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Meaningful metrics

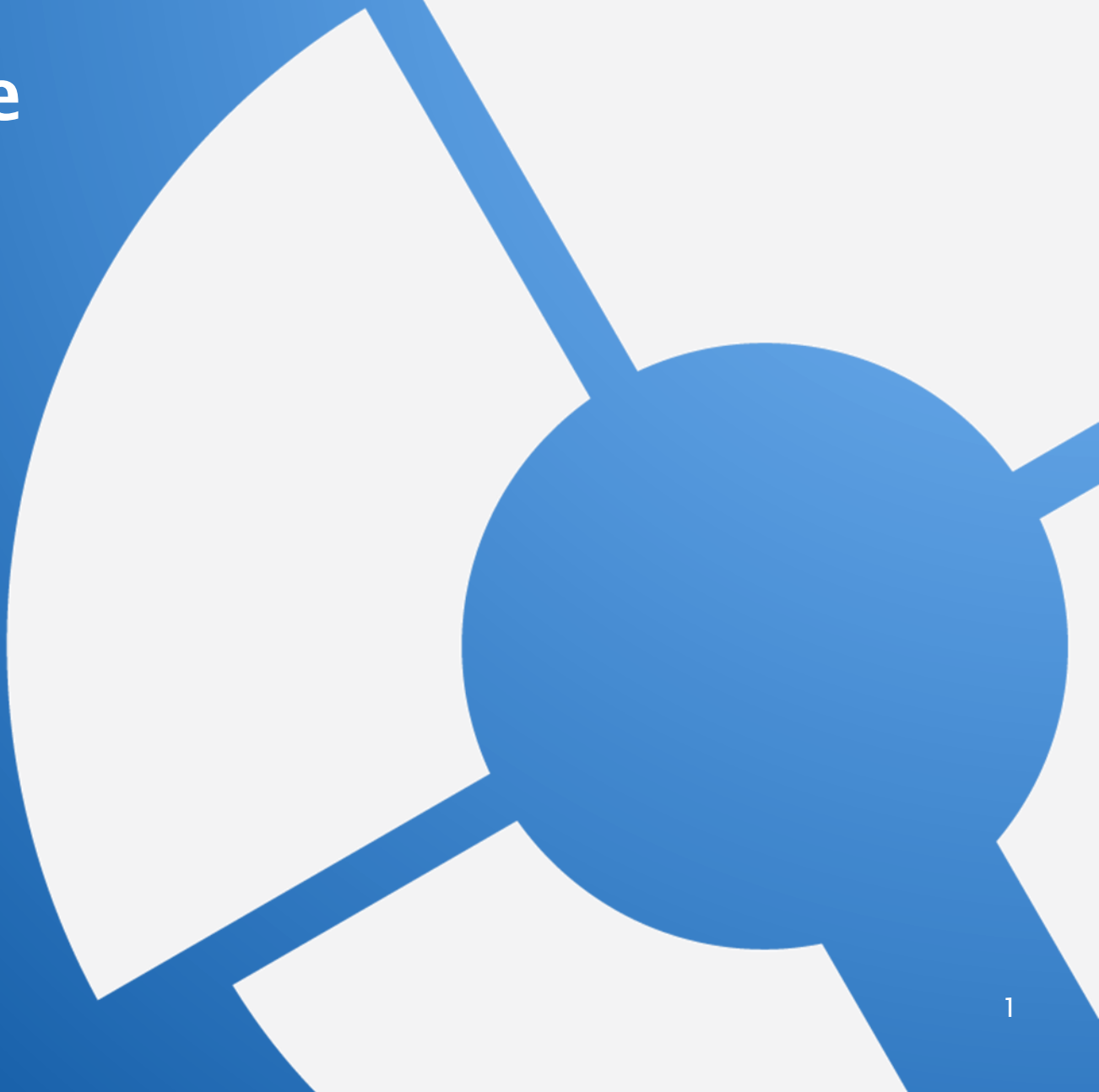
Impact as Performance

Paul Wouters

Universiteit Leiden

AESIS 2018
Consiglio Nazionale delle Ricerche,
Rome, 23 March 2018

Responsible evaluation



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Ian Sample, science correspondent

COMMENT
The Leiden Manifesto for research metrics

San Francisco
DORA
Declaration on Research Assessment

The Metric Tide
Report of the Independent Review of the Role of Metrics in Research Assessment and Management
July 2015

The Leiden Manifesto

- Quantitative evaluation should support expert assessment.
- Measure performance in accordance with the research mission.
- Protect excellence in locally relevant research
- Keep data collection and analytical processes open, transparent and simple.
- Allow for data verification
- Account for variation by field in publication and citation practices
- Data should be interpreted taking into account the difficulty of credit assignment in the case of multi-authored publications.
- Base assessment of individual researchers on *qualitative* judgment.
- False precision should be avoided (eg. the JIF).
- Systemic effects of the assessment and the indicators should be taken into account and indicators should be updated regularly

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Diana Hicks (Georgia Tech), Paul Wouters (CWTS), Ismael Rafols (SPRU/Ingenio), Sarah de Rijcke and Ludo Waltman (CWTS) (2015) *Nature* 520: 429–31. doi:10.1038/520429a

Responsible metrics

Responsible metrics can be understood in terms of:

- **Robustness**: basing metrics on the best possible data in terms of accuracy and scope;
- **Humility**: recognizing that quantitative evaluation should support – but not supplant – qualitative, expert assessment;
- **Transparency**: keeping data collection and analytical processes open and transparent, so that those being evaluated can test and verify the results;
- **Diversity**: accounting for variation by field, using a variety of indicators to reflect and support a plurality of research & researcher career paths;
- **Reflexivity**: recognizing the potential & systemic effects of indicators and updating them in response.

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Measuring is changing

- What counts as quality is shaped by how we measure and define “quality”
- What counts as impact is shaped by how we measure and define “impact”
- *Qualities* and *interactions* are the foundation for “excellence” and “impact” so we should understand those more fundamental processes first
- We need different indicators at different levels in the scientific system to inform wise management that strikes the right balance between trust and control
- Context is crucial for effective data standardization

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Context counts

- Responsible metrics is *not* supposed to be a universal standard
- Responsible metrics should be responsive and inclusive metrics
- The context shapes what responsible metrics means:
  - the urgency of social problems (poverty, inequality, unemployment and corruption)
  - local research and educational missions
  - the local appropriation of “the global”
  - the values embedded in the policies and communities

