



Carlo Ghezzi

DEIB-Politecnico di Milano

Being a researcher

Research evaluation

Outline

- Why evaluate? evaluation for quality
- Different kinds of evaluation
 - single result, a research effort, an individual (for promotion), a research unit (group, department, university)
- Peer review
- How is a research result evaluated for publication?
 - Paper/artifact
- How can research impact be evaluated?
- Bibliometrics
 - What is it?

Evaluation required to achieve quality

- Competition generates quality
- Competition requires evaluation
- Research demands high quality standards
- No surprise that research is heavily based on evaluation, researchers accustomed to constant assessment

Peer reviews

- Evaluations mostly done by peers (researchers) for other researchers
- The research edifice relies on the health of peer review processes
- Reviews are done on a voluntary basis, mostly unpaid
- Health of processes depend on adherence to shared principles, competence, dedication, and ethics
- *DO UT DES*

Spectrum of review activities

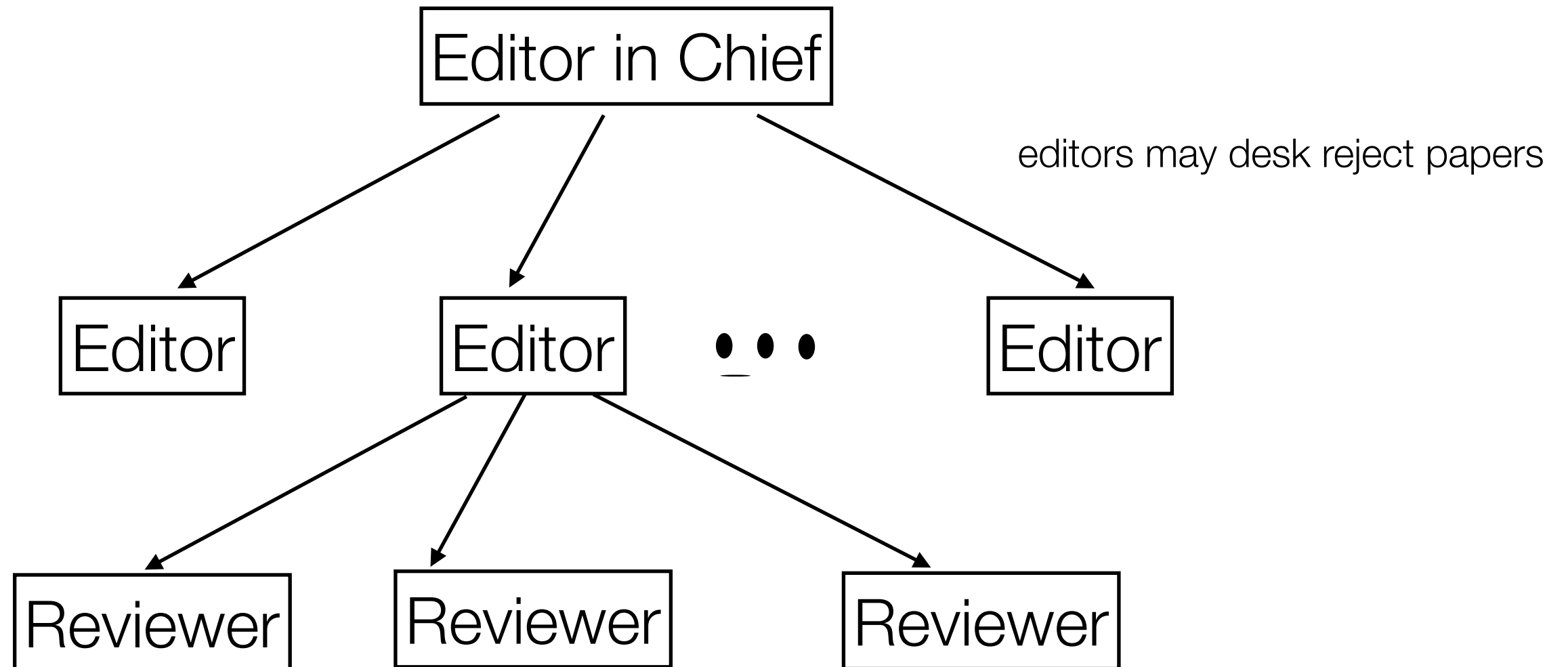
- Every valuable piece of work is evaluated (peer review) prior to publication
- Once published, a valuable piece of work is often evaluated by other researchers in comparison with other contributions
- Researchers referee other papers for publication
- A researcher is evaluated for promotion
- Researchers participate in promotion committees
- Researchers write proposals for funding, which are evaluated by other researchers
- Entire institutions (e.g., departments) are evaluated by review committees composed of researchers

Reviewing papers

Peer review: goals

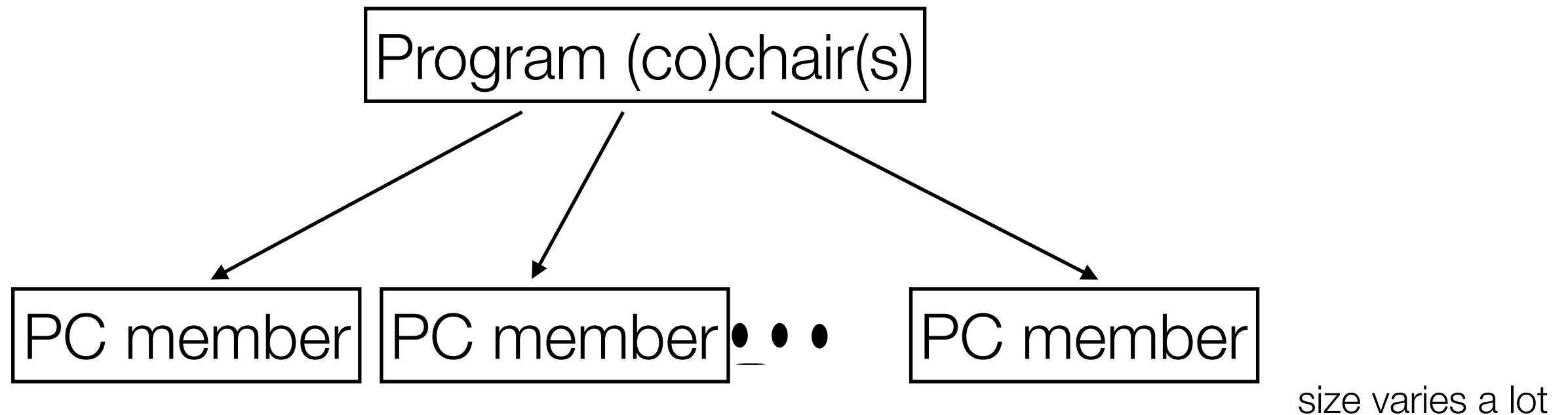
- Guarantees quality and integrity of diffusion of research results
- Without it there would be no control in scientific communication
- Determines the importance of findings
- Ensures that previous work is acknowledged
- Detects plagiarism and fraud

