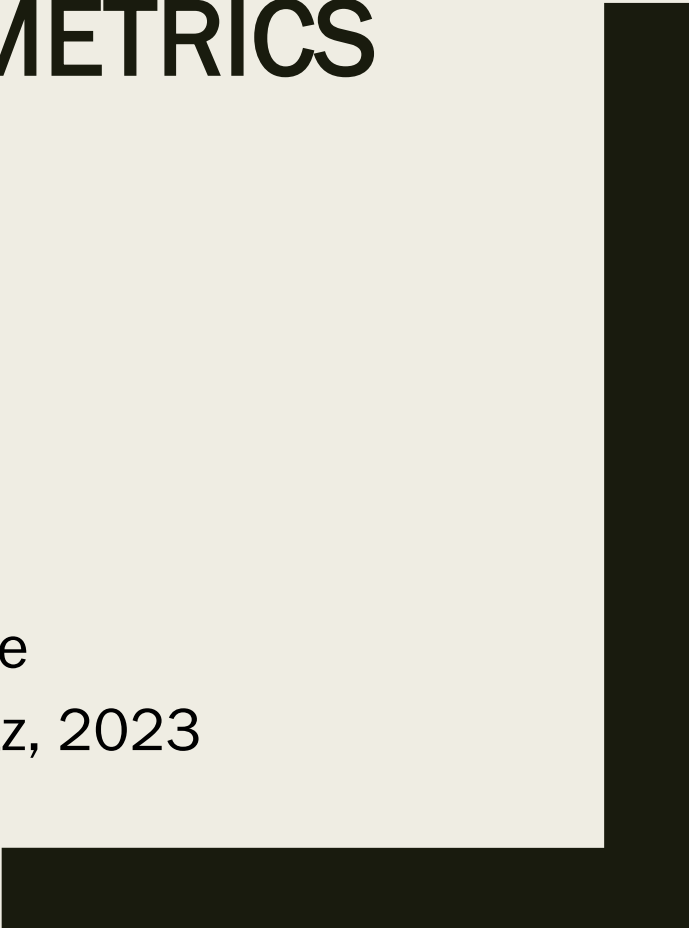




INTRODUCTION TO BIBLIOMETRICS

Stéphane Gorla – Université de Lorraine
Summer school in digital humanities, Metz, 2023



Purposes

- *Having a basic vocabulary about bibliometrics*
- *Know the main bibliometric variables and indicators*
- *Have an idea of its usefulness and biases*
- *Know a few sources for bibliometric research*
- *Being able to prepare research aimed at building reference corpora*
- *Knowing some tools and techniques that can be implemented*
- *Being able to apply these techniques to one's own research topic*

For a PhD student

- ***Bibliometric* methods can be highly valuable for PhD students in several ways:**
 - Literature Review: It helps in conducting a comprehensive literature review by identifying key authors, journals, and seminal works in the research area. This ensures that you are building on existing knowledge effectively.
 - Research Gap Identification: By analyzing the literature, you can identify gaps in existing research, which can guide the direction of your PhD work. You can identify areas that need further exploration or where there is limited research.
 - Publication Strategy: It can inform your publication strategy by helping you target journals or conferences that are most relevant and influential in your field.
 - Career Development: Understanding bibliometric concepts (indicators) can be useful for your academic career, as it's a skill that is increasingly valued in academia.

Notions and Definitions

■ *Scientometrics*

The quantitative methods of the research on the development of science as an informational process which proposed by Vasiliy Nalimov and Zinaida Mul'chenko (1969). These methods focus on the analysis of scientific fields or domains in relation to each other.

■ *Bibliometrics*

The application of mathematics and statistical methods to books and other media of communication which proposed by Alan Pritchard (1969).

Bibliometrics is a subset of scientometrics, specifically focusing on the bibliographic aspects of scholarly literature, such as citations and publication patterns, while scientometrics takes a more comprehensive view of the scientific research process, including the social and organizational aspects of science. Both fields use quantitative methods to gain insights into the world of academic research and scholarship.

Sources:

Mingers, J., & Leydesdorff, L. (2015). A review of theory and practice in scientometrics. *European journal of operational research*, 246(1), 1-19.

Nalimov, V. V. & Mul'chenko, Z. M. Наукометрия, Изучение развития Науки как информационного процесса [Naukometriya, the Study of the Development of Science as an Information Process] (in Russian). Moscow: Nauka, 1969.

Nalimov, V., & Mulcjenko, B. (1971). *Measurement of Science: Study of the Development of Science as an Information Process*. Washington DC: Foreign Technology Division.

Pritchard, A. (1969). Statistical bibliography or bibliometrics? *Journal of Documentation*, 25, 348-349.

Rousseau, R. (2021). Naukometriya, Nalimov and Mul'chenko. *Collnet Journal of Scientometrics and Information Management*, 15(1), 213-224.

Notions and Definitions

■ *Bibliometrics*

Bibliometrics is a set of quantitative methods used, notably in library and information science, as well as in the field of research evaluation. It involves the statistical analysis of various aspects of written publications, such as books, articles, and other forms of academic or scientific literature.

One goal of bibliometrics is to assess and measure the impact, influence, and productivity of authors, journals, institutions, or research fields based on the analysis of citation patterns, publication counts, and other bibliographic data. This field of study is widely used in academia and research to evaluate the significance and reach of scholarly work and to inform decision-making in academic publishing, funding, and research assessment. Among these methods there are citation analysis, content analysis, multidimensional analysis and network analysis.

Bibliometrics can be applied in other professional domains. For example, patent bibliometrics is similar with scholar bibliometrics. It is a valuable tool for analyzing the patent landscape, understanding technological innovation, and making informed decisions related to intellectual property and innovation strategies. It allows for data-driven insights into the world of patents and their role in advancing technology and innovation.

There are exist too: webometrics / cybermetrics, infometrics, econometrics, ...

Some bibliometrics applications for an university

Used in conjunction with other qualitative measures, bibliometrics can provide a comprehensive assessment of research and academic activities as:

- ***Research evaluation:***

- Faculty Assessment: Universities can use bibliometrics to evaluate the research productivity and impact of faculty members. This can inform promotion and tenure decisions.
- Departmental and Institutional Rankings: Bibliometric data can help universities assess the research performance of departments and the institution as a whole. This information can be used for strategic planning and benchmarking.

- ***Resource allocation:***

- Library Collection Management: Bibliometrics can guide libraries in making informed decisions about which journals, books, or databases to subscribe to based on their relevance and impact.
- *Research Funding Allocation*: Universities can use bibliometric data to allocate research funding to departments or projects based on their research track records.

Some bibliometrics applications for an university

■ *Research Collaboration and Networking:*

- Identifying Collaboration Opportunities: Bibliometrics can help researchers identify potential collaborators by analyzing co-authorship networks and research interests.
- Mapping Research Landscape: It can be used to map the research landscape in various disciplines, helping universities identify emerging areas and interdisciplinary research opportunities.

■ *Institutional Repositories:*

- Managing Institutional Repositories: Universities can use bibliometrics to track the usage and impact of materials in their institutional repositories, such as theses, dissertations, and open-access publications.
- Promoting open Access Initiatives: Bibliometrics can support universities in their efforts to promote open access publishing by tracking the impact of open access research.

Some bibliometrics applications for an university

■ *Monitoring and Reporting:*

- Research Impact Reporting: Universities can generate reports on the impact of their research output for various stakeholders, including funding agencies, alumni, and the public.
- Benchmarking: Bibliometrics can be used to benchmark a university's research performance against peer institutions regionally or globally.
- Publication Trends: Researchers can analyze publication trends in academic journals or conference proceedings. An abrupt increase in the number of publications in a particular area, especially if they are from a diverse set of authors and institutions, can be a sign of a new scientific domain gaining prominence.
- Citation Patterns: Citation analysis is a powerful tool in bibliometrics. When publications in a specific field start to receive more citations, it can indicate growing interest and recognition in that field (see the main bibliometrics laws).
- Keyword Analysis: Bibliometric analysis often involves examining the keywords used in academic publications. Researchers can track the appearance and frequency of new keywords or terms related to a specific scientific domain. An increase in the use of these keywords over time may indicate the emergence of a new field.

Some controversies and critics about bibliometrics

- ***Overreliance on Quantitative Metrics:***

- The citation counts and the use of journal impact factors to assess research quality and productivity are controversial. Critics argue that these metrics do not capture the full spectrum of research impact and can lead to skewed incentives and biases in academia.

- ***Inequality and Bias:***

- Bibliometrics can exacerbate existing inequalities in academia. Researchers from underrepresented groups or in less-resourced institutions may be at a disadvantage in terms of citation counts and access to high-impact journals, leading to systemic bias.

- ***Quality vs. Quantity:***

- Some argue that bibliometrics place too much emphasis on quantity (e.g., the number of publications) over quality (e.g., the significance and impact of research findings). This can discourage deep and innovative research in favor of producing more publications.

- ***Negative Impact on Scientific Culture:***

- Critics contend that the emphasis on bibliometrics can erode the scientific culture by promoting a competitive "publish or perish" mentality rather than fostering collaboration, open science, and creativity.

Some controversies and critics about bibliometrics

- ***Disciplinary Differences:***

- Different academic disciplines have unique publication and citation patterns. Using a one-size-fits-all approach to bibliometrics can disadvantage researchers and fields with different norms and practices.

- ***Language Differences:***

- Publications in English are cited far more than those in other languages, with no relation to their quality.