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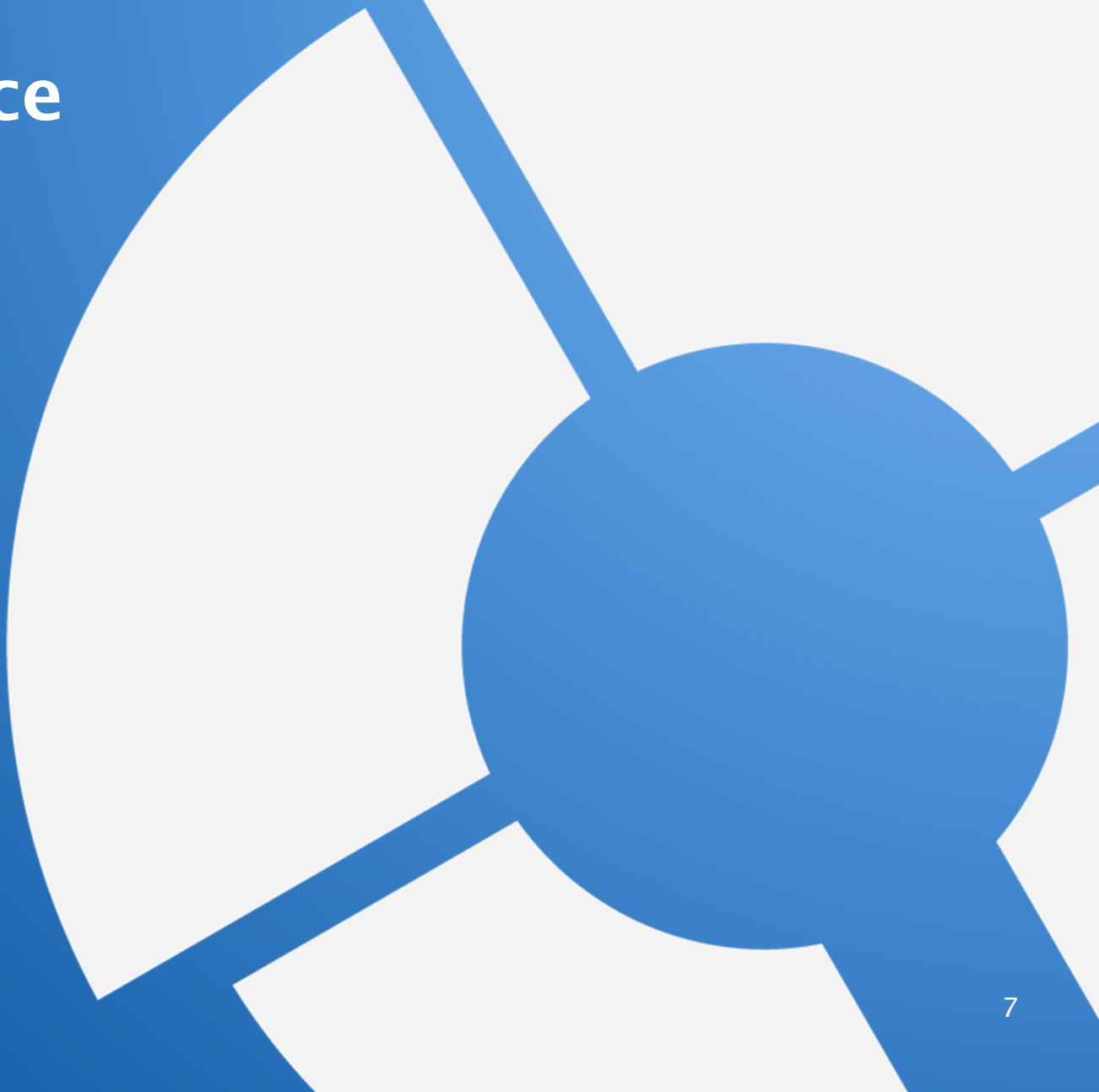
Open Science



Definition of open science

In May 2016, the Competitiveness Council adopted conclusions on 'The transition towards an Open Science system' where it acknowledges that "Open Science has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe".

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1. Reward and incentive systems
2. Measuring quality and impact
3. Future of scholarly publishing
4. FAIR open data
5. Open Science Cloud
6. Research integrity
7. Citizen Science
8. Open education and skills

OSPP recommendations – research indicators and next generation metrics

- Do not use journal brand or IF for individual researcher assessment as proxy for quality
- Develop indicators that capture full range of contributions
- Do pilots to check validity of these indicators as part of Horizon2020
- Apply ORCID and develop CV best practices
- All metadata should be open

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Open Science Monitor (in development)

- monitor for Europe and global observatory of open science trends
- reference point for the open science community
- determine impacts of OS
- structured analysis of policy relevant trends in OS
- comprehensive
- inclusive and open for comments

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Rewards working group

- Research Performing Organisations (RPOs) should be strongly encouraged to include OS practices in the evaluation of performance and of career development
- Research Funding Organisations (RFOs) should be strongly encouraged to include OS practices in the evaluation criteria for funding proposals and as part of the assessment of the researchers.
- The Open Science Career Assessment Matrix as central tool

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Expert Group Indictors for Open Science: Key considerations

- Open knowledge practices are the key issue (not open artefacts or outputs)
- Open science is very diverse
- Generic “OS indicators” are fundamentally in contradiction to the very concept of open science
- Open science is very dynamic: tools come and go
- Indicators are only useful if put in the right context and closely connected to the practices
- Existing/developing metrics are partial and only relevant in a specific context

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Key concepts

- Stimulate the bottom-up development of next generation metrics in the context of the practices that they are meant to indicate
- Indicator frameworks that guide the development and use of indicators
- Tool libraries / kits / boxes that are developed bottom-up need to be harvested and made available
- Do NOT try to develop or impose ”OS Indicators” top-down

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Draft recommendations:

Funding agencies, research performing organizations, publishers, and policy makers work together to prioritize **a four-fold approach to open science**:

- **creating novel infrastructures** to enable effective and efficient knowledge sharing at all points of the research cycle. These infrastructures should in the medium term replace the current scientific publication system by integrating appropriate quality control mechanisms.
- **building open knowledge practice capabilities** in all scholarly communities.
- **investing in best practices and exemplary initiatives** in knowledge sharing which are transformative in their field.
- **including these open knowledge practices in the reward and incentive systems** at national and European levels and removing performance indicators that act as barriers to engagement. We are mindful of the fact that these barriers may differ across scientific fields.

OpenCitations Corpus

Open citations

Make bibliographic citation data freely available and substantial benefits will flow, says **David Shotton**, director of the Open Citations Corpus.

When Heather Piwowar set out in May last year to investigate whether making research data publicly available increased the citation rates of articles[1], she never anticipated the difficulties. Piwowar, co-founder of ImpactStory[2], and who is based in Vancouver, Canada, was at the time a postdoc at Duke University in North Carolina. Lacking institutional access to Scopus, Elsevier's database of scholarly citations, she eventually obtained access through a research-worker agreement with Canada's National Science Library. But this required her to be fingerprinted to obtain a police clearance certificate because she had lived in the United States. "I wasted days trying to access the citation data required for *my* study," she told me. "It was just ridiculous." Piwowar needed to analyse citation counts for 10,000 articles, but the other major citation source, the Thomson Reuters Web of Science, did not at the time support queries using PubMed's unique identifier numbers. She explains: "Had there been open citation data, I could have written my own script!" ▸

IMPACT
A *Nature* special issue
nature.com/impact

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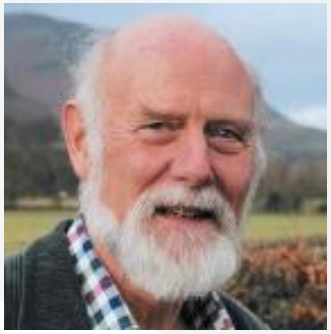
readily accessible online, he would have been saved considerable effort. Research practice suffers because access to citation data is currently so difficult.