Reviewing structure: journals



three reviewers is a standard case

Reviewing structure: conferences



Variations:

- PC members may delegate to reviewers
- Program board as a further level of hierarchy to manage large PCs

Collective decisions made by PC meetings (or PC board meetings)

Requirements for a peer reviewer

- Expert on the subject matter
- Understand the quality goals against which the object of evaluation must be assessed
- Able to spend time to produce a detailed and well-motivated report
- Follow ethical principles (more on ethics later)
 - no conflict of interests
 - fair, based on uniformly applied and well-defined criteria
 - constructive
 - not ego-centric

Good reviewer from an editor's perspective

- Provides thorough and comprehensive reports, with well founded and constructive comments for authors
- Demonstrates objectivity and consistency in evaluations
- Submits reports on time
- Provides clear recommendations to the editor

apply equally to editors

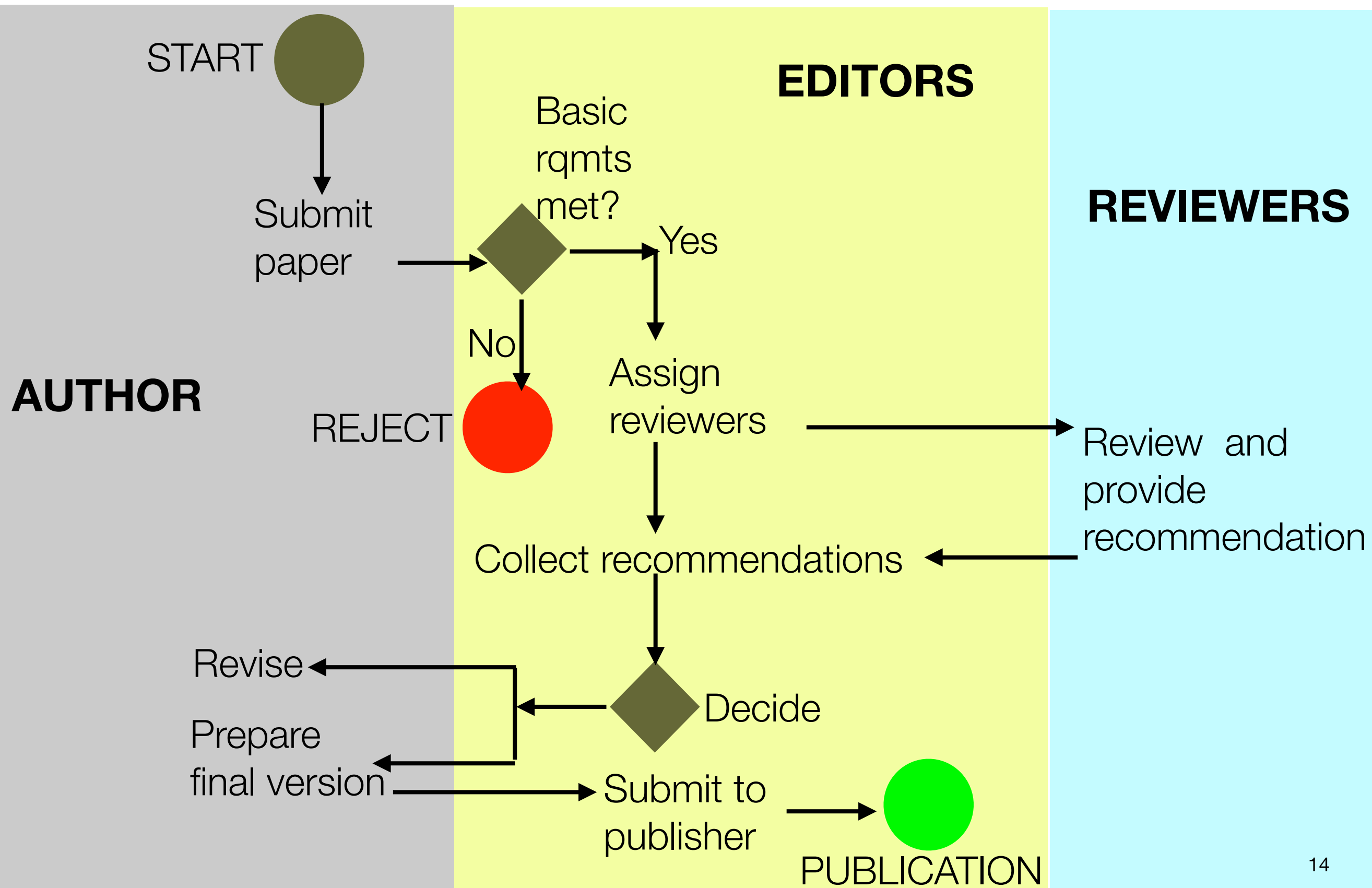
Anonymity

- The reviewer is normally undisclosed to authors
 - this is to allow reviewers to be frank in expressing their opinions
 - never to justify unfair behaviors shielded by anonymity
- The authors may be undisclosed to reviewers by "double-blind" review processes
 - to prevent reviewer's decisions based on the authors instead of contents
- Anonymity has inconveniences in both cases, as does removing anonymity—*discuss*

