Measuring what matters: metrics, incentives and openness

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Outline

• Metrics for Openness
• Metrics and Incentives
"It would be quite easy to generate a list of over 100 different (nested) measures to which each individual academic in the UK is now (potentially) subject. However, for our purposes here, we will consider just six domains: citations; workload models; transparent costing data; research assessments; teaching quality assessments; and university league tables. ...

The [h-]index has become reified; it has taken on a life of its own; a number that has become a rhetorical device with which the neoliberal academy has come to enact ‘academic value’.

"I’m starting to see that academia’s been approaching evaluation metrics from the wrong angle: most institutions simply measure what can be easily counted, rather than using carefully chosen data to measure their progress towards embodying important scholarly values."

"let’s use value-aligned evaluation practices to incentivize the “enriching” practices we want to encourage"

https://www.altmetric.com/blog/a-surprisingly-obvious-way-to-incentivize-openness-in-academia/
Getting our hands dirty: why academics should design metrics and address the lack of transparency.

Chris Elsden, Sebastian Mellor and Rob Comber

“complement critiques of metrics with getting our hands dirty in reflectively and critically designing metrics.”

http://blogs.lse.ac.uk/impactofsocialsciences/2016/04/06/getting-our-hands-dirty-why-we-should-design-metrics/
Starting point

• “Lonnie Thompson is one of the worst archiving offenders in paleoclimate, and that’s a real beauty contest.”
  – http://climateaudit.org/2006/07/06/new-thompson-article-at-pnas/#comment-55284

• Data unavailability → openness in general

• Ideas initially developed over talks at iSchools (UNC, UIUC, IU)
  – 2012

https://doi.org/10.1145/2132176.2132224
iSchool Dean *Openness Index* 2011

1  Georgia Tech, Illinois, IU-SIC, Syracuse, Toronto, UCD, UC-Irvine, UCL, UMD, UMich, UNC, UW
0.5  Tampere, UBC
0.25  CMU
0.2  Humboldt
0  IU-SLIS, PSU, RSLIS, Sheffield, UK, UMBC

No data: Drexel, FSU, Pitt, Rutgers, SMU, UC-Berkeley, UCLA, UNT, UT-Austin
No evaluation: Nanjing, Wuhan

Slide from *iConference 2012* presentation
Citation-based Metrics

• Journal Impact Factor
• Total citations, avg. Citations
  – half-life, immediacy, EigenFactor, etc.
• h-index since 2005
  – variants: g-index, hbar-index etc.
• Frequently used to characterise
  – Individuals, institutions, publication venues etc.
• Citations are not enough
• Diverse article-level metrics
• Impactstory
• Views, downloads, bookmarking etc. in ‘non-academic’ venues:
  – Wikipedia
  – Blogs, Twitter, Facebook
  – Mendeley, CiteULike
  – SlideShare

http://blog.impactstory.org/new-impactstory-logo/
Open Access

“By ‘open access’ to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself.”

http://www.budapestopenaccessinitiative.org/read
Missing Metrics

• We don’t have metrics that characterise authors’ behaviour with respect to Open Access issues
• So we can’t easily compare, chide or celebrate authors’ OAness


*Villavelius* Jan Velterop

Unfortunately it's 'publish or perish' and not 'share or be shunned' in the scientific ego-system. #SOPA #RWA

• Let’s fix that...
Openness Index

• Of the items *you* have published how many are free for anyone to read?
  – Practically: if someone searches for the title of your paper in Google do they find a copy they can read?
How to measure Openness?

• Grain size:
  – Person, Group, Dept, School, Institution, System
  – Journal/Conference/etc, Publisher
  – Sub-discipline, Discipline
  – Funder
  – State/Province, Country
Cross-Discipline

Björk et al. (PLoS ONE 2009)

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Gold %</th>
<th>Green %</th>
</tr>
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<tbody>
<tr>
<td>Medicine</td>
<td>7.8 %</td>
<td>13.9%</td>
</tr>
<tr>
<td>Biochemistry, Genetics &amp; Molecular Biology</td>
<td>6.2%</td>
<td>13.7%</td>
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<tr>
<td>Other Areas Related to Medicine</td>
<td>4.6%</td>
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<td>Mathematics</td>
<td>8.1%</td>
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<tr>
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<tr>
<td>Social Sciences</td>
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<td>17.9%</td>
</tr>
<tr>
<td>Chemistry and Chemical Engineering</td>
<td>5.5%</td>
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<tr>
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<td>13.6%</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>3.0%</td>
<td>20.5%</td>
</tr>
</tbody>
</table>
Institution

- University of Helsinki
- 7771 journal articles from 2007-8
- 5% sample

Figure 1: Collective Open Access availability.

