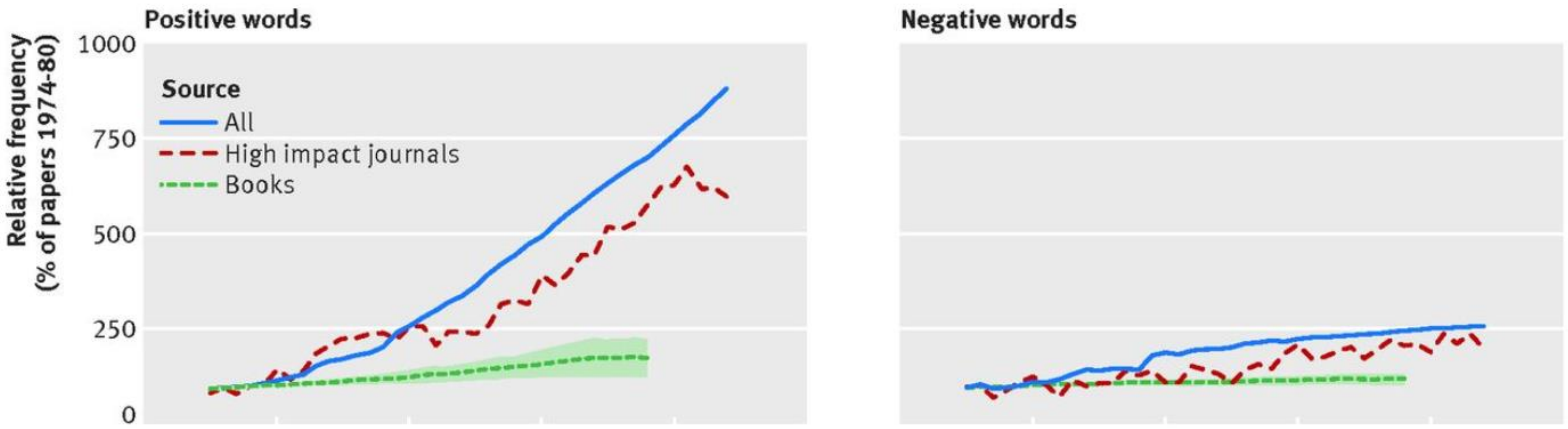
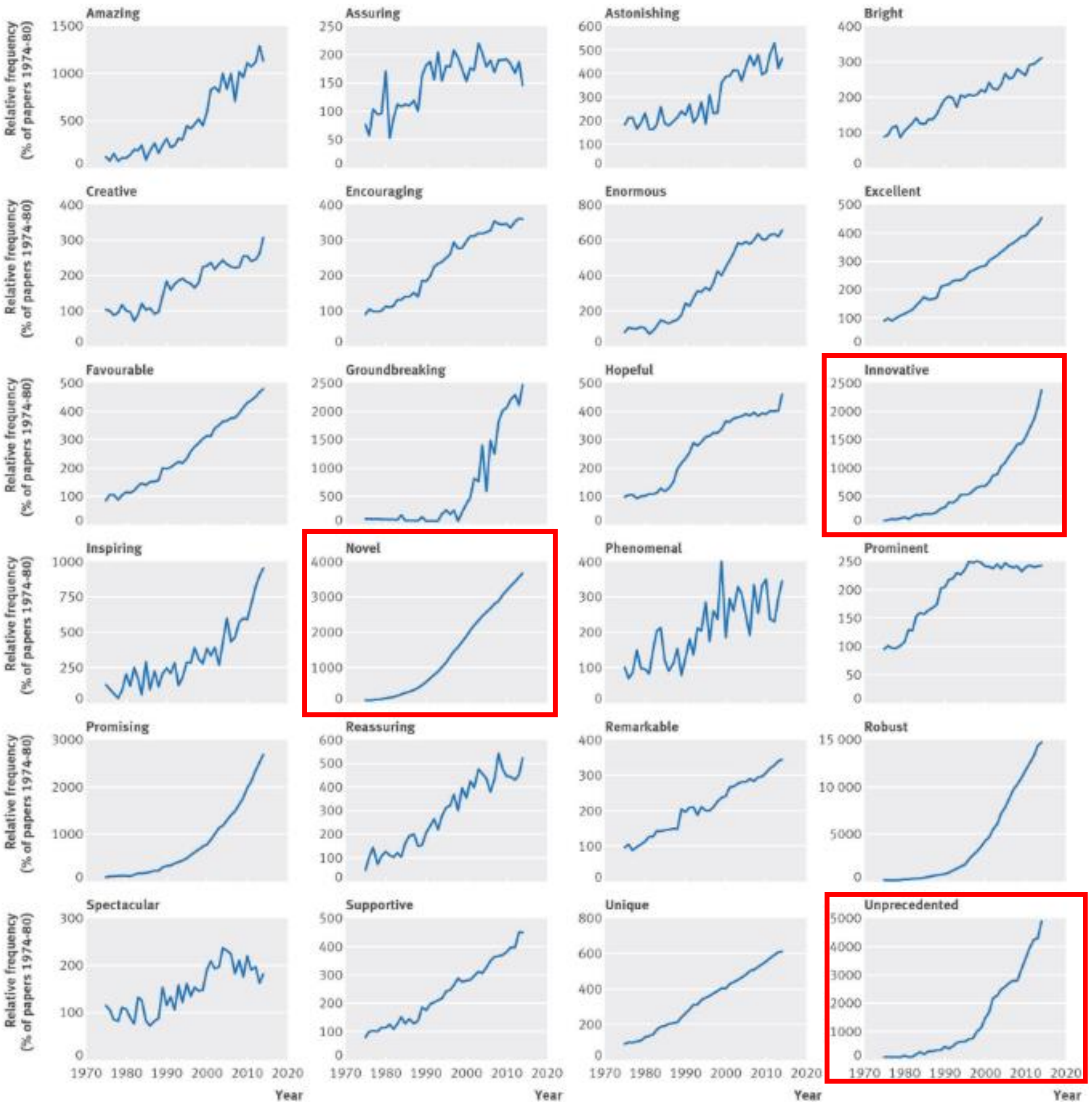
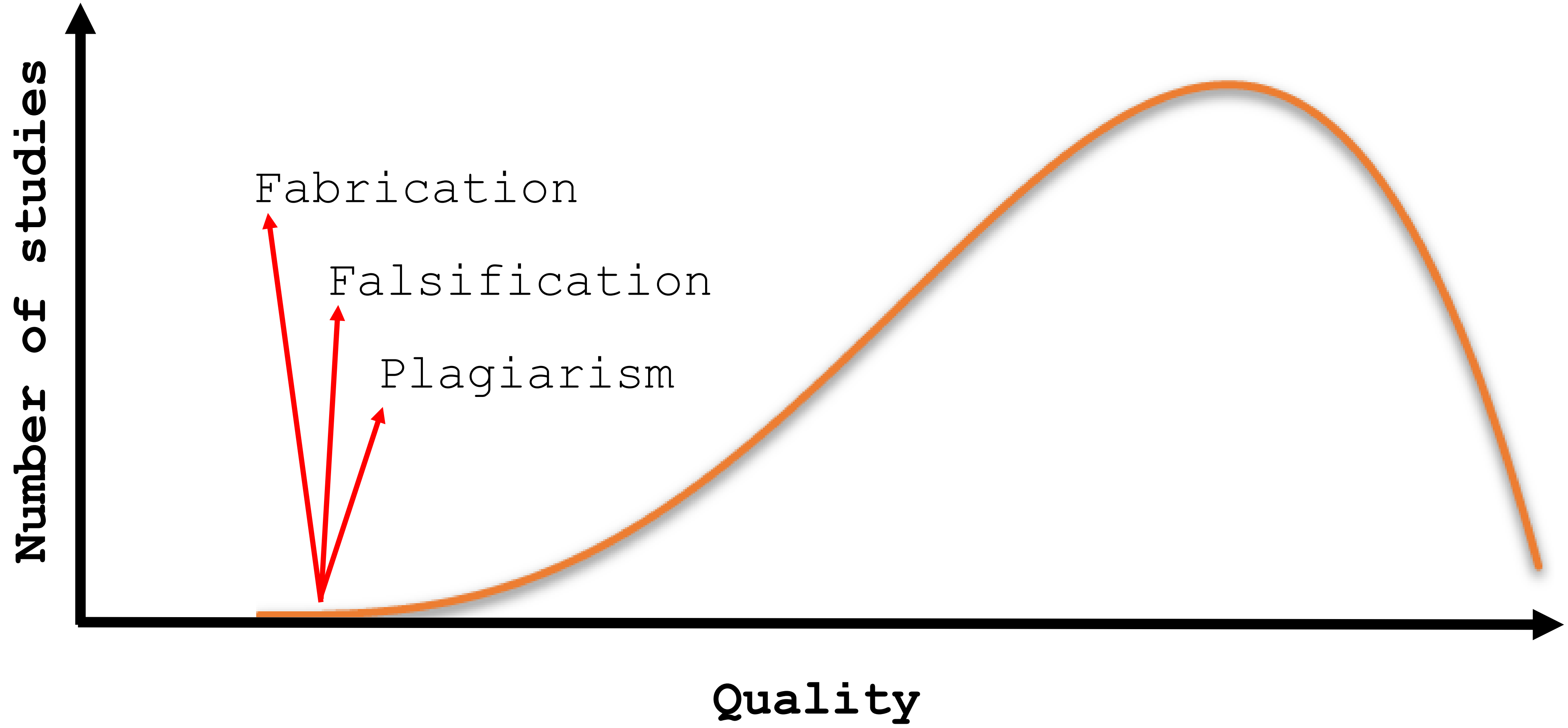