Reviewing papers

- You must put yourself in a positive mood
 - ask yourself what are the reasons why the paper should be accepted, not what are the reasons to reject it!
 - does the paper match the standards expected by the *specific* venue (workshop, conference, journal, book series, ...) to which it is submitted?
 - in terms of the three golden principles — originality, significance, and rigor
 - be constructive: help to improve instead of depressing the authors
- Carefully weight **reasons in favor** against **reasons against**

The process



Verdicts

- Accept
- Reject
- Revise
- Conferences normally only have accept, reject, but may include a rebuttal phase
- Acceptance rate normally viewed as a quality indicator (high bar)

Accept, revise, reject

- Remember that s a referee you are not deciding, but recommending, and you can use the full spectrum of recommendations
- Revise is by far the most common, e.e., you help the authors to improve their work so that it may become publishable
 - justify your requests and make them clear and actionable
- Revise normally comes in two forms: minor and major revision
- Major revision vs reject: give a MR only if you believe that what you are asking **can** be achieved (in a reasonable amount of time)
 - MR is not a completely different paper
 - wasting the author's and the reviewer's time to eventually converge on a paper that has lost its interest makes no sense

Review checklist

FIRST IMPRESSIONS

- How does the research stand against originality, significance, and rigor?
- Does the paper use proper structure and language?

ABSTRACT

- Is it a good summary?
- Does it include key findings?
- Length appropriate?

INTRODUCTION

- Effective, clear, well organized?
- Does it introduce and put into perspective what follows?
- Length appropriate?

MAIN CONTRIBUTIONS

- Detailed assessment of originality, significance, and rigor:
 - Can the contributions be used by others?
 - Is the description of the contribution accurate and correct?
 - Is the work clearly described against the state of the art?
- Is previous work adequately acknowledged, references correct?
- Are conclusions clearly stated and justified?
- Are figures and tables informative?

RECOMMENDATIONS

- Specific comments to improve the technical contribution
- Specific comments to improve the overall presentation structure
- Should anything be added/removed?
- Small change requests: style, grammar, minor technical problems

Author, editor, reviewer interactions

- Authors interact with editors, who act as mediators in communicating with reviewers
- In rebuttals or when resubmitting after request for revision, authors can interact indirectly with reviewers
- In the case of journals
 - editors monitor and coordinate reviewers
 - editors in chief monitor and coordinate editors

Project proposals: writing and reviewing

- Beginning researchers submit research proposals for approval
- Independent researchers submit proposals for competitive funding
- Writing proposals is an expensive process
- Access to competitive funding increasingly hard
- Success in competition viewed considered important for a researcher

Research proposals for funding

- Should be written and evaluated against the intended purpose of the funding scheme
- Bottom-up scheme
 - researchers free to generate their research plans, trying achieve breakthroughs
 - agenda entirely defined by researchers
 - researchers may be inspired and guided by standing open problems that concern society or industry
 - they are largely driven by their curiosity
 - often, but not necessarily, results are mainly theoretical
 - evaluation is based on scientific merit, but also on potential use
 - example EU ERC funding

Research proposals for funding

- Top-down scheme
 - the funding body sets a general research agenda and generates calls to which the scientific community has to respond
 - agenda mainly defined by "research consumers"
 - driven by societal/industrial challenges
 - often, but not necessarily, of pre-competitive nature
 - evaluation not only based on scientific merit, but also on potential use
 - example EU H2020 programs, collaboration industry-academia

Evaluation in promotion processes

- Promotion of researchers often based (non exclusively) on peer-review
- Researchers under review may suggest potential reviewers
- Reviewers provide reports to promotion committees, based on material provided by researchers being reviewed
- CV, copies of main papers, research statement, teaching statement, evidence of impact...

Evaluating research groups

- The case of departments
- Done for different objectives, e.g.
 - evaluation/ranking for funding distribution
 - evaluation part of self-improving strategy
- Examples
 - evaluation of all CS departments of Dutch universities
 - UK REF (Research Excellence Framework)
 - HK RAE (Research Assessment Exercise)

Evaluating impact of research

- Research outputs —papers, artifacts— can have impact
- Impact = positive influence
 - internal to research
 - external to society/industry
- More specifically
 - X has impact = others (researchers, practitioners) can/do "use" X to achieve something useful (from increasing knowledge to innovating society)
- Another dimension
 - short-term vs long-term

Impact vs publication count for papers

- ☑ Reward authors who care about creating useful artifacts that others can build on
- ☑ Foster research leading to results that are reusable and reproducible
- ☑ Value also negative results
- ☑ Avoid unsupported claims
- ☑ Contrast quantity-oriented publication strategies
- ☑ Evaluation effort increases, but number of submissions might decrease

How can impact be assessed?

