

**Altmetrics as traces of the
computerization of the research
process**

Henk F. Moed

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Short CV Henk F. Moed

Years	Position
1981-2009	Staff member at Centre for Science and Technology Studies (CWTS), Leiden Univ.
2009	Professor of Research Assessment Methodologies at Leiden University
2010 – Sept 2012	Elsevier , SciVal Dept. Senior Scientific Advisor
As from Sept 2012	Elsevier, AGRM Dept. Head of Informetric Research Group
July - Dec 2014	Stepwise decreasing ELS appointment to 0; Visiting professor at Univ Rome la Sapienza (SSSA)

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1	Introduction	What is altmetrics? Drivers of altmetrics development
2	Broad concept of altmetrics	Altmetrics as metrics of the computerization of the research proces
3	Theoretical foundation	Is there already a “Robert K. Merton” of altmetrics?
4	Potential and limitations	Distinctions that are not merely “classical” but also valid in altmetrics
5	Future research	Altmetrics based on a broad and reflective conception of research assessment

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<http://altmetrics.org/manifesto/> (2010)

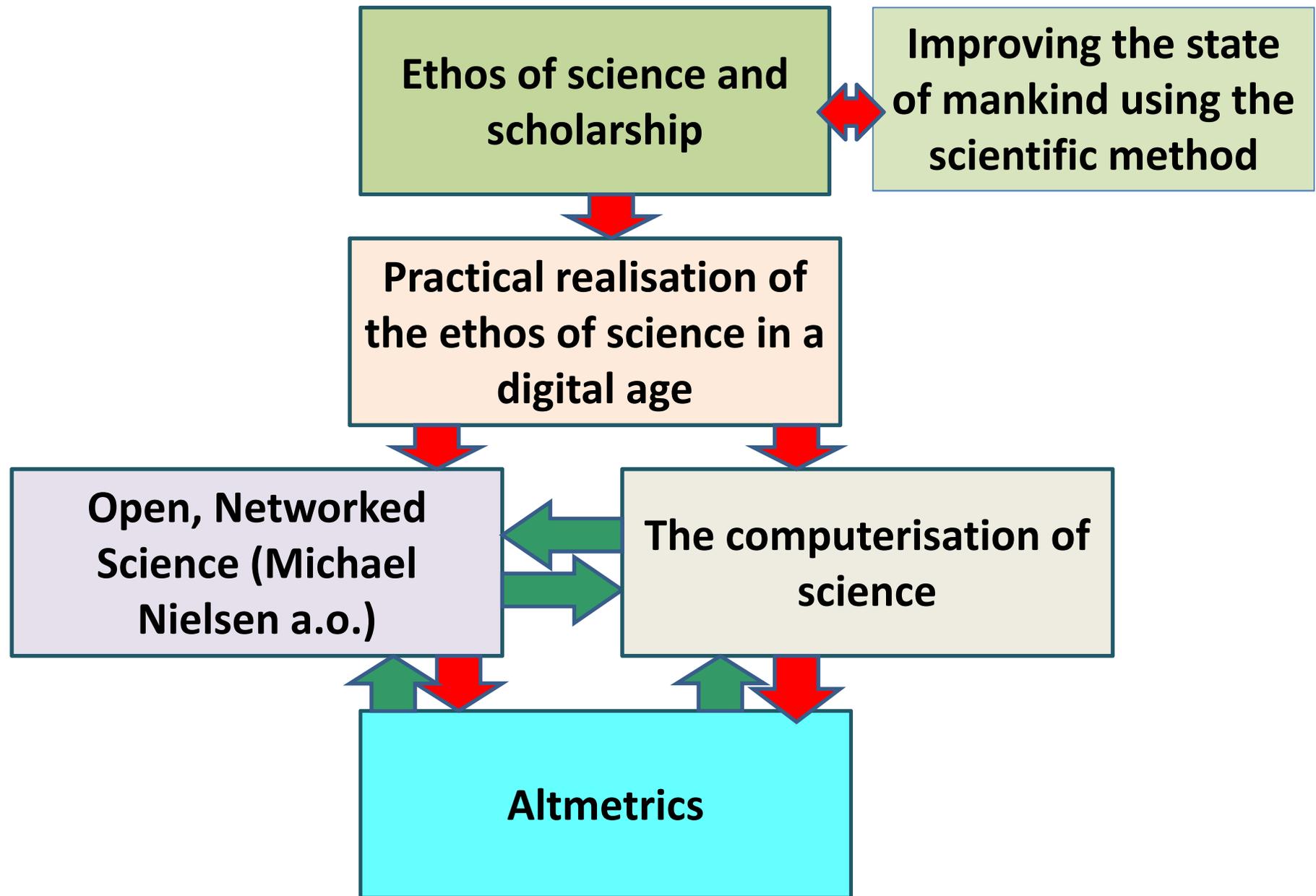
- “In growing numbers, scholars are moving their everyday work to the web”
- New online tools “reflect and transmit scholarly impact”
- Their use “forms a composite trace of impact far richer than any available before”
- “We call the elements of this trace **altmetrics**”