- ***Source Bias:***

- Results will vary depending on the sources (journals, conferences, books...) and data used in the calculations. The platforms that offer bibliometrics indicators do so on the basis of the sources they are able to interrogate.

- ***Manipulation and influence by a gamification / pointification system:***

- The use of bibliometrics in performance evaluation has led to concerns about researchers and institutions are being encouraged to game the system to their own advantage. These include abuse through self-citation, excessive authorship and other practices aimed at artificially inflating citation counts and other metrics.

How to use bibliometrics with ethics

- ***Transparent Methodologies:***

- Clearly document the methodologies and data sources used for bibliometric analyses. Make this information publicly available so that others can assess the validity of the analysis.

- ***Responsible Metrics Framework:***

- Encourage the use of multiple metrics and sources to provide a more holistic view of research impact, including qualitative assessments and alternative metrics (altmetrics).
- Implement measures to mitigate biases in bibliometric data, such as adjusting for field-specific differences in citation practices or considering the impact of research collaborations.

- ***Research on Metrics:***

- Invest in research that examines the impact and ethics of bibliometric practices. Encourage studies that evaluate the effectiveness of different assessment approaches.

- ***Expert Evaluation:***

- Encourage experts to consider the quality, significance, and societal impact of research, in addition to bibliometric metrics.

Principal bibliometric laws

- *(Alfred) Lotka's law (1926)*
 - Production and recognition systems in science follow a Pareto distribution, with **20% of researchers producing 80% of the publications.**
- *(Samuel) Bradford's law of scattering (1934)*
 - The references of documents follow a Pareto distribution, with **20% of the journals publishing 80% of the most cited articles.**
- *(George Kingsley) Zipf and (Benoit) Mandelbrot's law (1935 + 1952) : Long tail*
 - The distribution of words in a text or texts by the same author follows a unique Pareto law.

Some examples of altmetrics

- ***Article Views and Downloads:***

- Tracking the number of times a research article is accessed or downloaded from a publisher's website or a preprint server can provide insights into its popularity and interest.

- ***Online Reviews and Comments:***

- The presence of user-generated content, such as reviews and comments on platforms like ResearchGate or academic social networks, can reflect the engagement of the research community.

- ***Usage in Online Courses:***

- Inclusion of research papers or materials in online courses, syllabi, or educational resources can demonstrate their influence on teaching and learning.

☞ These other metrics and indicators also have their limits and shortcomings, and can be subject to manipulation.

Main bibliometric indicators

- ***Journal Impact Factor:***

- It assesses the influence of a journal by calculating the average number of citations received per paper published in that journal during a specific time period. It's primarily used to evaluate journals, not individual papers or authors.

- ***CiteScore (proposed by Scopus):***

- It measures the average number of citations received per document published in a journal over a specific time frame.

- ***Citation Count:***

- The number of times a publication has been cited by other scholarly works. It's one of the most common and widely used bibliometric indicators.

- ***Author Productivity:***

- It measures the total number of publications by an author, which can be used to gauge their research output.

- ***Co-authorship Network Analysis:***

- Analyzing co-authorship networks can reveal collaboration patterns and highlight influential researchers within a field.

Main bibliometric indicators

- ***H-index:***

- It measures both the productivity and impact of a researcher's work. An author has an h-index of h if they have published h papers that have each been cited at least h times.

- ***HA-index (proposed by Harzing's Publish or Perish tool):***

- This index divides the citation count of each paper by the age of that paper.

- ***I10-index (proposed by Google Scholar):***

- It represents, for one author, the number of papers with at least 10 citations.

- ***Egghe's G-Index:***

- It corresponds to the greatest number of articles for which all g articles received at least g^2 citations.

- ***Collaboration index:***

- It is a measure of the degree to which an author collaborates with others in their research. It is calculated by dividing the number of co-authored publications by the total number of publications authored by the individual.

Main variables used

- **Researcher Identifier:** a unique identifier for researchers, such as ORCID, to track their publications and citations accurately
- **Researcher's affiliation** and work country,
- **Publication year** and publication count,
- **Publication type** and **journal** name, **conference** name...
- Publication **language**,
- **Disciplinary field** of the journal or conference
- **Authorship position** and author's average position,
- **Co-authors** (and their affiliations),
- **Citation** count and self-citation count,
- Cited references,
- Words used in **titles** or **summaries** of researcher's publications, **keyword** indexed...

Google Scholar : indicators for authors consulted one by one



Some scientific platforms presenting bibliometric indicators or variables directly

Researchgate : indicators for authors consulted one by one


ResearchGate

HomeQuestionsJobs


Search for research, journals, people, etc.

3

3



Add new



Stéphane Gorla

PhD · Professor (Assistant) at University of Lorraine

France | Website

Current activity

Research Interest Score

Citations

h-index

138.0

200

7

Citations over time

Profile

Research (111)

Stats

Following

Saved list

+ Add research

View your latest weekly report >

Overall publications stats

138.0	14,163	200	15
-------	--------	-----	----

Some scientific platforms presenting bibliometric indicators or variables directly

Hal.science : indicators for many variables, but not h-index.

N.B : This platform is interesting if you want to get a better idea of French academic research than many other more general platforms.

The screenshot displays the HAL open science platform interface. At the top, the HAL logo is on the left, and navigation links for 'EN' and 'Sign In' are on the right. Below the header, a search bar contains the query '"board game"'. To the right of the search bar is an orange '+ Upload' button. The main content area shows '127 Results'. On the left, a 'Filter your results' sidebar is visible, with two active filters: 'Type of deposit' and 'Document type'. The 'Type of deposit' filter shows 'Fulltext' (82), 'Notice' (44), and 'Annex' (1). The 'Document type' filter shows 'Conference papers' (54). The search results are sorted by 'Relevance'. Two results are visible: 'Transformation of the Japanese Board Game Market Shifting from amateurship to professionalization' by Yannick Deplaedt (2021) and 'Vancouver Maneuver: Designing a Cooperative Augmented Reality Board Game' by Alexander Golombek, Michael Lankes, and Jürgen Hagler (2021). Red arrows point from the text 'Please click on' to the search bar and the 'Type of deposit' filter.

HAL open science

HAL

EN Sign In

"board game"

+ Upload

Please click on

127 Results

sorted by Relevance

Filter your results

Type of deposit

- ☐ Fulltext 82
- ☐ Notice 44
- ☐ Annex 1

Document type

- ☐ Conference papers 54

Transformation of the Japanese Board Game Market Shifting from amateurship to professionalization

Yannick Deplaedt

2021

Proceedings hal-03830509v1

Vancouver Maneuver: Designing a Cooperative Augmented Reality Board Game

Alexander Golombek , Michael Lankes , Jürgen Hagler

15th International Conference on Entertainment Computing (ICEC), Sep 2016, Wien, Austria. pp.286-289, (10.1007/978-3-319-46100-7_31)

Conference papers hal-01640283v1

Some scientific platforms presenting bibliometric indicators or variables directly

Lens.org : indicators for many variables + h-index, but only limited to user account

LENS.ORG English Our Apps Pricing About Guest Work Area Register / Sign in Support

379 Scholarly Works boardgame Search

Scholar Search Results

Scholarly Works (379) = boardgame

Filters: No filters applied

Scholarly Works 379 Works Cited by Patents 0 Citing Patents 0 Patent Citations 0 Works Cited by Scholarly 127

Scholarly Works Explore Citations New Table List Analysis

Citing Scholarly Works (1,627)
Cited Scholarly Works (2,920)
Citing Patents (0)

Share Export Hide Analysis Sort by Relevance

University of Melbourne Telkom University Uniwersytet Wrocławski The University of Texas at Austin

Some scientific platforms presenting bibliometric indicators or variables directly

Semanticscholar.org : indicators for many variables + h-index, but only limited to user account

SEMANTIC SCHOLAR

\ "tabletop game\"

Search 🔍

Sign In

Create Free Account

About 612,000 results for "\ "tabletop game\""

Fields of Study ▾ Date Range ▾ Has PDF Author ▾ Journals & Conferences ▾

Sort by Relevance ▾

Design and Development of a Narrative Acquisition in Technical Students in
Lance Bunt · Psychology · 2022
—A serious **tabletop game** called “Gr8 Su
Communication skills module at the North
the details... [Expand](#)

Save Alert Cite

The Analogy Game How can a tabletop
analogies and lead to improved anal
Education · 2022
Analogical thinking is a deep part of how
widely studied for educational purposes.

Authors

- ☐ Zhu Han (430)
- ☐ Xavier Gamé (390)
- ☐ X. Gamé (350)
- ☐ Tamer Başar (350)
- ☐ Gamal Esmat (330)
- ☐ Mark D. Griffiths (320)
- ☐ Gamal A. El-Hiti (310)
- ☐ Mohamed Gamal El-Din (310)
- ☐ Dusit Tao Niyato (270)
- ☐ Pascal Rischmann (260)

Promoting Soft Skills

undergraduate

frica. This paper presents

ayers' understanding of

daily lives and has been

their own analogies and...

Please click on

Some scientific platforms presenting bibliometric indicators or variables directly

Scinapse.io : indicators for many variables + h-index for author, impact factor for journals, etc.