- Paper
 - is the "quality" of the paper indicated by the "quality" of the venue?
 - then the problem would rating the quality of a venue
 - how has the paper influenced other researchers?
 - is number of citations a good indicator?
 - easy to get, objective
 - how has a paper eventually influenced practice?
 - requires careful investigation
 - hard to achieve, may be subjective

Quality of a venue

- We already mentioned that there is a shared culture in every research community that agrees on ranking of main venues
- There are increasingly popular attempts to quantify impact by counting references from other papers to papers appearing in a given venue
 - IMPACT FACTOR

Impact factor

- Impact factor (IF) of a scientific journal captures the yearly average number of citations to articles published in that journal; precisely:
 - in any given year, the impact factor of a journal is the number of citations, received in that year, of articles published in that journal during the two preceding years, divided by the total number of articles published in that journal during the two preceding years (can also be done for any other period, e.g., 5 years):

$$\text{IF}_y = \frac{\text{Citations}_{y-1} + \text{Citations}_{y-2}}{\text{Publications}_{y-1} + \text{Publications}_{y-2}}$$

- it is used as a proxy for the academic impact of a journal within its field
 - journals with higher impact factors are deemed to be more important than those with lower ones

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The *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)* is published monthly. Its editorial board strives to present most important research results in areas within TPAMI's scope.
[Aims & Scope >](#)

9.455 Impact Factor

0.06412 Eigenfactor

4.714 Article Influence Score

Latest Published Articles

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Motion Segmentation via Generalized Curvatures
Robert Am ; Pradyumna Narayana ; Bruce Draper ; Tegan Emerson ; Michael Kirby ; Chris Peterson
Sep-12 2018

SegNet: A Deep Convolutional Encoder-Decoder Architecture for Image Segmentation
Vijay Badrinarayanan ; Alex Kendall ; Roberto Cipolla
Jan-02 2017

Segmentation of Laser Point Clouds in Urban Areas by a Modified Normalized Cut Method
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Image Super-Resolution Using Deep Convolutional Networks
Jun-01 2015

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3.331 Impact Factor ⓘ

0.00502 Eigenfactor ⓘ

1.012 Article Influence Score ⓘ

Latest Published Articles

Value-Flow-Based Demand-Driven Pointer Analysis for C and C++ Sep-11 2018

Popular Articles

The Oracle Problem in Software Testing: A Survey Nov-20 2014

Mac OS X dock with various application icons.

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The VLDB Journal - Springer

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The VLDB Journal

The International Journal on Very Large Data Bases

ISSN: 1066-8888 (Print) 0949-877X (Online)

Description

Published on behalf of the VLDB Endowment, this journal contains scholarly contributions that examine information system architectures, the impact of technological advancements on information systems, and the development of novel database applications.

The VLDB Journal also publishes a number of special issues in addition to the regular ones. One issue of each volume (usually the third) is devoted to selected papers from the ... show all

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Regular Paper

PUG: a framework and practical implementation for why and why-not provenance

The VLDB Journal

27th 2018

The International Journal on Very Large Data Bases

Springer

Impact Factor

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819

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and even worse

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Impact factor - Wikipedia Top Journals of Computer Science & Electronics with Impact Factors: June, 2015 Screenshot Mac | Salvatore Arbia

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Top Journals of Computer Science & Electronics with Impact Factors: June, 2015 1 / 23

Ranking is based on Impact Factor, 2015

Vanity press and journals forcing authors to pay for their research are filtered out.

Rank	Publisher	Journal Name	Impact Factor
1	IEEE	IEEE Transactions on Fuzzy Systems ISSN : 1083-8306 - Bimonthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=31	8.746
2	IEEE	IEEE Communications Surveys and Tutorials ISSN : 1553-377X - Quarterly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=3708	6.806
3	WorldSci	International Journal of Neural Systems ISSN : 0129-0657 - Bimonthly http://www.worldscientific.com/ijns/ijns.html	6.507
4	IEEE	IEEE Transactions on Industrial Electronics ISSN : 0278-0146 - Monthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=41	6.498
5	Elsevier	Remote Sensing of Environment ISSN : 0034-4257 - Monthly http://www.elsevier.com/locate/remote	6.393
6	IEEE	IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics ISSN : 1083-4419 - http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=3427	6.22
7	IEEE	IEEE Signal Processing Magazine ISSN : 1053-5266 - Bimonthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=73	5.852
8	IEEE	IEEE Transactions on Pattern Analysis and Machine Intelligence ISSN : 0162-8828 - Monthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=34	5.781
9	IEEE	IEEE Wireless Communications ISSN : 1538-1264 - Bimonthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=7742	5.417
10	MISRC	MIS Quarterly: Management Information Systems ISSN : 0276-7768 - Quarterly http://www.misq.org	5.311
11	OxfordUP	Bioinformatics ISSN : 1367-4803 - Bimonthly http://bioinformatics.oxfordjournals.org/	4.981
12	IEEE	Proceedings of the IEEE ISSN : 0018-9210 - Monthly http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?number=3	4.934
13	Blackwell	Computer-Aided Civil and Infrastructure Engineering ISSN : 1093-9667 - Monthly http://www.wiley.com/doi/journal/10.1002/ce.10001	4.925
14	IOS	Integrated Computer-Aided Engineering ISSN : 1088-2509 - Quarterly http://www.iospress.nl/doi/10.1016/j.icade.2014.03.001	4.690
15	ChemistryGen	Journal of Cheminformatics ISSN : 1751-2546 - irregular	4.547