Categorization of altmetrics data sources (Mike Taylor)

Type of activity	Data Source Examples
Social activity	Facebook, Twitter
Scholarly activity	Reader libraries, e.g., Mendeley
Scholarly commentary	Scholarly blogs, F1000Prime
Mass media coverage	NY Times, BBC, CNN

Three drivers of Altmetrics

Domain	Driver	Description
Policy, Politics	Emphasis on societal merit	Awareness of the multi-dimensionality of research performance
Technology	ICT development	Development of websites and software in order to support and foster social interaction
Science	Open Science movement	Making research, data and dissemination accessible to all levels of an inquiring society



Computerization of the research process

Information processing

Searching, browsing, reading behavior

Usage data (e.g. downloads) patterns

Communication & organization

Online tools amplifying collective intelligence

Use of blogs, wikis, issue trackers

Research assessment

Scholars' interaction with research outputs

Mentions in social media & ref managers

Research data & methodologies

Big data; crowdsourcing; analysis software

Analysis top cited articles by subject field

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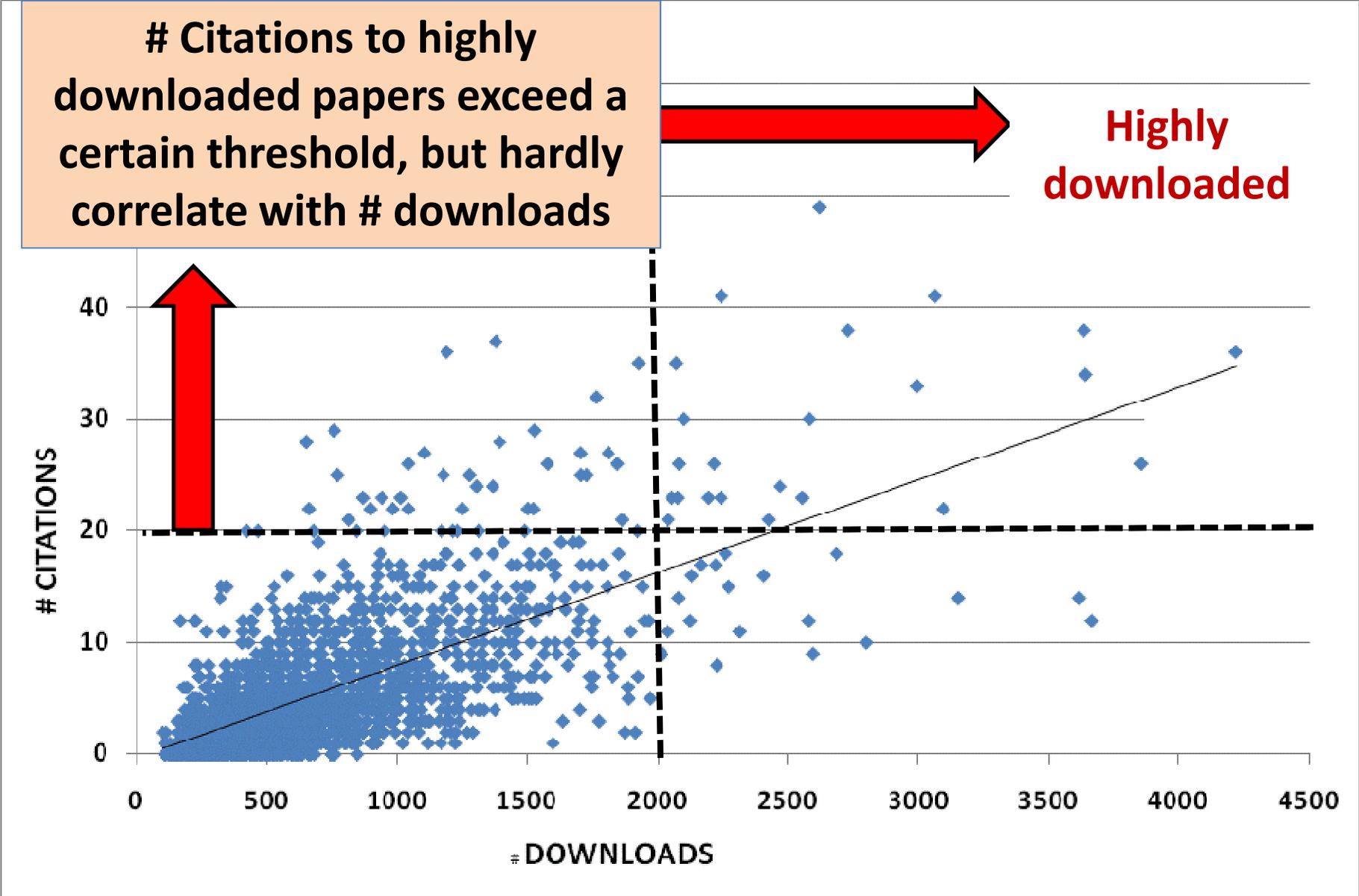
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10 important factors differentiating between downloads and citations

