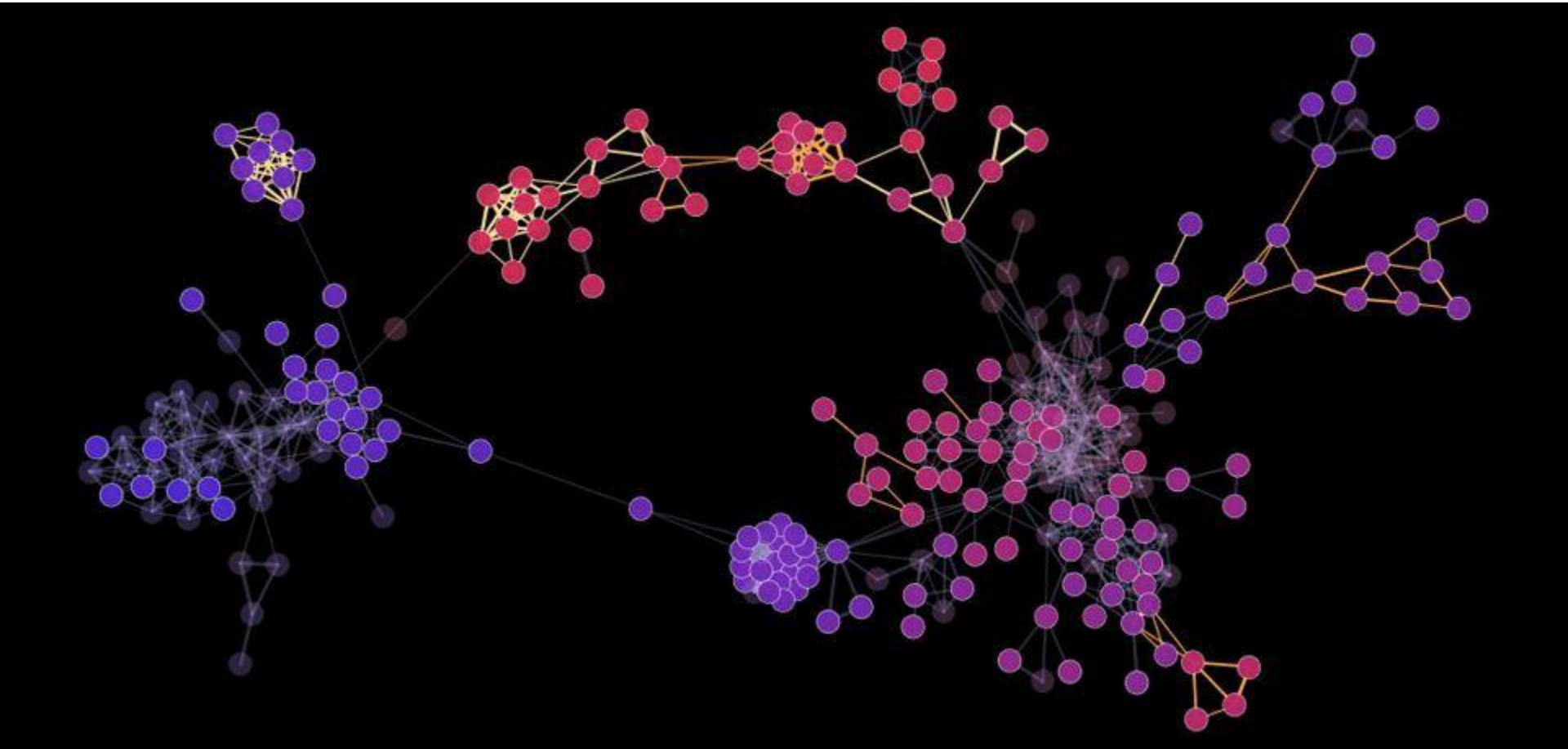
Tutorial

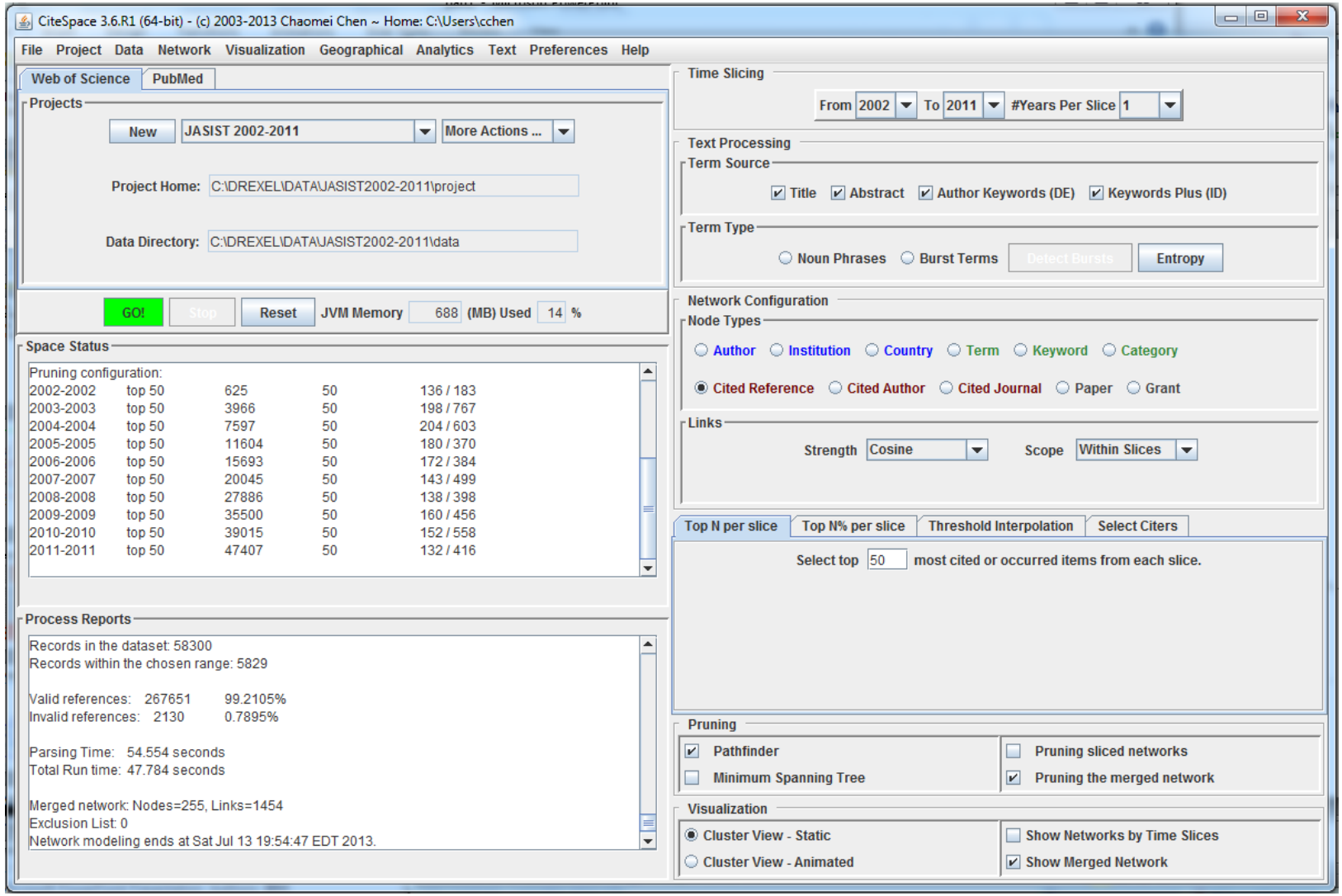
2

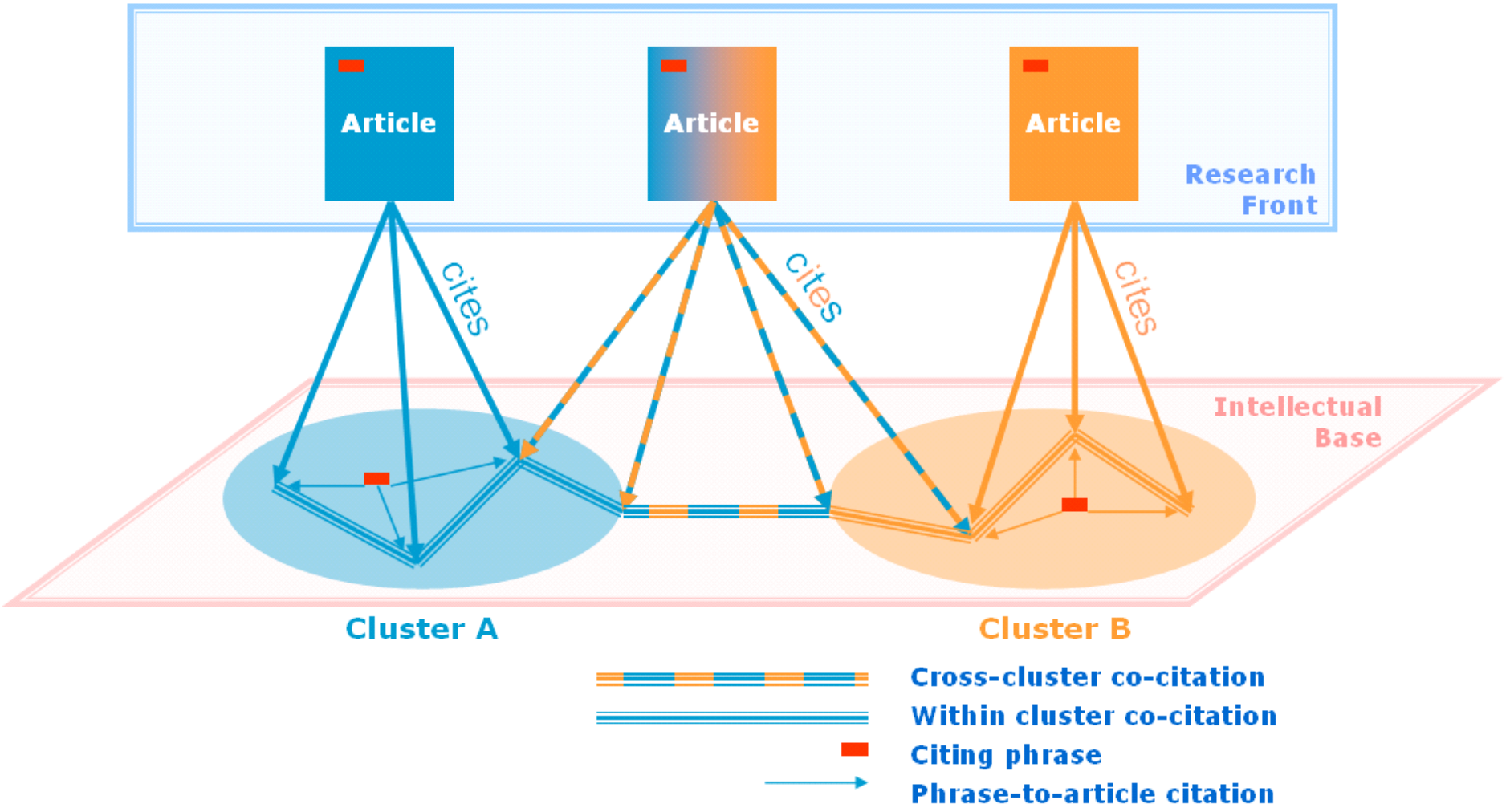
CiteSpace: Visualizing and Analyzing the Structure and Dynamics of Scientific Fields