In this open-access age, it is a scandal that reference lists from journal articles — core elements of scholarly communication that permit the attribution of credit and integrate our independent research endeavours — are not readily and freely available for use by all scholars.

To rectify this, citation data now need to be recognized as a part of the commons — those works that are freely and legally available for sharing — and placed in an open repository. To that end, since 2010 I have led a project funded by two small grants totalling £132,000 (US$212,000) from Jisc (www.jisc.ac.uk), a UK information technology research and



that of the others, because it includes books, theses, preprints, technical reports and other non-peer-reviewed 'grey' literature.

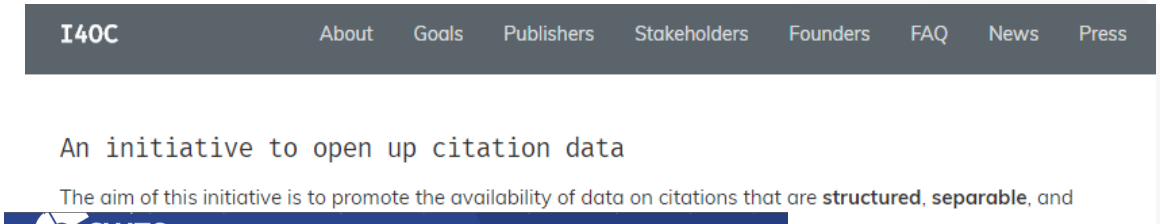
All these sources have licence restrictions that prevent the re-publication of their citation data. For this reason, bibliometrics papers are rarely permitted to publish the data on which their conclusions are based — hampering reuse, validation of findings and other advantages of open data.

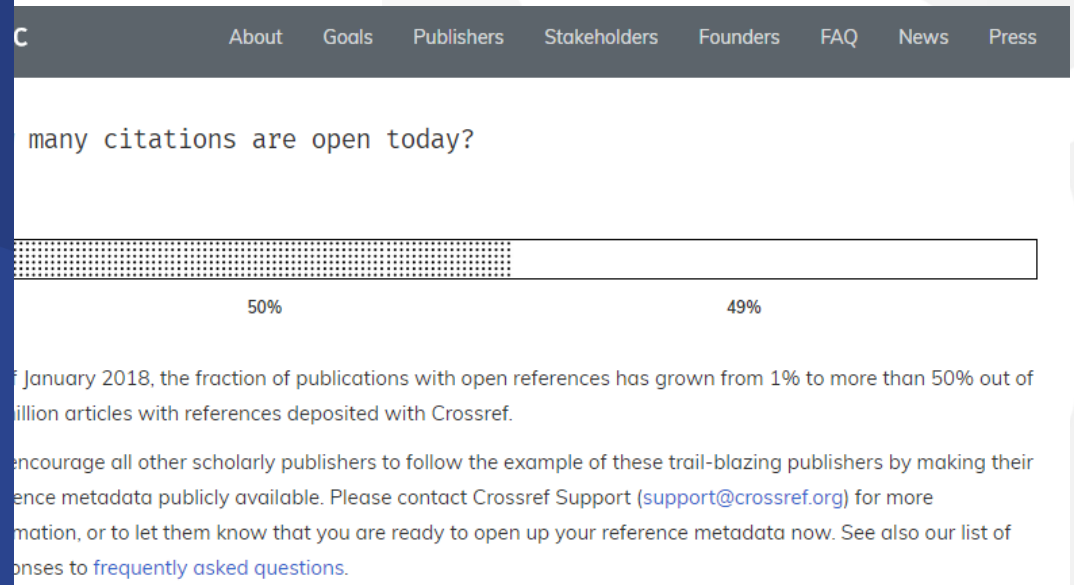
Worse, the available citation data are not accurate. My own citation record differs

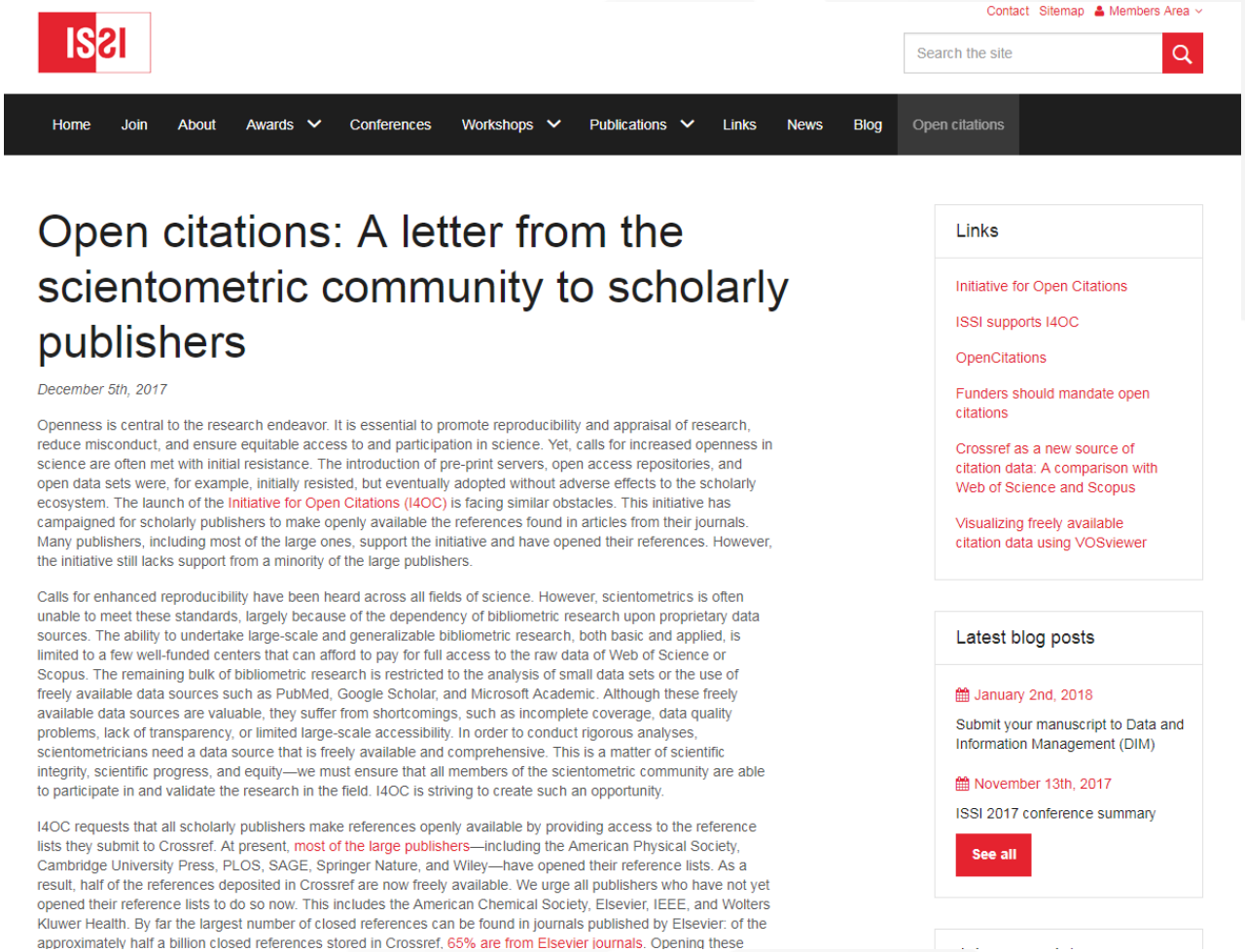
Nature, 2013, 502, 295–297

Initiative for Open Citations (I4OC)