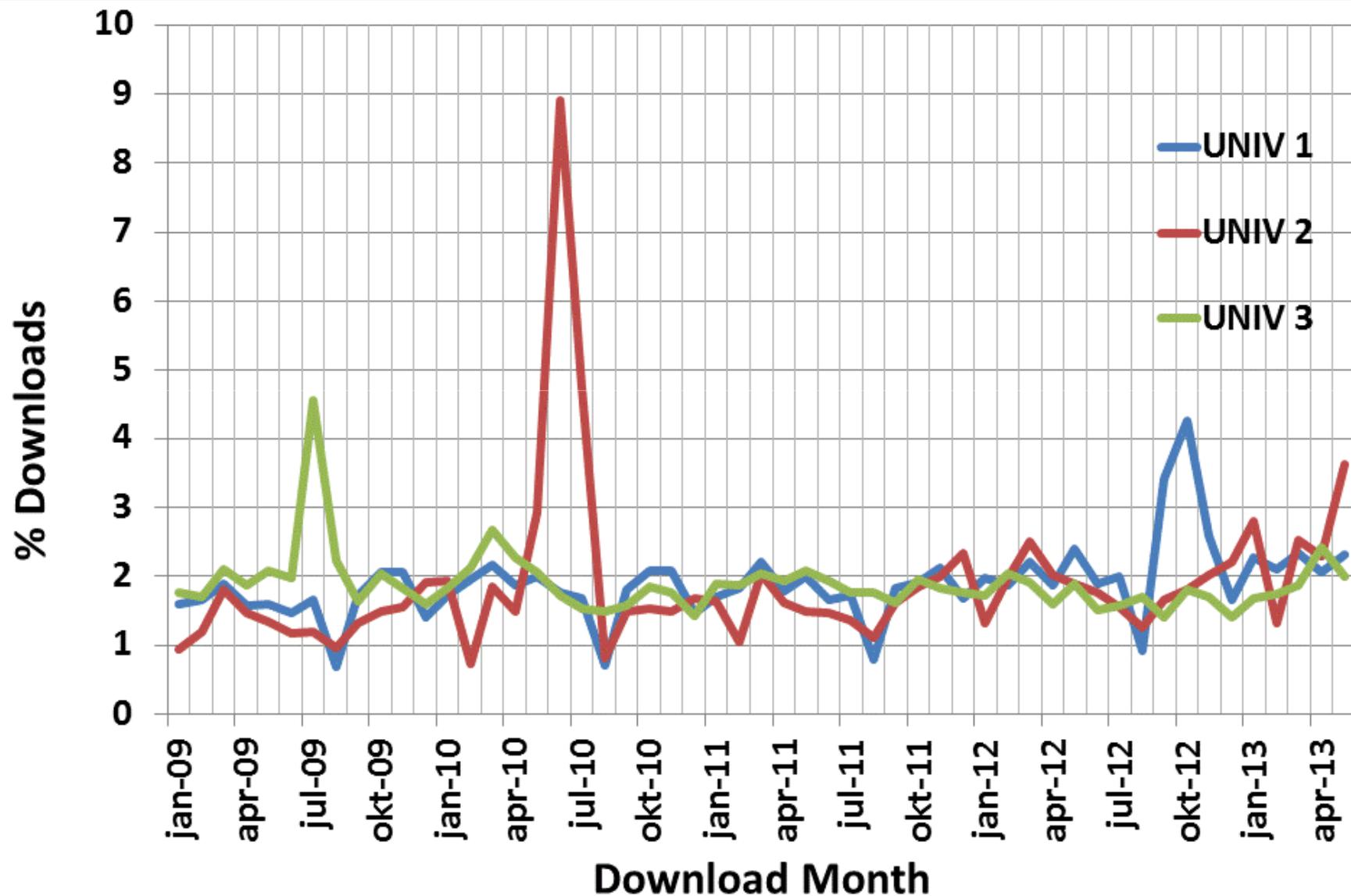
[Moed & Halevi, JASIST, 2014a]