The screenshot displays the Scinapse.io interface for a search query "board game". The top navigation bar includes the Scinapse logo, a search bar with the query, and links for History and Collection. Below the navigation bar, there are tabs for All, Authors, Journals, Fields, Trends, and Search. The main content area is divided into several sections:



- Author:** Displays 35 authors. Two authors are highlighted: Oliver Board (New York University) and Hilary Longhurst (Auckland District Health Board). A link "Show All Author Results >" is present.
- Publication:** Shows 3,659 papers. A note indicates "Showing papers for board game(Exact matching papers for 'board game')". A "Create Alert" button is available.
- Published Year:** A bar chart showing the distribution of publications from 2000 to 2023. The chart shows a steady increase in publications over time, peaking around 2020-2021. A "Reset" button is located at the top right of the chart.
- History:** A section titled "History" with a link "View all history >". It lists recent users: Trevor P Crowe and Douglas J. R. Kerr.

Red arrows point from the "Journals" and "Trends" tabs to the "Published Year" bar chart, with the text "Please click on" written in red next to the chart.

Learning Computational Thinking Without a Computer: How

Some scientific platforms presenting bibliometric indicators or variables directly

ACM Digital Library : indicators for many variables



Provided by Universite de Lorraine

Browse

About

Sign in

Register

Journals

Magazines

Proceedings


Books

SIGs

Conferences

People

"board game"



Please try this too

People

Names 


Institutions 

Authors 

Editors 


Reviewers 

Publications

Journal/Magazine 

1,400 Results for: All: "board game"

 Edit Search

 Save Search

 RSS

Searched The ACM Full-Text Collection (708,372 records) | [Expand your search to The ACM Guide to Computing Literature \(3,555,811 records\)](#)

RESULTS

VIDEOS

Showing 1 – 20 of 1,400 Results

☐ Select All

per page: 10 20 50 | Relevance 



RESEARCH-ARTICLE

August 2012



Enhancing collaboration in tabletop board game



[Taoshuai Zhang](#),



[Jie Liu](#),



[Yuanchun Shi](#)

APCHI '12: Proceedings of the 10th asia pacific conference on Computer human interaction • August 2012, pp 7–10 • <https://doi.org/10.1145/2350046.2350050>

Some scientific platforms presenting bibliometric indicators or variables directly

PubMed : indicators for many variables + co-citations

 An official website of the United States government [Here's how you know](#) ✓



Log in



"board game"



Search

[Advanced](#) [Create alert](#) [Create RSS](#)

[User Guide](#)

Save


Email

Send to

Sort by:

Best match



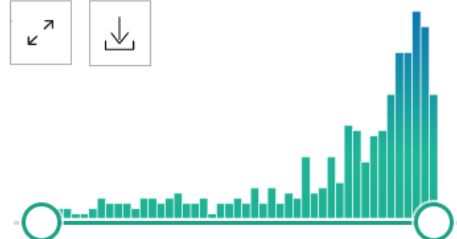
Display options 

MY NCBI FILTERS 

327 results

« < Page 1 of 33 > »

RESULTS BY YEAR



Enterovirus board game for elementary school children: A pilot study.

1 Chen MF, Wu CS, Tsai CC, Tsai MY.

Cite Public Health Nurs. 2022 Mar;39(2):500-505. doi: 10.1111/phn.12976. Epub 2021 Sep 19.


PMID: 34537984

Share

OBJECTIVE: To evaluate the effect of an enterovirus **board game** on improving knowledge of enterovirus for elementary school children in Taiwan. ...INTERVENTION: Each experimental group of four to five children participated in a 40-min enterovirus **board game**

Some scientific platforms presenting bibliometric indicators or variables directly

Dimensions.ai : indicators for many variables

 Dimensions

Free text in full data

Save / Export

Support

Register

Log in

FILTERS

FAVORITES

> PUBLICATION YEAR

> RESEARCHER

> RESEARCH CATEGORIES

> PUBLICATION TYPE

> SOURCE TITLE

> JOURNAL LIST

> OPEN ACCESS

PUBLICATIONS

73,516

DATASETS

145

GRANTS

335

PATENTS

67,098

CLINICAL TRIALS

124

POLICY DOCUMENTS

711

☒ Show abstract

Sort by: Relevance

Title, Author(s), Bibliographic reference - [About the metrics](#)

[Development of a board game to assist pharmacists learning the potentially inappropriate medications in older people](#)

Mohd Shahezwan Abd Wahab, Amanina Rashid, Aida Azlina Ali, Izzati Abdul Halim Zaki, Rosmalia...
2022, Currents in Pharmacy Teaching and Learning - Article

BACKGROUND AND PURPOSE: Pharmacists have been reported to have inadequate awareness about potentially inappropriate medications (PIMs) in older people. This warrants more efforts to enhance their fami... [more](#)

Citations

1

+ Add to Library

[Impact of Two Types of Board Games on Drug-Use Prevention in Adolescents at Senior High Schools](#)

Chiu-Mieh Huang, Li-Chun Chang, Mei-Chih Wang, Ching-Ho Sung, Fen-He Lin, Jong-Long Guo
2022, Games for Health Journal - Article

< ANALYTICAL VIEWS

RESEARCH CATEGORIES

46 Information and Computing Sciences

16,052

39 Education

9,085

52 Psychology

7,359

47 Language, Communication and Culture

6,115

3901 Curriculum and Pedagogy

5,449

OVERVIEW

Citations

1.0 M

Citations (Mean)

13.83



About Dimensions · LinkedIn · Twitter

Privacy policy · Cookie settings · Legal terms


© 2023 Digital Science & Research Solutions, Inc.

Some scientific platforms presenting bibliometric indicators or variables directly

Scopus : indicators for many variables & h-index for authors & CiteScore for journals



Scopus Preview

 Author Search


Sources



SG

This author profile is generated by Scopus. [Learn more](#)

Pusser, Brian

 [University of Virginia](#), Charlottesville, United States

 6506583299 

 [Connect to ORCID](#)

578

Citations by 494 documents

26


Documents

11

h-index [View h-graph](#)

 Set alert

 Save to list

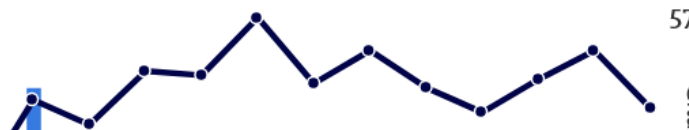
 Edit profile

 More

Document & citation trends

7

nents



57

Cita



Scopus Preview

Scopus Preview users can only view a limited set of features. Check your institution's access to view all documents and features.

Some scientific platforms presenting bibliometric indicators or variables directly

Web of Science (WoS) : indicators for many variables & h-index for authors

Web of Science™

Search

Sign In ▾

Register

Search > Results for "board gam*" (A... > Citation Report: "board gam*" (All Fields)

Citation Report

Please click on

🔍 "board gam*" (All Fields)

Analyze Results

🔔 Create Alert

📄 Export Full Report

Publications

2,376

Total

From 1950 ▾ to 2023 ▾

Citing Articles

16,844 Analyze

Total

15,969 Analyze

Without self-citations

Times Cited

20,981

Total

18,387

Without self-citations

8.83

Average per item

60

H-Index

Some scientific platforms presenting bibliometric indicators or variables directly

Harzing's Publish or Perish tool (PoP): h-index and G-index for authors and others scores

Harzing's Publish or Perish (Windows GUI Edition) 8.9.4538.8589

File Edit Search View Help

My searches
Trash

Search terms	Source	Papers	Cites	Cites/year	h	g	hI,norm	hI,annual	hA	acc10	Search date	Cache date	Last
✓ Stéphane Gorla - Centre de Rec...	Google Sch...	105	425	22.37	10	16	9	0.47	2	1	24/08/2023	24/08/2023	
✓ 0000-0003-2768-6180	OpenAlex	144	61	3.21	4	5	3	0.16	1	0	24/08/2023	24/08/2023	
✓ gorla, lorraine	Scopus	8	9	0.82	1	3	1	0.09	1	0	24/08/2023	24/08/2023	
✓ stephane AND gorla	Semantic Sc...	3	5	0.56	1	2	1	0.11	1	0	24/08/2023	24/08/2023	
✓ gorla, lorraine	Crossref	2	0	0.00	0	0	0	0.00	0	0	24/08/2023	24/08/2023	

< >

Scopus search

Authors: gorla Years: 0 - 0 Search

Affiliations: lorraine Search Direct

Publication name: ISSN: Clear All

Title words: Revert

Keywords: New

Citation metrics

Publication years: 2012-2022
Citation years: 11 (2012-2023)
Papers: 8
Citations: 9
Cites/year: 0.82
Cites/paper: 1.13
Cites/author: 9.00
Papers/author: 8.00
Authors/paper: 1.00
h-index: 1
g-index: 3
hI,norm: 1
hI,annual: 0.09
hA-index: 1
Papers with ACC >= 1,2,5,10,20: 1,0,0,0,0

Copy Results
Save Results

Paper details

Select a paper in the results list (to the left of this pane) to see its details here.

Conv. Paper Details

Tools

Preferences...