Relative frequencies of individual words as used in PubMed between 1975 and 2014

Vinkers et al., 2015

Today

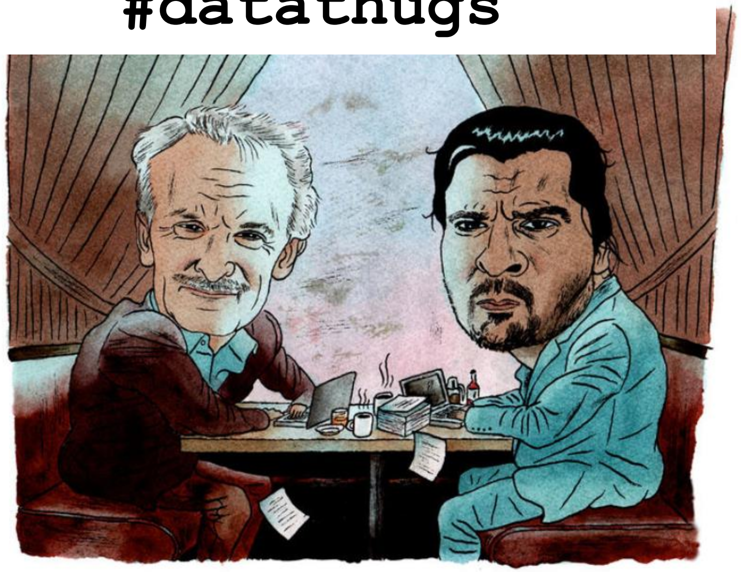

Number of studies
Fabrication
Falsification
Plagiarism
Quality

Don’t do what Donny Dont does!

“In short, peer review misses all the hard stuff, and a worrying amount of the easy stuff”

James Heathers,
Northwestern University

#datathugs



Brian Wansink: The grad student who never said no

“Every day we would scratch our heads, ask "Why," and come up with another way to reanalyze the data with yet another set of plausible hypotheses. Eventually we started discovering solutions”

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J Surg Res. 2019 Apr 26;241:235-239. doi: 10.1016/j.jss.2019.03.062. [Epub ahead of print]

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Is the Power Threshold of 0.8 Applicable to Surgical Science?-Empowering the Underpowered Study.

Bababekov YJ[1], Hung YC[2], Hsu YT[2], Udelsman BV[2], Mueller JL[2], Lin HY[2], Stapleton SM[2], Chang DC[2].

Author information

Abstract

BACKGROUND: Many articles in the surgical literature were faulted for committing type 2 error, or concluding no difference when the study was "underpowered". However, it is unknown if the current power standard of 0.8 is reasonable in surgical science.

