2023-05-18

A Field Normalized Exploration of Awoken Papers

Hansen, Samuel

https://dx.doi.org/10.7302/7992

https://hdl.handle.net/2027.42/177438

http://creativecommons.org/licenses/by-nc-sa/4.0/

A Field Normalized Exploration of Awoken Papers

Sam Hansen
Mathematics & Statistics Librarian
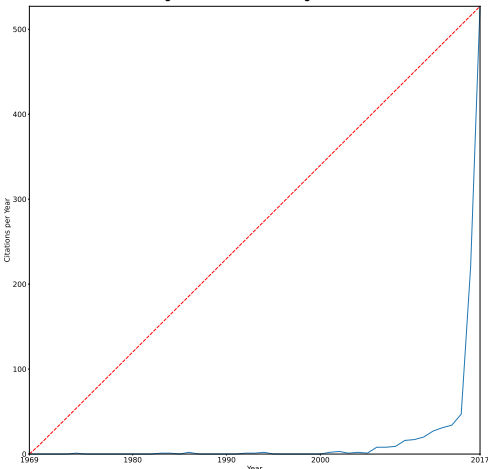University of Michigan, Ann Arbor

Awoken Papers & Sleeper Coefficients

- **Awoken Papers (APs)** are papers which receive few to no citations for a number of years and then receive a sudden spike in citations
- **Sleeper Coefficients (SC)** for all articles in Clarivate's Web of Science were calculated using the formula from Ke, Ferrara, Radicchi, and Flammini[a]

$$B = \sum_{t=0}^{t_m} \frac{\frac{c_{t_m}-c_0}{t_m} \cdot t + c_0 - c_t}{\max(1, c_t)}$$

  - t is the age of an article
  - c_t is the number of citations it receives in year t
  - m is the year with the most citations.

- The papers with SC values in the top 0.1% of all articles are defined to be APs
- A Discipline's **AP Ratio** is a discipline's number of APs divided by its total article count

Awoken Paper Example

Citation History for Investigating Causal Relations by Econometric Models and Cross-spectral Methods with a dotted line indicating a linear growth to its max citation. The SC is essentially calculating the difference between these two plots.

[a]https://www.pnas.org/doi/10.1073/pnas.1424329112

Mathematics is the biggest driver for the creation of Awoken Papers

Raw AP Counts and Ratios

Top Disciplines by Ke Et. Al. (1900-2014)	Top Disciplines by Total AP Counts (1900-2017)	Top Disciplines by AP Ratio (1900-2017)
Physics, Multidisciplinary	Chemistry, Multidisciplinary	Anatomy & Morphology
Chemistry, Multidisciplinary	Physics, Multidisciplinary	Social Sciences, Mathematical Methods
Multidisciplinary Sciences	Multidisciplinary Sciences	Statistics & Probability
Mathematics	Mathematics	Physics, Multidisciplinary
Medicine, General & Internal	Chemistry, Physical	Mathematics
Physics, Applied	Medicine, General & Internal	Audiology & Speech-Language Pathology
Surgery	Physics, Applied	Anthropology

Observations

- The differences between Ke Et. Al.'s 1900-2014 calculation of raw AP counts and my 1900-2017 are minor
- Normalizing the raw counts by the total number of articles indexed in Web of Science in a discipline drastically changes which disciplines rank as the largest creators of APs
- While inter- and multidisciplinarity were seen to drive the creation of APs by Ke Et. Al., mathematical content seems to correlate strongly with higher AP Ratios

← Awoken Papers Data

AP Ratio for Highly Cited Articles

At Least 100 Citations[a]	At Least 300 Citations[b]	At Least 500 Citations[c]
Mathematics	Mathematics	Mathematics
Statistics & Probability	Psychology, Mathematical	Psychology, Mathematical
Psychology, Mathematical	Psychology, Psychoanalysis	Engineering, Multidisciplinary
Social Sciences, Mathematical Methods	Social Sciences, Interdisciplinary	Social Sciences, Interdisciplinary
Engineering, Geological	Statistics & Probability	Metallurgy & Metallurgical Engineering
Physics, Multidisciplinary	Metallurgy & Metallurgical Engineering	Operations Research & Management Science
Anthropology	Engineering, Multidisciplinary	Audiology & Speech-Language Pathology
Social Sciences, Interdisciplinary	Audiology & Speech-Language Pathology	Transportation Science & Technology
Mathematics, Applied	Mathematics, Applied	Social Sciences, Mathematical Methods
Crystallography	Social Sciences, Mathematical Methods	Statistics & Probability

Observations

- Mathematics, in many different forms, is by far the most likely area to generate highly cited APs
  - **At least half** of the top 10 disciplines for each citation cut off are mathematical in nature
- Multi- and Interdisciplinary, social science, and engineering disciplines all generate highly cited APs with regularity
- For mathematics articles published in the last century, there is
  - Over a **1 in 10** chance that is an Awoken Paper for articles with 100 Citations (11.5%, the next highest is 6.6%)
  - Over a **1 in 5** chance that is an Awoken Paper for articles with 300 Citations (22.7%, the next highest is 16.2%)
  - Over a **1 in 4** chance that is an Awoken Paper for articles with 500 Citations (26.2%, the next highest is 21.9%)

Limitations

- Web of Science indexes more STEM content than other subject areas
- Not all Subject Categories are indexed for whole period under investigation