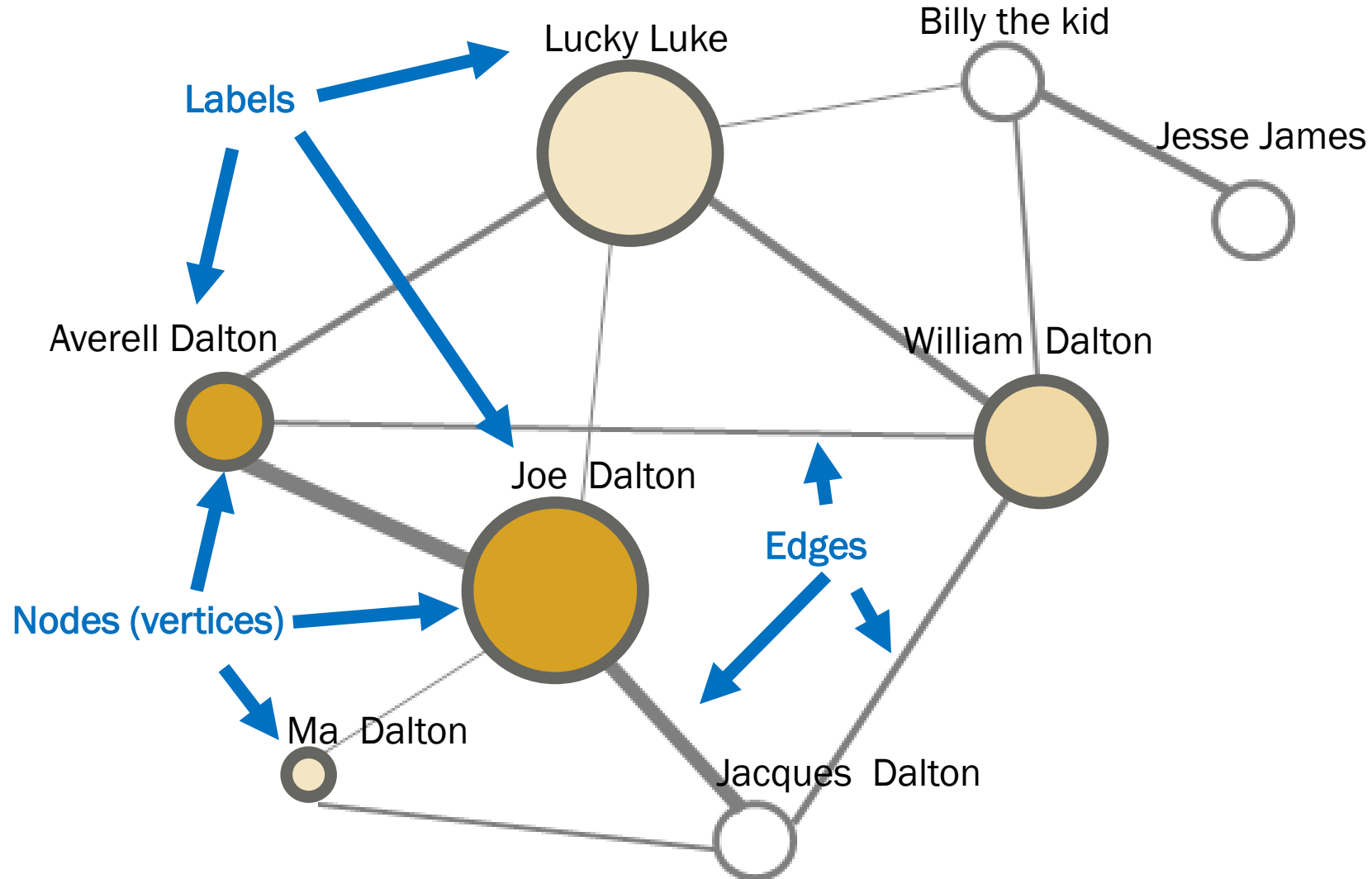
Online User's Manual
Frequently Asked Questions
Training Resources
YouTube Channel
Become a PoP Supporter

After you can use a text mining tool as KH coder

	Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher	
<input checked="" type="checkbox"/>	1	0.11	4	S. Gorla	Developmental strategy of a serious game: Between processes ...	2014	CEUR Workshop Proceedin...		
<input checked="" type="checkbox"/>	0	0.00	6	S. Gorla	How the interpretation frame inventory method can help to ide...	2019	Journal of Innovation Econ...		
<input checked="" type="checkbox"/>	0	0.00	10	S. Gorla	How to adapt a tactical board wargame for marketing strategy ...	2012	Journal of Intelligence Stud...		
<input checked="" type="checkbox"/>	0	0.00	7	S. Gorla	Information - information for innovation: Strategic, competitive...	2021	Innovation Economics, Eng...		
<input checked="" type="checkbox"/>	0	0.00	8	S. Gorla	Information, knowledge and agile creativity	2019	Information, Knowledge a...		
<input checked="" type="checkbox"/>	0	0.00	9	S. Gorla	"The creative watch": A new phrase to reference an emerging inf...	2014	Canadian Journal of Infor...		
<input checked="" type="checkbox"/>	0	0.00	5	S. Gorla	The matter of public in the serious use of gaming in an educati...	2022	Understanding Publics: The...		
<input checked="" type="checkbox"/>	h	8	1.33	1	O. Annad	Web information monitoring and crowdsourcing for promotin...	2017	Arabian Journal of Geoscie...	
<input type="checkbox"/>	8	8.00	2	C. Fillol	Does arsenic in soil contribute to arsenic urinary concentrations ...	2010	Science of the Total Enviro...		
<input type="checkbox"/>	3	3.00	3	A. Laurain	Safety and efficacy of the combination simeprevir-sofosbuvir in...	2019	BMC Infectious Diseases		

Please verify the authors and uncheck if necessary

Principal notions of network analysis



Principal notions of network analysis

- *Entities and network:*

- The identification and analysis of a network of entities implies the existence of at least one **relationship between the entities** under study. In bibliometrics, they are co-authors, co-citations and word co-occurrences.
- The relationships highlighted may be **oriented**, bidirectional or **non-oriented**.
- When drawing a network, certain rules must be followed. Software for creating or highlighting networks includes, at least by default, association rules.

- *Network density:*

- The density of a network is the ratio of the number of existing arcs (oriented links) or edges (non-oriented links) to the maximum number of possible arcs or edges.

Principal notions of network analysis

- ***Connectivity:***

- The connectivity of a graph designates the absence of vertices (nodes) isolated from others.
- A graph is said to be connected if every pair of vertices in the graph is connected.

- ***Degree:***

- For a non-oriented graph, its degree corresponds to the number of links attached to a node X.
- For a directed graph, it's the number of links pointing to a node Y or leaving a node Y..

- ***Centrality:***

- Centrality measures the relative position of nodes within a set.

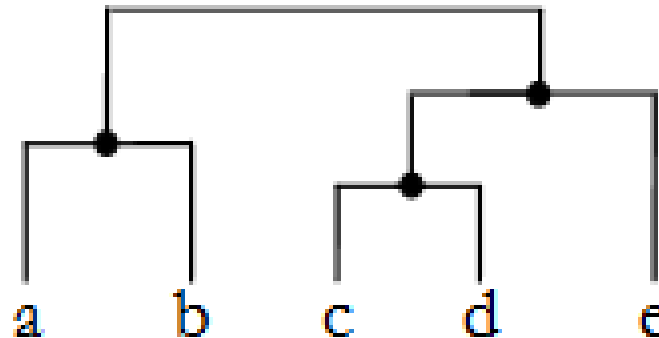
Network construction and analysis

- *Construction and analysis of the drawn network should be based on a number of questions, such as:*
 - Which entities are the most important?
 - Which entities are most closely linked?
 - Which entities are most peripheral?
 - Are there any groupings of entities?
 - Do certain entities play the role of unavoidable pivots?
 - Which entities have the strongest links?
 - Why are these entities so closely linked?
 - What is the true nature of these links?