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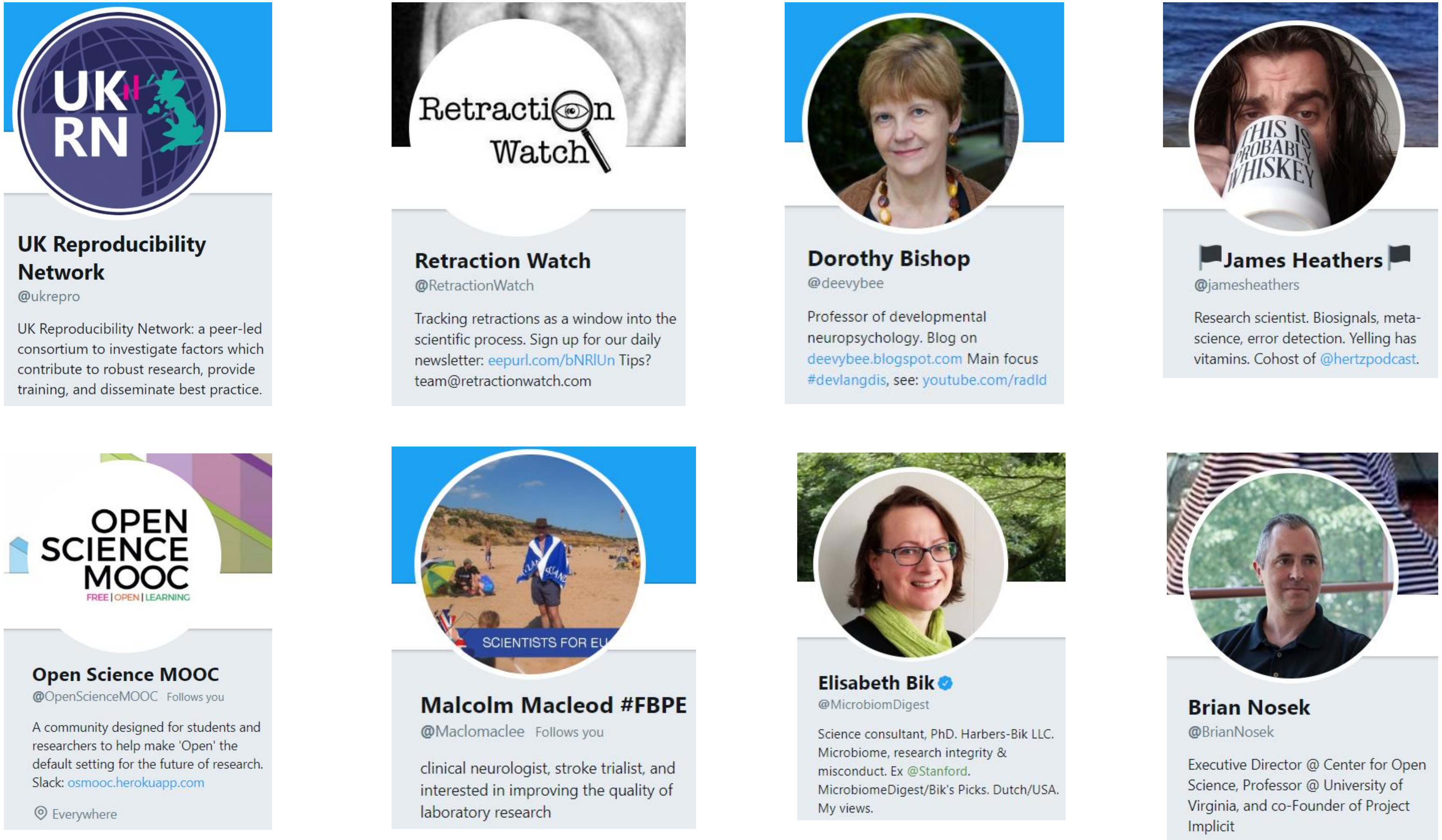

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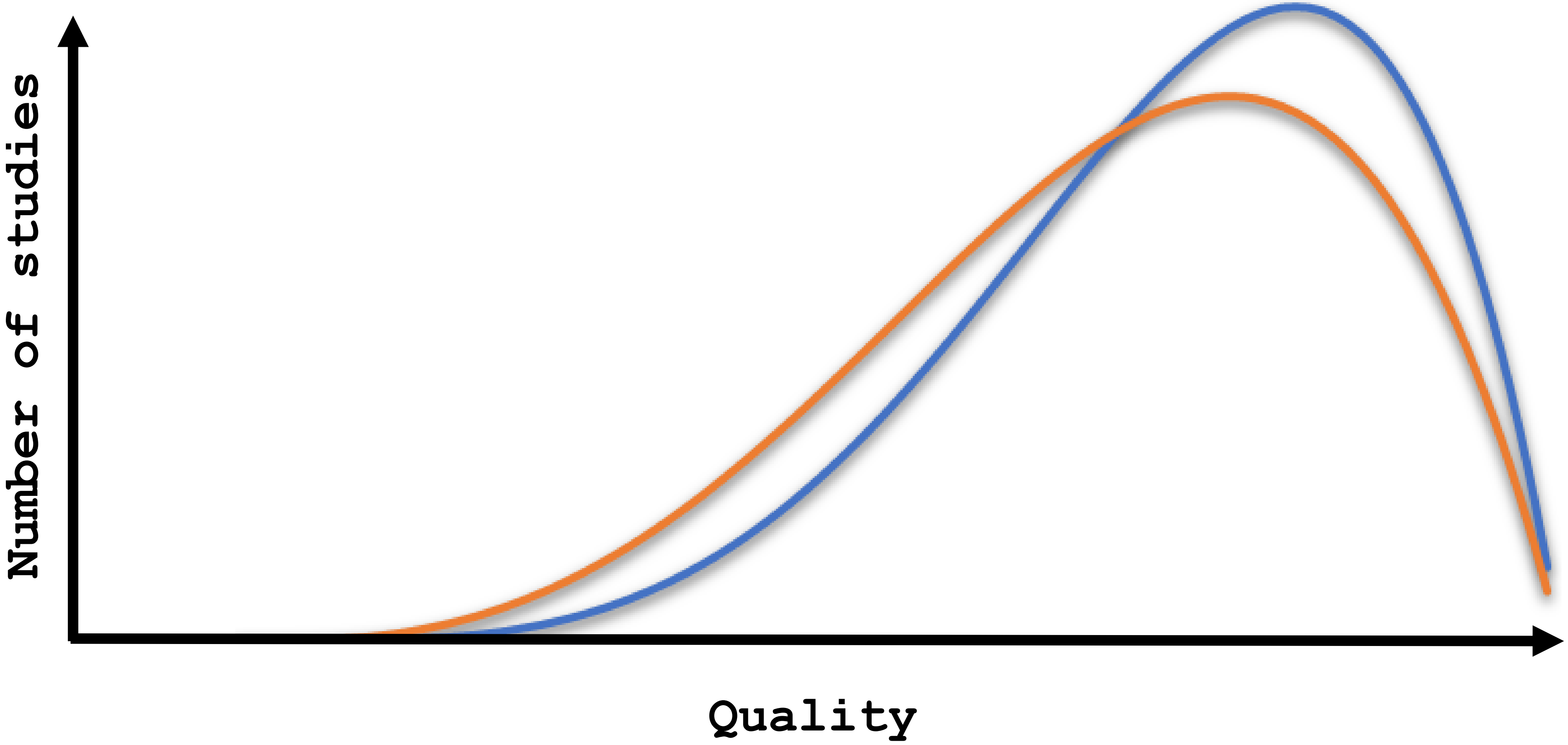
Tomorrow



