



# Running with the Devil: On the Use and the Misuse of Bibliometrics and How Social Science Research can Profit from Bibliometrics

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Research Methods Seminar University of Lausanne, 3. November 2015

# Outlook

- Introduction to bibliometric indicators
- Bibliometrics and the SSH
- Quality of music: A non-(or un-)scientific example for what bibliometrics cannot do
- Light at the end of the tunnel: What bibliometrics can do

# Introduction to Bibliometrics





# What is Bibliometrics?

- Term coined by Pritchard (1969), when he defined bibliometrics as:
  - „... the application of mathematical and statistical methods to books and other media of communication.“ (Pritchard, 1969)
- Today, bibliometrics is:
  - The analysis of the number of publications (all kinds of document types) and/or citations using also other bibliographic (meta-)data
- Use of bibliometric studies by:
  - Bibliometricians (basic research)
  - Disciplines/scholars (strategic and informational uses)
  - Science administrators (research evaluation, research policy)

# Bibliometrics vs Scientometrics vs. Altmetrics

- No exact distinction (Glänzel, 2003: synonyms)
- Bibliometrics (Pritchard, 1969):
  - Citation analysis, analysis of document types, author networks etc.
  - What can be done with meta data from publication data bases
- Scientometrics (Nalimov & Mulchenko, 1969):
  - Analysis of communication and research processes
  - Includes bibliometrics but makes use also of other data on scholarly work: prizes, presentations, curricula etc.
- Altmetrics:
  - Bibliometrics with Web 2.0 data: analysis of Twitter feeds, Mendeley, Research Gate, download statistics from journals etc.

# Godfathers of bibliometrics

- Candolle describes the scientific strength of nations in 1873 according to memberships in associations
- Lotka (1926) described the frequency distributions of publications → Lotka's Law
- Gross & Gross (1927) aimed to identify the most important journals in their field (chemistry) by counting the citations
- Bradford (1934) described the frequency distributions of papers in journals → Bradford's Law
- Zipf (1935) studied the frequencies of words in papers and generalised Lotka's and Bradford's Laws → Zipf's Law  
→ not really a bibliometrician but a linguist

## Roots of modern bibliometrics (1/2)

- Modern bibliometrics started with Eugene Garfield  
\* 16.09.1925, New York
- Garfield (1955). Citation Indexes for Science.  
*Science*, 122/3159, 108-111.
- Institute for Scientific Information (ISI, 1960-1992)
- Now Thomson Reuters
- 1976: Publication of the ***Journal Citation Reports*** (JCR)  
including the ***Journal Impact Factor*** (JIF)  
(note that the JIF was invented by Martyn and Gilchrist  
(1968))



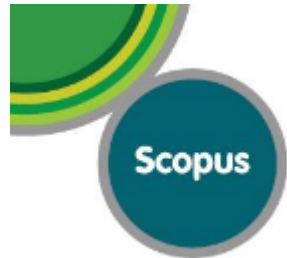
## Roots of modern bibliometrics (2/2)

- Derek J. de Solla Price  
22.01.1922, Leyton, UK – 3.9.1983
- “Little science, big science” (1963)
- Exponential growth of science  
(personnel and publications) Price’s Law
- From small scale (erudite scholar) to large scale (huge teams, government or private funding of infrastructure)





# Data availability as a driver: growth



# Bibliometric Laws

- Lotka's Law:
  - The number of authors writing  $x$  papers is about  $1/n^a$  of those with one paper ( $a=2$  in most disciplines)
  - About 75% write only one article, 25% two or more, 4% five or more
- Bradford's Law:
  - The number of relevant articles diminishes exponentially
  - $1:n:n^2 \rightarrow$  10 core journals in subject will cover 12 articles. For the next 12 article, 20 journals have to be searched, then 40 etc.
- Zipf's Law:
  - The frequency of any citation/item is inversely related to its rank in the frequency table
  - If most cited document has 30 citations, the second most cited has 15, the third most has 10 etc.

# Bibliometric indicators: JIF (1/2)

## Journal Impact Factor (JIF) in the Web of Science (WoS):

- $JIF = (\text{Number of citations in year } t \text{ of the documents published in the journal from the years } t-1 \text{ und } t-2) / (\text{number of „Citable Items“ in the years } t-1 \text{ and } t-2)$
- Documents = article, review, proceeding paper, notes, letter, editorial note, etc.
- Citable Item = article, review, proceeding paper
- Advantage: Librarians can select most used journals
- Critique:
  - Documents vs. citable items: artificial pushing of JIF possible
  - Short citation window of 2 years; SSH 5-year JIF, but still short
  - Ecological fallacy if used as an indicator for an article
  - Not comparable across disciplines: different citation practices

# Bibliometric indicators: h-index (1/2)

## h-Index (Hirsch, 2005)

- „A scientist has index  $h$  if  $h$  of his/her NP papers have at least  $h$  citations each, and the other  $(NP - h)$  papers have fewer than  $h$  citations each.“