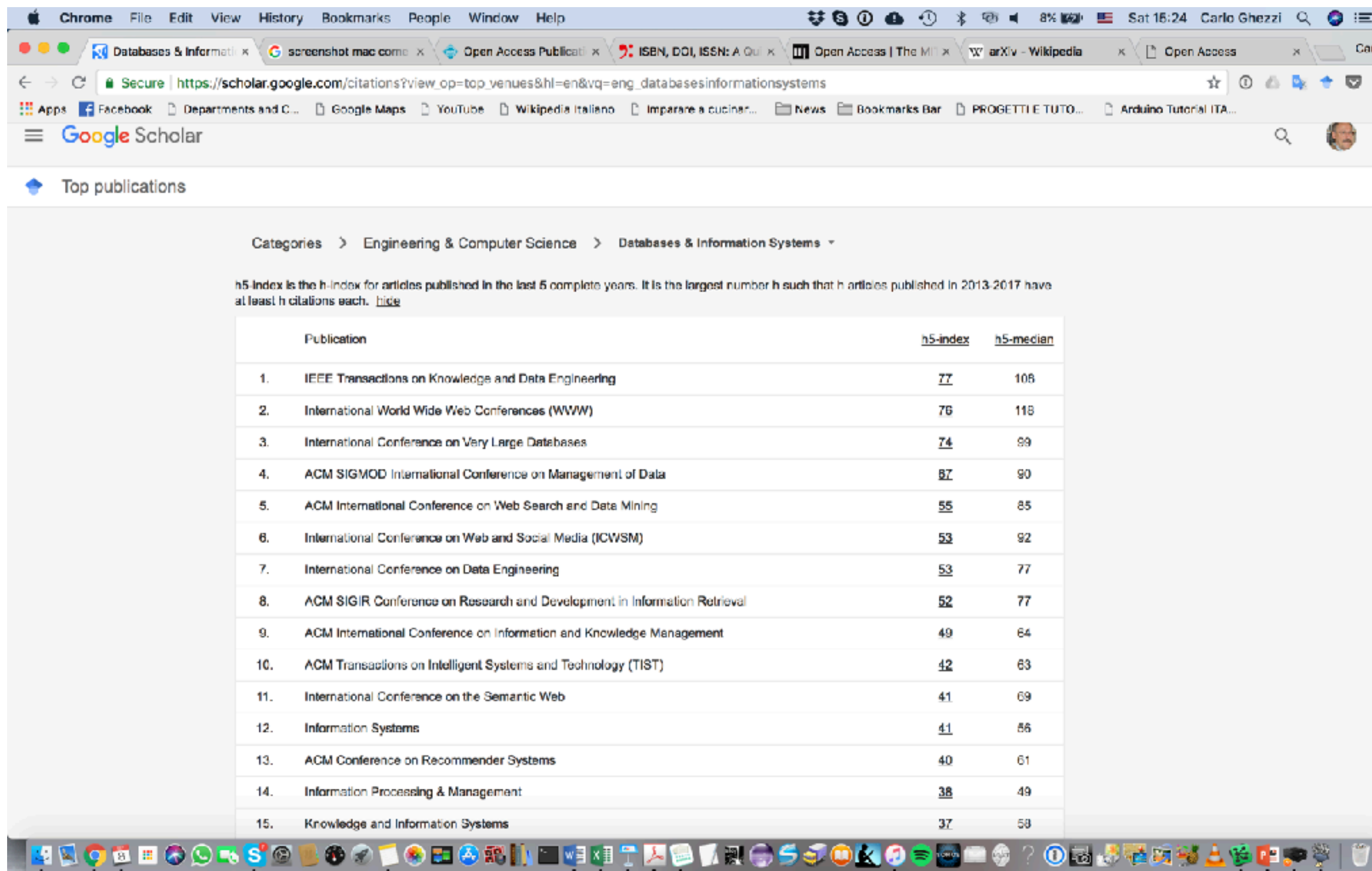
Impact factor: evaluation

- ❖ Easy, appealing, objective
 - Not reproducible by independent audits, depends on examined population (e.g., no conferences)
 - Absurd if used for cross-area comparisons
 - see PAMI vs TSE vs VLDB
 - Can be "manipulated" by unfair editorial policies
 - Review articles vs original research
 - Citation counts have highly skewed distributions, the mean number of citations is potentially misleading
 - Ranking papers based on IF of the publication venue completely misleading

Other measures

- h5-index generalizes to venues a metric originally introduced to measure both the productivity and citation impact of the publications of a researcher
- It is the h index for articles published in the last complete years. In 2018, it is the largest number h such that h articles published in 2013-2017 have at least h citations each
- Higher values indicate higher impact
- Google uses it for all its indexed publications sources

Example from Google Scholar



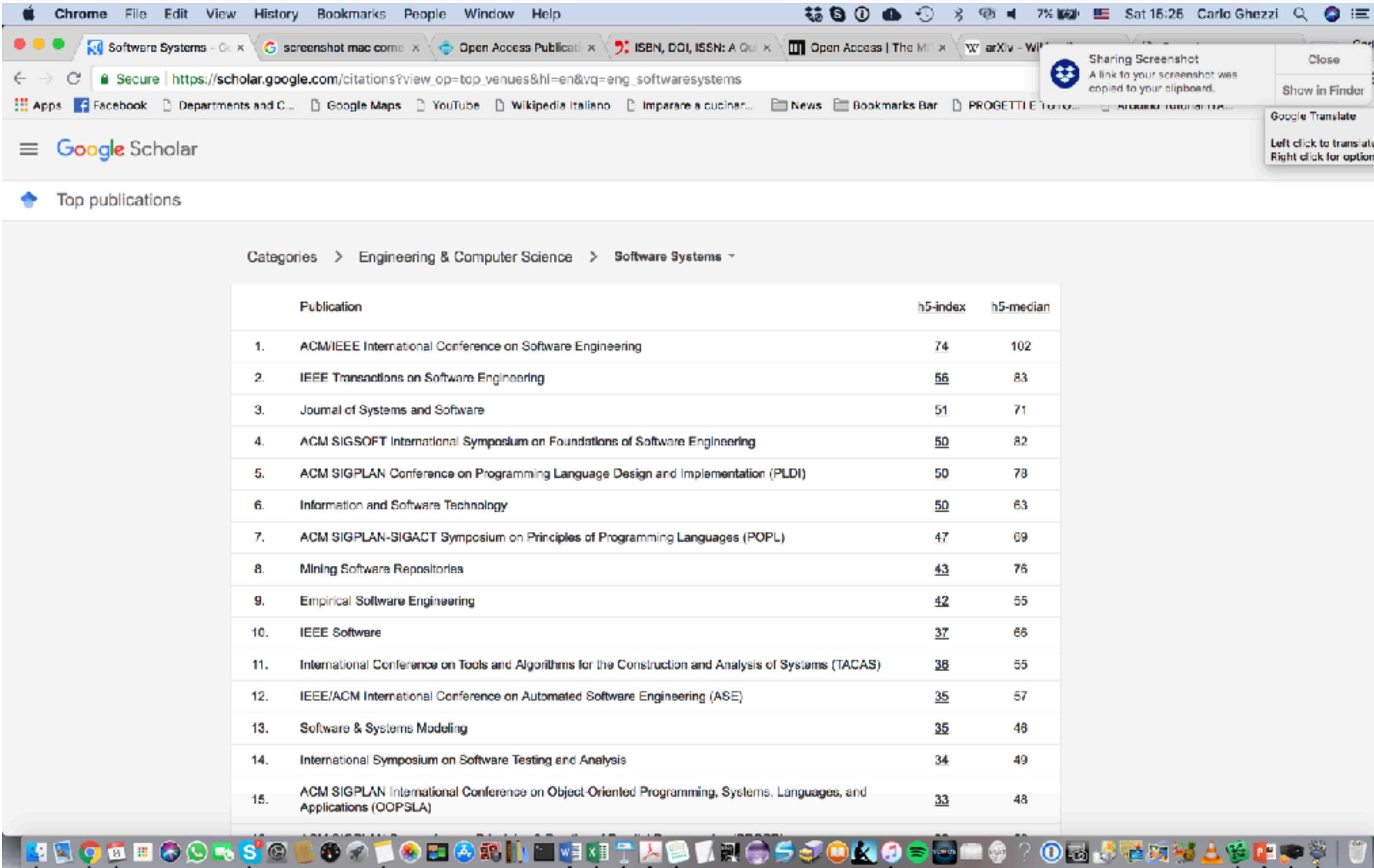
The screenshot shows a Google Scholar page titled "Top publications" for the category "Databases & Information Systems". The page lists 15 top venues with their h5-index and h5-median values. The browser's address bar shows the URL: https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng_databasesinformationsystems. The browser's taskbar at the bottom shows various application icons.