Who benefits most from reproducibility?

Casey Greene
@GreeneScientist

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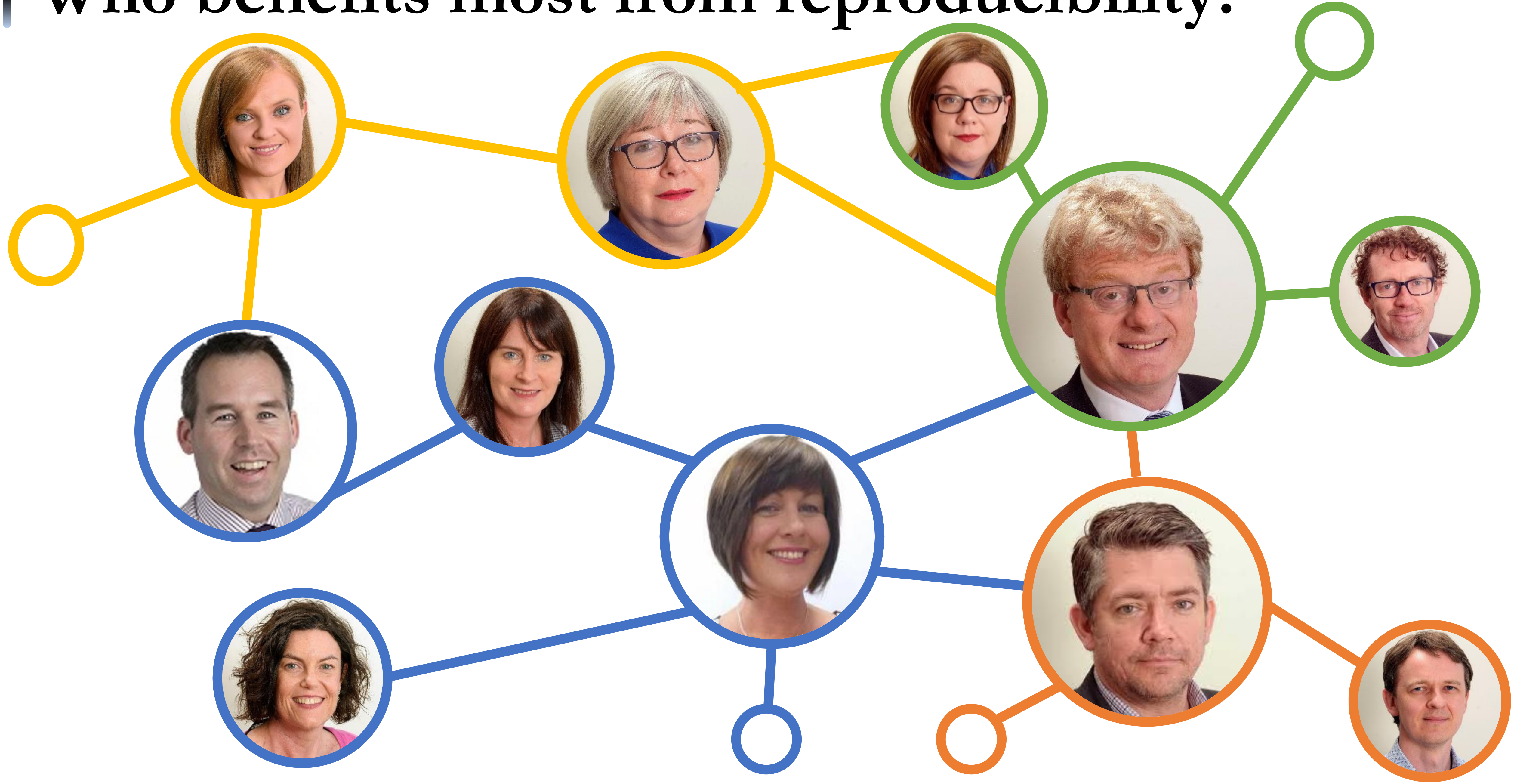
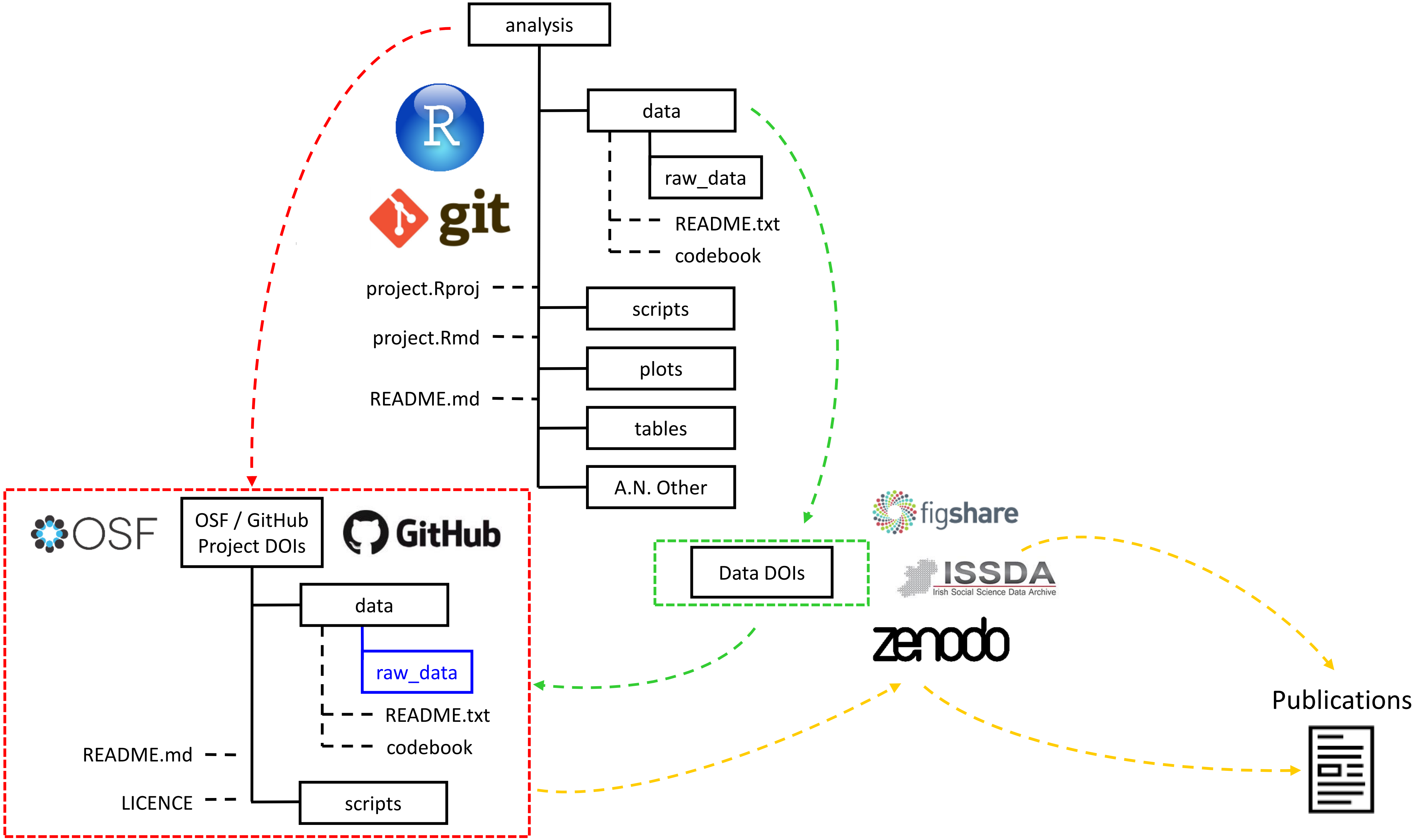
1:17 PM - 26 Oct 2016 from Manhattan, NY