I4OC







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Open citations: A letter from the scientometric community to scholarly publishers

December 5th, 2017

Openness is central to the research endeavor. It is essential to promote reproducibility and appraisal of research, reduce misconduct, and ensure equitable access to and participation in science. Yet, calls for increased openness in science are often met with initial resistance. The introduction of pre-print servers, open access repositories, and open data sets were, for example, initially resisted, but eventually adopted without adverse effects to the scholarly ecosystem. The launch of the Initiative for Open Citations (I4OC) is facing similar obstacles. This initiative has campaigned for scholarly publishers to make openly available the references found in articles from their journals. Many publishers, including most of the large ones, support the initiative and have opened their references. However, the initiative still lacks support from a minority of the large publishers.

Calls for enhanced reproducibility have been heard across all fields of science. However, scientometrics is often unable to meet these standards, largely because of the dependency of bibliometric research upon proprietary data sources. The ability to undertake large-scale and generalizable bibliometric research, both basic and applied, is limited to a few well-funded centers that can afford to pay for full access to the raw data of Web of Science or Scopus. The remaining bulk of bibliometric research is restricted to the analysis of small data sets or the use of freely available data sources such as PubMed, Google Scholar, and Microsoft Academic. Although these freely available data sources are valuable, they suffer from shortcomings, such as incomplete coverage, data quality problems, lack of transparency, or limited large-scale accessibility. In order to conduct rigorous analyses, scientometricians need a data source that is freely available and comprehensive. This is a matter of scientific integrity, scientific progress, and equity—we must ensure that all members of the scientometric community are able to participate in and validate the research in the field. I4OC is striving to create such an opportunity.

I4OC requests that all scholarly publishers make references openly available by providing access to the reference lists they submit to Crossref. At present, most of the large publishers—including the American Physical Society, Cambridge University Press, PLOS, SAGE, Springer Nature, and Wiley—have opened their reference lists. As a result, half of the references deposited in Crossref are now freely available. We urge all publishers who have not yet opened their reference lists to do so now. This includes the American Chemical Society, Elsevier, IEEE, and Wolters Kluwer Health. By far the largest number of closed references can be found in journals published by Elsevier: of the approximately half a billion closed references stored in Crossref, 65% are from Elsevier journals. Opening these

Links

Initiative for Open Citations

ISSI supports I4OC

OpenCitations

Funders should mandate open citations

Crossref as a new source of citation data: A comparison with Web of Science and Scopus

Visualizing freely available citation data using VOSviewer

Latest blog posts

January 2nd, 2018

Submit your manuscript to Data and Information Management (DIM)

November 13th, 2017

ISSI 2017 conference summary

See all

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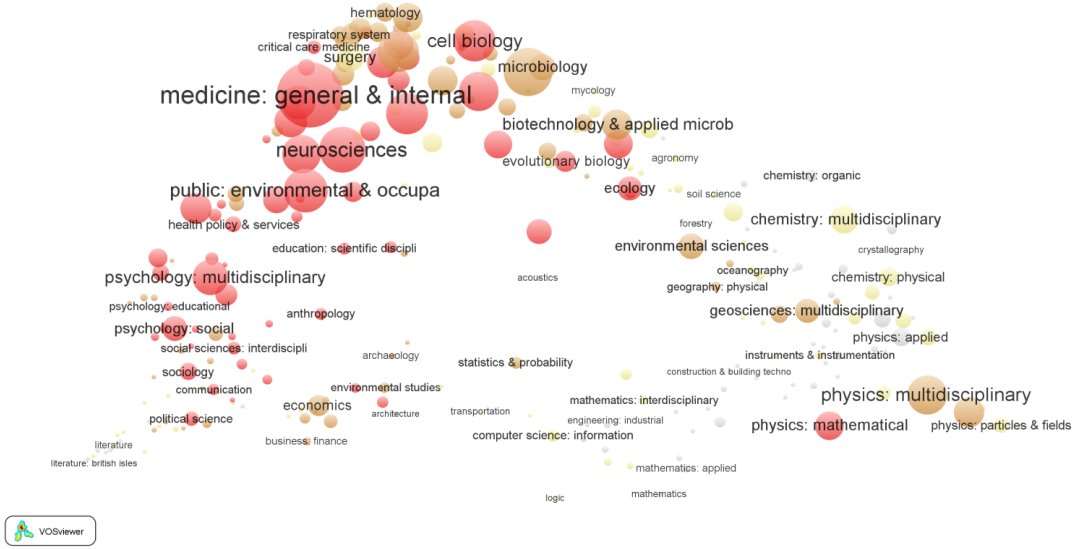
“Altmetrics”: some examples