Categories > Engineering & Computer Science > Databases & Information Systems

h5-index is the h-index for articles published in the last 5 complete years. It is the largest number h such that h articles published in 2013-2017 have at least h citations each. [hide](#)

	Publication	h5-index	h5-median
1.	IEEE Transactions on Knowledge and Data Engineering	77	106
2.	International World Wide Web Conferences (WWW)	76	118
3.	International Conference on Very Large Databases	74	89
4.	ACM SIGMOD International Conference on Management of Data	67	90
5.	ACM International Conference on Web Search and Data Mining	55	85
6.	International Conference on Web and Social Media (ICWSM)	53	92
7.	International Conference on Data Engineering	53	77
8.	ACM SIGIR Conference on Research and Development in Information Retrieval	52	77
9.	ACM International Conference on Information and Knowledge Management	49	64
10.	ACM Transactions on Intelligent Systems and Technology (TIST)	42	63
11.	International Conference on the Semantic Web	41	69
12.	Information Systems	41	56
13.	ACM Conference on Recommender Systems	40	61
14.	Information Processing & Management	38	49
15.	Knowledge and Information Systems	37	59

Example from Google Scholar



The screenshot shows a Google Scholar page for the category 'Software Systems'. The browser window is Google Chrome, and the URL is https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng_softwaresystems. The page displays a list of 15 top publications in the field, ranked by their h5-index and h5-median. The browser's address bar shows the URL, and the page title is 'Google Scholar'. The browser's menu bar includes 'File', 'Edit', 'View', 'History', 'Bookmarks', 'People', 'Window', and 'Help'. The browser's status bar shows the time 'Sat 15:25' and the user 'Carlo Ghezzi'. The browser's tabs include 'Software Systems - Google Scholar', 'screenshot mac.com', 'Open Access Publications', 'ISBN, DOI, ISSN: A Quick...', 'Open Access | The MIT Press', and 'arXiv - Wikipedia'. The browser's bookmarks bar includes 'Apps', 'Facebook', 'Departments and...', 'Google Maps', 'YouTube', 'Wikipedia Italiano', 'Imparare a cucinar...', 'News', 'Bookmarks Bar', and 'PROGETTI E...'. The browser's notifications area shows a 'Sharing Screenshot' notification and a 'Google Translate' notification. The browser's taskbar includes icons for various applications, including Google Chrome, Google Maps, YouTube, Wikipedia Italiano, Imparare a cucinar..., News, Bookmarks Bar, PROGETTI E..., and various system utilities.

Categories > Engineering & Computer Science > Software Systems

	Publication	h5-index	h5-median
1.	ACM/IEEE International Conference on Software Engineering	74	102
2.	IEEE Transactions on Software Engineering	56	83
3.	Journal of Systems and Software	51	71
4.	ACM SIGSOFT International Symposium on Foundations of Software Engineering	50	82
5.	ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)	50	78
6.	Information and Software Technology	50	63
7.	ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL)	47	69
8.	Mining Software Repositories	43	76
9.	Empirical Software Engineering	42	55
10.	IEEE Software	37	66
11.	International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)	36	55
12.	IEEE/ACM International Conference on Automated Software Engineering (ASE)	35	57
13.	Software & Systems Modeling	35	48
14.	International Symposium on Software Testing and Analysis	34	49
15.	ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA)	33	48

Relation to impact of a paper

- Any of the metrics proposed to assess impact of a venue have some merit, but also numerous drawbacks
- Extrapolating the results to individual paper is completely arbitrary
- These can never be used as replacements for expert assessment based on careful peer review

Other useful objective data

- Number of downloads for artifacts
- Number of licenses for artifacts
- Artifacts associated with papers accepted by conference/journal
- Advances that lead to commercial exploitation or adoption by industry or standard bodies.