Who benefits most from reproducibility?



Where to begin…

What does this allow us to do?



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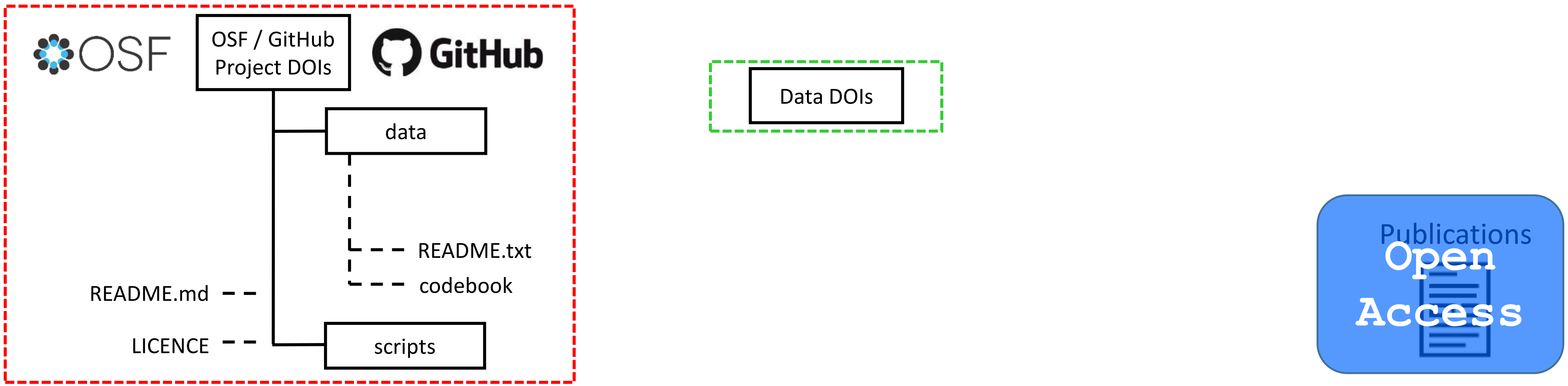

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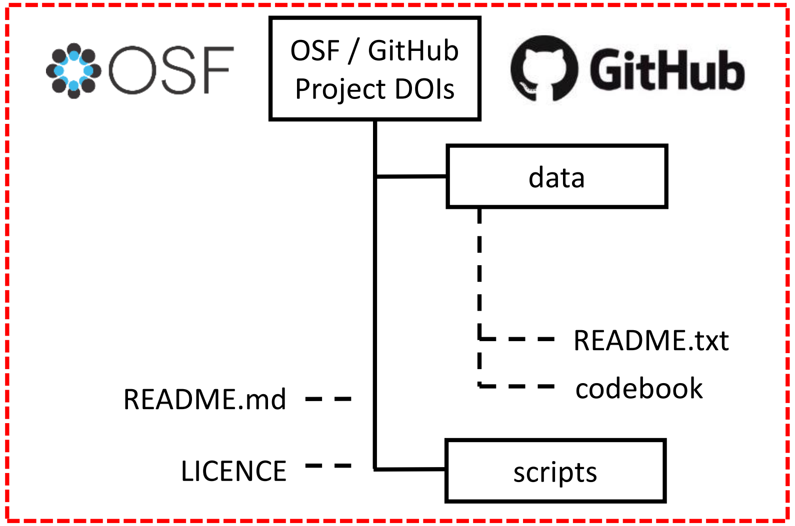