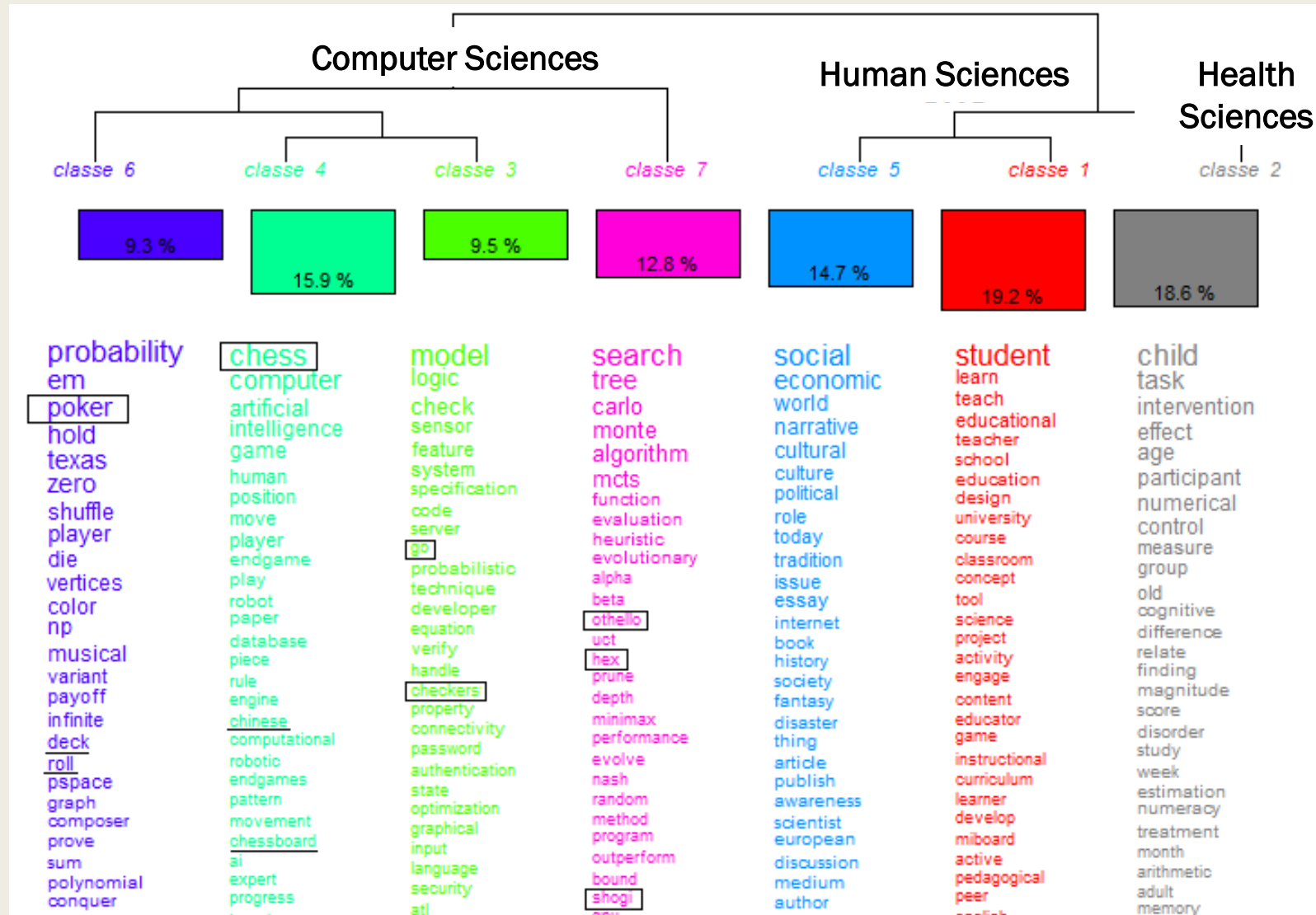
Dendrogram and hierarchical clustering

■ *Characteristics:*

- Most often, the dedicated algorithm involves creating, at each step, a partition obtained by aggregating pairwise the closest elements. These are unsupervised clustering algorithms. They are sensitive to the initially defined partitions, but some propose an "average" ranking based on multiple iterations of clustering on the same dataset. They have default parameters, but they are adjustable, especially the number of main branches one wishes to obtain. Tools like Iramuteq (and R), KH coder, or Orange data mining can be used to generate them.
- As a result, the algorithm provides a hierarchy of partitions in the form of classification trees also known as dendrograms.



Dendrogram and hierarchical clustering



(Iramuteq classification from the PoP boardgame reference corpora)

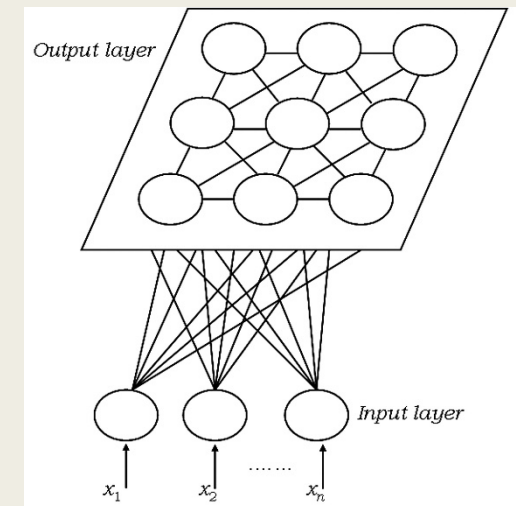
Self Organizing Map and classification

■ *Characteristics:*

- Kohonen maps, also known as Self-Organizing Maps (SOM), are generated using an unsupervised classification method, but one that does not rely on points (the positions of elements in an n-dimensional space) like dendrograms do. Instead, they are based on a tiling of enclosures around these points, using others called neurons.
- The "classic" structure of the charts obtained by this type of algorithm is a tiling in hexagons. The result of this type of classification is somewhat like a tree seen from above, where only the main elements are displayed, with the others located one or more levels below in function of areas colored.
- Tools like KH coder, Orange data mining or XLSTAT can be used to generate them.

Image source:

<https://cybernetist.com/2017/01/13/self-organizing-maps-in-go/>



Dendrogram and hierarchical clustering



(KH coder
classification from the
PoP boardgame
reference corpora)

Proposition for the methodology beginning

- *Define the subject and the goal*

- One must decide what is going to be explored, define the goal of the work (exploring a topic, examining publications from an institution or a group of authors, conducting a literature review, etc), and the kind of data and/or documents.

For my example case, I have chosen to explore a research topic in order to identify the most significant authors and the distribution of publications. The topic is **the academic research about board games**, the period is **2018-2022**. The kind of data are **bibliographic references** (including: authors, years and titles) and the type of document is **journal publications**.

- *Identify keywords and expressions to use*

Next, we need to define the vocabulary at the heart of this topic and the time period to be studied. To do this, it can be helpful to rephrase the problem in one or two different ways and to use a tool for this.

With my example, I use ChatGPT 3,5 to have two new problem/topic expressions. The result is:

1. "Academic Inquiries into Board Games"

2. "Scholarly Investigations into Board Games"

Proposition for the methodology beginning

- *Identify keywords and expressions to use*

ChatGpt didn't help me in this example case, but sometimes, it is very useful to reconsider a topic.

For the keywords and other expressions, I'm focus on "board game" expression. I need to found few tools for this operation. I can use the Web of Science platform to select few keywords with it proposes to me. Used this way, this tool allows you to add a few terms to your list, but it is rarely entirely satisfying, even though it already helps. With my example, thus I add to my keywords list: table top game. I'll use two others online tool.

The screenshot displays the Web of Science search interface. At the top, the 'Web of Science' logo is on the left, and 'Search' is in the center. On the right, there are links for 'Sign In' and a 'Register' button. A left sidebar contains a 'MENU' icon and several navigation icons. The main content area shows the search results for 'board game' (All Fields), indicating 1,519 results from the Web of Science Core Collection. Below the result count, there is a search bar with the query 'board game' (All Fields) and a 'Search' button. To the right of the search bar are three buttons: 'Analyze Results', 'Citation Report', and 'Create Alert'. At the bottom, there is a section for 'Quick add keywords' with a list of suggested terms: '+ BOARD GAME', '+ BOARD GAMES', '+ EDUCATIONAL BOARD GAME', and '+ DIGITAL BOARD GAME'. A red arrow points to the right arrow at the end of this list, with the text 'Click on' written above it.

Web of Science™ Search Sign In Register

Search > Results for "board game" (All Fields)

1,519 results from Web of Science Core Collection for:

Analyze Results Citation Report Create Alert

Search "board game" (All Fields) Search

+ Add Keywords Quick add keywords: < + BOARD GAME + BOARD GAMES + EDUCATIONAL BOARD GAME + DIGITAL BOARD GAME >

Click on

Few notions for methodology : keyword tools

Reverso



Reverso

Translation

Context

Grammar Check

Synonyms

Conjugation



Download for Windows

Log in

EN



English



board game



Synonyms for board game in English

A-Z



board game ⁿ



Noun

table game

parlour game

gaming board

poker

parlor game

party game

poker table

game board

! crap table

card table

Few notions for methodology : keyword tools

OneLook Thesaurus



"board game"

tabletop game: Any game suitable for playing on a table or other flat surface. [types](#)

[More ►](#)

Closest meaning first ▾

[Advanced filters](#)

[Idea map](#)

Tip: Click on a result below to see more details.

[All](#) [Nouns](#) [Adjectives](#) [Verbs](#) [Adverbs](#) [Idioms/Slang](#) [Old](#)

- | | | | | |
|-------------------------|--------------------|--------------------|-------------------|--------------------|
| 1. tabletop game | 21. bolivia | 41. chess board | 61. dauber | 81. gammon |
| 2. strategy game | 22. bouquet | 42. codille | 62. dealer | 82. gin |
| 3. party game | 23. brailling | 43. coin | 63. demon | 83. gin rummy |
| 4. ace | 24. brelan | 44. cold deck | 64. depot | 84. gleek |
| 5. agon | 25. broad | 45. commerce | 65. dice game | 85. go |
| 6. all fours | 26. bullet | 46. concave | 66. domino | 86. goban |
| 7. alquerque | 27. butcher | 47. concentration | 67. doubling cube | 87. gobang |
| 8. ambace | 28. buzzword bingo | 48. consequences | 68. dragon | 88. grab |
| 9. anaconda | 29. card | 49. convex | 69. draughts | 89. grace |
| 10. baccara | 30. card game | 50. cooler | 70. draughtsboard | 90. guessing game |
| 11. baccarat | 31. card mechanic | 51. cooncan | 71. durak | 91. halma |
| 12. battleship | 32. card table | 52. couleur | 72. face card | 92. hangman |
| 13. beggar-my-neighbor | 33. cardhouse | 53. cram | 73. fairy chess | 93. happy families |
| 14. bingo | 34. cardplayer | 54. crib | 74. fancy | 94. heart |
| 15. bingo card | 35. carte | 55. cribbage | 75. faro | 95. highlander |
| 16. black | 36. cassino | 56. cribbage board | 76. fleurettes | 96. horizon |
| 17. blackjack | 37. cater | 57. crimp | 77. flower garden | 97. house |
| 18. blocker | 38. cell | 58. d12 | 78. foundation | 98. house of cards |
| board game | | dam | game of chance | house |

Proposition for the methodology beginning

- *Identify keywords and expressions to use*

- Now, after selection, I have a principal list of keywords.

My **principal list** includes: board game, boardgame, card game, dice game, game board, gameboard, parlor game, parlour game, party game, table game, tabletop game.

But I have a second list specific to certain games: baccarat, blackjack, crap table, checkers, chess game, domino, draughts, gin rummy, goban, kriegspiel, majhong, mahjongg, poker, reversi, scopa, scrabble, shatranj, shogi. By reading it, we can add to this list other famous games that we are aware of: awale, oware, backgammon, clue game, cluedo, game of the goose, goose game, monopoly, stratego, trivial pursuit, Xiangqi.