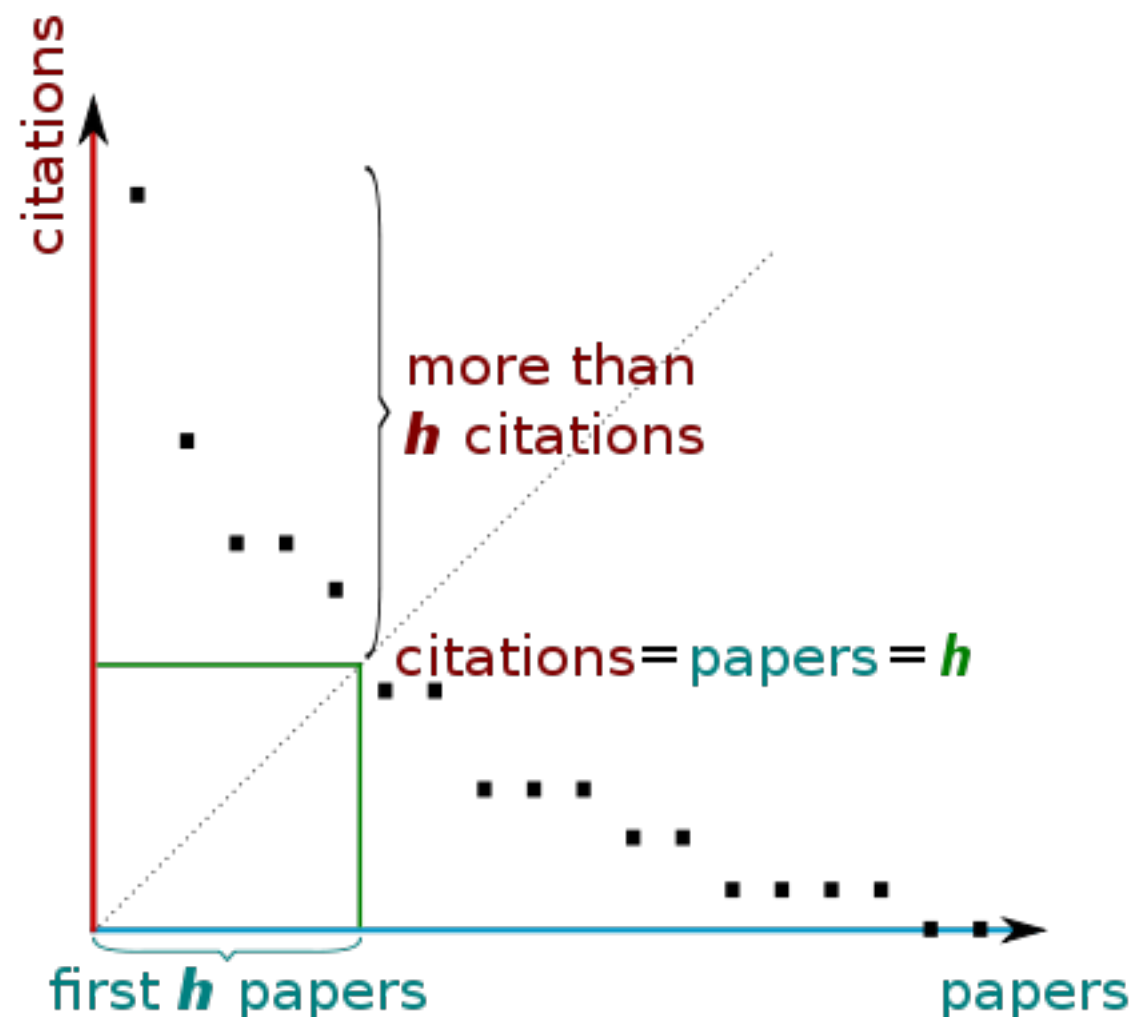
Reviewing researchers

Similar story

- Main bibliometric index is h-index
- Bibliometrics becoming dominant
- But exclusive and blind use of bibliometrics dangerous

H-index

- Captures both the productivity and citation impact of the publications of a researcher
- Suggested in 2005 by Jorge E. Hirsch, a physicist at UCSD, as a tool for determining theoretical physicists' relative quality, hence Hirsch index (H-index) or Hirsch number




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Maurizio Lenzerini - Google Sci X

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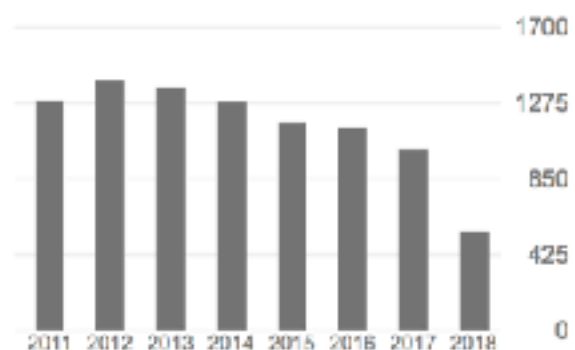
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TITLE	CITED BY	YEAR
Data integration: A theoretical perspective M Lenzerini Proceedings of the twenty-first ACM SIGMOD-SIGACT-SIGART symposium on ...	3079	2002
A comparative analysis of methodologies for database schema integration C Batini, M Lenzerini, SB Navathe ACM computing surveys (CSUR) 18 (4), 323-364	2533	1986
Tractable reasoning and efficient query answering in description logics: The DL-Lite family D Calvanese, G De Giacomo, D Lembo, M Lenzerini, R Rosati Journal of Automated reasoning 39 (3), 385-429	1270	2007
Fundamentals of data warehouses M Jarke, M Lenzerini, Y Vassiliou, P Vassiliadis Springer Verlag	734 *	2003
Linking data to ontologies A Poggi, D Lembo, D Calvanese, G De Giacomo, M Lenzerini, R Rosati Journal on data semantics X, 133-173	653	2008
Automatic Composition of E-services That Export Their Behavior D Berardi, D Calvanese, G De Giacomo, M Lenzerini, M Mecella International Conference on Service-Oriented Computing, 43-58	543	2003
Reasoning in description logics	437	1998

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Citations	24821	8532
h-index	79	36
i10-index	176	102



Co-authors [VIEW ALL](#)