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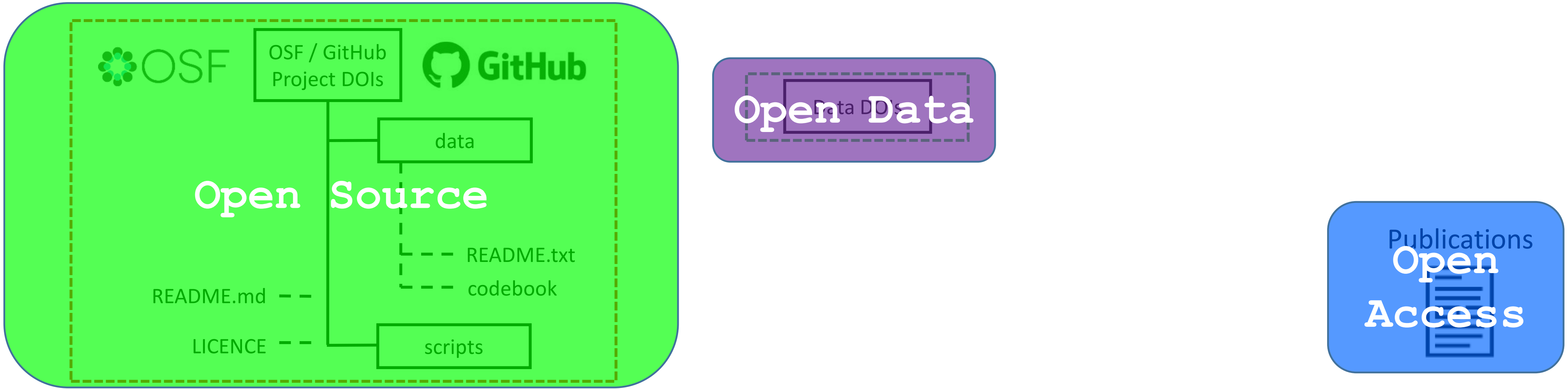

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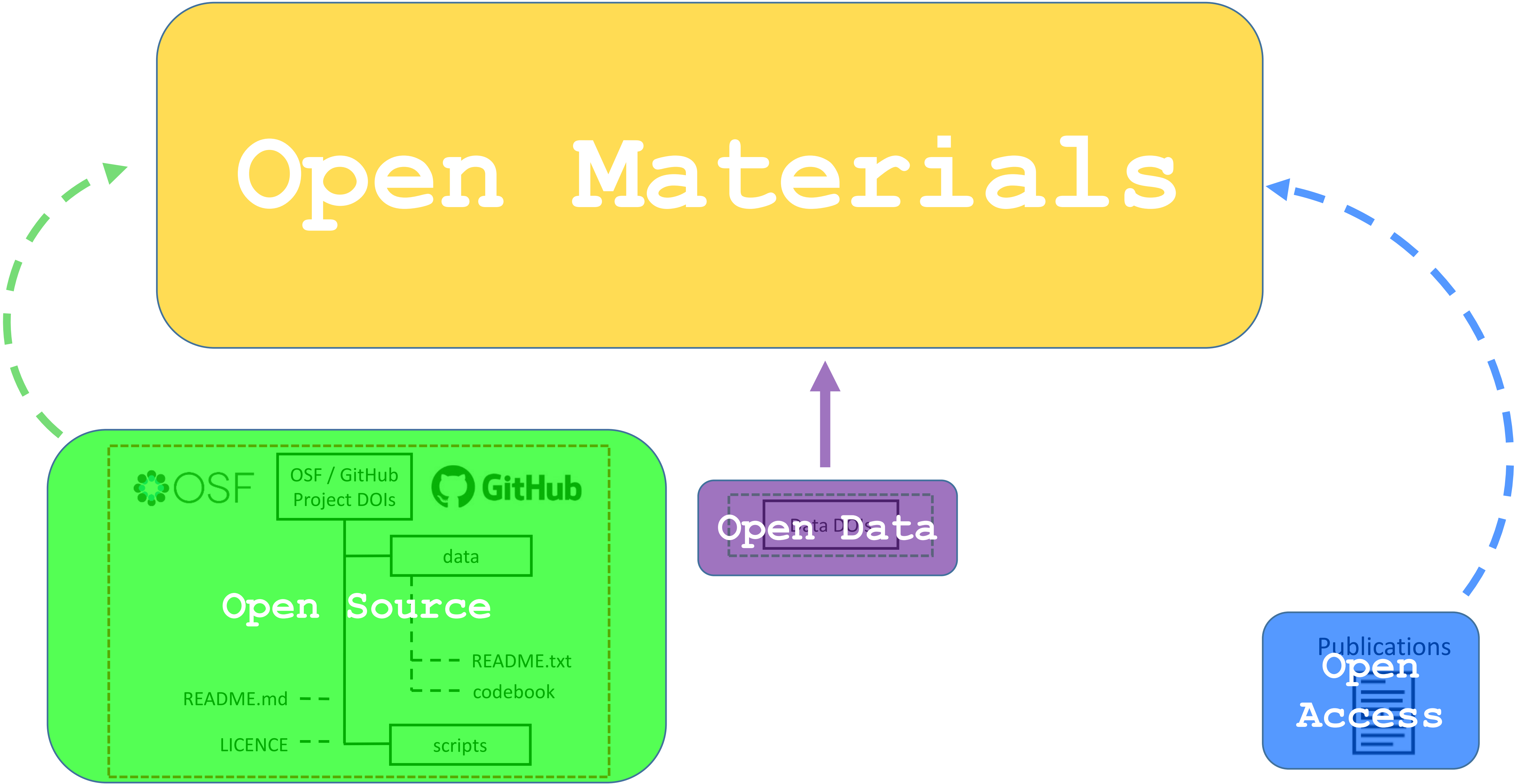

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f) Data Management Plan – 2 pages max.
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  - How data will be curated & preserved?
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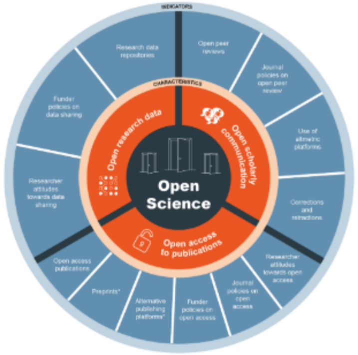
Open Research

The HRB is committed to ensuring that its funded research is open, accessible and usable, so it can have the greatest possible impact.