- 1 **Usage leak:** Not all downloads may be recorded.
- 2 **Citation leak:** Not all citations may be recorded.
- 3 **Downloading** the full text of a document does **not** mean that it is **read**.
- 4 The **user (reader)** and the **author (citer)** population may not coincide.
- 5 Distribution # downloads **less skewed** than that of # cites, and depends upon the **type of document** differently
- 6 Downloads and citations show different **obsolescence functions**.
- 7 Downloads and citations measure **distinct concepts**.
- 8 Downloads and citations may **influence one another** in multiple ways.
- 9 Download counts are more sensitive to **manipulation**.
- 10 Citations are **public**, usage is **private**.

Correlation between downloads and citations for a single journal



Monthly downloads for 3 user institutions: large variations over time [Moed & Halevi, JASIST, 2014a]



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Analysis top cited articles by subject field

Comp Sci-related top-cited articles in Scopus [G. Halevi in Res Trends]

# Cites	Discipline	Article Title
17,171	Agr & Biol Sci, Mol Biol; Medicine	MEGA4: Molecular Evolutionary Genetics Analysis (MEGA) software version 4.0 (2007)
4,335	Business, managemt, social sciences	User acceptance of information technology: Toward a unified view (2003)
5,325	Chemistry	UCSF Chimera - A visualization system for exploratory research and analysis (2004)
15,191	Computer Sci; Eng	Distinctive image features from scale-invariant keypoints (2004)
1,335	Energy	Geant4 developments and applications (2006) [software for simulating passage of particles through matter]
7,784	Engineering; Math	A fast and elitist multi-objective genetic algorithm: NSGA-II (2002)
4,026	Environm Sci	GENALEX 6: Genetic analysis in Excel. Population genetic software....(2006)
4,404	Materials Science	The SIESTA method for ab initio order-N materials simulation (2002)
10,921	Physics & Astron	Coot: Model-building tools for molecular graphics (2004)

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HEFCE: Output that embody research in humanities may include:

Output form	Output form
• books (authored or edited)	• grammars
• chapters in books	• dictionaries
• journal articles	• digital and broadcast media
• working papers	• live presentations (performances)
• published conference papers	• artefacts
• electronic resources & publications	• designs and exhibitions
• exhibition or museum catalogues	• films, videos and other media types
• translations; scholarly editions	• software design and development
• creative writing and compositions	• advisory report
• curatorship and conservation	• the creation of archival collections
• databases	

Indicators that are appropriate in one context may be useless or invalid in another [Moed & Halevi, JASIST, 2014b]

The choice of indicators depends upon:

- **What units are to be assessed**
- **Which aspect is being assessed?**
- **Why is the assessment done?**
- **“Meta” assumptions on the state of the system under assessment**

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Michael Nielsen's "Reinventing Discovery" (Princeton U.P. 2012)

Discipline	Key Concept
Biology	Diversity
Physics	Critical mass
ComputerScience	Open source software
ComputerScience	Architecture

Michael Nielsen's "Reinventing Discovery" - 1

Concept (Biology): Diversity

"To amplify cognitive intelligence, we should scale up collaborations, increasing cognitive diversity and the range of available expertise as much as possible".