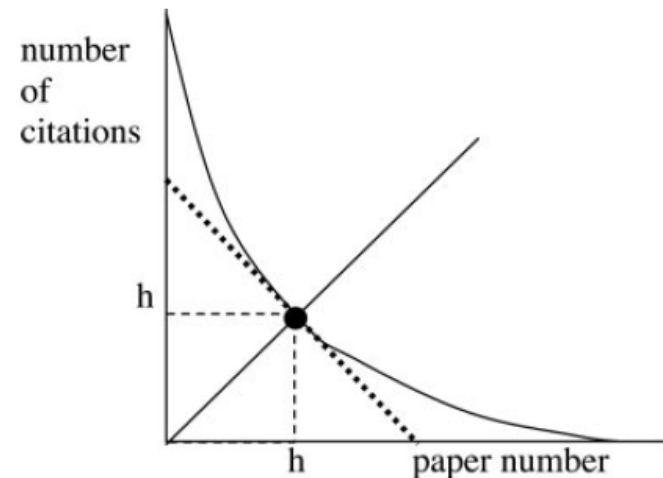
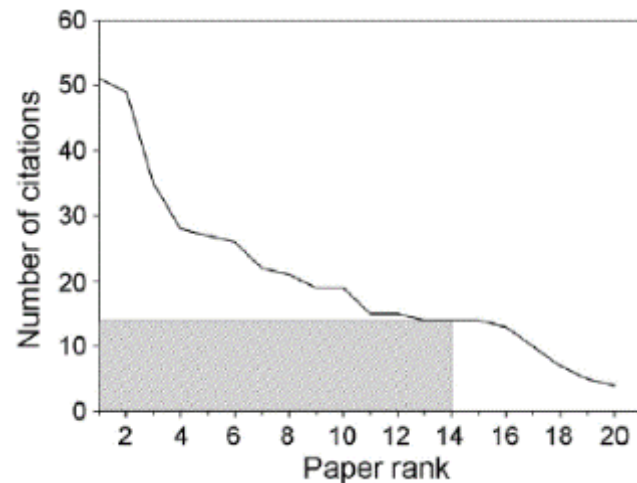
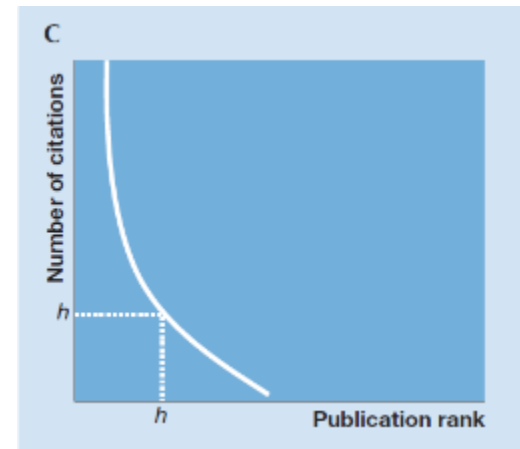
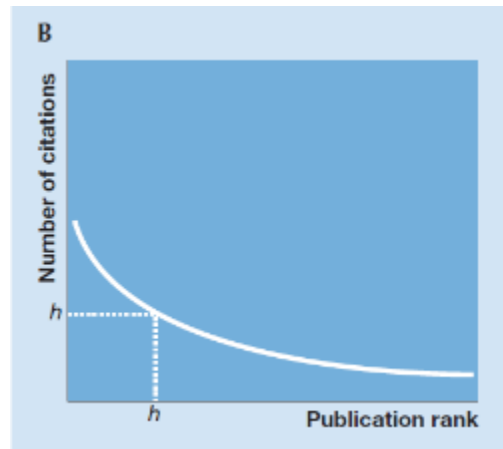
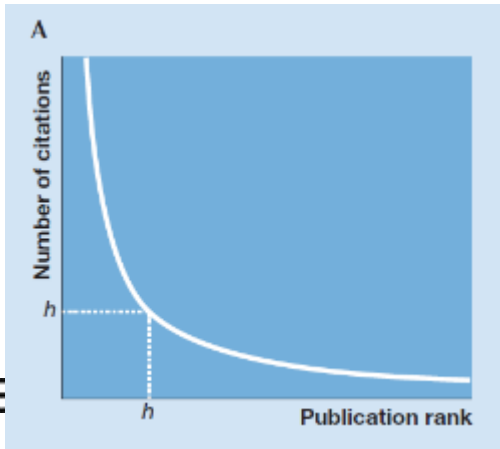


Fig. 1. Schematic curve of number of citations versus paper number, with papers numbered in order of decreasing citations. The intersection of the 45° line with the curve gives  $h$ . The total number of citations is the area under the curve. Assuming the second derivative is nonnegative everywhere, the minimum area is given by the distribution indicated by the dotted line, yielding  $a = 2$  in Eq. 1.

## Bibliometric indicators: h-index (2/2)

- Advantages:
  - Individual research performance (though possible on all levels)
  - Combining number of publications AND number of citations
  - Quite robust measure for “excellence” (high scores)
- Disadvantages/Critique:
  - Preference for researchers with long careers (cannot diminish)
  - Not comparable across disciplines: different citation practices
  - Poor discrimination (same h-index but different distribution)



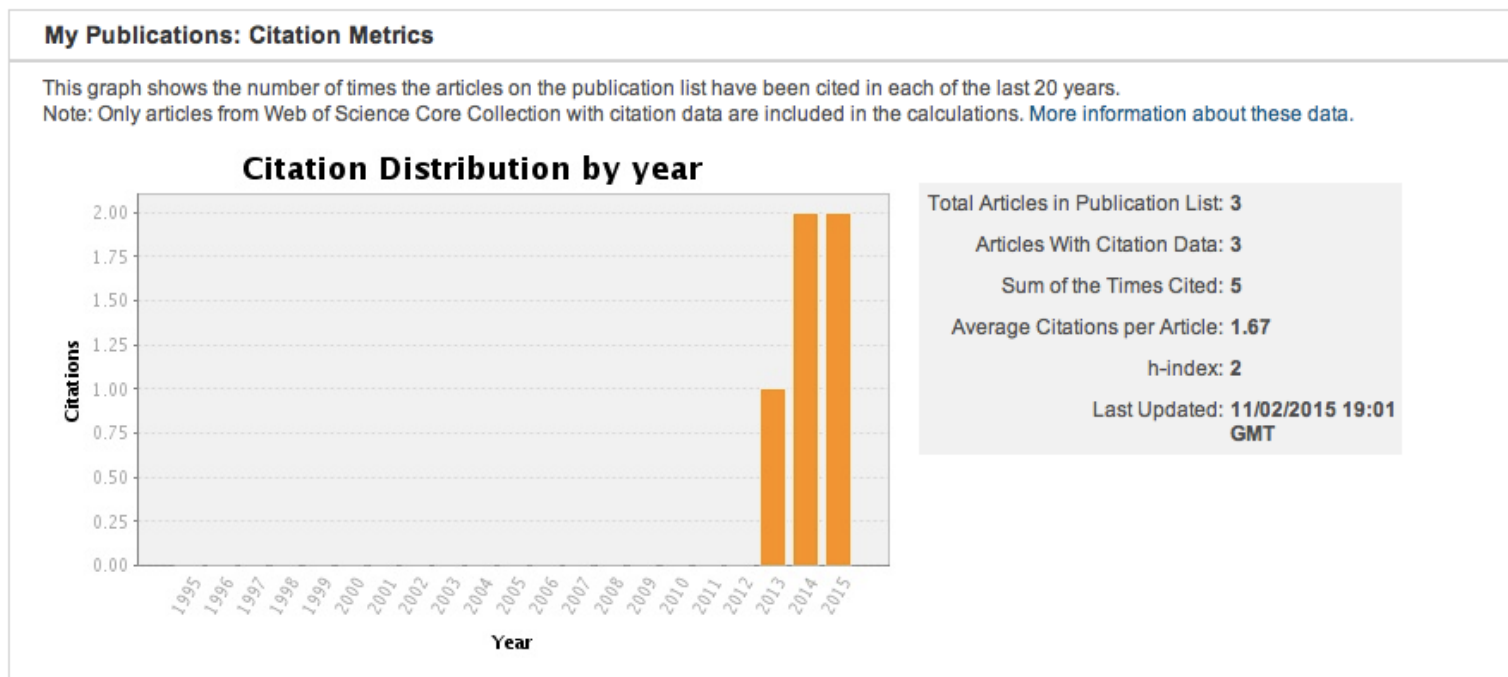


# Bibliometric data bases

- Three commercial players
  - Thomson Reuters, Elsevier and Google
  - Plus: Web 2.0 and scholarly databases (PubMed or APA)
- Different types
  - ISI: Idea of the “core” journals: Only most important journals that cover about 80% of all scholarly output and most of the citations
  - Web of Science and Scopus try to keep this ideal
  - Google: anything but asymptotically everything
  - Research Gate, Mendeley etc.: Only uploaded, no quality control, completely arbitrary

# Different data base, different results

- My citations and h-index by Thomson Reuters
  - 3 Documents, 5 citations, h-index=2



# Different data base, different results

- My citations and h-index by Scopus
  - 3 documents, 10 citations, h-index=2

Scopus Preview

Scopus SciVal | Login ▾ Help ▾

This is a preview of SCOPUS.