Coverage by fields

http://dx.doi.org/10.1108/AJIM-12-2014-0173

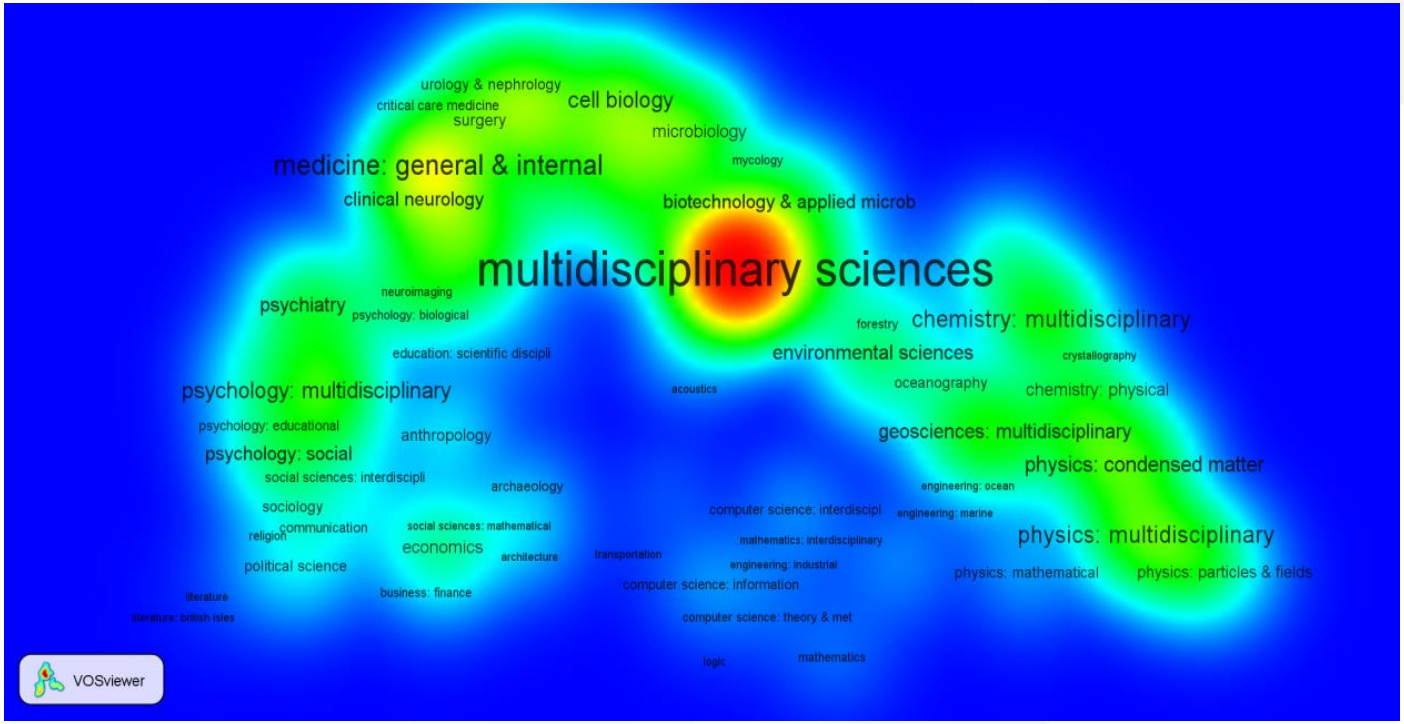
- Some relevant patterns:
  - Twitter: **stronger in Social Sciences and General medicine, weaker in Natural Sciences and Humanities**