And if I want a more complete study, I can use the fusion of the two last lists as my secondary list.

My **secondary list** includes: awale, oware, baccarat, backgammon, battleship, blackjack, clue game, cluedo, crap table, checkers, chess game, gameboard, draughtsboard, domino, draughts, game of the goose, goose game, gin rummy, goban, guess who, happy families, kriegspiel, majhong, mahjongg, monopoly, poker, reversi, risk game, scopa, scrabble, shatranj, shogi, stratego, trivial pursuit, wargame, Xiangqi.

It is preferable that the keywords in this second list also include the term game to limit response errors due to homonyms and surnames.

Few notions for methodology : sourcing

- For the next steps, we will focus on the main list. Anyway, the method used is exactly the same if we merge the two lists (main and secondary); only the number of collected references and duplicates will be higher.

- ***Sourcing (source and tool identification)***

Now, I need to identify the scientific platforms to query and/or specific tools to use. In any case, for each of these, I need to understand the syntax of their query language (possibly dedicated APIs) and determine if the interface accepts expressions in quotation marks, Boolean operators, truncation operator (especially for plurals), and fields that can be specifically queried. To do this, we first need to conduct tests.

As for the fields to be queried, these will include the fields: title, abstract, and keywords. Additionally, there will be the year/period field and the document type field.

All platforms allow for document export (often in CSV and/or BibTeX formats).

As specific tools or intermediaries that enable you to collect data through export or direct querying, you have the choice of:

- Bibliographic reference management tools, including **EndNote**, **Mendeley**, and **Zotero**.
- Tools for querying multiple platforms, including **Harzing's Publish or Perish** tool and **VosViewer**.

Few notions for methodology : investigation

■ *Example with Hal*

Despite what one might think, this platform doesn't actually accept the truncation operator. Likewise, to specify the document type, it's better to select it from the right-hand menu, and do the same for the years. We need to add plurals to this main list as well as 'ing' forms that we find interesting.

Thus, with OR (Boolean operator) as a separator, the principal list begins :

"board game" OR "boardgame" OR "card game" OR "dice game" OR "game board" OR "parlor game" OR "parlour game" OR "party game" OR "table game" OR "tabletop game" OR "board games" OR "boardgames" OR "card games" OR "dice games" OR "games board" OR "parlor games" OR "parlour games" OR "party games" OR "table games" OR "tabletop games" OR "board gaming" OR "boardgaming" OR "card gaming" OR "dice gaming" OR "game board" OR "parlor gaming" OR "parlour gaming" OR "party gaming" OR "table gaming" OR "tabletop gaming"

Few notions for methodology : investigation

■ *Example with Hal*

And for the second keywords list :

(game OR games OR gaming) AND (awale OR oware OR baccarat OR backgammon OR Battleship OR blackjack OR Clue OR cluedo OR “crap table” OR checkers OR chess OR gameboard OR domino OR draughts OR “game of the goose” OR "guess who" OR “goose game” OR “gin rummy” OR “goban” OR "happy families" OR kriegsspiel OR majhong OR mahjongg OR monopoly OR poker OR reverse OR “risk game” OR scopa, scrabble OR shatranj OR shogi OR stratego OR trivial pursuit OR wargame OR xiangqi)

HAL science ouverte

Chercher un document, un auteur, un mot clef...

Recherche avancée

Information de documents

Mots-Clés ▾ "board game" OR "boardgame" OR "card game" OR "dice game" OR ' [Supprimer]

Titres ▾ [Ajouter]

Auteur

Click on for advanced query

Few examples with tool

- *Hal.science = 1 platform*

It is also necessary to compile the results obtained from 3 queries focusing on the fields title, abstract, and keywords, respectively. Fortunately, this platform offers many APIs to save you time. These 3 equations will yield 3 result tables in CSV format. You will need to construct a file by adding and unbolting their results.

Query 1 : [https://api.archives-ouvertes.fr/search/?q=title_t:\(\"board game\" OR \"boardgame\" OR \"card game\" OR \"dice game\" OR \"game board\" OR \"parlor game\" OR \"parlour game\" OR \"party game\" OR \"table game\" OR \"tabletop game\" OR \"board games\" OR \"boardgames\" OR \"card games\" OR \"dice games\" OR \"games board\" OR \"parlor games\" OR \"parlour games\" OR \"party games\" OR \"table games\" OR \"tabletop games\" OR \"board gaming\" OR \"boardgaming\" OR \"card gaming\" OR \"dice gaming\" OR \"game board\" OR \"parlor gaming\" OR \"parlour gaming\" OR \"party gaming\" OR \"table gaming\" OR \"tabletop gaming\"\)&fq=submittedDateY_i:\[2018 TO 2022\]&fq=docType_s:ART&wt=csv&fl=label_s](https://api.archives-ouvertes.fr/search/?q=title_t:(\)

Query 2 : [https://api.archives-ouvertes.fr/search/?q=abstract_t:\(\"board game\" ... OR \"tabletop gaming\"\)&fq=submittedDateY_i:\[2018 TO 2022\]&fq=docType_s:ART&wt=csv&fl=label_s](https://api.archives-ouvertes.fr/search/?q=abstract_t:(\)

Query 3 : [https://api.archives-ouvertes.fr/search/?q=keyword_sci:\(\"board game\" ... OR \"tabletop gaming\"\)&fq=submittedDateY_i:\[2018 TO 2022\]&fq=docType_s:ART&wt=csv&fl=label_s](https://api.archives-ouvertes.fr/search/?q=keyword_sci:(\)

Few examples with tool

- ***Web of Science = 1 platform***

With this platform, with advanced search, you can use the truncation operator. You can also check the 'Analyze Results' section.

Query: (((TI=("board gam*" OR "boardgam*" OR "card gam*" OR "dice gam*" OR "game board*" OR "gameboard*" OR "parlor gam*" OR "parlour gam*" OR "party gam*" OR "table gam*" OR "tabletop gam*")) OR AB=("board gam*" OR "boardgam*" OR "card gam*" OR "dice gam*" OR "game board*" OR "gameboard*" OR "parlor gam*" OR "parlour gam*" OR "party gam*" OR "table gam*" OR "tabletop gam*")) OR KP=("board gam*" OR "boardgam*" OR "card gam*" OR "dice gam*" OR "game board*" OR "gameboard*" OR "parlor gam*" OR "parlour gam*" OR "party gam*" OR "table gam*" OR "tabletop gam*")) AND PY=(2018-2022)) AND DT=(Article)

However, for importing references (Citation Report -> Export Full Report), you will need to do them in groups of up to 1000 at a time and then compile them.

I have 1118 references with this query, so I need to export records 1-1000 + 1001-1118.

Few examples with tool

- ***Harzin's Publish or Perish (PoP) = 6-7 platform as sources***

If you can use Windows you can download this tool

Platforms for search:

- Crossref
- Google Scholar
- PubMed
- OpenAlex
- Scopus
- Semantic Scholar
- (Web of Science)

Few examples with tool

■ *Harzin's Publish or Perish (PoP) tool for Google Scholar*

For a large cover interrogate Google Scholar with PoP can be a good idea, but:

- Each query needs to be crafted based on the platform being queried.
- Its queries are limited query (title words and keywords fields) to 256 characters and imports are limited to 1000 if specified. Therefore, the search may require more than one query per platform, per year and per the field title words and keywords.
- To interrogate Google Scholar, you need to perform a first query on titles and a second one on keywords. As for the document type, we can work around it by specifying that the publication name must include the term 'journal' or 'review' .
- As this tool will generate multiple queries to query Google Scholar, it is also necessary to spread the queries over time (one per hour, for example) in order to avoid being rejected by Google as a robot.
- At the end, I can compile results of each query with a copy (select results and click on Copy Results (for Excel as an example)).

Few examples with tool

■ *Harzin's Publish or Perish (PoP) tool : export results*

Harzing's Publish or Perish (Windows GUI Edition) 8.9.4538.8589

File Edit Search View Help

My searches

- Board Game Studies
- Mes publis
- Trash

Search terms	Source	Papers	Cites	Cites/year	h	g	hl,norm	hl,annual	hA	acc10	Search date	Cache date
✓ journal OR review, "board game..."	Google Sch...	383	1874	374.80	22	30	13	2.60	10	10	27/08/2023	29/08/2023
✓ journal OR review, "board game..."	Google Sch...	140	961	192.20	16	26	10	2.00	9	8	27/08/2023	29/08/2023
✓ journal OR review, wargame OR...	Google Sch...	67	218	43.60	9	12	7	1.40	5	3	28/08/2023	28/08/2023
✓ journal OR review, (game OR ga...	Google Sch...	61	124	24.80	6	9	3	0.60	4	0	28/08/2023	28/08/2023
✓ journal OR review, (game OR ga...	Google Sch...	57	174	34.80	8	11	4	0.80	4	2	29/08/2023	29/08/2023
✓ journal OR review, "board gami...	Google Sch...	7	14	3.50	1	3	1	0.25	1	0	27/08/2023	27/08/2023

Google Scholar search

Authors: Years: 2018 - 2022 Search

Publication name: journal OR review ISSN: Search Dir

Title words: wargame OR wargaming Clear All

Keywords: Revert

Maximum number of results: 1000 Include: ☒ CITATION records ☒ Patents New

Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher
✓ h 23	23.00	3	E Lin-Greenberg	Wargame of drones: remotely piloted aircraft and crisis escalati...	2022	Journal of Conflict Resoluti...	journals.s...
✓ h 24	24.00	4	E Lin-Greenber...	Wargaming for international relations research	2022	European Journal of ...	journals.s...
✓ 2	2.00	5	AW Reddie, BL ...	Evidence of the unthinkable: Experimental wargaming at the nu...	2022	Journal of Peace Research	journals.s...
✓ 5	5.00	7	P Perla	Wargaming and the cycle of research and learning	2022	Scandinavian Journal of Mi...	sjms.nu

Tools

Preferences...