Click here to learn more about accessing SCOPUS with our Integration Services. Visit also our [SCOPUS Info Site](#).

The Scopus Author Identifier assigns a unique number to groups of documents written by the same author via an algorithm that matches authorship based on a certain criteria. If a document cannot be confidently matched with an author identifier, it is grouped separately. In this case, you may see more than 1 entry for the same author.

Print | E-mail

**Ochsner, Michael**

Universität Lausanne Schweiz, Lausanne, Switzerland

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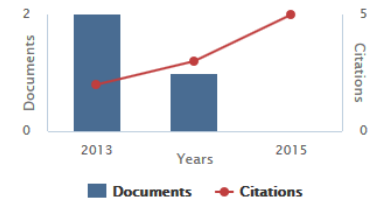
Citations: 10 total citations by 7 documents

h-index: 2

View h-graph

Co-authors: 2

Subject area: Social Sciences

**3 Documents** | Cited by 7 documents | 2 co-authors**3 documents** [View in search results format](#)

Sort on: Date Cited by ...

[Export all](#) | [Add all to my list](#) | [Set document alert](#) | [Set document feed](#)

Voraussetzungen für die Beurteilung der Qualität geisteswissenschaftlicher Forschung: Zusammenführung der Befunde aus vier empirischen Studien [Setting the stage for the assessment of research quality in the humanities. Consolidating the results of four empirical studies]

Ochsner, M., Hug, S.E., Daniel, H.-D.

2014

Zeitschrift für Erziehungswissenschaft

1

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Criteria for assessing research quality in the humanities: A delphi study among scholars of english literature, german literature and art history

Hug, S.E., Ochsner, M., Daniel, H.-D.

2013

Research Evaluation

3

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Four types of research in the humanities: Setting the stage for research quality criteria in the humanities

Ochsner, M., Hug, S.E., Daniel, H.-D.

2013

Research Evaluation

6

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Publication range: 2013 - 2014

References: 139

**Source history:**

Zeitschrift für Erziehungswissenschaft


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Research Evaluation

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# Different data base, different results

- My citations and h-index by Google Scholar
  - 9 documents, 53 citations, h-index=5



**Michael Ochsner**

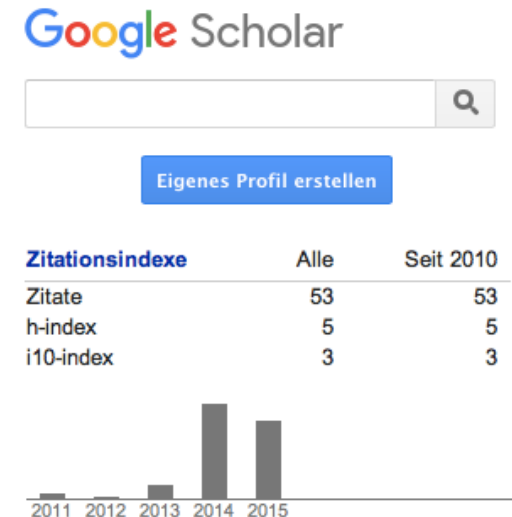
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Titel	1-9	Zitiert von	Jahr
<b>Criteria for assessing research quality in the humanities: a Delphi study among scholars of English literature, German literature and art history</b>			
SE Hug, M Ochsner, HD Daniel Research Evaluation, rvt008		13	2013
<b>Four types of research in the humanities: Setting the stage for research quality criteria in the humanities</b>			
M Ochsner, SE Hug, HD Daniel Research Evaluation 22 (2), 79-92		13	2013



# Different data base, different results

- My citations and RG-Score by ResearchGate
  - 10 documents, 14 citations  
4.77 RG-Score  
282 Reads, 2.68 impact points



Michael Ochsner  4.77

Dr. 

[Add your position](#) 

ETH Zurich, Zürich · Department of Humanities, Social an... 

OVERVIEW

CONTRIBUTIONS

INFO

STATS

RG SCORE

## Show your career's best

Use your profile overview page to present yourself and your research. Customizing your profile is the best way to show your peers what you've been working on, create exposure for your current projects, and start building your network.

10

PUBLICATIONS

282

Reads

14

Citations

2.68

Impact Points

[View stats](#)



## Different data base, different results

Top researcher: Lutz Bornmann (1% SocSci)

- WoS: 199 documents, 2793 citations, h-index=27
- Scopus: n/a
- Google: 304 documents, 6487 citations, h-index=41
- ResearchGate: 246 documents, 3769 citations, RG=43.14, 10K reads, 659.2 impact points



Lutz Bornmann  43.14

Dr. Dr. habil.

Sociologist of Science

Max Planck Society, Munich · Administrative Headquarters

# Different data base, different results

- Impact Factors by data base:
  - WoS
    - Research Evaluation: 1.123
    - Zeitschrift für Erziehungswissenschaft: 0.299
  - Scopus
    - Research Evaluation: 1.103; SJR: 0.605
    - Zeitschrift für Erziehungswissenschaft: 0.436; SJR: 0.28
  - Research Gate
    - Research Evaluation: 0.85
    - Zeitschrift für Erziehungswissenschaft: 0.99

# Different data base, different results

- WoS: Not all citations are detected:

<p>27. <b>Bibliometric monitoring of research performance in the social sciences and the humanities: A review</b>            By: Nederhof, A.J.            Conference: 8th International Conference on Science and Technology Indicators Location: Leiden, NETHERLANDS Date: SEP 23-25, 2004  <b>SCIENTOMETRICS</b> Volume: 66 Issue: 1 Pages: 81-100 Published: JAN 2006</p> <p> <a href="#">Full Text from Publisher</a> <a href="#">View Abstract</a></p>	<p>Times Cited: <b>181</b>  <i>(from Web of Science Core Collection)</i></p>
<p>28. <b>Four Types of Research in the Humanities: Setting the Stage for Research Quality Criteria in the Humanities</b>            By: Ochsner, M.; Hug, S. E.; Daniel, H. D.            Research Evaluation Volume: 22/2 Pages: 79-92 Published: 2012</p> <p></p>	<p>Times Cited: <b>2</b>  <i>(from Web of Science Core Collection)</i></p>
<p>29. <b>The representation of the social sciences and humanities in the Web of Science-a comparison of publication patterns and incentive structures in Flanders and Norway (2005-9)</b>            By: Ossenblok, Trycken L. B.; Engels, Tim C. E.; Sivertsen, Gunnar  <b>RESEARCH EVALUATION</b> Volume: 21 Issue: 4 Pages: 280-290 Published: OCT 2012</p> <p> <a href="#">Full Text from Publisher</a> <a href="#">View Abstract</a></p>	<p>Times Cited: <b>14</b>  <i>(from Web of Science Core Collection)</i></p>

- Scopus: Misspelled or wrong citation = not captured
- Google: Citation from anywhere, duplicates (same article = 3 items → citations divided)
- See Sjögarde, 2014: Especially for non-hard science (citation styles?)