Chaomei Chen



OVERVIEW:
THE DESIGN OF CITESPACE

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Article
Research Front
cites
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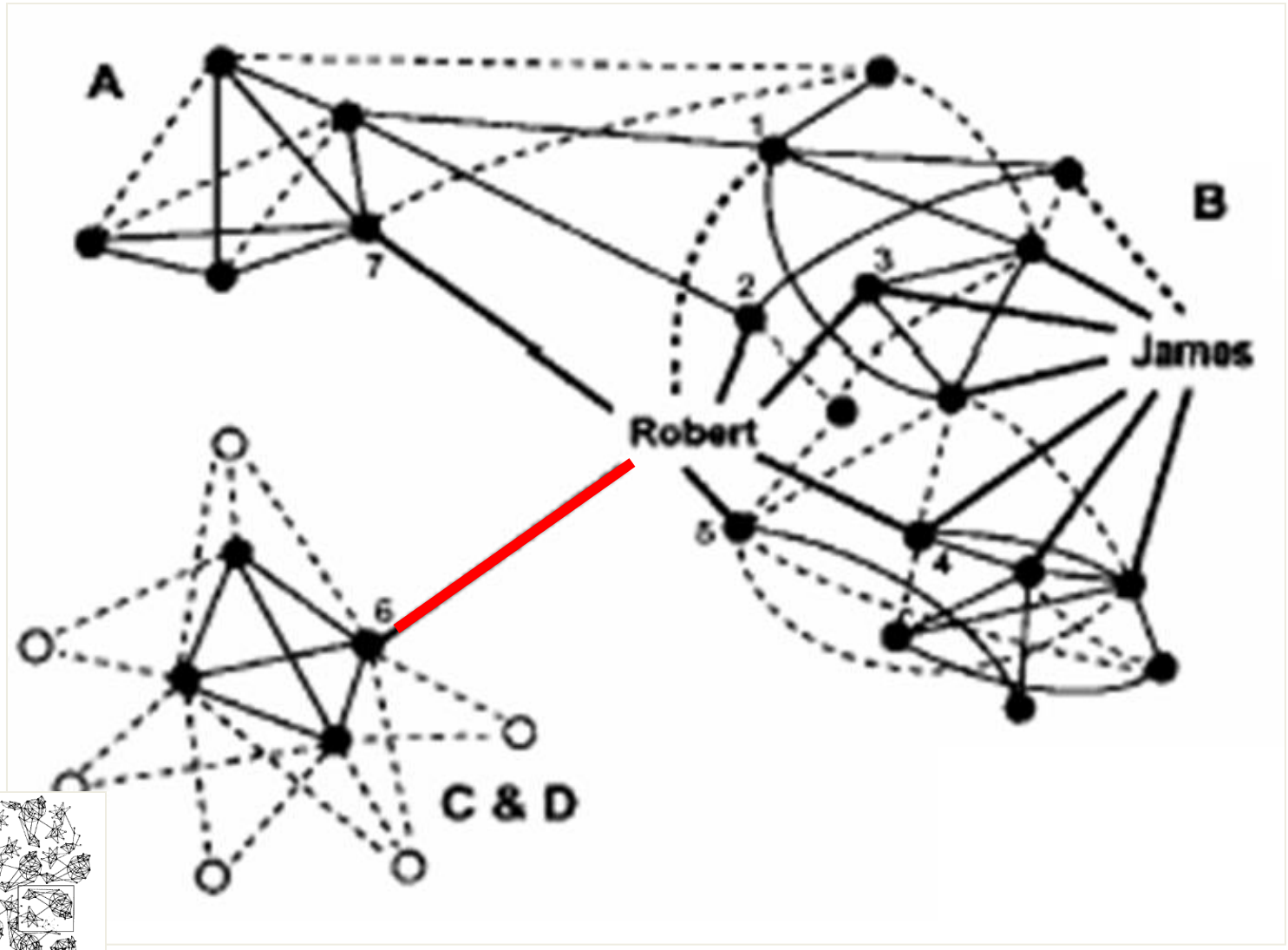
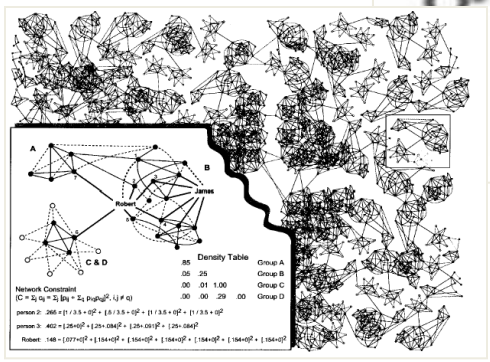
Cluster A
Cluster B
Cross-cluster co-citation
Within cluster co-citation
Citing phrase
Phrase-to-article citation

Structural Holes in Social Networks





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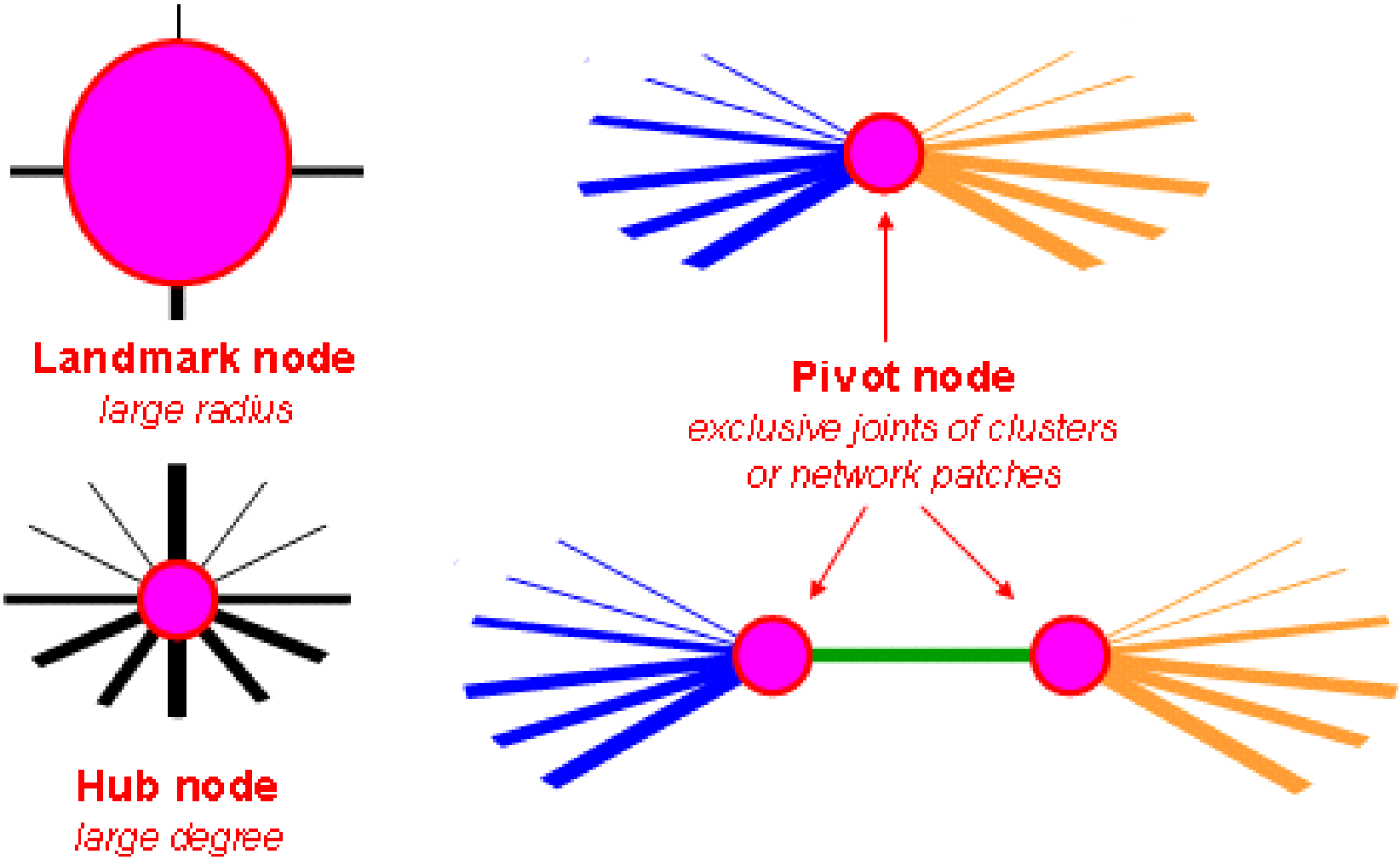
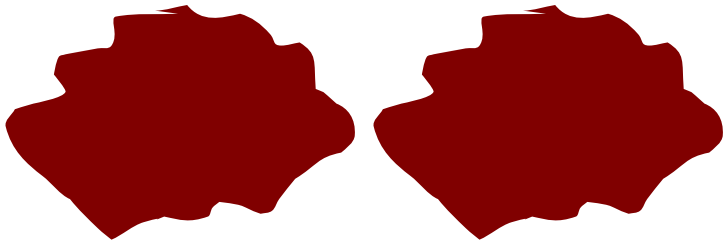
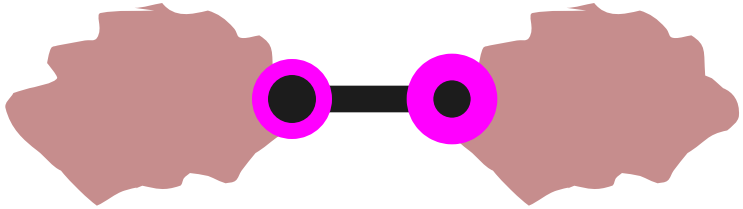

Landmark node
large radius
Pivot node
exclusive joints of clusters
or network patches
Hub node
large degree

Expected Patterns

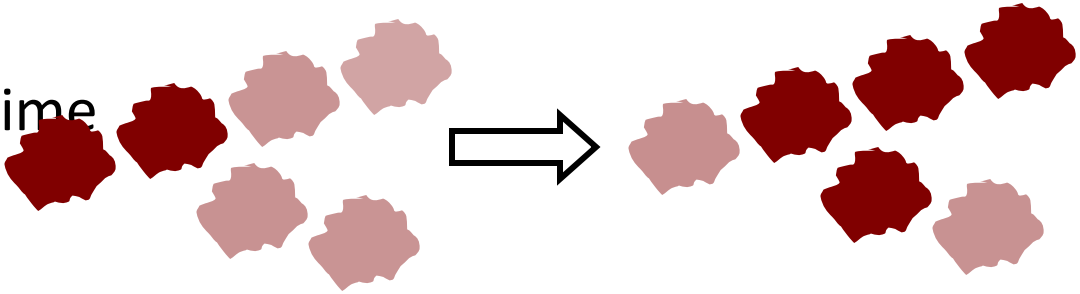
- Thematic grouping



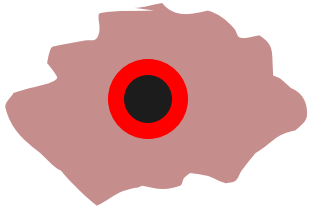
- Intellectual turning points



- Thematic change over time



- Abrupt changes associated with triggers



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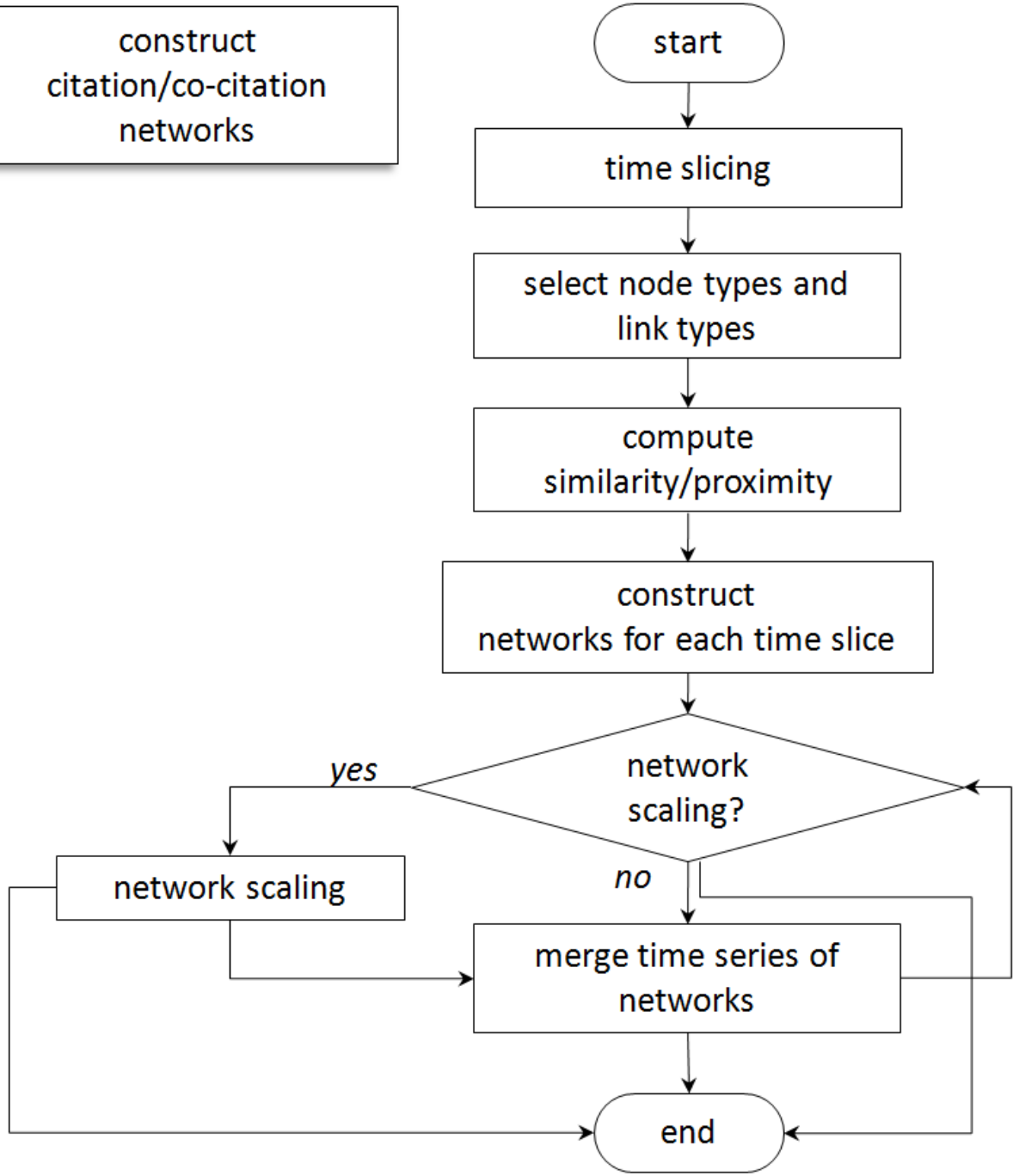
construct citation/co-citation networks
start
time slicing
select node types and link types
compute similarity/proximity
construct networks for each time slice
network scaling?
yes
no
network scaling
merge time series of networks
end

AU Galea, S
Ahern, J
Resnick, H
Kilpatrick, D
Bucuvalas, M
Gold, J
Vlahov, D

Author / Co-author

TI Psychological sequelae of the September 11 terrorist attacks in New York City.