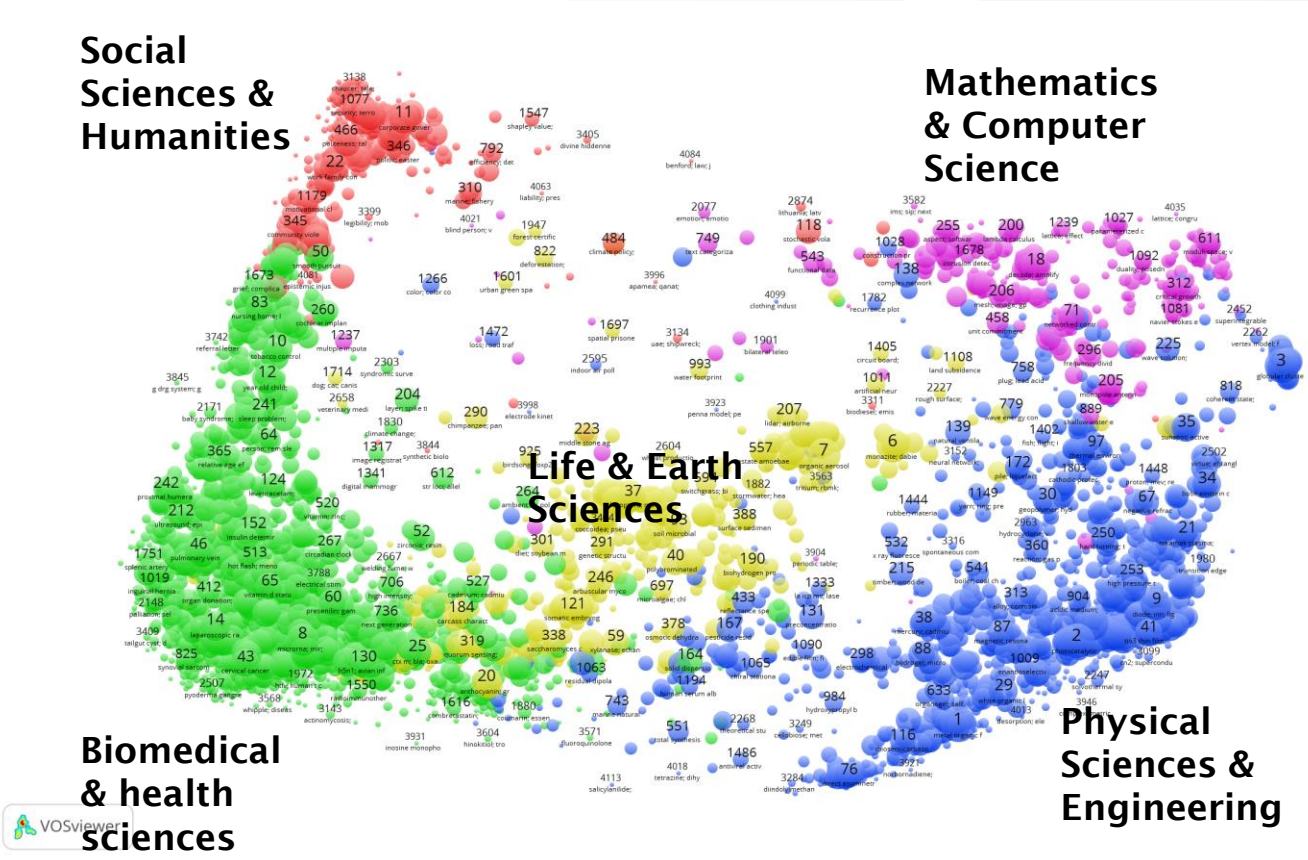
Coverage by fields

http://dx.doi.org/10.1108/AJIM-12-2014-0173

- Blogs and news media have a strong **focus on multidisciplinary journals!**

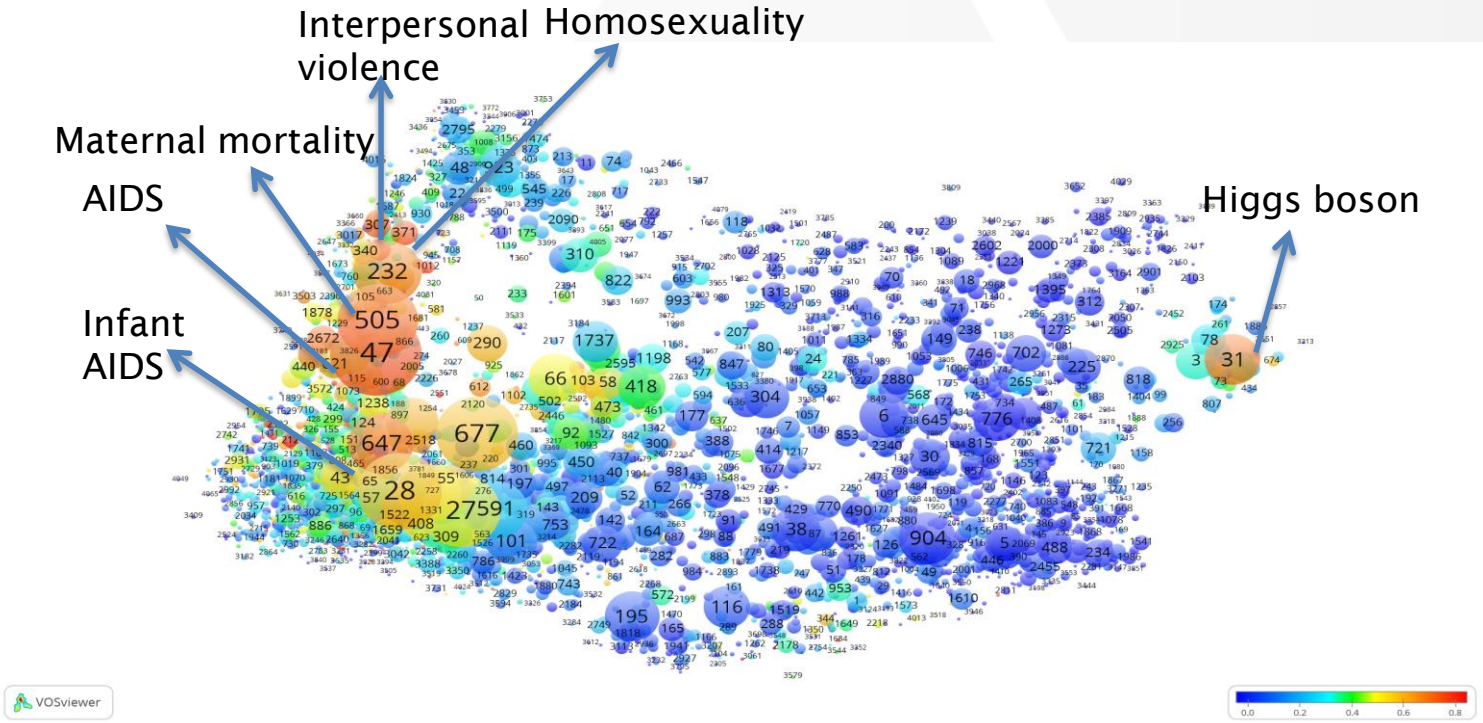


Twitter thematic landscapes



Twitter thematic landscape – Africa

Prop. Publications tweeted



New approaches in evaluation

Recommendations on measuring impact at AESIS 2017

- Develop new evaluative methodologies to both *enable* and *make visible* societal impact of scholarship and research as well as interactions between researchers and society
- Re-orient academic assessment systems towards incentives for interaction with society; end assessments that basically promote academic arrogance and insularity
- Combine quantitative with qualitative evidence of impact and always put the evidence in context (keep in mind: *Measuring is Changing* and *Context Counts*)

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Quality/impact are produced by assessment practices and structures

- What counts as excellence is shaped by how "excellence" is measured and defined
- What counts as impact is shaped by how "impact" is measured and defined
- *Qualities* and *interactions* are the input for "excellence" and "impact" but the context of assessment is as important in shaping what counts as quality and impact
- Indicators are the semiotic vehicles that translate between "daily life of a researcher" and "science policy" at the level of the research organization

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Evaluative Inquiry

- Rethinking research excellence and academic quality.
- Research quality is not just an academic issue, but relevant to policy, professional networks and societal domains.
- Metric analyses offer limited understanding of reality. A portfolio of different methodologies offers additional perspectives.
- Evaluations are often used as accountability tools. As such they don’t enable organizational learning. The evaluative inquiry aspires to both.

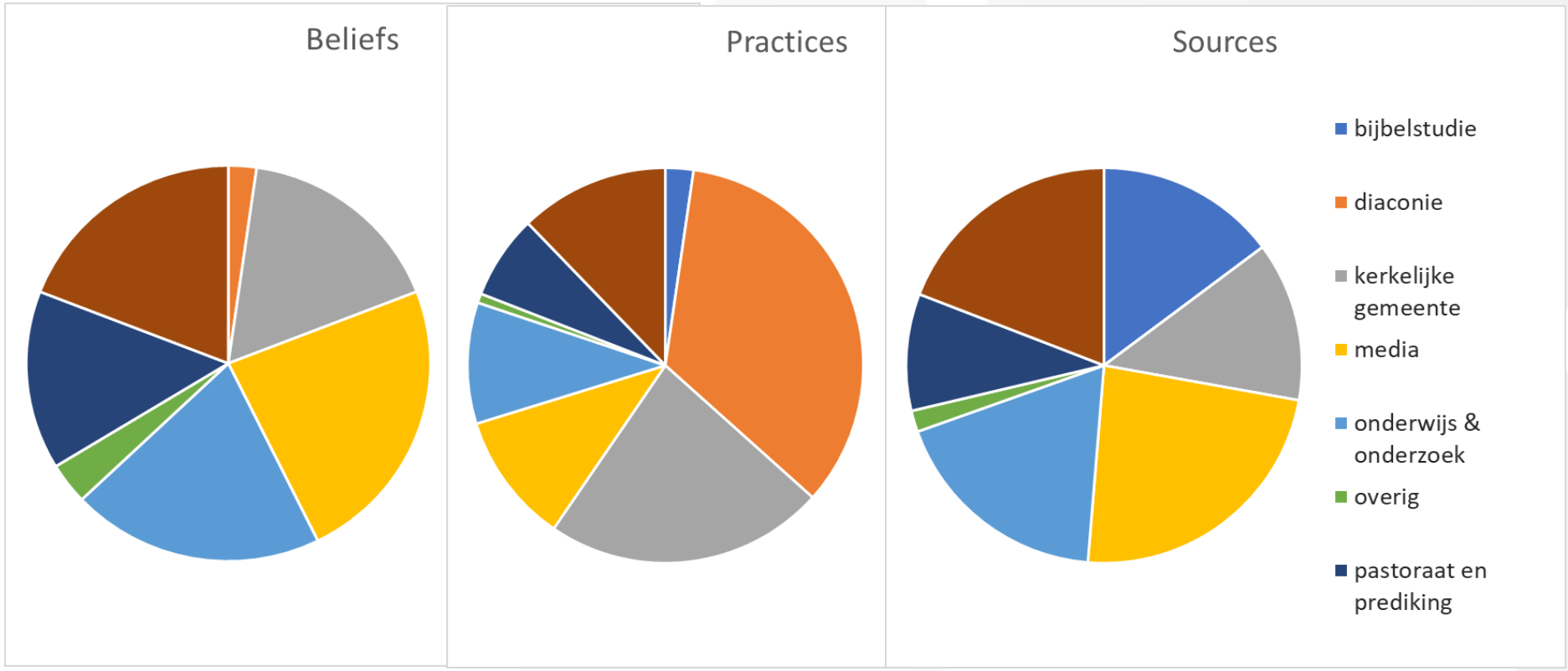
The Evaluative Inquiry's method

1. Exploration	What are the central issues and questions of the project? Document analysis and conversations with client.
	Design of research approach and specification of combination of methods.
2. Data collection and analysis	# Contextual Response Analysis (Prins, n.d.); contextual scientometrics (Waltman & van Eck, 2016); bibliographic coupling; co-citation analyses; Area Based Connectedness (Noyons, 2018) # Interviews with researchers and stakeholders about institutional organization, academic themes, output and impact.
	Workshops – data collection for SWOT analysis and/or testing of hypotheses.
3. Reporting	Analysis of institutional organization as well as the relations between academic themes, output and impact. SWOT. Suggestions for self-assessment.