Michael Nielsen's "Reinventing Discovery" - 2

Concept (Physics): Critical Mass

"Ideally, the collaboration will achieve designed serendipity...Conversational critical mass is achieved and the collaboration becomes self-stimulating".

Michael Nielsen's "Reinventing Discovery" - 3

Concept (Computer Science): Open source software

Open Source collaboration used four patterns:

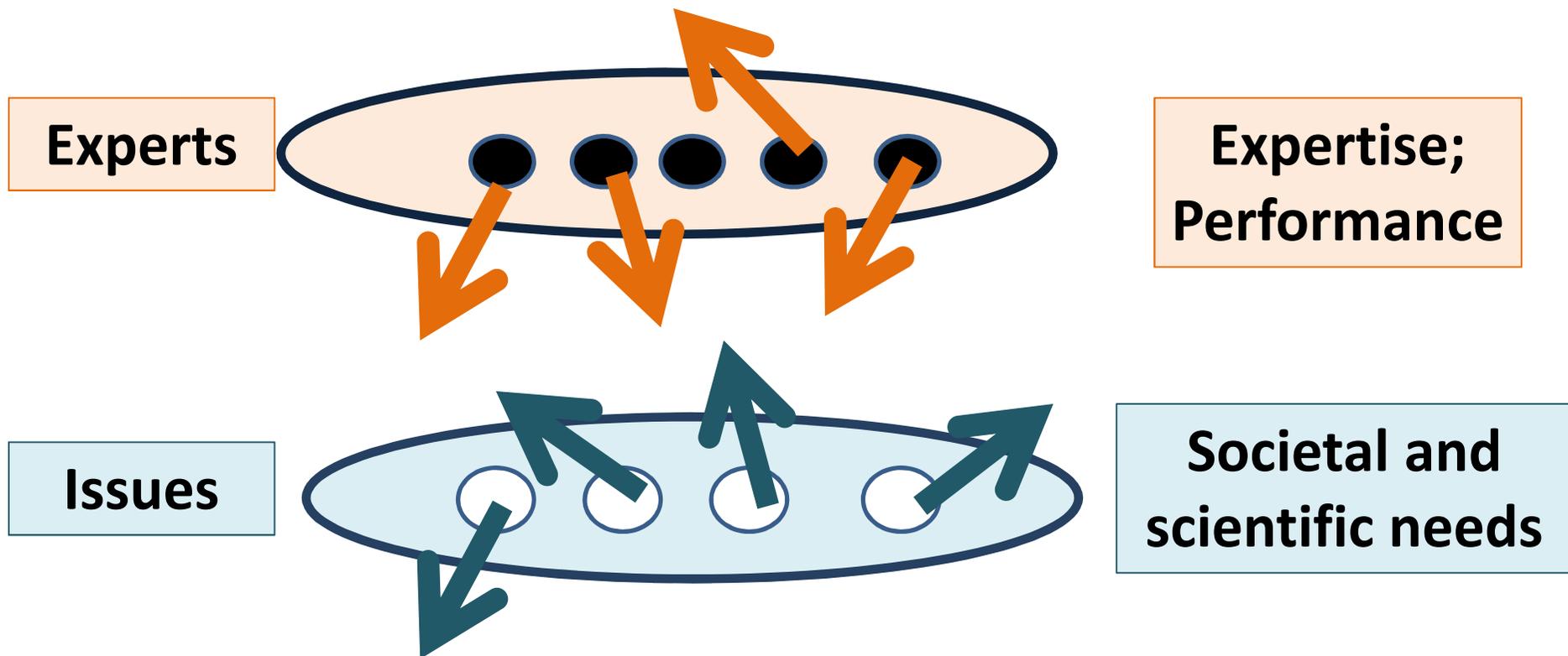
- Commitment to working in modular way;**
- Encouraging small contributions;**
- Allowing easy reuse of earlier work;**
- Using signaling mechanisms (e.g., scores) to help people to decide where to direct attention**