There is a fundamental shift across Europe towards making research more transparent, collaborative, accessible and efficient. This Open Science movement is a strategic priority for the European Commission in research and innovation policy and an EU high-level Expert Group, the Open Science Policy Platform (OSPP 2016-2018) has been established to consider key implementation areas.



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Science Foundation Ireland joins DORA

14th February 2019, Dublin – Science Foundation Ireland has become a signatory to the San Francisco Declaration of Research Assessment (DORA), making a formal commitment to assessing the quality and impact of research through means other than journal impact factors.

The movement towards FAIR data

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www.nature.com/scientificdata

SCIENTIFIC DATA

Amended: Addendum

OPEN

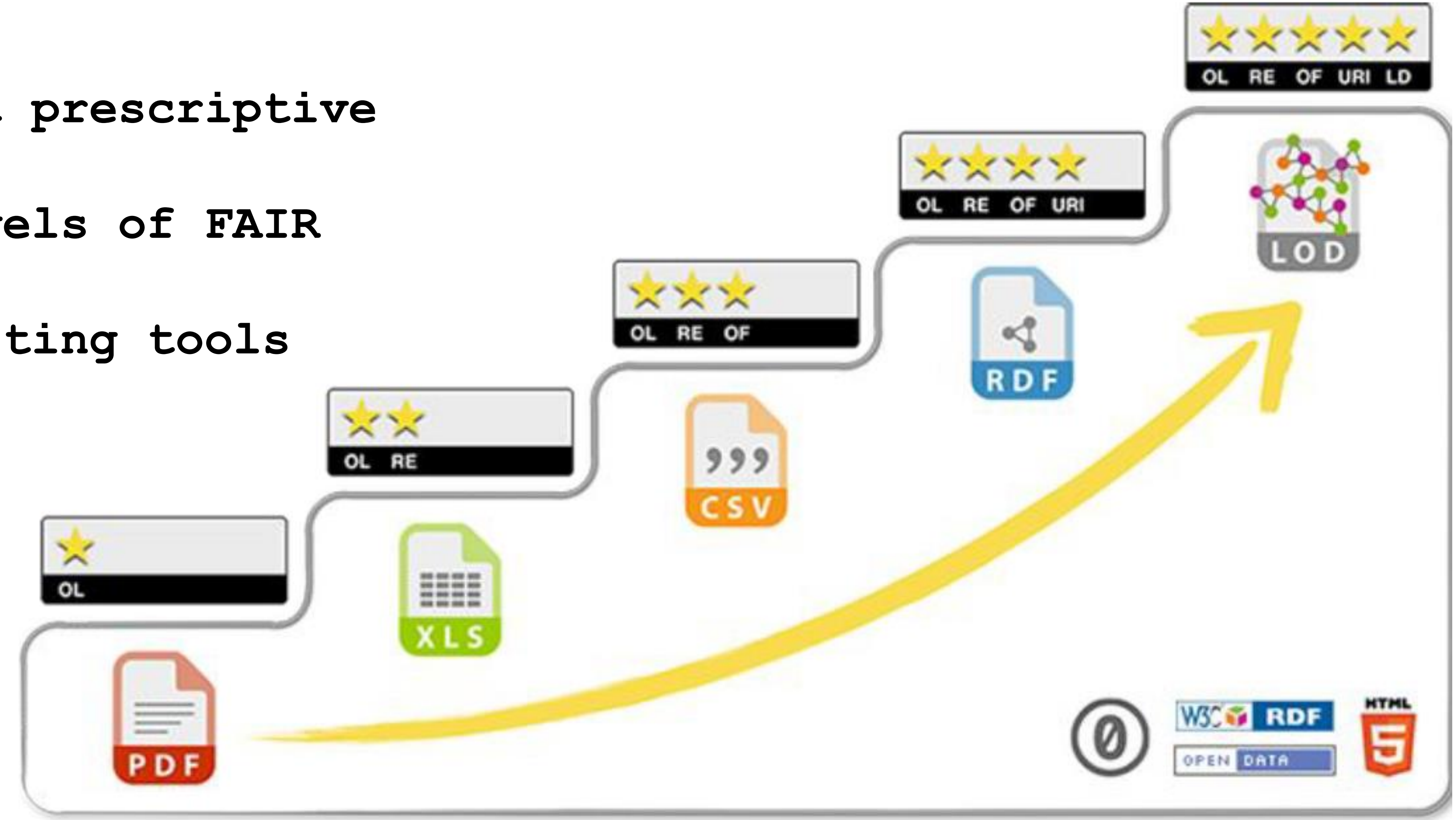
SUBJECT CATEGORIES
» Research data
» Publication characteristics

Comment: The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson *et al.*#

Three main take home messages

- **FAIR is not prescriptive**
- **Varying levels of FAIR**
- **Use of existing tools**



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R: A Hitchhikers Guide to Reproducible Research

University College Cork Summer 2019

Instructors

Brendan Palmer
Darren Dahly

Course notes

- GitHub repository: https://github.com/bapalmer/R-A_Hitchhikers_Guide_to_Reproducible_Research