Online User's Manual

Frequently Asked Questions

Training Resources

Citation metrics

Publication years: 2018-2022

Citation years: 5 (2018-2022)

Papers: 383

Citations: 1874

Cites/year: 374.80

Cites/paper: 4.92

Cites/author: 140

Papers/author: 383

Authors/paper: 1.00

h-index: 22

Search Report (basic)

Search Report (extended)

Metrics as CSV

Metrics as CSV with Header

Metrics for Excel

Metrics for Excel with Header

Results as CSV

Results as CSV with Header

Results for Excel

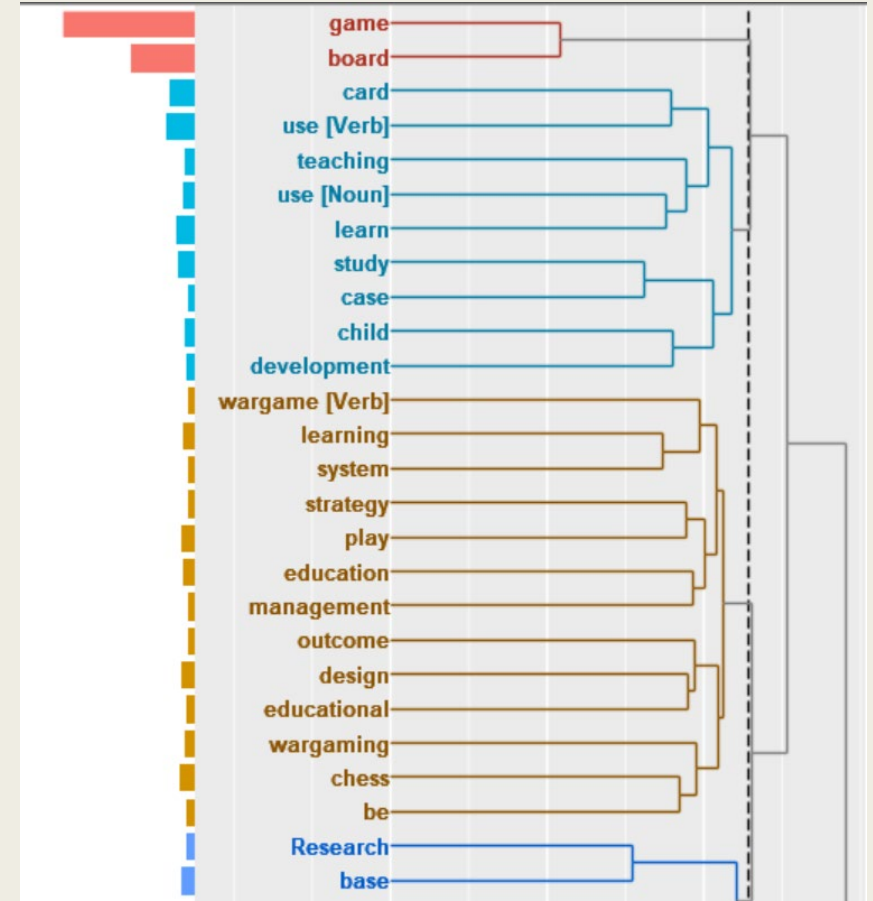
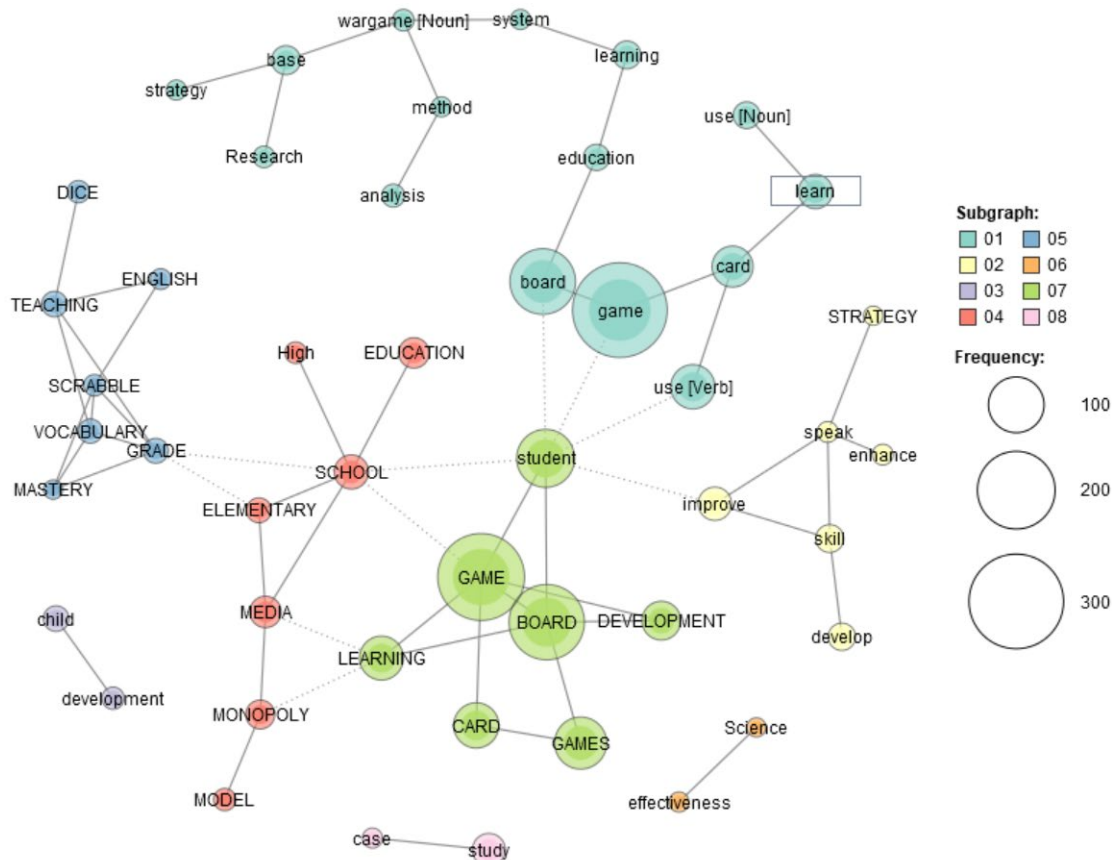
Results for Excel with Header

Results as BibTeX

Few examples with tool

- *After you can adapt your data and use a text mining tool like KH coder*

N.B.: Data processing with this software can be very time-consuming.



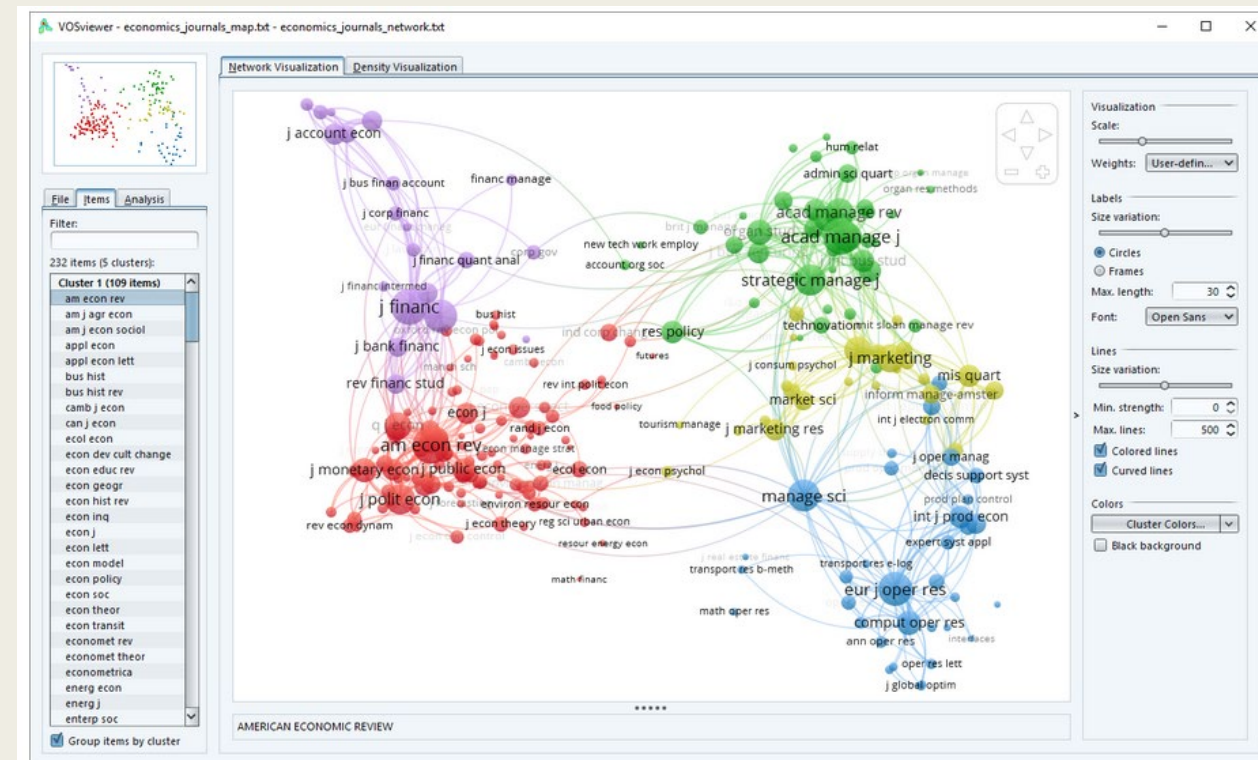
Few examples with tool

■ *VOSviewer = a network visual analytics tool*

For Windows or MacOS, but it seems exist a package for Linux.