SO NEW ENGLAND JOURNAL OF MEDICINE

LA English

DT Article

ID POSTTRAUMATIC-STRESS-DISORDER; NATIONAL COMORBIDITY SURVEY; MAJOR DEPRESSION; NATURAL DISASTER; SOCIAL SUPPORT; OKLAHOMA-CITY; PREVALENCE; PSYCHOPATHOLOGY; SURVIVORS; SYMPTOMS

AB Background: The scope of the terrorist attacks of September 11, 2001, was unprecedented in the United States. We assessed the prevalence and correlates of acute post-traumatic stress disorder (PTSD) and depression among residents of Manhattan five to eight weeks after the attacks. Methods: We used random-digit dialing to contact a representative sample of adults living south of 110th Street in Manhattan. Participants were asked about demographic characteristics, exposure to the events of September 11, and psychological symptoms after the attacks. Results: Among 1008 adults interviewed, 7.5 percent reported symptoms consistent with [illegible] related to the attacks, and 9.[illegible] consistent with current depression (with ``current`` defined as occurring within the previous 30 days). Among respondents who lived south of Canal Street (i.e., near the World Trade Center), the prevalence of PTSD was 20.0 percent. .....

Terms/Noun Phrases

C1 New York Acad Med, Ctr Urban Epidemiol Studies, New York, NY 10029 USA. Columbia Univ, Mailman Sch Publ Hlth, Dept Epidemiol, New York, NY USA. Med Univ S Carolina, Natl Crime Victims Res & Treatment Ctr, Charleston, SC 29425 USA. Schulman Ronca & Bucuvalas, New York, NY USA. Bellevue Hosp Ctr, New York, NY 10016 USA.

RP Galea, S, New York Acad Med, Ctr Urban EpidemiolStudies, Rm 556,1216
5th Ave, New York, NY 10029 USA.

Location

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GOENJIAN AK, 2001, AM J PSY
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ROTHBAUM BO, 1992, J TRAUMA STRESS, V5, P455
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RUEF AM, 2000, CULTURAL DIVERSITY E, V6, P235
SHAH B, 1997, SUDAAN USERS MANUAL
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SHALEV AY, 2000, J CLIN PSYCHIAT S5, V61, P33
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SHORE JH, 1989, J NERV MENT DIS, V177, P681
TUCKER P, 2000, J BEHAV HEALTH SER R, V27, P406

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TC 179

Citation Counts

PU MASSACHUSETTS MEDICAL SOC/NEJM
PI WALTHAM
PA WALTHAM WOODS CENTER, 860 WINTER ST,, WALTHAM, MA 02451-1413 USA
SN 0028-4793
J9 N ENGL J MED
JI N. Engl. J. Med.
PD MAR 28
PY 2002
VL 346
IS 13
BP 982
EP 987
PG 6
SC Medicine, General & Internal
GA 534UY
UT ISI:000174608600006
ER

Year of Publication

Citing Article

co-occurring burst terms

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*AM PSYCH ASS, 1994, DIAGN STAT MAN MENT
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ORTEGA AN, 2000, AM J PSYCHIAT, V157, P615
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RUBONIS AV, 1991, PSYCHOL BULL, V109, P384
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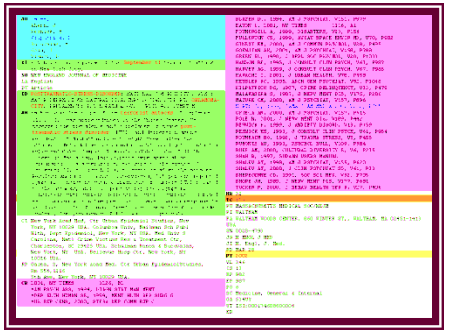

author co-citation

document co-citation

journal co-citation

ACA/DCA/JCA

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Title / Author	Cited by	Year
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Interacting with hypertext: A meta-analysis of experimental studies C Chen, R Rada Human-computer interaction 11 (2), 125-156	395	1996
Information visualization: Beyond the horizon C Chen Springer	359	2004
Information visualisation and virtual environments C Chen Springer	341	1999
Searching for intellectual turning points: Progressive knowledge domain visualization C Chen Proceedings of the National academy of Sciences of the United States of ...	319	2004
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The structure and dynamics of cocitation clusters: A multiple-perspective cocitation analysis C Chen, F Ibekwe-SanJuan, J Hou Journal of the American Society for Information Science and Technology 61 (7 ...	111	2010

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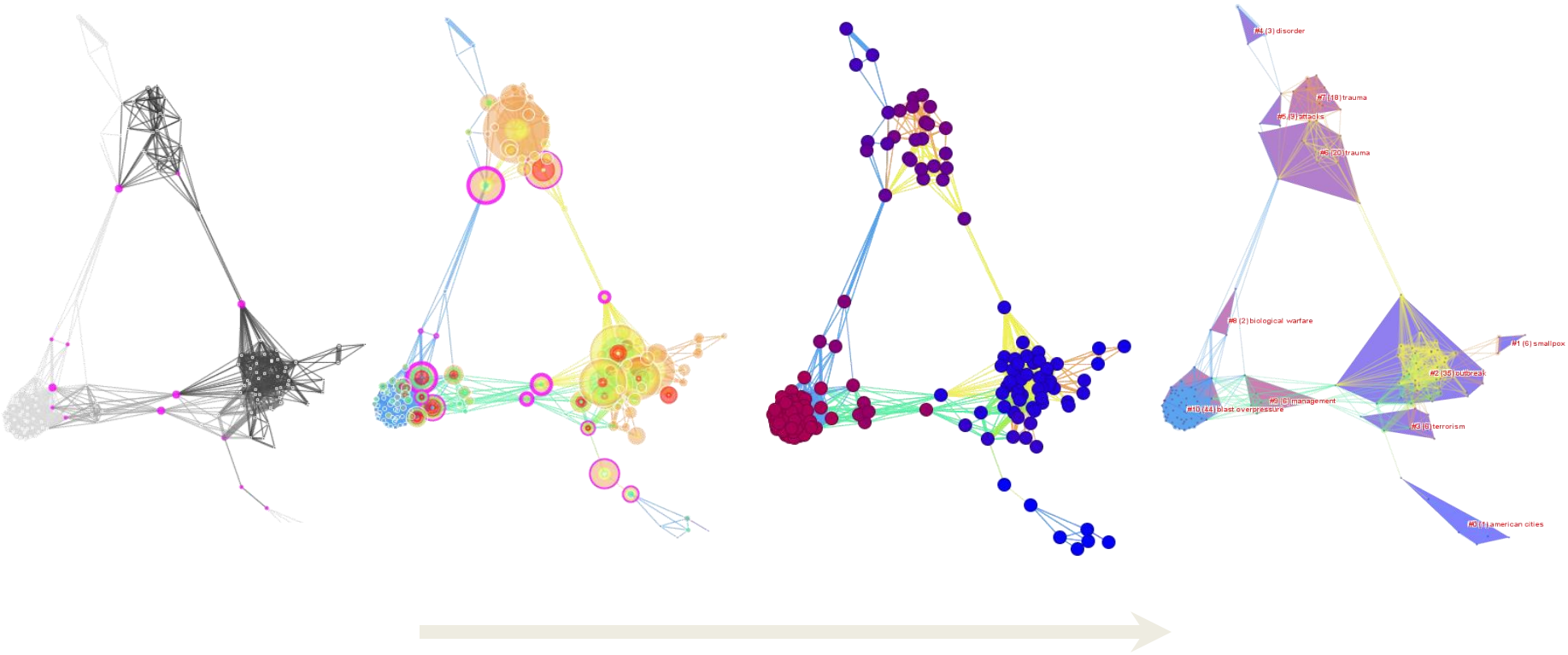
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#5 (8) attacks
#6 (20) trauma
#8 (2) biological warfare
#1 (6) smallpox
#2 (35) outbreak
#9 (5) management
#10 (44) blast overpressure
#3 (8) terrorism
#0 (1) american cities

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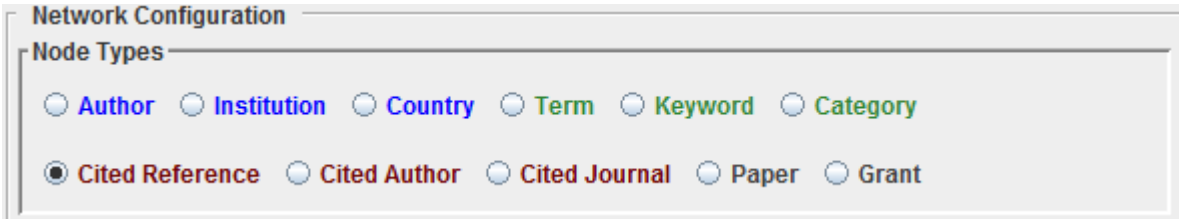


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CR Chen CM, 2006, J AM SOC INF SCI TEC, V57, P359, DOI 10.1002/asi.20317
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CR Chen CM, 2006, J AM SOC INF SCI TEC, V57, P359, DOI 10.1002/asi.20317
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PY 2012
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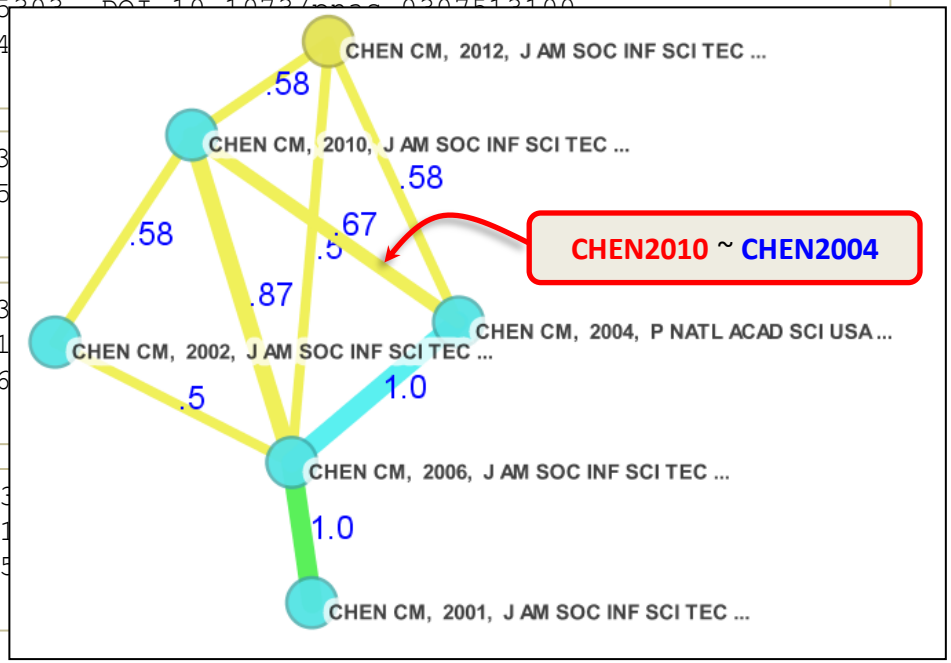
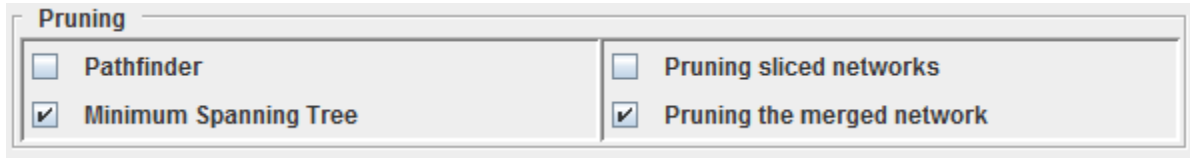
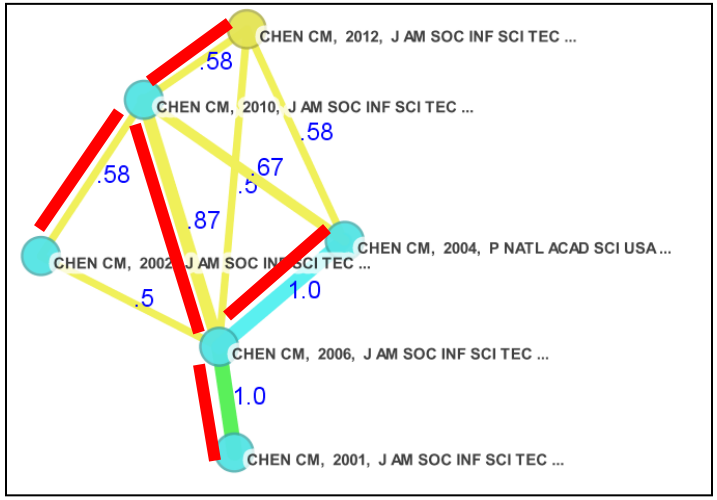
= 2/3
= 0.67