# Differences also in interpretation

- Selective vs. comprehensive
  - WoS and Scopus: all citations are from scholarly articles published in peer reviewed journals, in the natural sciences also the most used and most important journals (not so in the SSH)
  - Google: citation from anything like articles in peer reviewed journals to presentations or student's qualifying works
- Quality
  - WoS and Scopus: clear rules for inclusion, quality control
  - Google: algorithms and crawlers, many duplicates, easy to manipulate
  - ResearchGate and others: Uploads by users, no quality controls, same article twice, missing authors etc.

# Bibliometric analyses

- Poor Man's Bibliometrics (Marx & Bornmann, 2013)
  - Direct use of indicators of data bases (worst case: Google)
  - Possible because of expansion of availability of data
  - Simple indicators: JIF, h-index, SNIP, i10
    - If data is not cleaned: they are very biased
    - If used on wrong aggregation level: they are very biased
    - If used across different fields: they are very biased
- Professional Bibliometrics
  - Acquired relevant data, enormous time to clean
  - Sophisticated field normalization
  - Inclusion of non-source items for some fields (SSH)
  - Large numbers of indicators
  - Professional interpretation of results



# Altmetrics: A hype (but a sarcastic joke)

- Use of Twitter, Facebook, Google+, Mendeley, Research Gate
- For 1.3 million indexed papers in WoS:
  - Only Twitter is significantly correlated with citation, therefore, only Twitter usable (Costas, Haustein, Larivière, 2014)
  - However:  $N=1,300,000$ ;  $r=0.195$
- Also known: 15% of scholars use Twitter, about 30% of Tweets are automated → extreme selection bias
- Easy to manipulate → researchers as professional Tweeters?
- What do we want to measure? “We are ready to do professional altmetrics, we only have to find out, what the numbers are actually measuring” (One prominent author in a presentation at Nordic Workshop on Bibliometrics and Research Policy 2014)
- Absolutely no control over data, entries come and go

# Bibliometrics and the SSH



# Bibliometrics are not valid in the SSH

- Consensus among bibliometricians that bibliometrics are not (yet) applicable to the SSH
  - Different publication patterns (Hicks, 2004)
  - Different citation practices (van Leeuwen, 2006)
  - Lack of coverage in data bases (van Leeuwen, 2013)
  - Language issues (Nederhof, 2005)
  - US over-covered (60%) UK over-covered (20%); not only English-bias (70% in English) but especially nationality (Chi, 2014)
- Further problems:
  - No linear progress of research (cf. Price's Law; Lack, 2008)
  - Interaction with public – non-scholarly publications are important
  - WoS and Scopus exhibit citation-matching problems for non-hard science publications → Loss of citations



# Book Citation Index

- Thomson Reuters reacted with inclusion of books
  - However, not usable (Gorraiz, 2012)
  - Mostly, natural sciences and engineering books
  - Almost only edited volumes
  - Monographs: entries chapter by chapter
  - No transparency on which books are included and why (vs. clear selection criteria for journals)
- Elsevier also includes books
  - Same problems as above: chapter by chapter
- Google
  - Books included as long as they are open access or publisher has a contract with Google (bias!)