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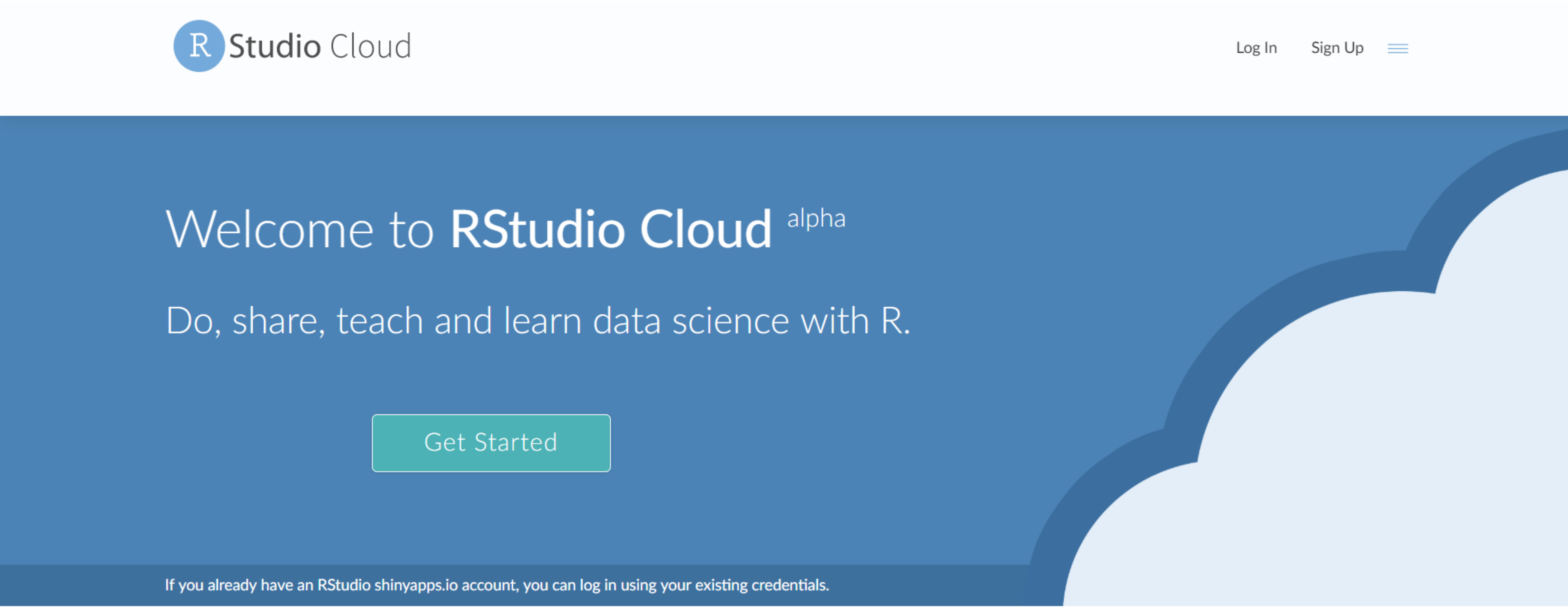

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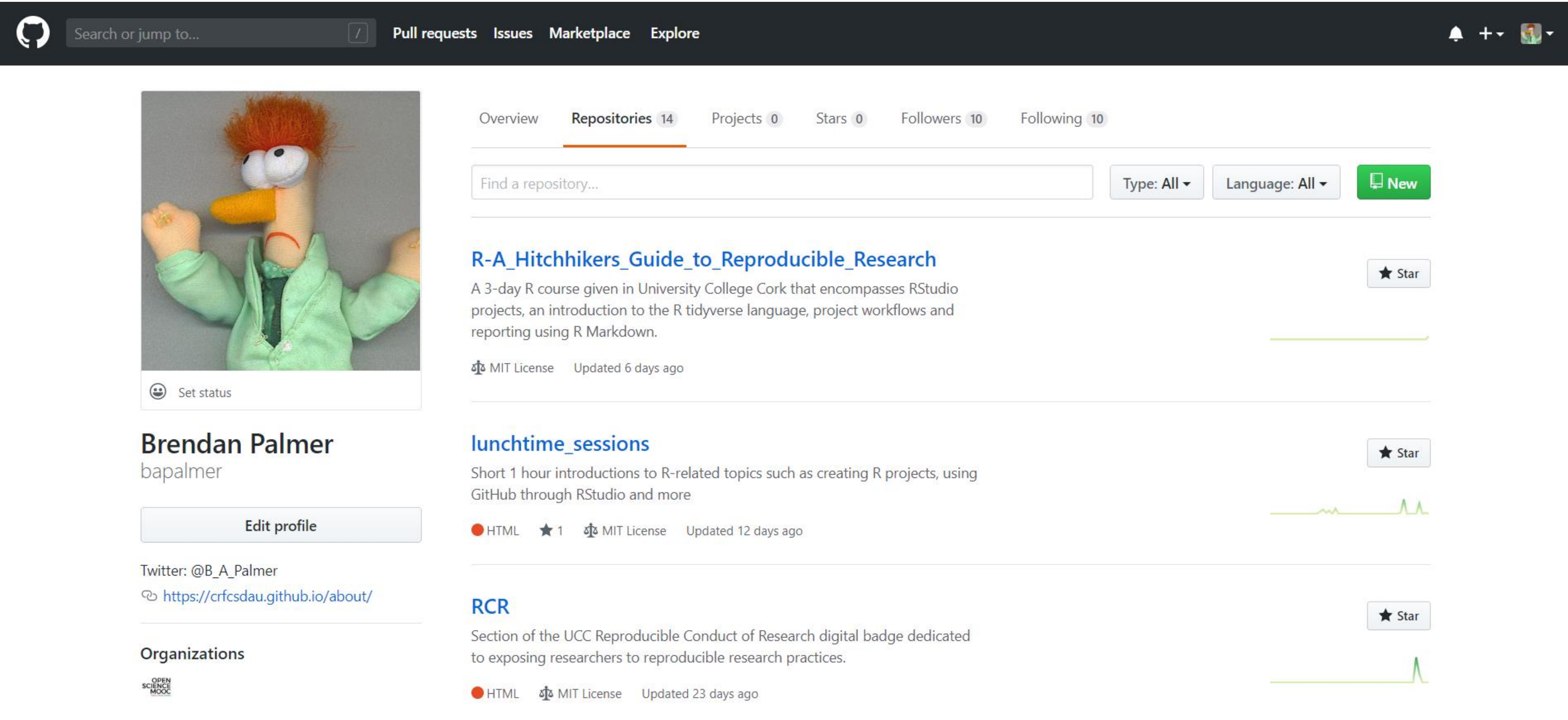

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Central theme of this workshop

Workshop content