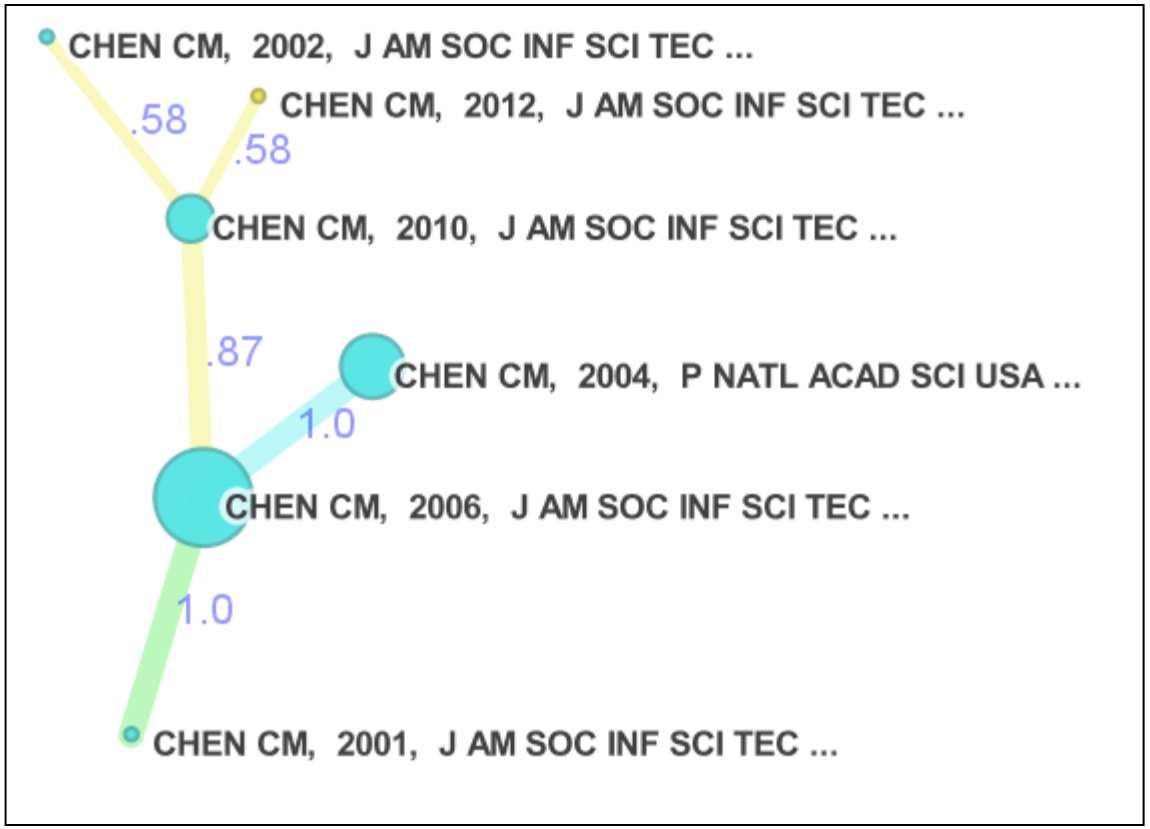


Pruning the network

Minimum Spanning Tree (MST)

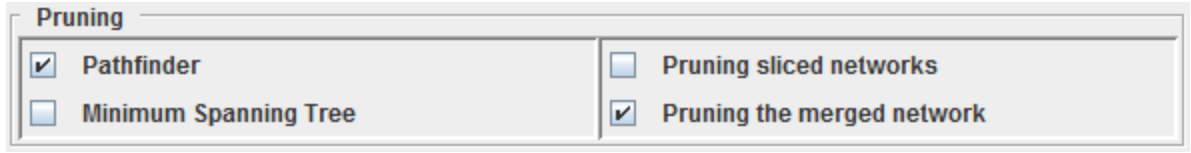


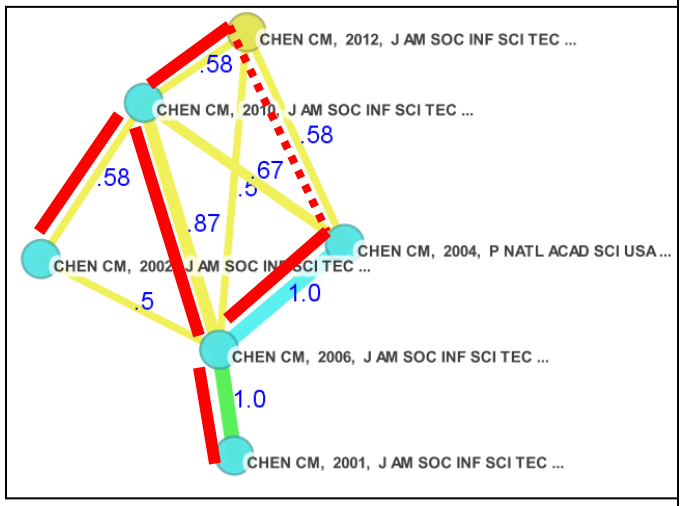


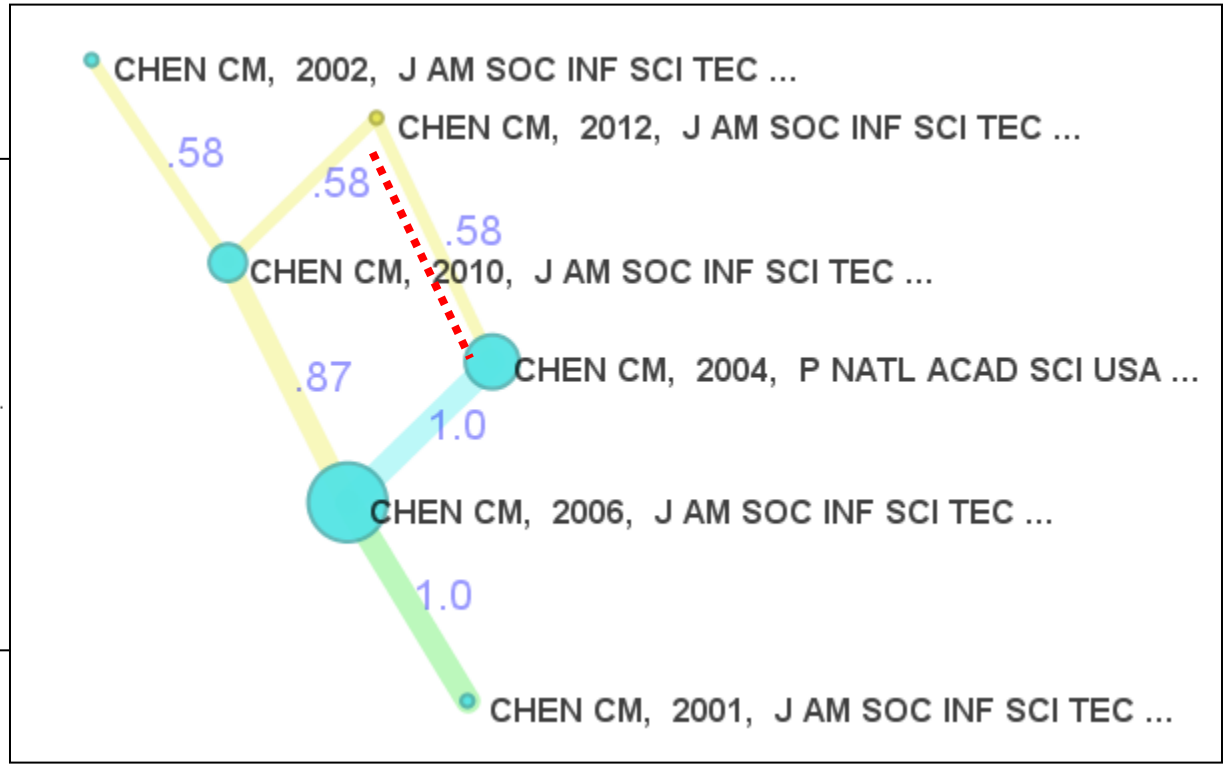


Pruning the network

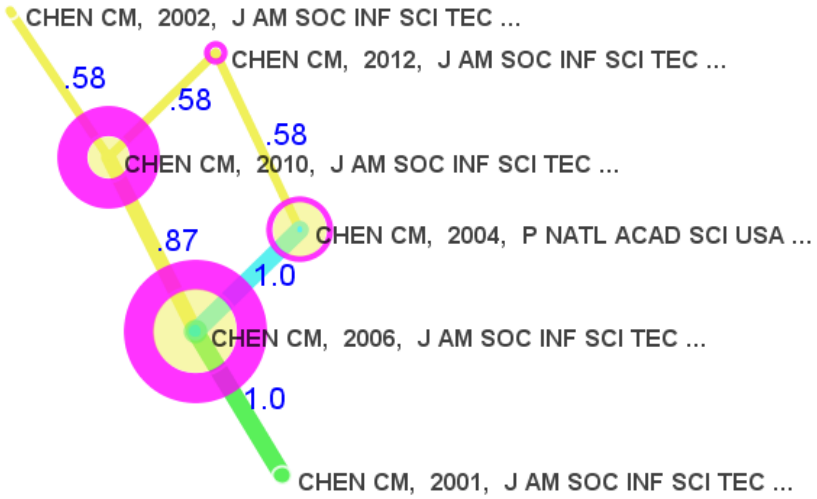
Pathfinder Network Scaling

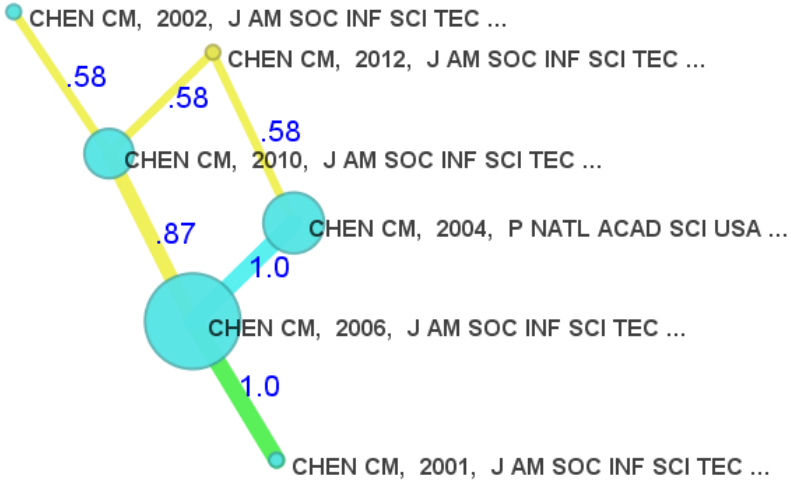






Citation Tree Rings





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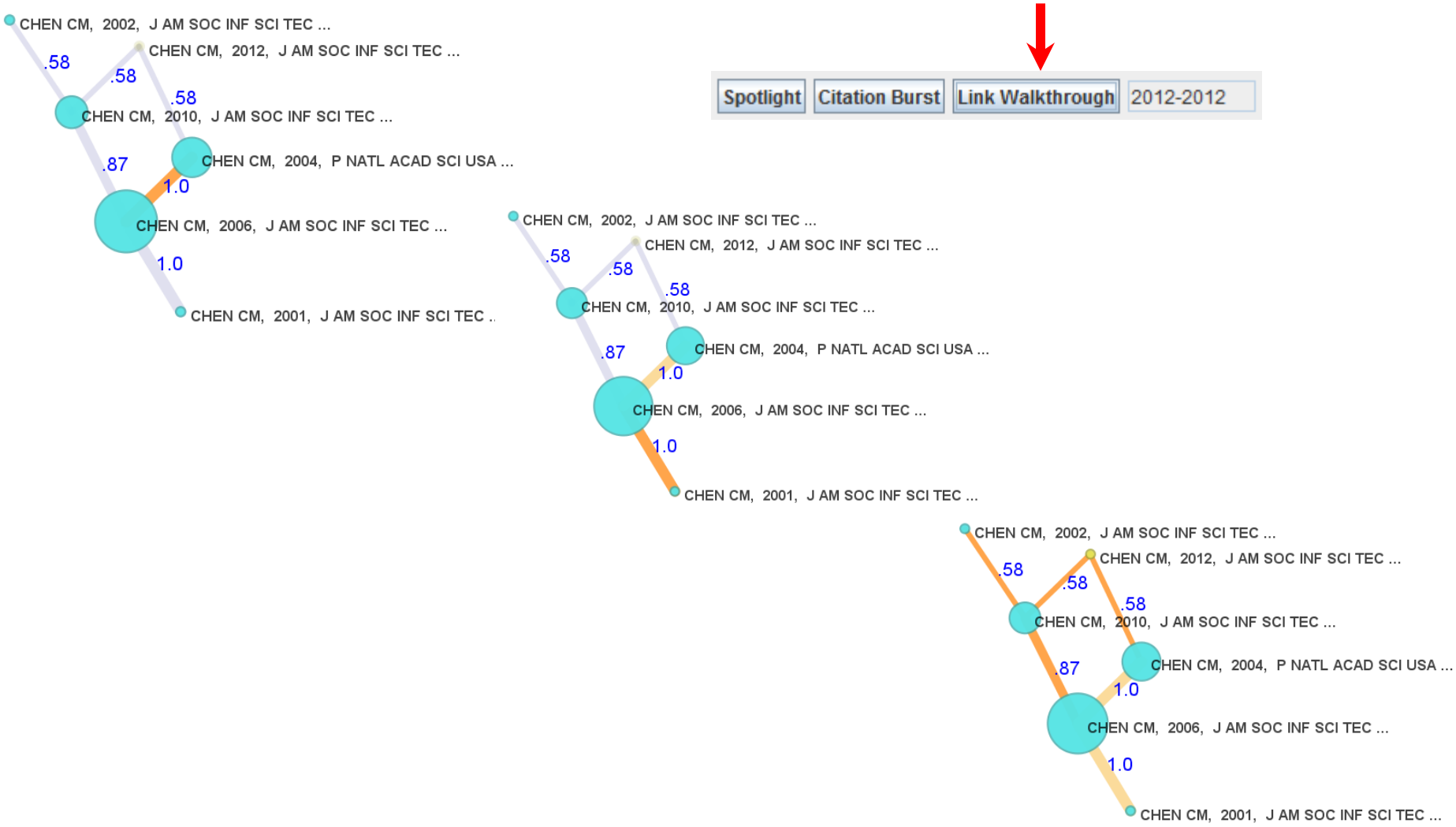