# Coverage issues (internal)

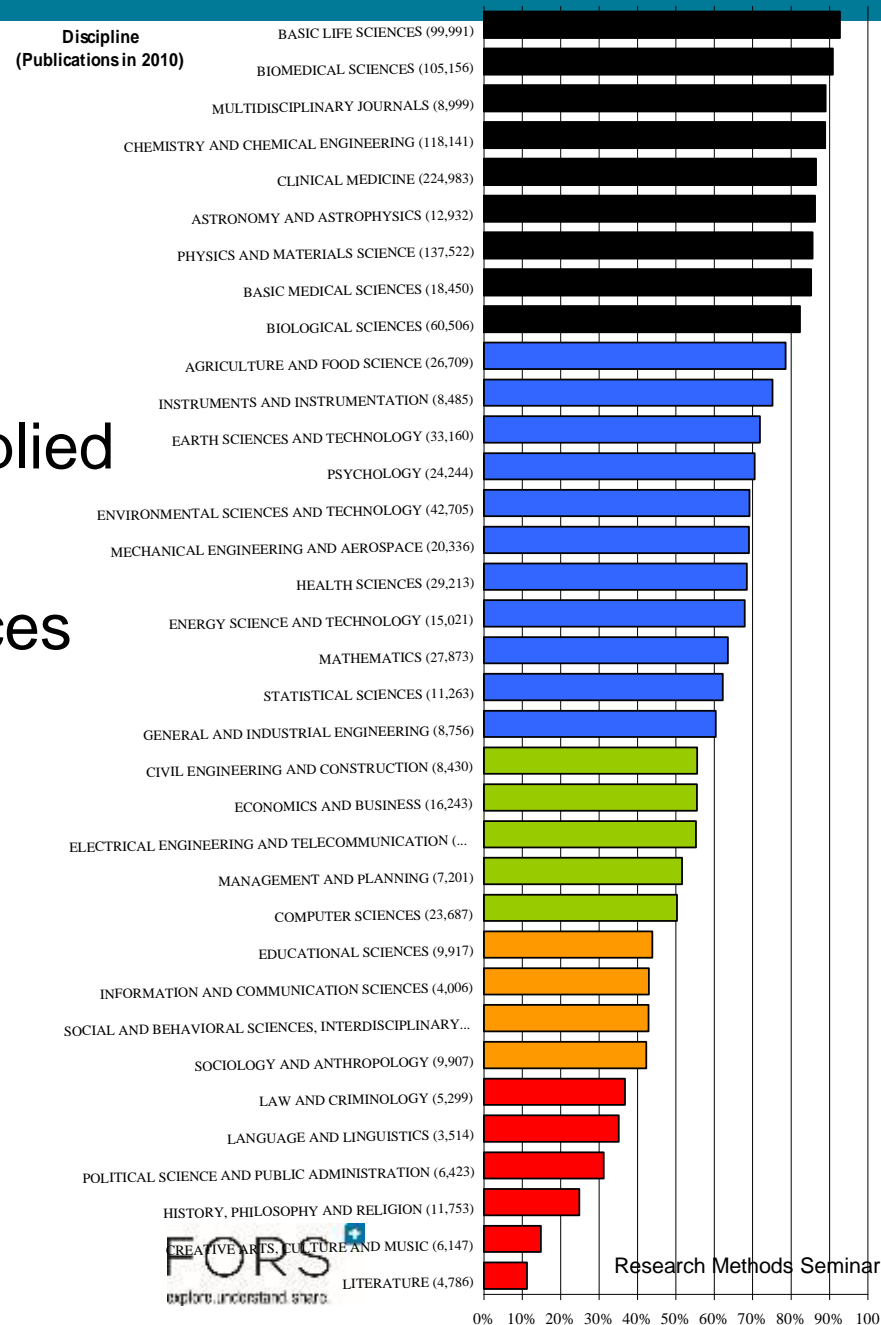
Black: hard sciences

Blue: engineering/applied

Green: economics

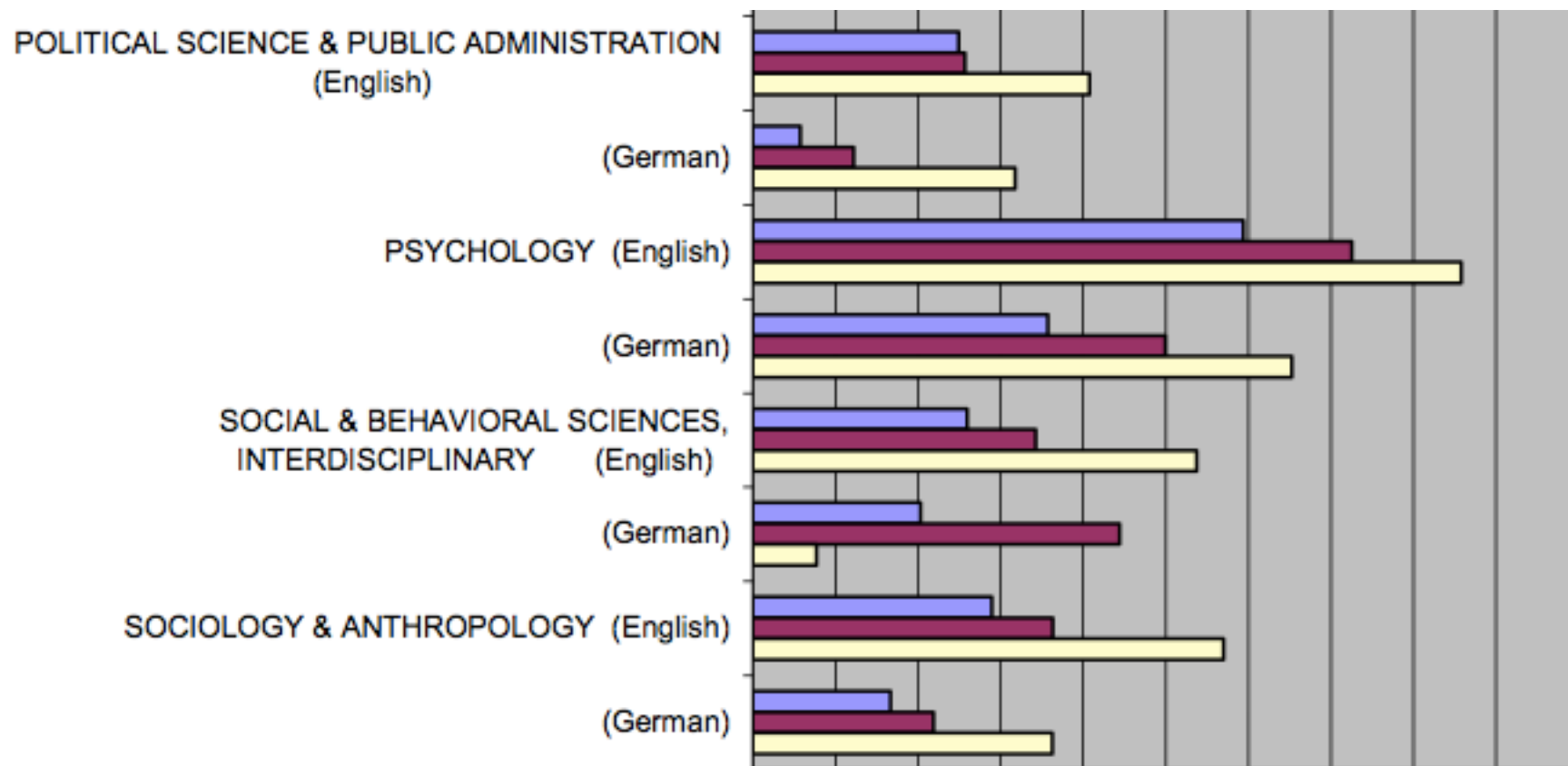
Orange: social sciences

Red: humanities





# Coverage issues (internal)



# Evaluative bibliometrics: citations and quality

- Bibliometrics widely used in STEM to evaluate research
- This comes with assumptions
  - Citations as “currency of science” (Merton, 1962, personal communication to Garfield)
  - Citation as a predictor for quality (but: citations measure many things, Moed, 2005; Bornmann et al., 2008)
  - Coverage: the data base must include most important research adequately (80%-rule)
  - Linear progress of research
  - Citation practices are similar in subjects that are evaluated (but: van Leeuwen, 2006)
  - There is nothing else that is not correlated with citations that is important for the quality of research (but: Ochsner et al., 2012; Hug et al., 2013)

# Conclusion

- Bibliometrics not usable for evaluative purposes in SSH
- Nevertheless high pressure to do so
  - External: Science policy (e.g., REF)
  - Internal: Appointments are very often done using “poor man’s” bibliometrics
  - Internal: Scholars themselves start to use “poor man’s” bibliometrics
- However, even in natural sciences where data is quite reliable, scholars start to oppose (DORA, Leiden-Manifesto)