-  **Giuseppe De Giacomo**
Sapienza Università di Roma >
-  **Diego Calvanese**
Professor of Computer Science, ... >
-  **Riccardo Rosati**
Università di Roma La Sapienza >
-  **Domenico Lembo**
Sapienza Università di Roma >


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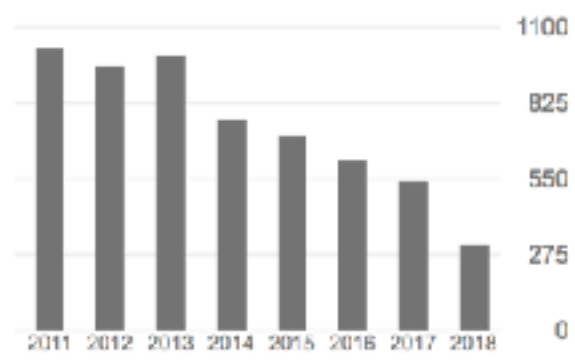
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[Software Engineering](#)

TITLE	CITED BY	YEAR
On the criteria to be used in decomposing systems into modules DL Parnas Communications of the ACM 15 (12), 1053-1058	6369	1972
Software aging DL Parnas Proceedings of the 16th international conference on Software engineering ...	1472 *	1994
On the design and development of program families DL Parnas IEEE Transactions on software engineering, 1-9	1225	1976
A rational design process: How and why to fake it DL Parnas, PC Clements IEEE transactions on software engineering, 251-257	1041	1986
A technique for software module specification with examples DL Parnas Communications of the ACM 15 (5), 330-336	1007	1972
Designing software for ease of extension and contraction DL Parnas IEEE transactions on software engineering, 128-138	911	1979
Concurrent control with "readers" and "writers"	705	1971

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Citations	24224	3936
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i10-index	129	55



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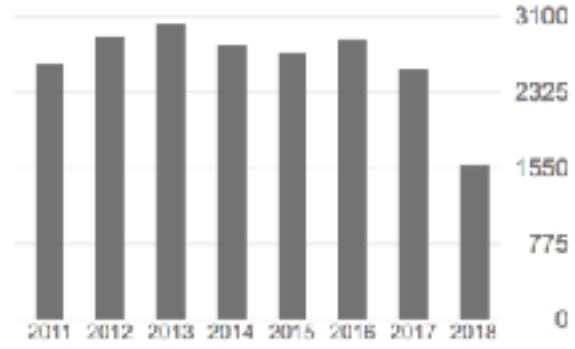
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TITLE	CITED BY	YEAR
A note on two problems in connexion with graphs EW Dijkstra Numerische mathematik 1 (1), 269-271	22028	1959
A discipline of programming EW Dijkstra, EW Dijkstra, EW Dijkstra, EU Informaticien, EW Dijkstra prentice-hall	7343	1976
Cooperating sequential processes EW Dijkstra The origin of concurrent programming, 65-138	2819	1968
Self-stabilization in spite of distributed control EW Dijkstra Selected writings on computing: a personal perspective, 41-46	2479	1982
Guarded commands, nondeterminacy and formal derivation of programs EW Dijkstra Communications of the ACM 18 (8), 453-457	2454	1975
Structured programming OJ Dahl, EW Dijkstra, CAR Hoare Academic Press Ltd.	2088	1972
Notes on structured programming	1808	1970

Cited by [VIEW ALL](#)

	All	Since 2013
Citations	57808	15525
h-index	46	26
i10-index	118	42



2011 2012 2013 2014 2015 2016 2017 2018

Author ordering

- Does it reflect the level of contribution?
 - convention variability across areas
 - in ICST and Mathematics ordering of authors is generally not significant and differs across sub-fields
 - increasingly, the first author is the person who has made the most significant intellectual contribution to the work
 - importance of the first author reflected in the common practice of referring to a paper by the first author's name e.g. 'XXX et al. report that...'
 - publishing a paper as the first author may be crucial for the scientific career of a Ph.D. student

Sources of bibliometric data

- Google Scholar is the main open source <https://scholar.google.com/>
- Microsoft Academic <https://academic.microsoft.com/>
- Scopus (Elsevier), subscription based
- ISI Web of Science (Thomson Reuters), subscription based
 - Scopus and WoS are journal based, not so useful for ICST
 - for a comparison: <http://instr.iastate.libguides.com/c.php?g=120420&p=785310>
- Scimago (<https://www.scimagojr.com/index.php>), powered by the Scopus database
- For iCST conference ranking <http://portal.core.edu.au/conf-ranks/?search=&by=all&source=CORE2018&sort=arank&page=1>

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- Public repositories of bibliographic data
 - dblp <https://dblp.uni-trier.de/>
 - ArXiv <https://arxiv.org/search/>, Zenodo <https://zenodo.org/>
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Some conclusions

- Bibliometrics became dominant
- At the same time, increasing awareness of its limitations and dangers
- Numerical measurements (such as citation and publication counts) must never be used as the sole evaluation instrument. They must be filtered through human interpretation, specifically to avoid errors, and complemented by peer review and assessment of outputs other than publications. In particular, numerical measurements must not be used to compare researchers across scientific disciplines, including across subfields of a broad area
- In the absence of specific indications, author ordering should not serve as a factor in the evaluation of researchers.
- In assessing publications and citations, the use of public archives should be favored. When using ranking and benchmarking services provided by for-profit companies, the respect of open access criteria is mandatory. Journal-based or journal-biased ranking services are inadequate for most of informatics and must not be used.
- Any evaluation, especially quantitative, must be based on clear, published criteria. Furthermore, assessment criteria must themselves undergo assessment and revision.

see INFORMATICS RESEARCH EVALUATION, <http://www.informatics-europe.org/publications.html>

Conclusions

- The goals of external evaluation via peer review
 - reviewing papers
 - reviewing researchers
- Quality vs quantity
- Evaluating for impact
- Quantitative evaluation and bibliometrics, problems and pitfalls