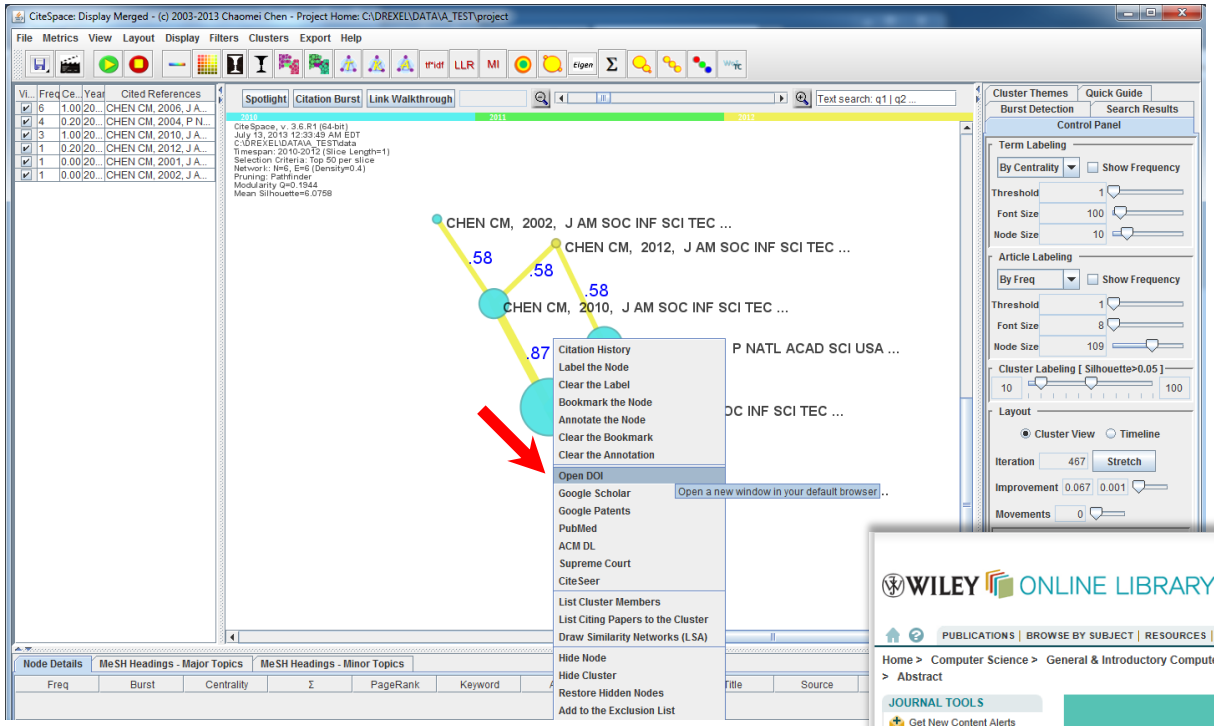
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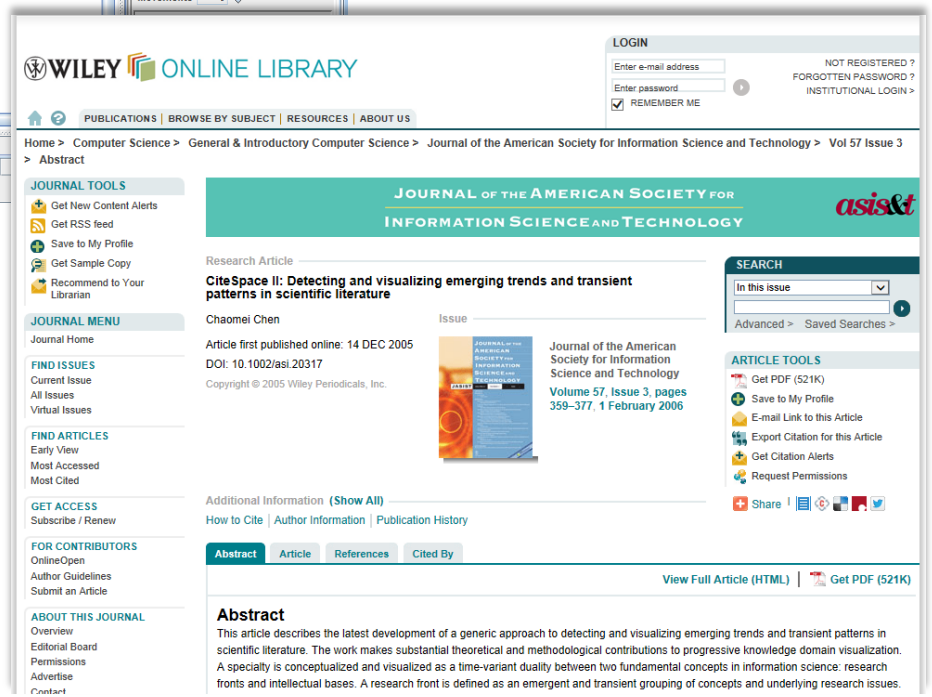
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Home > Computer Science > General & Introductory Computer Science > Journal of the American Society for Information Science and Technology > Vol 57 Issue 3 > Abstract
JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY
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Research Article
CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature
Chaomei Chen
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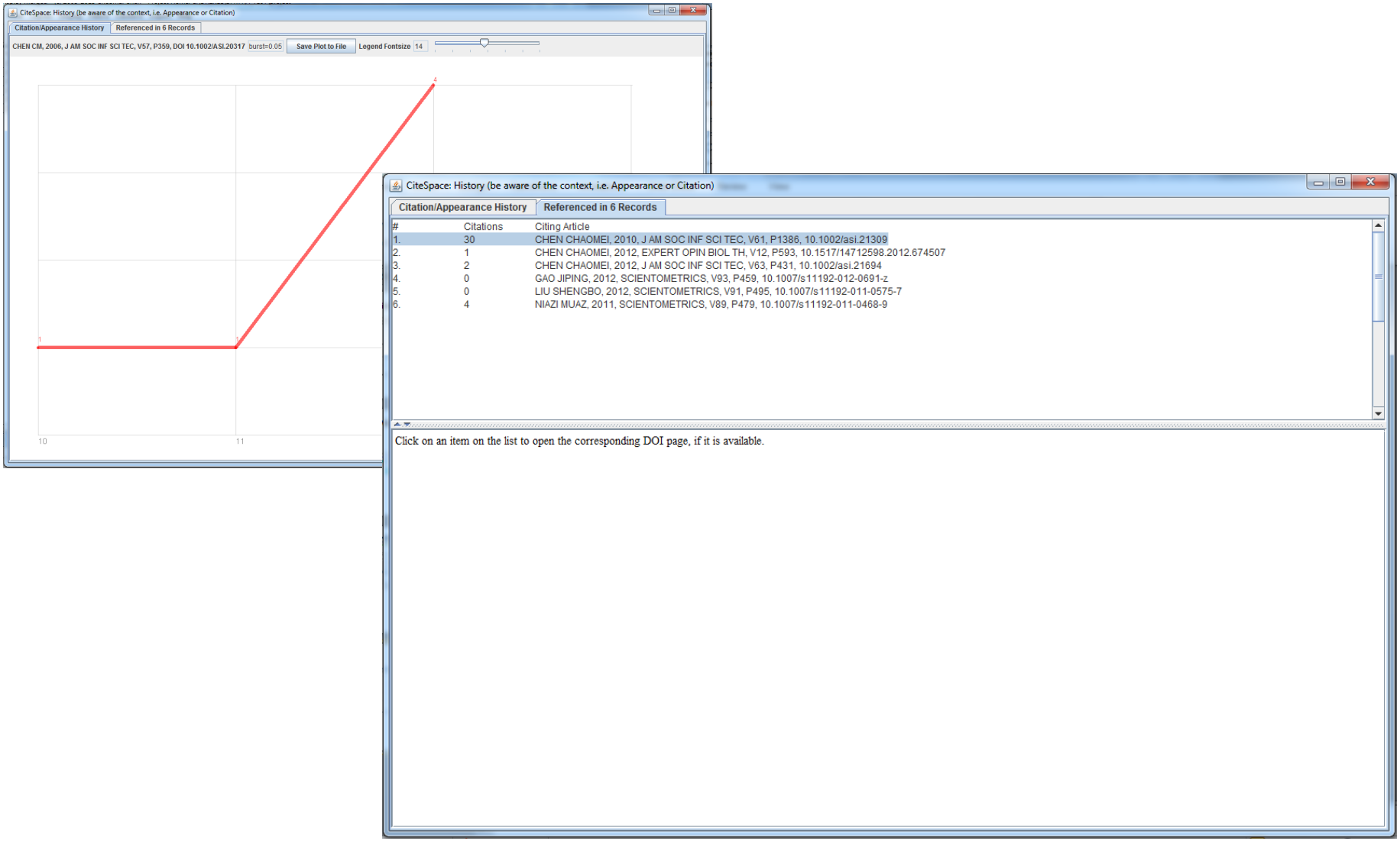
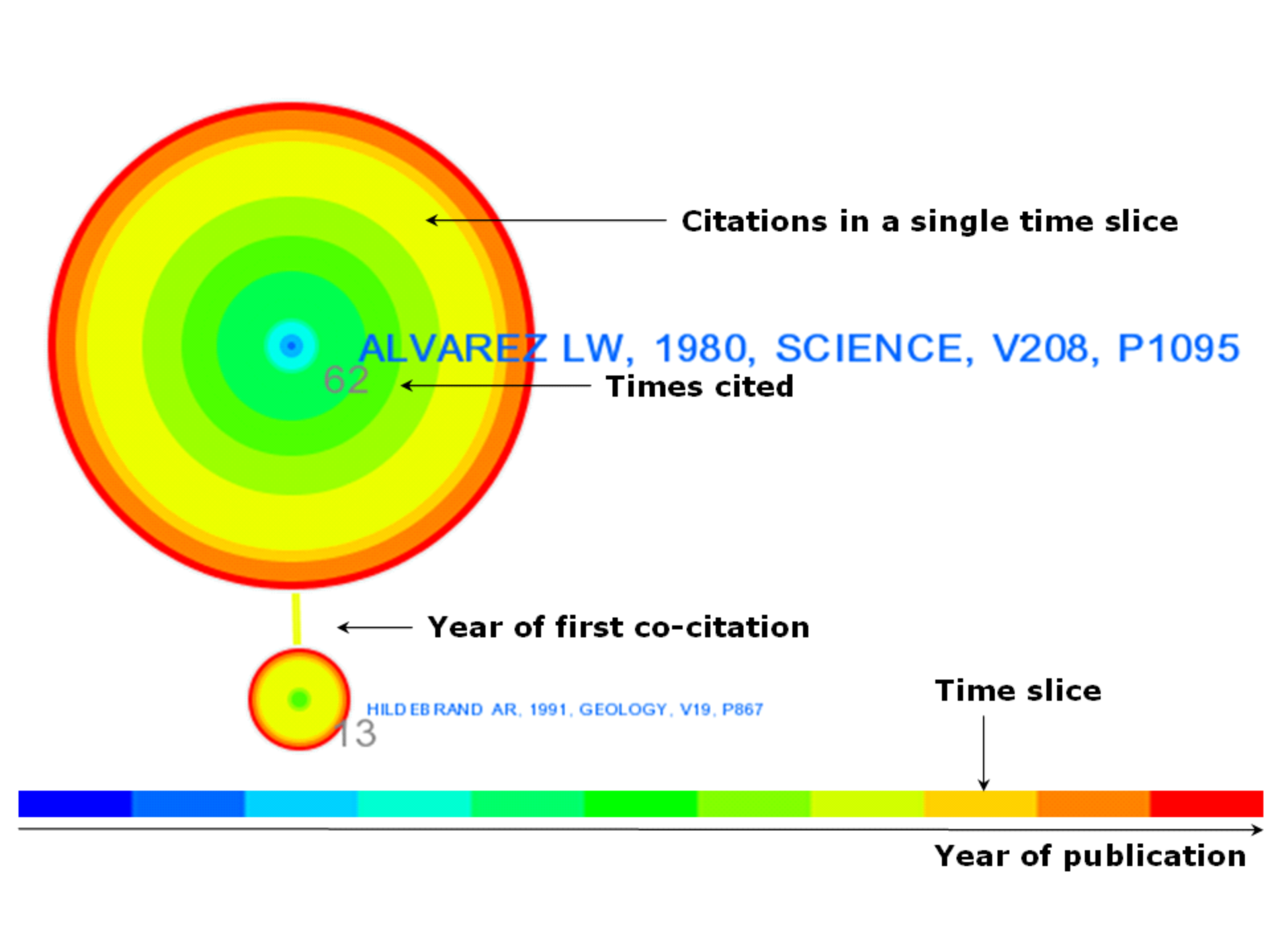
Issue
Journal of the American Society for Information Science and Technology
Volume 57, Issue 3, pages 359–377, 1 February 2006
Abstract
This article describes the latest development of a generic approach to detecting and visualizing emerging trends and transient patterns in scientific literature. The work makes substantial theoretical and methodological contributions to progressive knowledge domain visualization. A specialty is conceptualized and visualized as a time-variant duality between two fundamental concepts in information science: research fronts and intellectual bases. A research front is defined as an emergent and transient grouping of concepts and underlying research issues.