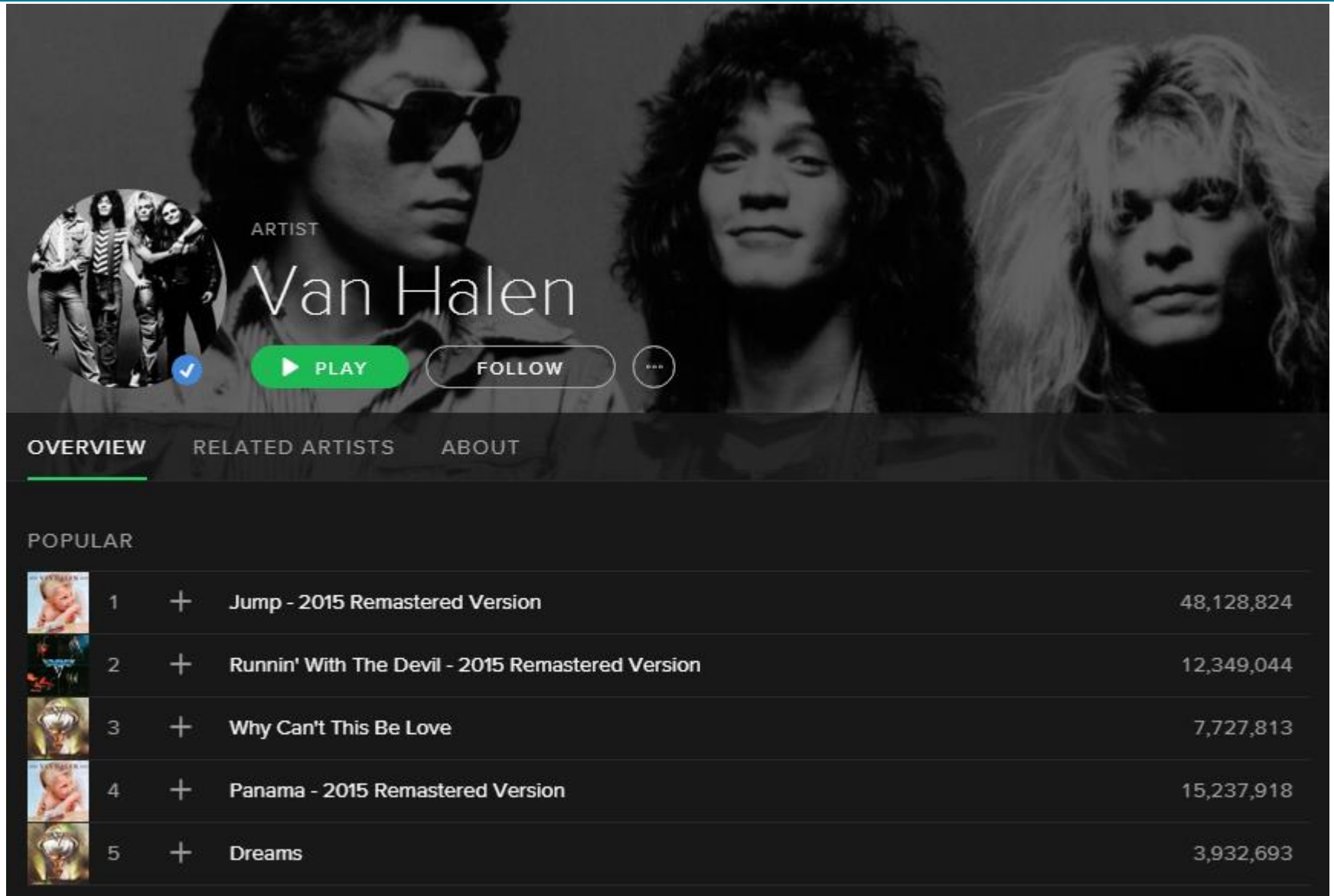
# Music as an example





# Spotify

- Streaming service
- Provides statistics for each group, album, song etc.
- Provides playlists according to these statistics “Most listened” but also “hot”, “Best of” etc.








ARTIST

# Van Halen

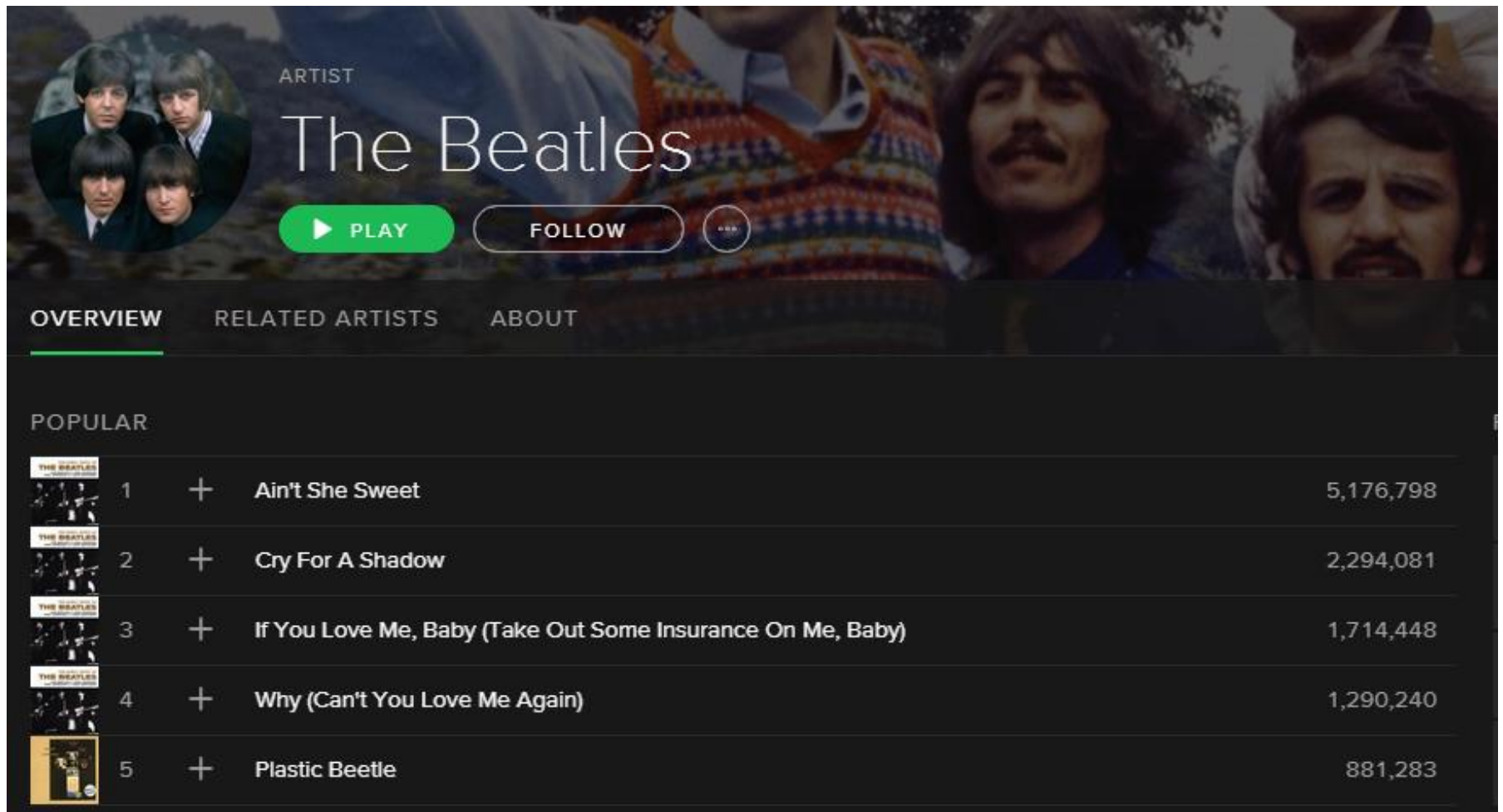
PLAY FOLLOW ...