It can use data from:

- Web of Science (plain text files)
- Scopus (csv files)
- Dimensions (if you have a user account)
- Lens (csv files)
- PubMed (Pubmed format files)
- Publish or Perish (Endnote or RIS files)
- Mendeley (RIS files)
- Zotero (RIS files) ...



Few examples with tool

- *VOSviewer: example with fata from Web of Science*

The screenshot displays the Web of Science search results page. A search query is entered in the top search bar: `(((TI=("board gam*" OR "boardgam*" OR "card gam*" OR "dice gam*" OR "game board*"OR "gameboard*" OR "parlor gam*" OR "parlour gam`. Below the search bar, there are buttons for "Add Keywords" and "Quick add keywords:". The "Refine results" section is visible, showing a search bar for "Search within results...". The "Quick Filters" section includes checkboxes for "Highly Cited Papers" (5) and "Hot Papers" (1). A modal dialog box titled "Export Records to Plain Text File" is open in the foreground. The dialog box has a close button (X) in the top right corner. Under "Record Options", the "Records from:" option is selected, with input fields showing "1" and "1000". Below this, the text "No more than 500 records at a time" is displayed. Under "Record Content:", a dropdown menu shows "Full Record and Cited References". At the bottom of the dialog box, there are "Export" and "Cancel" buttons.

>I
MENU

Search: (((TI=("board gam*" OR "boardgam*" OR "card gam*" OR "dice gam*" OR "game board*"OR "gameboard*" OR "parlor gam*" OR "parlour gam

+ Add Keywords Quick add keywords: D GAMES + CA

Publications You may also like...

Refine results

Search within results...

Quick Filters

☐ 🏆 Highly Cited Papers 5

☐ 🔥 Hot Papers 1

Export Records to Plain Text File

Record Options

☐ All records on page

☒ Records from: 1 to 1000

No more than 500 records at a time

Record Content:

Full Record and Cited References

Export Cancel

Create Map



Select files

Web of Science

Scopus

Dimensions

Lens

PubMed

Web of Science files: ?

study WOS BG1.txt WOS BG2.txt WOS BG3.txt WOS BG4.txt

Select Web of Science Files

The use
Science

Rechercher dans :

test boardgame studies

WOS BG1.txt
WOS BG2.txt
WOS BG3.txt
WOS BG4.txt

You can select
more than 1 file

Nom de fichier :

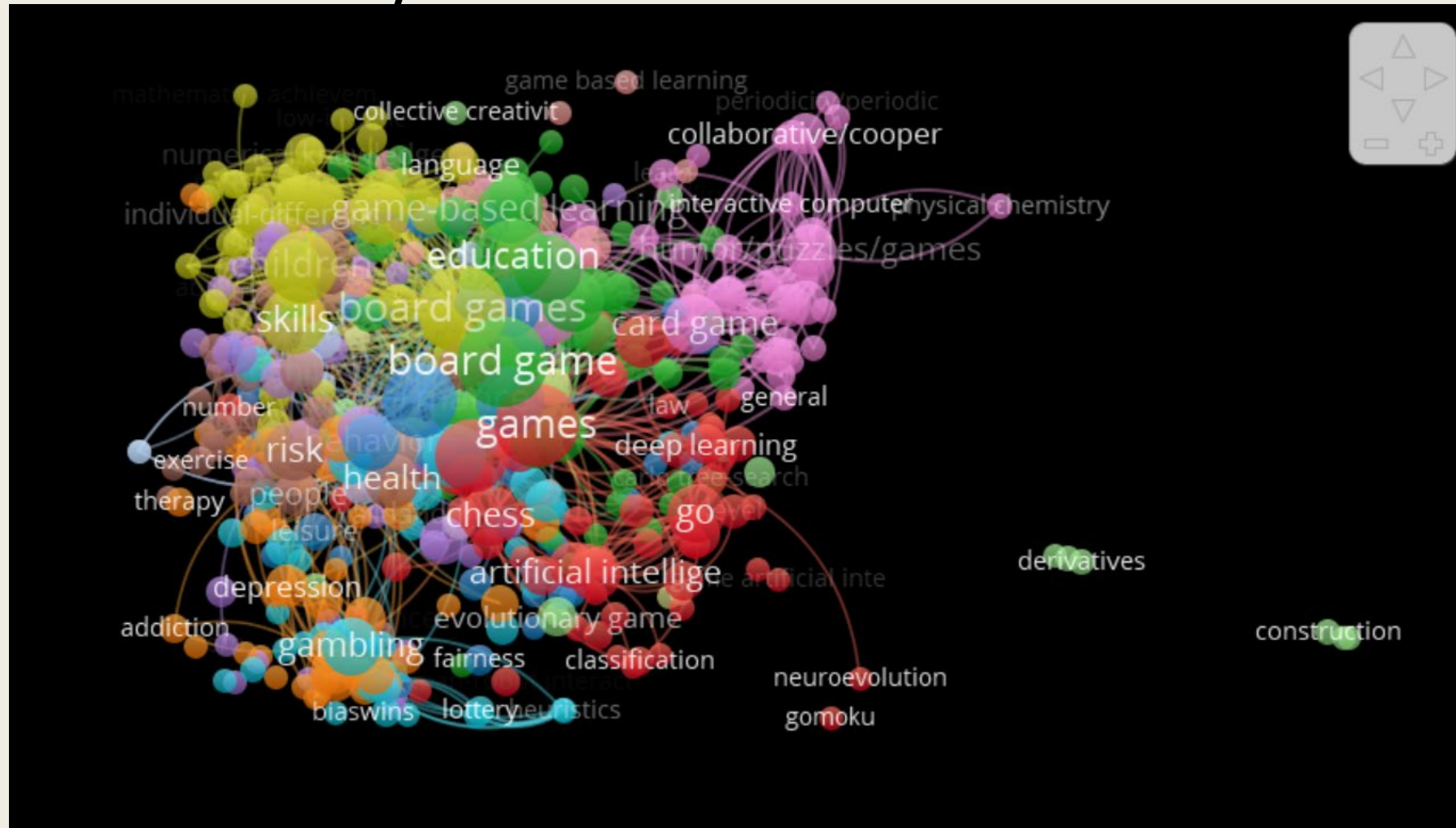
"WOS BG1.txt" "WOS BG2.txt" "WOS BG3.txt" "WOS BG4.txt"

Fichiers du type :

Text files (*.txt)

Few examples with tool

- *VOSviewer: example with fata from Web of Science*



Few examples with tool

■ *From VOSviewer to Gephi :*

- save with VOSviewer as a GML file and open it with Gephi
- Duplicate id in Label column and chose an spatialization algorithm and attributes for visual organization.

Select one

Click on

The screenshot shows the VOSviewer software interface. On the left, the 'Déplacement (Configurer)' panel is open. It has tabs for 'Noeuds' and 'Liens'. Under 'Noeuds', there are options for 'Unique' and 'Classement'. The 'Classement' dropdown is set to 'weight<total_link_strength>'. Below this, 'Taille min' is set to 1 and 'Taille max' is set to 4. There is a 'Spline...' button and an 'Appliquer' button. The 'Spatialisation' section is expanded, showing 'Ajustement des labels' and an 'Exécuter' button. Below that, the 'LabelAdjust' section is visible, with 'Vitesse' set to 1.0 and 'Inclure la taille du noe' checked. At the bottom of the panel, there is an 'Ajustement des labels' section with 'Réglages...' and 'Réinitialiser' buttons. The main area of the software displays a large, complex network visualization with many nodes and edges. The nodes are labeled with various terms, and the edges represent relationships between them. The interface is in French.

Bibliography

Ball, R. (2020). *Handbook bibliometrics*. Walter de Gruyter GmbH & Co KG.

Ball, R. (2017). *An introduction to bibliometrics: New development and trends*. Chandos Publishing.

Ninkov, A., Frank, J. R., & Maggio, L. A. (2022). Bibliometrics: Methods for studying academic publishing. *Perspectives on medical education*, 11(3), 173-176.

Mingers, J., & Leydesdorff, L. (2015). A review of theory and practice in scientometrics. *European journal of operational research*, 246(1), 1-19.

Nalimov, V., & Mulcjenko, B. (1971). *Measurement of Science: Study of the Development of Science as an Information Process*. Washington DC: Foreign Technology Division.

Pritchard, A. (1969). Statistical bibliography or bibliometrics? *Journal of Documentation*, 25, 348-349.

Rostaing, H. (2021). *La bibliométrie au service des Sciences de l'Information et de la Communication*. In Captas, documentation et numérique.

Rousseau, R. (2021). Naukometriya, Nalimov and Mul'chenko. *Collnet Journal of Scientometrics and Information Management*, 15(1), 213-224.

Your turn

Now you can carry out a bibliometric analysis on your own research topic