DOI Access

Citation History of a Cited Reference

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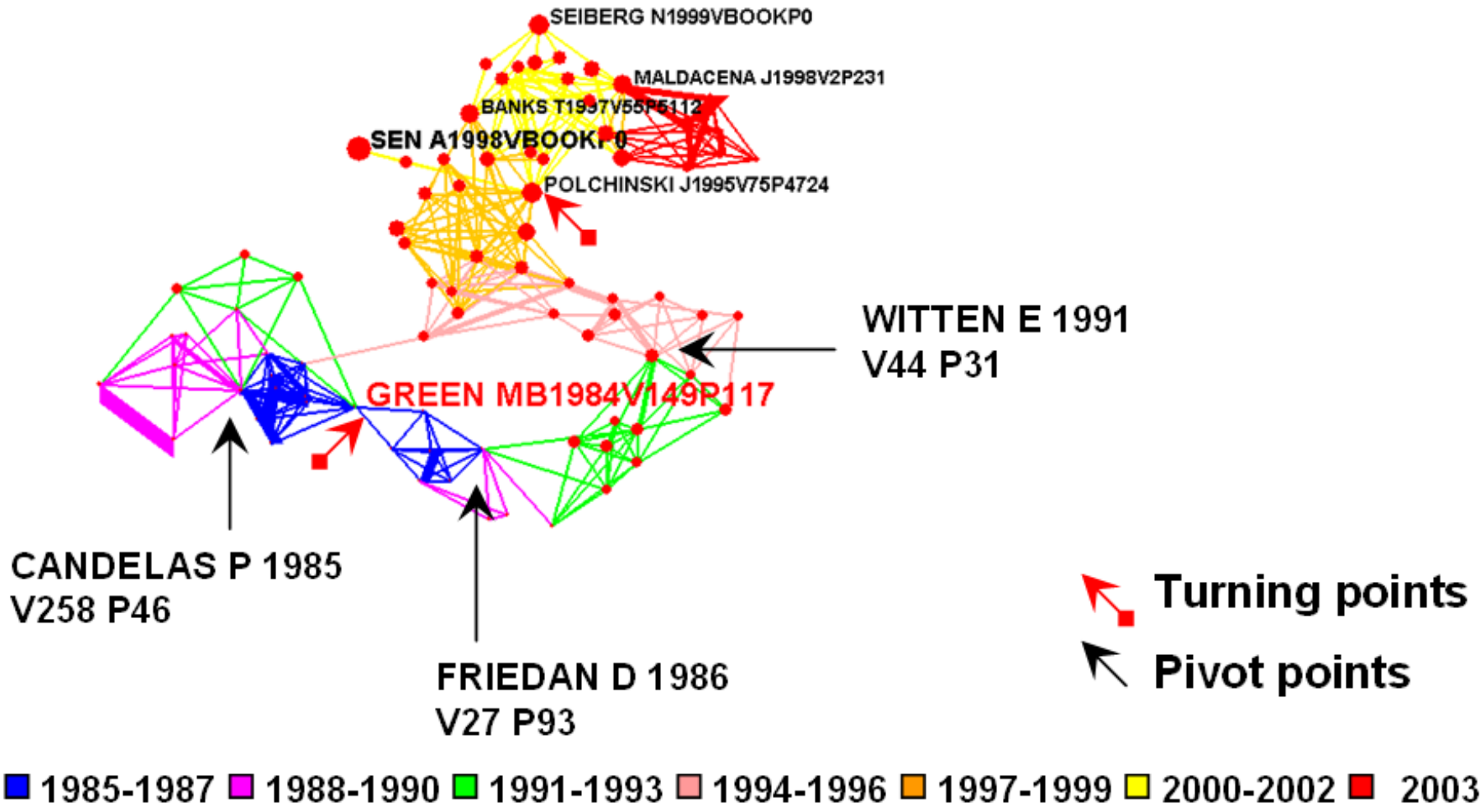
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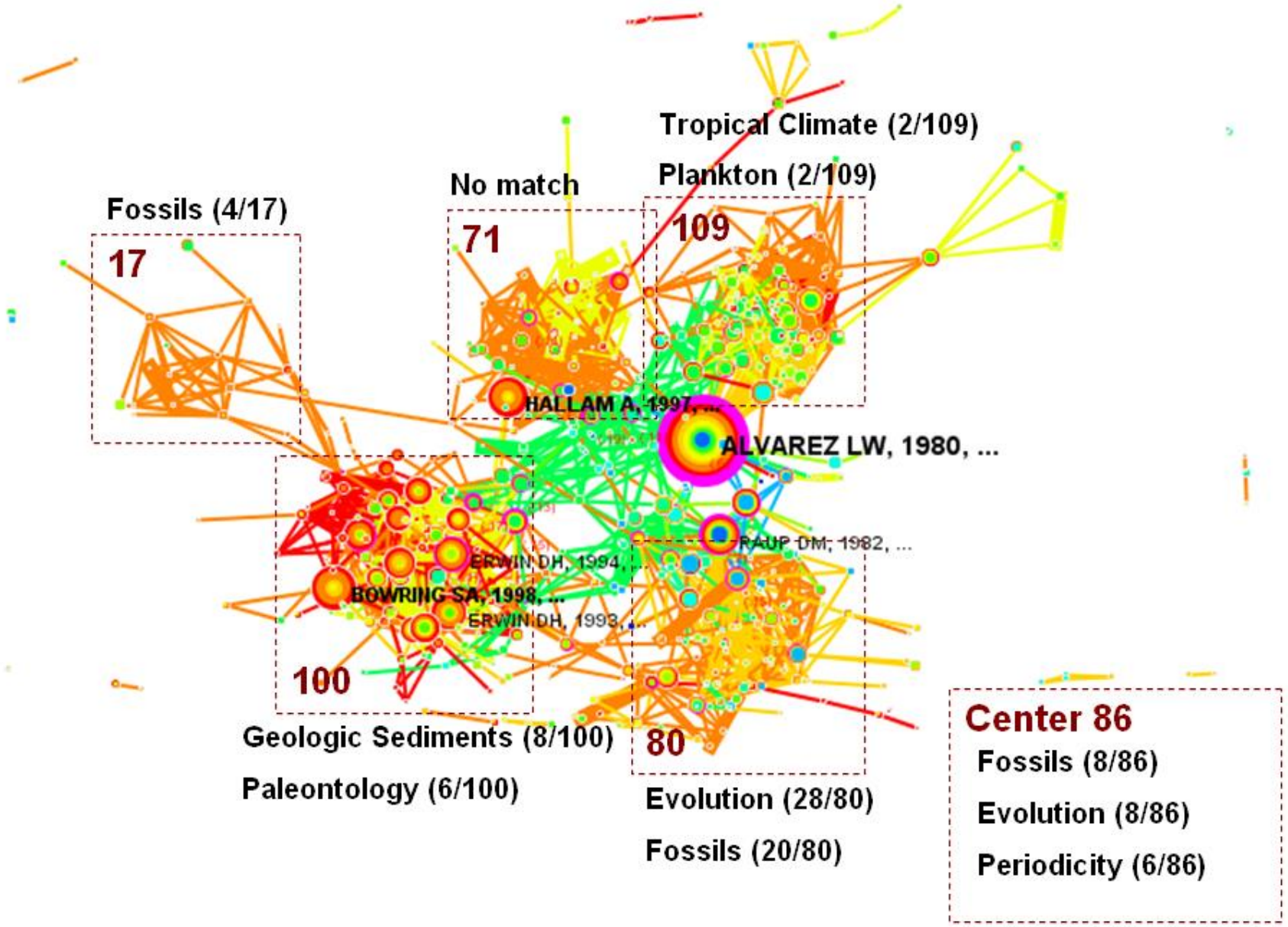
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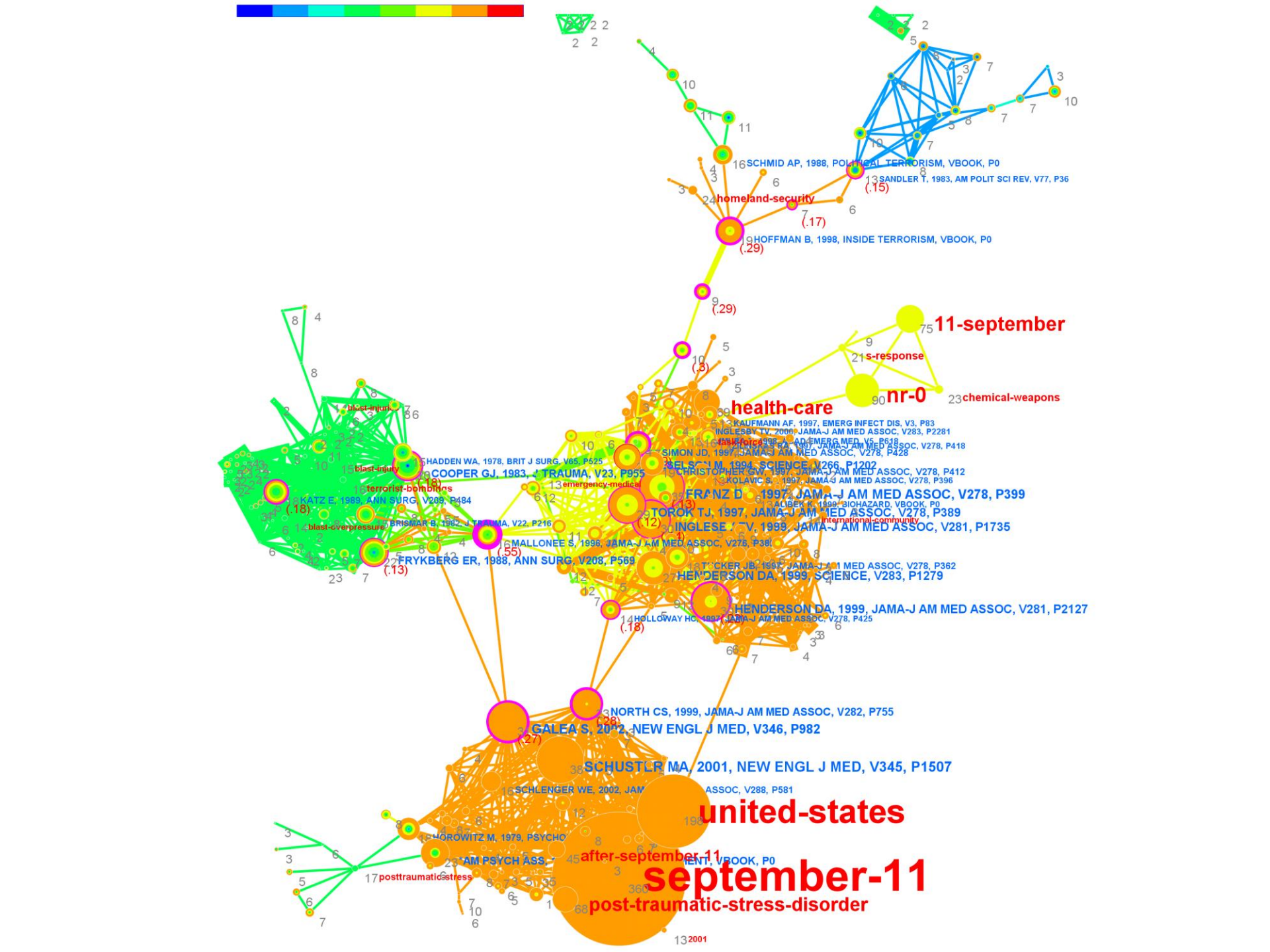
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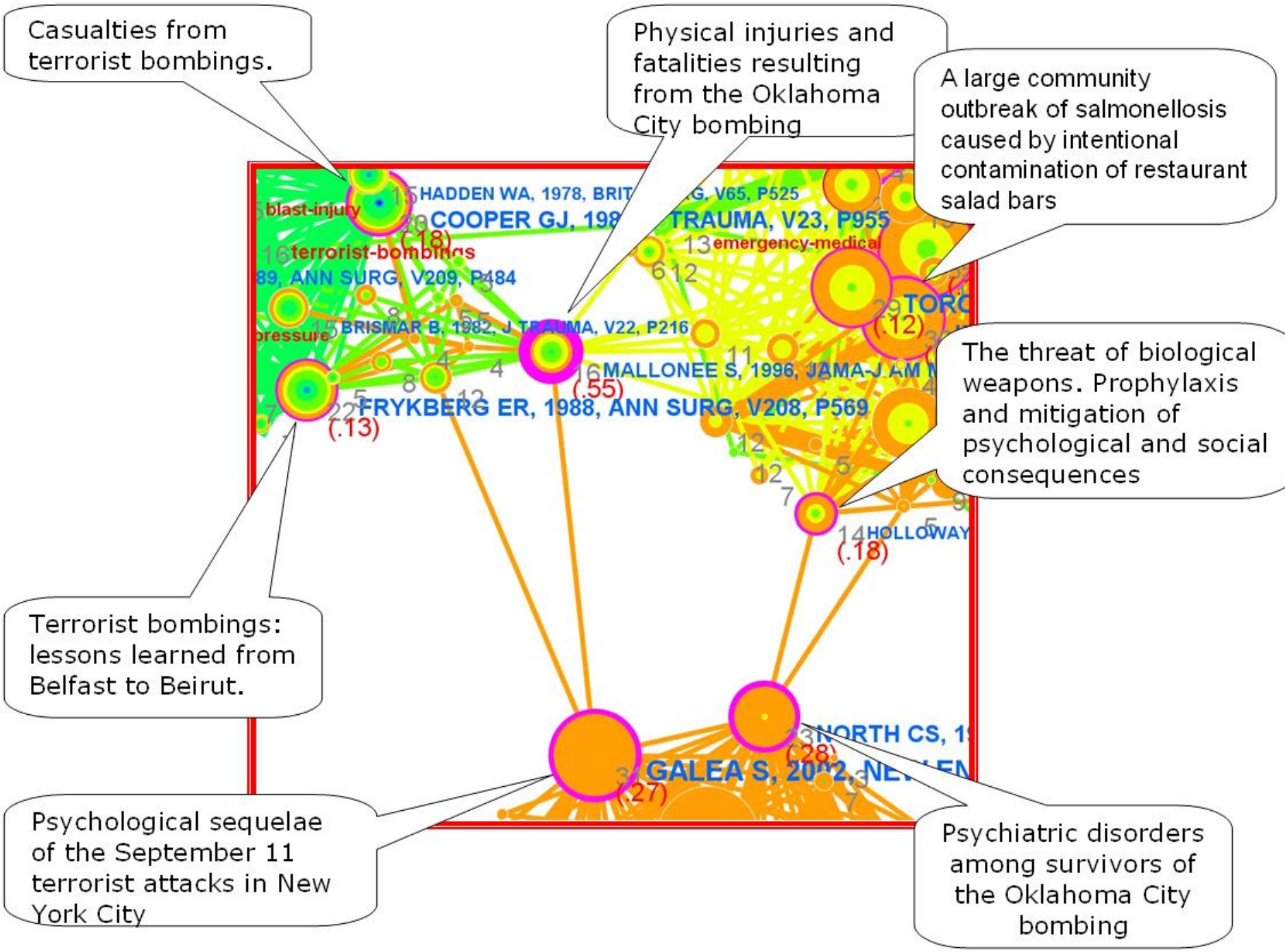
2001