OVERVIEW RELATED ARTISTS ABOUT

POPULAR

	1	+	Jump - 2015 Remastered Version	48,128,824
	2	+	Runnin' With The Devil - 2015 Remastered Version	12,349,044
	3	+	Why Can't This Be Love	7,727,813
	4	+	Panama - 2015 Remastered Version	15,237,918
	5	+	Dreams	3,932,693

# And the Beatles?








ARTIST

## The Beatles

PLAY FOLLOW

OVERVIEW RELATED ARTISTS ABOUT

POPULAR

	1	+	Ain't She Sweet	5,176,798
	2	+	Cry For A Shadow	2,294,081
	3	+	If You Love Me, Baby (Take Out Some Insurance On Me, Baby)	1,714,448
	4	+	Why (Can't You Love Me Again)	1,290,240
	5	+	Plastic Beetle	881,283



ARTIST

# Ludwig van Beethoven



PLAY

FOLLOW



OVERVIEW

RELATED ARTISTS

ABOUT

## LATEST RELEASE



Violin Sonatas Nos. 6, 7 And 10

30 OCTOBER 2015

## POPULAR



1



Sonata No. 14 "Moonlight" in C-Sharp Minor", Op. 27 No. 2: I. Adagio sostenuto

1,006,825



2



Piano Sonata No. 14 in C-Sharp Minor, Op. 27, No. 2, "Moonlight": I. Adagio sostenuto

6,694,406



3



Piano Sonata in D Major, Op. 28 - 'Pastoral': I. Allegro

3,300,433



4



Piano Sonata No. 4 in E-Flat, Op. 7: III. Allegro

1,391,440



5



Concerto for Piano and Orchestra No. 5 in E-Flat Major, Op. 73: II. Adagio un poco moto...

937,500





ARTIST

# Macklemore & Ryan Lewis

▶ PLAY

FOLLOW

...

OVERVIEW

RELATED ARTISTS

ABOUT

## LATEST RELEASE



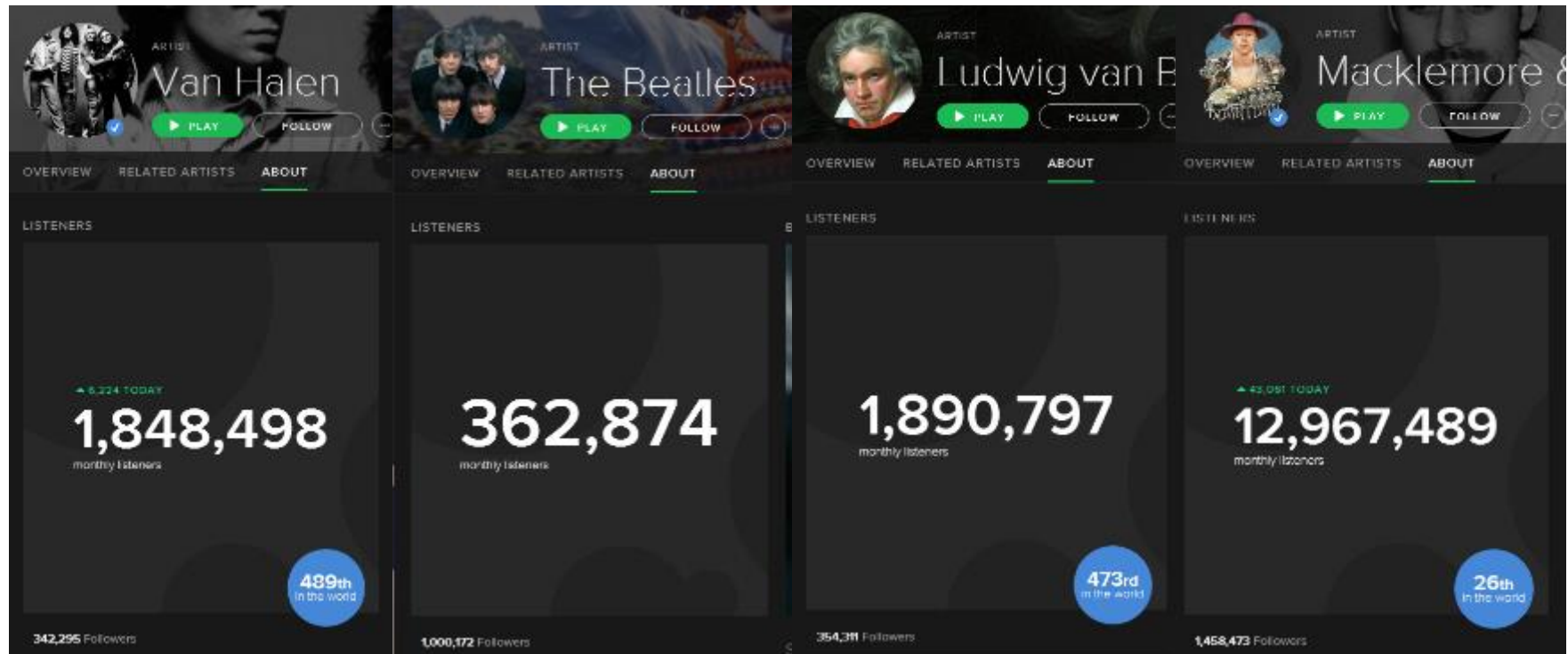
Downtown (feat. Eric Nally, Melle Mel, Kool Moe Dee &amp; Grandmaster Caz)

27 AUGUST 2015

## POPULAR

	1	+	Downtown (feat. Eric Nally, Melle Mel, Kool Moe Dee & Grandmaster Caz)	EXPLICIT	67,637,931
	2	+	Thrift Shop - feat. Wanz	EXPLICIT	266,297,258
	3	+	White Walls - feat. ScHoolboy Q, Hollis	EXPLICIT	75,496,964
	4	+	Can't Hold Us - feat. Ray Dalton		352,479,890
	5	+	Otherside (feat. Fences) [Ryan Lewis Remix]		22,892,414