Koskinen et al. (SI 2010)
### Sub-Institution

![Sub-Institution Chart]

**Figure 3:** Open Access availability by faculty.

*The sum is more than 100% because of the co-authored articles across faculties. (Figure 3)*

Faculties of the University of Helsinki

Koskinen et al. (SI 2010)
Statistics Overview
Skitmore, Martin

Key Figures
Collection
394 Works
96.9% Full-text
80.9% Open-access

Total Usage
474,116 Downloads
99.1% External

Last 28 Days
2,701 Downloads

Individuals

• Missing?
• Each author gets an Openness Index defined across their publications

• Conferences + journals →
  – Twidale = 0.82
  – Nichols = 0.91

https://impactstory.org/u/0000-0003-0321-7267
What to measure?

- OA-gratis v OA-libre
  - Same value?
- Publication OA status
  - Equal value for an OA journal v self-archive?
- Publication type
  - Is C + J a reasonable middle ground?
  - → *Practical Openness Index* (POI)
Effective Openness Index (EOI)

• After taking account of existing copyright agreements
• Of the items an author could have made open, how many are actually open?
  – Difficult to automate
  – Individual author addenda
    special issue one-off copyright arrangements
Preservation

• “Knowing that faculty Web sites are deleted after they leave the university and that the maintenance of departmental servers varies over time, some faculty interviewed in 2006 expressed concern about the preservation of their ‘legacy’”

  Covey (2009)

• Simple OI doesn't take into account the location
  – personal web space as good as IR?
Preservation-Friendly Openness Index (PFOI)

= open items in legacy-friendly locations / all items

Yes  IR, open access journal, publisher DL
No   personal web/FTP space
?    research group web space

PFOI values are Twidale = 0.45 and Nichols = 0.84
Acce$$$ Index

• How much does it cost to access your research?

• For all the items that are not open:
  – Sum the cost to access them
  – Simple: individual independent items
  – Complex: bulk deals, joining societies etc.

Twidale = US$1,484 (over 20 items), Nichols = US$183 (over four items) in 2016
John Q. Public Institutional Cost Index

• If one person had the time ...

• How much would it cost to access all of your university's research output in 2016?
UI Mission

“To create a brilliant future for the University of Illinois in which the students, faculty and staff thrive and the citizens of Illinois, the nation and the world benefit”

https://www.uillinois.edu/about/mission/

citizens ≠ people with access via institutional subscriptions

citizens ≠ people with money who can go through paywalls

iBiosphere Rich Jorgensen
Yes, ethical science now requires each of us to publish in a way that makes our publicly funded research truly accessible to all #RWA
26 minutes ago

https://whoneedsaccess.org/
Actual Individual Purchase Index

• How much was actually paid to publishers to access your outputs?

• How much was actually paid to publishers to access your institution's research outputs?

• Royalty statements for books do contain this data – for the rest ...?
The ‘Open Paper’

• Defining measures across sets of papers
  – Interest comes from the set membership
• Set = references in a paper
• *Open Reference Index* (ORI) is the proportion of all the cited works of a paper that are themselves OA.
• The ORI for the *Metrics for Openness* paper at the time of writing was 0.92
Open Papers?

• a *Fully Open Paper*:
  – Which itself is Open Access, and
  – Where all of the references it relies on are Fully Open Papers

• Does an *Open Paper* exist in the literature?

• Does a *Fully Open Paper* exist?
Acce$$ Support Index

- What does it cost to access the closed items in a reference list?
- an Acce$$ Index calculated over the set of closed references it is an Acce$$ Support Index.
- For Metrics for Openness the Acce$$ Support Index for the eight non-open items cited was US$3,662 (2016)
Open Science/Research

“Open science is the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process.”