2. *What was the major impact or implication of your article on subsequent research?*

   There have been a number of articles that have been published after the September 11 attacks, all discussing in some respect the psychological consequences of those attacks/potential implications of terrorism. I think our article (a) established the importance of terrorist events for population mental health (b) clearly laid out the fact that persons in the general population (not just victims) can have psychological disorders after a mass disaster.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A large community outbreak of salmonellosis caused by intentional contamination of restaurant salad bars
The threat of biological weapons. Prophylaxis and mitigation of psychological and social consequences
Terrorist bombings: lessons learned from Belfast to Beirut.
Psychological sequelae of the September 11 terrorist attacks in New York City
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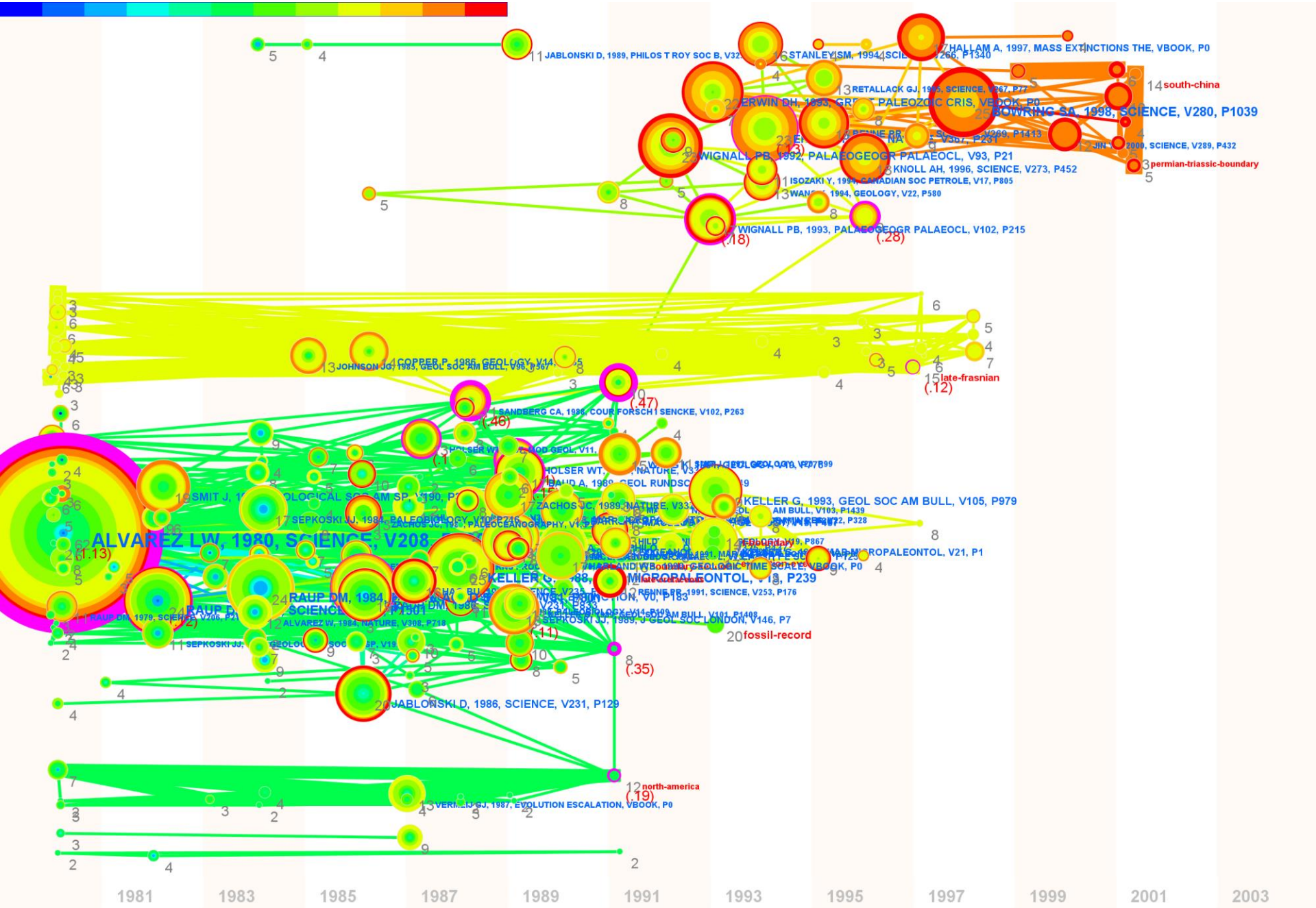
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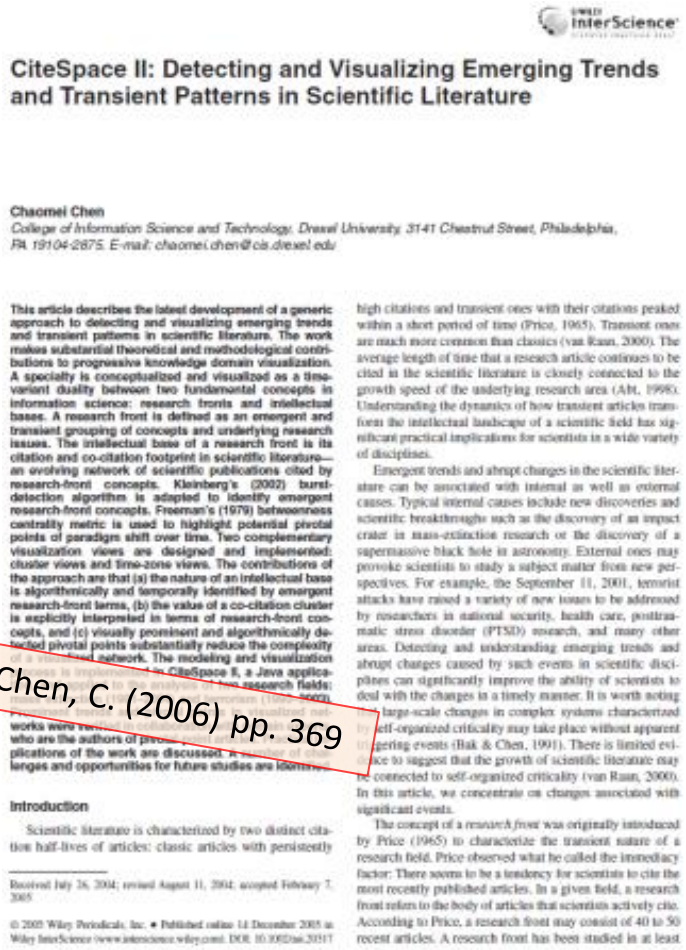

InterScience

CiteSpace II: Detecting and Visualizing Emerging Trends and Transient Patterns in Scientific Literature

Chaomei Chen
College of Information Science and Technology, Drexel University, 3141 Chestnut Street, Philadelphia, PA 19104-2875. E-mail: chaomei.chen@cis.drexel.edu

This article describes the latest development of a generic approach to detecting and visualizing emerging trends and transient patterns in scientific literature. The work makes substantial theoretical and methodological contributions to progressive knowledge domain visualization. A specialty is conceptualized and visualized as a time-variant duality between two fundamental concepts in information science: research fronts and intellectual bases. A research front is defined as an emergent and transient grouping of concepts and underlying research issues. The intellectual base of a research front is its citation and co-citation footprint in scientific literature—an evolving network of scientific publications cited by research-front concepts. Kleinberg's (2002) burst-detection algorithm is adapted to identify emergent research-front concepts. Freeman's (1979) betweenness centrality metric is used to highlight potential pivotal points of paradigm shift over time. Two complementary visualization views are designed and implemented: cluster views and time-zone views. The contributions of the approach are that (a) the nature of an intellectual base is algorithmically and temporally identified by emergent research-front terms, (b) the value of a co-citation cluster is explicitly interpreted in terms of research-front concepts, and (c) visually prominent and algorithmically detected pivotal points substantially reduce the complexity of a visualized network. The modeling and visualization [illegible] is implemented in CiteSpace II, a Java application [illegible] analysis of two research fields: [illegible] works were ranked [illegible] who are the authors of pivotal [illegible] plications of the work are discussed. A [illegible] lenges and opportunities for future studies are identified.

Introduction

Scientific literature is characterized by two distinct citation half-lives of articles: classic articles with persistently high citations and transient ones with their citations peaked within a short period of time (Price, 1965). Transient ones are much more common than classics (van Raan, 2000). The average length of time that a research article continues to be cited in the scientific literature is closely connected to the growth speed of the underlying research area (Abt, 1998). Understanding the dynamics of how transient articles transform the intellectual landscape of a scientific field has significant practical implications for scientists in a wide variety of disciplines.

Emergent trends and abrupt changes in the scientific literature can be associated with internal as well as external causes. Typical internal causes include new discoveries and scientific breakthroughs such as the discovery of an impact crater in mass-extinction research or the discovery of a supermassive black hole in astronomy. External ones may provoke scientists to study a subject matter from new perspectives. For example, the September 11, 2001, terrorist attacks have raised a variety of new issues to be addressed by researchers in national security, health care, posttraumatic stress disorder (PTSD) research, and many other areas. Detecting and understanding emerging trends and abrupt changes caused by such events in scientific disciplines can significantly improve the ability of scientists to deal with the changes in a timely manner. It is worth noting that large-scale changes in complex systems characterized by self-organized criticality may take place without apparent triggering events (Bak & Chen, 1991). There is limited evidence to suggest that the growth of scientific literature may be connected to self-organized criticality (van Raan, 2000). In this article, we concentrate on changes associated with significant events.