PThU data collection and analysis

- Contextual Response Analysis: (online) analysis of users of research results to establish which (potentially unknown) users are being reached.
- Interviews with employees and stakeholders about the institutional organization and impact pathways: connections between themes and ambitions; mobilization of people and resources; outputs; impact on societal, academic and professional domain.
- Workshop to test hypotheses and collect material for SWOT.

CRA analysis: different profiles…



Research teams have distinct profiles

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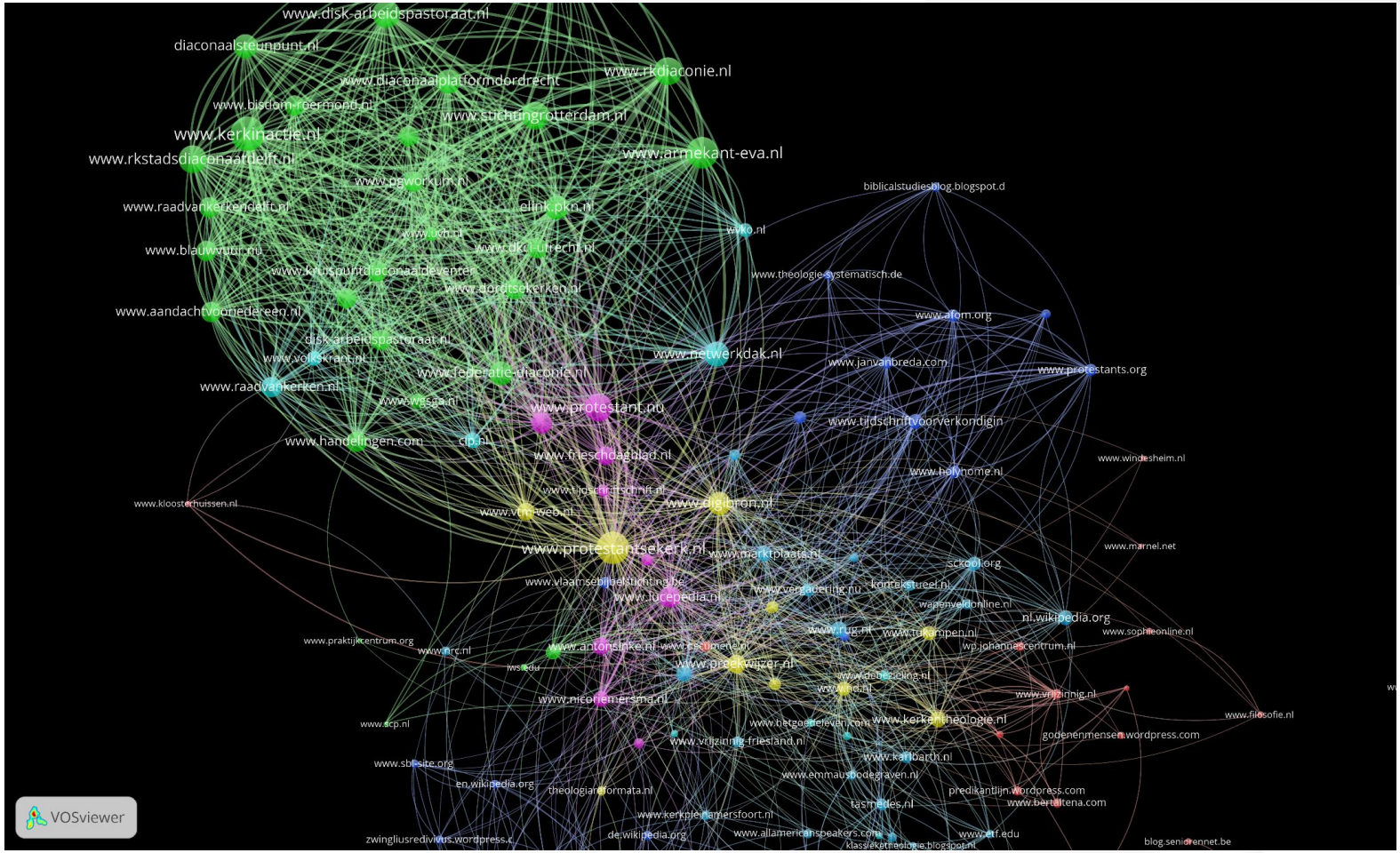
And affinities



PThU staff connected in co-citation map

Results evaluative inquiry

- Detailed analysis of:
  - Evolution and transformation of research topics
  - Possibility to diversify and protect local excellence
  - Translation knowledge in outputs, outcomes, impacts
  - Distinction between different phases of generating impact (scientific, societal)
  - Involved networks of actors and types of resources
  - Influence research on academic and societal networks and fields

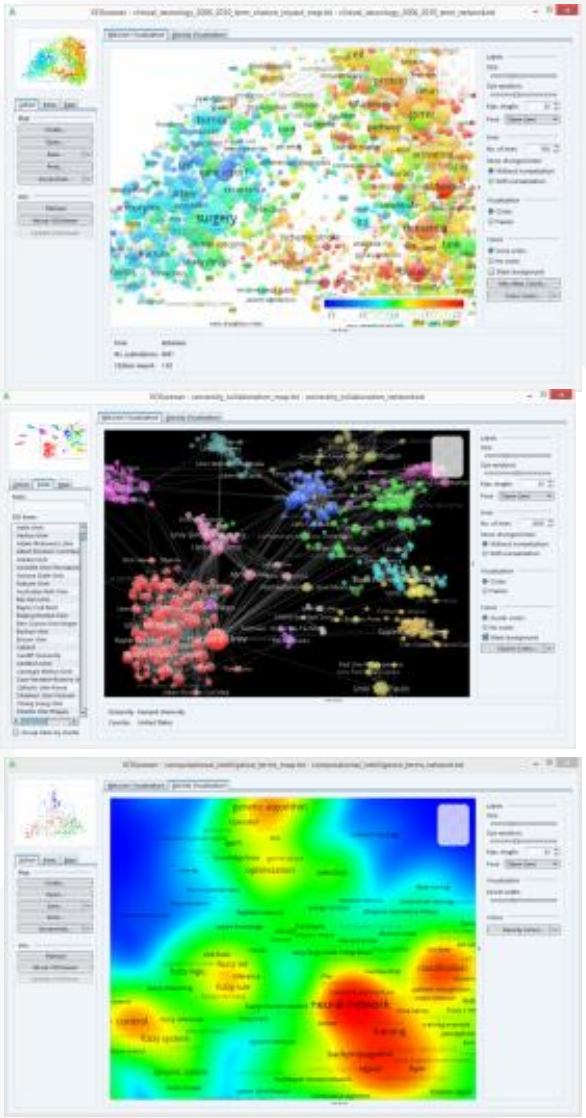
- Characteristics
  - tailor made and modular
  - content oriented, learning capacity central
  - mixed methods approach
  - Indicators as ‘proxies’ for narratives
- Makes visible:
  - mission and research topics
  - communication and collaboration patterns
  - all types of output and results
  - conditions for research and infrastructure
  - process determinants (eg open science, gender diversity)

What can you do with it

- Can serve as a starting point to develop or refine the missions of the organization
- Based on the views and experiences of researchers and users (bottom up)
- Articulating what is already going on
- And identifying new possibilities
    - New audiences, existing ones
    - Ways of communication next to books and articles
    - A clearer structure of the organization, in terms of programs, centres and projects

Map interactions rather than output

- Innovation interactions take place in heterogeous networks of actors
- Science is “applied” in translation processes: science is not immediately useful
- Mapping impact means mapping these interaction processes rather than isolated impact results



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Fewer numbers, better science

Scientific quality is hard to define, and numbers are easy to look at. But bibliometrics are warping science — encouraging quantity over quality. Leaders at two research institutions describe how they do things differently.