Michael Nielsen's "Reinventing Discovery" - 4

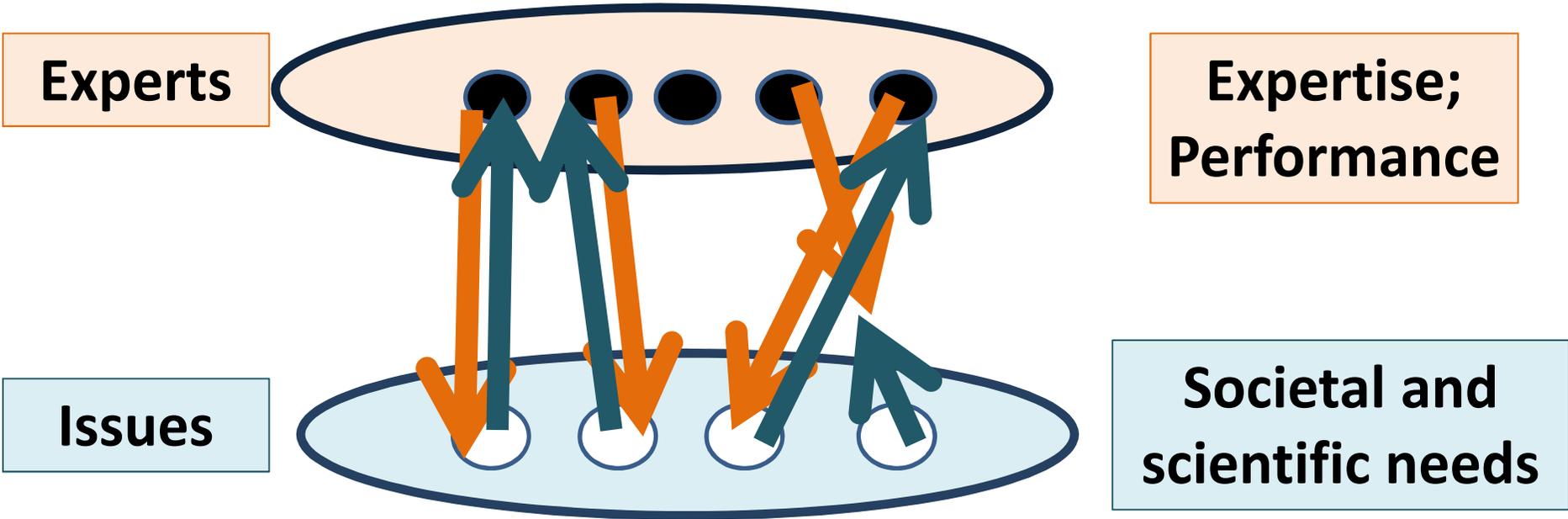
Concept (Computer Science): Architecture

"Online tools must establish an architecture of attention that directs each participant where it is best suited – i.e., where they have maximal competitive advantage"

Architecture of attention – current state



Architecture of attention – ideal state



**Michael Nielsen's "Reinventing Discovery" - 5
Concepts: data web; data driven intelligence**

**Towards a "Data Web":
a linked web of data that connects all
parts of knowledge; an online network
intended to be read by machines;**

**Data driven intelligence is controlled by
human intelligence and amplifies
collective intelligence**

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Research Assessment: Relevant distinctions - 1

Distinction	Implications for altmetrics (conjectures)
Scientific-scholarly ↔ Societal impact	Social media reflect primarily societal impact or attention
Opinion ↔ scientific finding or fact	Blogs tend to express opinions rather than scientific facts
Peer-reviewed ↔ non-peer reviewed	Social websites have no quality control

Research Assessment: Relevant distinctions - 2

Distinction	Implications for altmetrics (conjectures)
Immediate ↔ delayed response; attention ↔ influence	Reflection needed in order to assess significance
Intended ↔ unintended effects; strategic behavior	Attitude towards social media determines visibility therein
Formal ↔ natural ↔ life ↔ social ↔ technical science	Differences in validity and utility of altmetrics among the sciences

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Conclusions

- **Altmetrics is more than research performance metrics derived from social media**
- **Altmetrics can be conceived as metrics of the computerization of the research process**
- **Altmetrics can provide tools to further shape (design, monitor, improve, facilitate) this process**

Be aware of delicate relationship between (alt)metrics developers, information providers and funders

Type of actors	Principal assessment criteria
Scientific developers of Altmetrics	1. Validity; accuracy; statistical soundness; 2. Applicability
Information providers	1. Business value; product enhancement 2. Acceptability

Thank you for your attention