Nielsen (2011)

• Data
• Code
Data Archiving

• “Lonnie Thompson is one of the worst archiving offenders in paleoclimate, and that’s a real beauty contest.”

  http://climateaudit.org/2006/07/06/new-thompson-article-at-pnas/#comment-55284

• This statement cannot be evaluated with current metadata ...  
  – Implies existence of paper and author-specific data archiving metadata  
  – and a ranking of researchers ordered by their data archiving rates

Nichols, Twidale & Cunningham (iConf 2012)
Empty rhetoric over data sharing slows science

Governments, funders and scientific communities must move beyond lip-service and commit to data-sharing practices and platforms.

12 June 2017

http://www.nature.com/news/empty-rhetoric-over-data-sharing-slows-science-1.22133

Journals’ Retreat From Data-Sharing Mandate Puts Onus on Universities and Government

By Paul Basken | JUNE 12, 2017  ✔ PREMIUM

http://www.chronicle.com/article/Journals-Retreat-From/240323
Data Archiving Index

• If a paper creates/uses a dataset does it
  – Archive or uniquely identify the data in an open location

  = papers with open data / papers with data

• Lots of data release issues to get a ‘fair’ index
  – Privacy, commercial, ...
Code Archiving Index

• “anything less than the release of source programs is intolerable for results that depend on computation”
  Ince, Hatton & Graham-Cumming (Nature 2012)

*Biostatistics* (2011), 12, 4, pp. 637–652
doi:10.1093/biostatistics/kxr002
Advance Access publication on February 5, 2011

Estimating the acute health effects of coarse particulate matter accounting for exposure measurement error
Illegality Index

• How much of your work is available in contravention of existing copyright agreements?
  = illegally available papers / all papers

• At the Repository level this is partially a measure of:
  – Workflow copyright checking effectiveness and academics' behaviour

• ... But other people can illegally distribute your work!
Metrics for Openness

- Openness Index
  - Effective Openness Index
  - Preservation-Friendly Openness Index
- Acce$$ Index
  - *John Q. Public* Institutional Cost Index
- Actual Individual Purchase Index
- The ‘Open Paper’
- Data Archiving Index
- Code Archiving Index
- Illegality Index
Metrics as Designed Artefacts

• Designed not discovered
• A design space
• Multiple, often conflicting goals
• Multiple constraints
• Invidious tradeoffs
• Dealing with edge cases
• Use in context
• Incentives
• Appropriation & misuse

"We should understand metrics as designed artefacts."

http://blogs.lse.ac.uk/impactofsocialsciences/2016/04/06/getting-our-hands-dirty-why-we-should-design-metrics/
From Social Science to Social Engineering

• In the natural sciences a metric typically measures a thing that has no awareness of being measured: the temperature of a star, the capacity of a battery, etc.
• When we measure people, there is the possibility that they know that they are being measured.
• When you are measuring scientists, that possibility becomes a probability,
• When you are measuring scientific publishing, it becomes a certainty –
• Those being measured may change their behaviour.
Campbell’s Law

• "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor."
  • http://en.wikipedia.org/wiki/Campbell%27s_law

• But is that always a bad thing?
• Can it sometimes be a good thing?
• What if the change is in a desirable direction?
Metrics as Persuasive Technologies

- Metric design should not be considered purely as an objective scientific process but as a behavioural, managerial and political act, with the potential to nudge behaviour closer or further from a particular desired state.
  — (Thaler & Sunstein, 2008)

- The metric can be constructed as a form of advocacy
  - intended to change in a certain direction
Unintended Consequences

• Unintended OK, but unanticipated?
• Testing
  – White hat testing
• Considering use in context
• Account for human behavior
• Account for human innovation
Exploiting Campbell’s Law to Nudge

• Devise metrics that encourage behavioural change towards greater openness.
• Gaming: The negative effect of Campbell’s law
  – where people do an action that improves the metric while failing to improve access, or improving access less than if they had made their papers fully open.
• A challenge for metric designers is to minimize the incentives for subversion.
  – Ideally design a metric such that subverting it is more effort than engaging in the desirable change in behaviour.
• Minimize disincentives
  – Don’t want a metric that accidentally discourages certain kinds of openness
• Can we measure the effect of the metric in changing that which it measures?
Sociotechnical Systems Design and Power