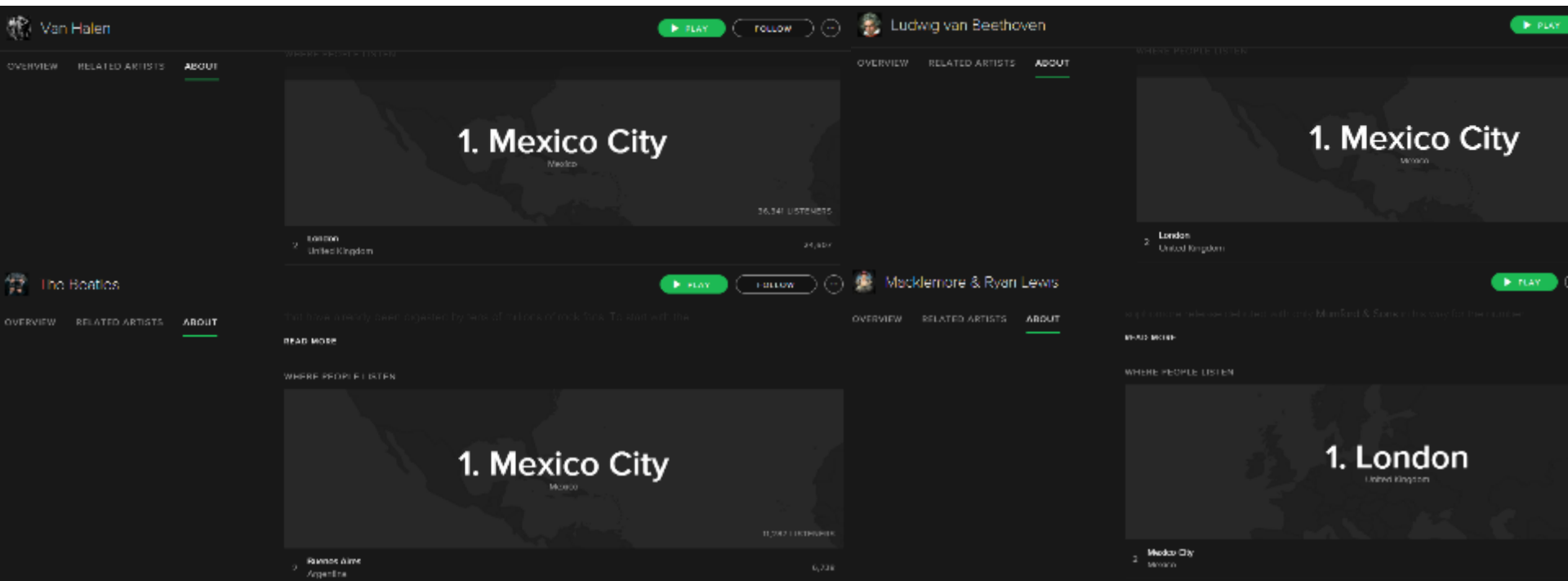
# OK, maybe followers?



## Albums sold?

- Beatles: 600 Millions
  - Van Halen: 96.5 Millions
  - Beethoven: approx. 10 Millions
  - Macklemore & Ryan Lewis: <2 Millions
- Obviously, Spotify's data base is biased, so are album sales: coverage issues, language issues, music styles
- And, just like WoS, Scopus, and even Google:

# Where do the listeners (or listens) come from?





# Light at the end of the tunnel



# Spotify: What are “listens” really good for?





ARTIST

# Van Halen

▶ PLAY

FOLLOW



1,848,498  
MONTHLY LISTENERS

OVERVIEW

RELATED ARTISTS

ABOUT



David Lee Roth



Aerosmith



Whitesnake



Def Leppard



KISS



Sammy Hagar



Quiet Riot



Ace Frehley



Mötley Crüe



Poison



Ted Nugent



Tesla





ARTIST













# The Beatles





362,874  
MONTHLY LISTENERS

OVERVIEW RELATED ARTISTS ABOUT

 <p>John Lennon</p>	 <p>Paul McCartney</p>	 <p>The Hollies</p>	 <p>The Kinks</p>	 <p>Ringo Starr</p>	 <p>George Harrison</p>
 <p>The Zombies</p>	 <p>Badfinger</p>	 <p>The Beach Boys</p>	 <p>The Who</p>	 <p>Tony Sheridan</p>	 <p>Manfred Mann</p>





ARTIST

# Ludwig van Beethoven

▶ PLAY

FOLLOW



1,890,797  
MONTHLY LISTENERS

OVERVIEW

RELATED ARTISTS

ABOUT



Franz Joseph Haydn



Wolfgang Amadeus Mozart



Franz Schubert



Ferdinand Ries



Johann Nepomuk Hummel



Luigi Cherubini



Carl Czerny



Louis Spohr



Hector Berlioz



Gioachino Rossini



Felix Mendelssohn



Robert Schumann



ARTIST

# Macklemore & Ryan Lewis

▶ PLAY

FOLLOW

12,967,489  
MONTHLY LISTENERS

OVERVIEW

RELATED ARTISTS

ABOUT



Macklemore



Outasight



Hoodie Allen



B.o.B



Classified



Blue Scholars



Dyme Der



Aloe Blacc



Chiddy Bang



Travie McCoy



Grieves



Kid Cudi

# What can bibliometrics be used for?

- Analogous to Spotify: discover related authors, papers, emerging fields
- What it has been developed for:
  - Help for librarians (most used journals, core journals of subject etc.)
  - For retrieval problems
- But also for science policy:
  - Detect emerging fields
  - Build new organisational units (university level)
- Yet, in SSH always be cautious and look for results of different data bases (languages, regions, fields etc.)



# Conclusions



## Take-home messages

- Never use evaluative bibliometrics in SSH
- Don't trust the data – any data
- Never use the IF to judge an article
  - Do never sum up your articles according to JIF (ResearchGate!)
- Do not select your journal ONLY according to JIF
- If you talk bibliometrics: mention the data base you are referring to (“I have an h-index of 12” – Google or WoS?)
- Never compare bibliometric indicators across disciplines
- Use citations to find new references and new authors
- Use citation networks to discover new topics

# Thank you for your attention

- More information:
    - European Association for Research Evaluation in the SSH:  
[www.evalhum.eu](http://www.evalhum.eu)
    - Swiss project on research evaluation in the SSH:  
[www.performances-recherche.ch/](http://www.performances-recherche.ch/) (Website under construction but partly available)
    - Our own project on quality criteria for research in the humanities:  
<http://www.psh.ethz.ch/forschung/anwendung-von-bottom-up-kriterien-zur-beurteilung-von-geisteswis.html>
- [http://www.sagw.ch/sagw/laufende-projekte/Qualitaet-Leistung/Theoretische Grundlagen.html](http://www.sagw.ch/sagw/laufende-projekte/Qualitaet-Leistung/Theoretische_Grundlagen.html)