REDEFINE EXCELLENCE

Fix incentives to fix science

Rinze Benedictus and Frank Miedema

An obsession with metrics pervades science. Our institution, the University Medical Center Utrecht in the Netherlands, is not exempt. On our website, we proudly declare that we publish about 2,600 peer-reviewed scientific publications per year, with higher than average citation rates.

A few years ago, an evaluation committee spent hours discussing which of several faculty members to promote, only to settle on the two who had already been awarded particularly prestigious grants. Meanwhile, faculty members who spent time crafting policy advice had a hard time explaining how this added to their scientific output, even when it affected clinical decisions across the country.

Publications that directly influenced patient care were weighted no higher in evaluations than any other paper, and ▶

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ACUMEN portfolio

aim is to give researchers a voice in evaluation

- evidence based arguments
- shift to dialog orientation
- selection of indicators
- narrative component
- Good Evaluation Practices
- envisioned as web service

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ACUMEN Portfolio

Career Narrative

Links expertise, output, and influence together in an evidence-based argument; included content is negotiated with evaluator and tailored to the particular evaluation

Expertise

- scientific/scholarly
- technological
- communication
- organizational
- knowledge transfer
- educational

Output

- publications
- public media
- teaching
- web/social media
- data sets
- software/tools
- infrastructure
- grant proposals

Influence

- on science
- on society
- on economy
- on teaching

Evaluation Guidelines

- aimed at both researchers and evaluators
- development of evidence based arguments (what counts as evidence?)
- expanded list of research output
- establishing provenance
- taxonomy of indicators: bibliometric, webometric, altmetric
- guidance on use of indicators
- contextual considerations, such as: stage of career, discipline, and country of residence

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Portfolio & Guidelines

- Instrument for empowering researchers in the processes of evaluation
- Taking in to consideration all academic disciplines
- Suitable for other uses (e.g. career planning)
- Able to integrate into different evaluation systems

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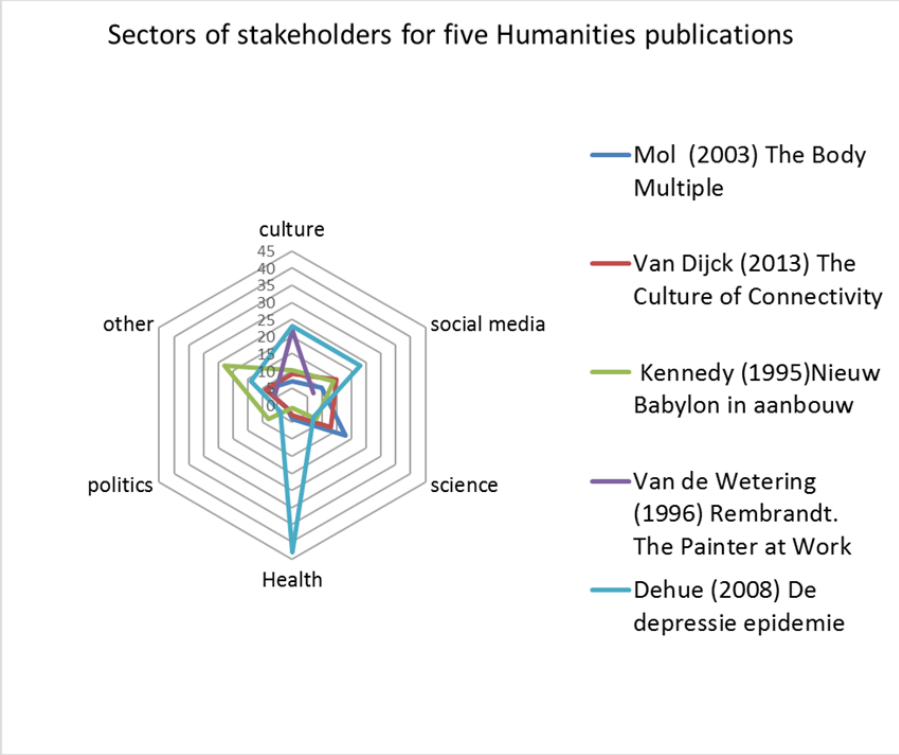
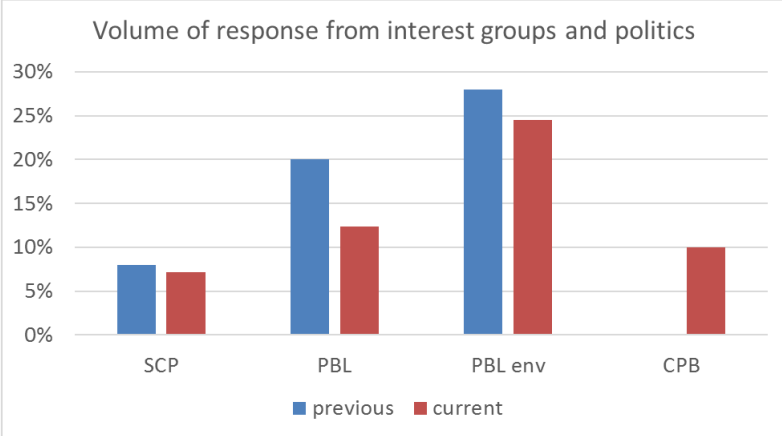
Context Response Analysis (CRA)

- Tracing use, classifying the user in society, science, news and politics
  - Goal: Enabling evaluation in terms of learning from past performance
  - Developed in concurrence with SIAMPI, ERiC
  - Method: formalized searches in Parliament, LexisNexis, Google & Bing, GS
  - Result: profiles of research units, identified stakeholders
- Flexibility
  - Operationalize the method to address issues and questions in the evaluation
  - Identifying meaningful interactions or groups of stakeholders

CRA types of outcome





Hybrid outcomes of research: combined academic and societal interest

Next steps in management and policy

- Remove performance indicators that are no longer contributing to the mission
- Do not artificially isolate “impact” from “quality”
- Embrace variety rather than give in to policy push for “one approach”
- Develop experiments with interactive evaluation exercises with researchers and stakeholders
- Map interactions rather than measure impact

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Thank you for your attention