- Metrics considered as (very small) sociotechnical systems
- Metric design is not just Information Science but also Sociotechnical Engineering.
- The power of the metric designer
- Tendency to design metrics that make you look good
- Consider special cases that matter to you
- Overlook special cases that don’t matter to you
- Power erodes inconvenience for the powerful
It’s proxies all the way

- Measuring ‘impact’ or ‘research effectiveness’ or ‘quality’
- Citations, reads, influence, altmetrics
- Errors, type I & II, error bias
- Levels of use and appropriateness

I had considered as an alternative title for my talk “Citation Sanity and Insanity -- the Obsession and Paranoia of Citations and Impact Factors.” Others might have preferred “Uses and Abuses of Impact Factors.” – Eugene Garfield
Journal Impact Factor as a case of metric appropriation

• Developed as a measure of quality of the journal to inform library purchasing decisions (a proxy)
• Now also used as a measure of the quality of the papers in the journal (a proxy-proxy)
• Even used as a measure of the quality of the researcher who publishes papers in that journal (a proxy-proxy-proxy)
• Perhaps some day as a measure of the quality of the department or the university that employs the researcher who publishes in that journal (a proxy-proxy-proxy-proxy)
What’s in a name? In social engineering: – A Lot

• Rather shocking to the purist scientist, particularly in the natural sciences.
• The value of a metric for drug resistance is unlikely to change more rapidly just because of what you call it.
• But an Acce$$ Index score may
• Journal Impact Factor renamed as the US Librarians’ Purchasing Indicator
  – “In submitting your CV please include the Impact Factor for each journal publication”
  – “In submitting your CV please include the US Librarians’ Purchasing Indicator for each journal publication”
Metrics used in other metrics

• Shanghai Jiao Tong Academic Ranking of World Universities
  – uses data about publication venues (Science and Nature) and citations.
• Possible uses of openness score in derived measures
• Must consider the pathological case - even if you don’t want to
• Another risk if a poor score correlates with prestige.
Incentives and Dogfooding

• Creating our own openness metrics was enlightening
  – Like other persuasive technologies for reflection
    • What you eat, how you spend your time, how much exercise, etc.

• Review one's publishing history differently
  – different to how we do it for annual reviews, promotion applications.

• Looking at non open access papers makes one wonder why not?
  • and how one can avoid the embarrassment of a rather low-looking score.

• What about you?
The power of hypothetical metrics

- As critiques
  - Challenge the authority of imposed metrics
  - Fight metrics with metrics
  - Gresham’s Law: “Bad money drives out good”
  - Debase the currency of metrics by minting new ones
  - Critical metrics
  - Administrator Metrics

- As alternatives

- As nudges

- Even if easy to compute openness metrics are never deployed
  - openness metrics can still have a rhetorical effect.

- Just talking about hypothetical openness metrics seems to frame a discussion and seems to change our understanding of a wider set of issues.
Value of (yet) more metrics?

- “What gets measured gets noticed”
- “What gets measured gets managed” - Drucker
- “What gets measured gets to frame the issue”

- Can you subvert an altmetrics measure?
- Can you subvert an Openness Index?
Harnessing Paranoia for Good

• Metrics can have effects on behaviour even without explicit enforcement.
• Just a thought experiment, but one that may yet turn out to be a testable hypothesis.
• The case of the tenure process in the USA.
  – Commendable aims of ensuring academic freedom
  – But it seems to engender a substantial amount of fear, even paranoia, amongst junior faculty.
• Departments and universities have various explicit and implicit factors used in tenure cases
  – Junior faculty are advised accordingly.
• Ex: publications in certain journals may be strongly encouraged or even required.
• If a university's promotion rules required a faculty member to submit their OI as part of their tenure case materials, we would confidently expect a rapid and substantial increase in openness scores for junior faculty.
• For our Machiavellian purposes, this may not even be necessary.
• Just the suspicion that the OI might be used in the tenure process may be enough to channel paranoia into becoming more open.
• The fear that an external reviewer might use the OI in her assessment (assuming it was as easy to discover as say the h-index is on Google Scholar) may be sufficient,
  – even if openness is not explicitly considered in the home department’s deliberations.