The concept of a *research front* was originally introduced by Price (1965) to characterize the transient nature of a research field. Price observed what he called the immediacy factor: There seems to be a tendency for scientists to cite the most recently published articles. In a given field, a research front refers to the body of articles that scientists actively cite. According to Price, a research front may consist of 40 to 50 recent articles. A research front has been studied in at least

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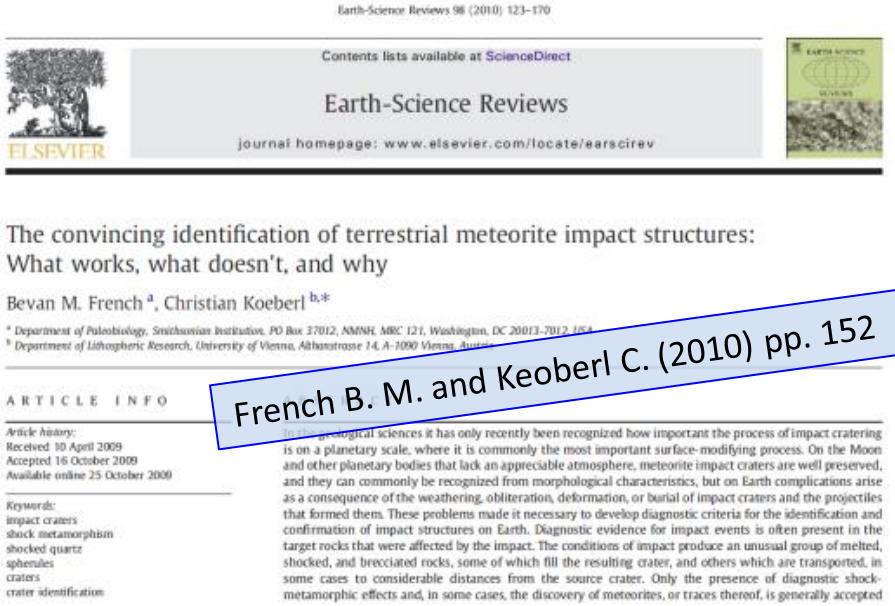
Chen, C. (2006) pp. 369



Earth-Science Reviews 98 (2010) 123–170

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The convincing identification of terrestrial meteorite impact structures: What works, what doesn't, and why

Bevan M. French [a], Christian Koeberl [b,*]

[a] Department of Paleobiology, Smithsonian Institution, PO Box 37012, NMNH, MRC 121, Washington, DC 20013-7012, USA
[b] Department of Lithospheric Research, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria

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crater identification

[illegible] geological sciences it has only recently been recognized how important the process of impact cratering is on a planetary scale, where it is commonly the most important surface-modifying process. On the Moon and other planetary bodies that lack an appreciable atmosphere, meteorite impact craters are well preserved, and they can commonly be recognized from morphological characteristics, but on Earth complications arise as a consequence of the weathering, obliteration, deformation, or burial of impact craters and the projectiles that formed them. These problems made it necessary to develop diagnostic criteria for the identification and confirmation of impact structures on Earth. Diagnostic evidence for impact events is often present in the target rocks that were affected by the impact. The conditions of impact produce an unusual group of melted, shocked, and brecciated rocks, some of which fill the resulting crater, and others which are transported, in some cases to considerable distances from the source crater. Only the presence of diagnostic shock-metamorphic effects and, in some cases, the discovery of meteorites, or traces thereof, is generally accepted

French B. M. and Keoberl C. (2010) pp. 152

2006

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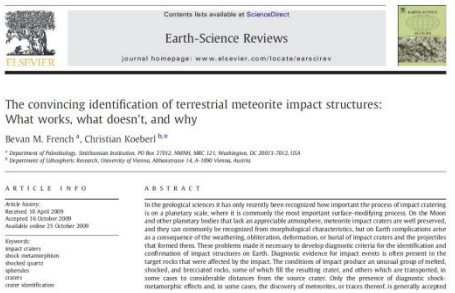
7.1.1. Background

The end of the Permian period, about 250 Ma ago, is marked by the largest known mass extinction in geological history. At this time, in two closely-separated events, more than the 90% of known marine species disappeared, accompanied by a major portion of terrestrial species as well (Erwin, 1993, 2006). Since the establishment of a firm connection between the later K–T extinction and a major impact event (Alvarez et al., 1980), numerous workers have searched for evidence of a similar connection between another large impact event and the Permian extinctions. Most efforts have concentrated on the younger and larger of the two extinction events, which marks the actual Permian–Triassic (P–Tr) boundary at 251 Ma.

French B. M. and Keoberl C. (2010) pp. 152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ABSTRACT

In the geological sciences it has only recently been recognized how important the process of impact cratering is on a planetary scale, where it is commonly the most important surface-modifying process. On the Moon and other planetary bodies that lack an appreciable atmosphere, meteorite impact craters are well preserved, and they can commonly be recognized from morphological characteristics, but on Earth complications arise as a consequence of the weathering, obliteration, deformation, or burial of impact craters and the projectiles that formed them. These problems made it necessary to develop diagnostic criteria for the identification and confirmation of impact structures on Earth. Diagnostic evidence for impact events is often present in the target rocks that were affected by the impact. The conditions of impact produce an unusual group of melted, shocked, and brecciated rocks, some of which fill the resulting crater, and others which are transported, in some cases to considerable distances from the source crater. Only the presence of diagnostic shock-metamorphic effects and, in some cases, the discovery of meteorites, or traces thereof, is generally accepted

Chen, C. (2006) pp. 369


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Chaomei Chen

College of Information Science and Technology, Drexel University, 3141 Chestnut Street, Philadelphia, PA 19104-2875. E-mail: chaomei.chen@cis.drexel.edu

comparable to that of the Chicxulub crater to the K-T impact theory. The discovery of the Chicxulub crater dramatically boosted the credibility of the K-T impact theory. Encouraged by the successful puzzle-solving experience, many scientists appear to have adapted the same approach to solve a different puzzle—by applying the impact theory to an earlier mass extinction. Finding the impact crater is the next logical step. Identifying a Permian-Triassic boundary impact crater has attracted the attention of many researchers. It was in this context that the current research front has emerged.

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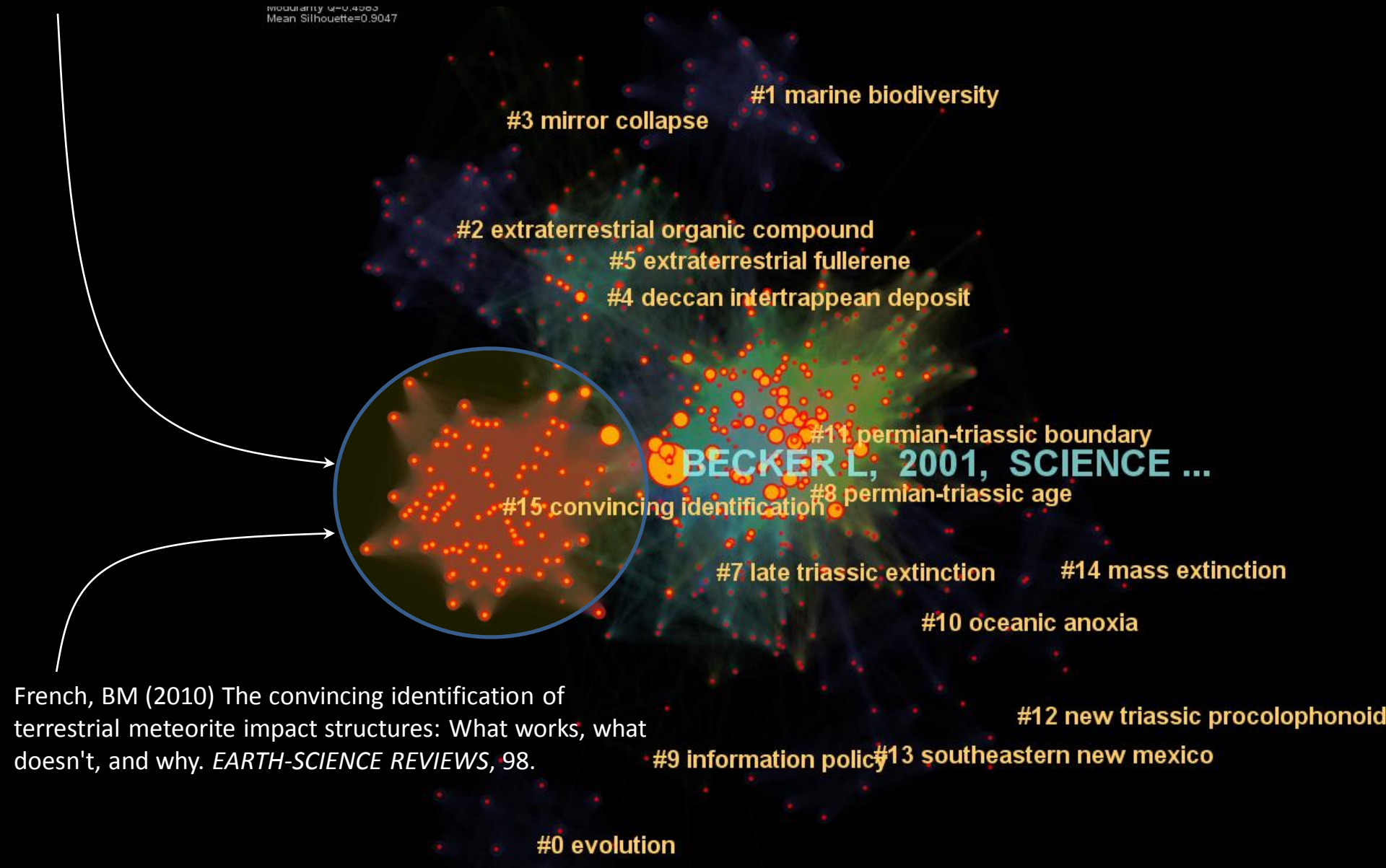

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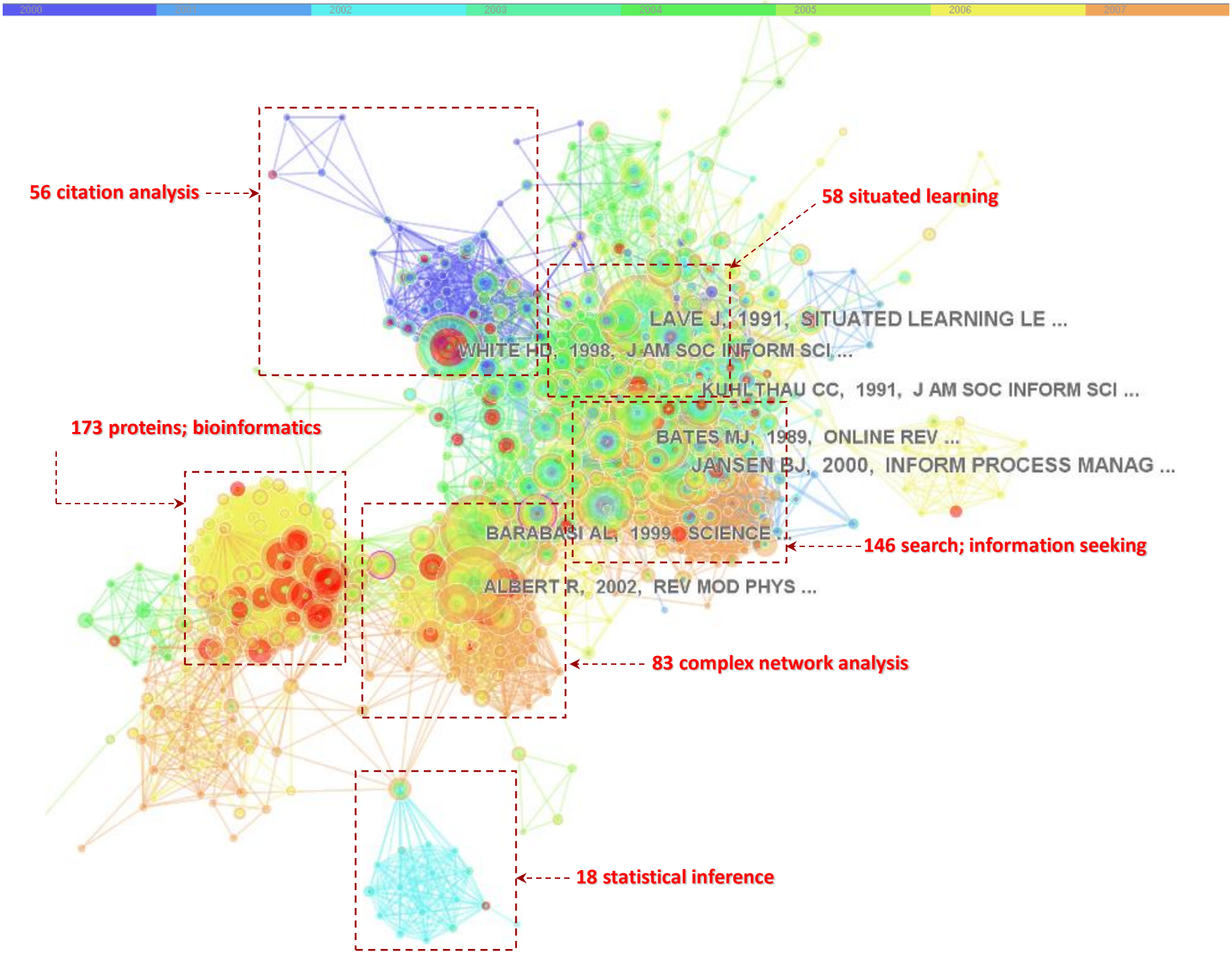
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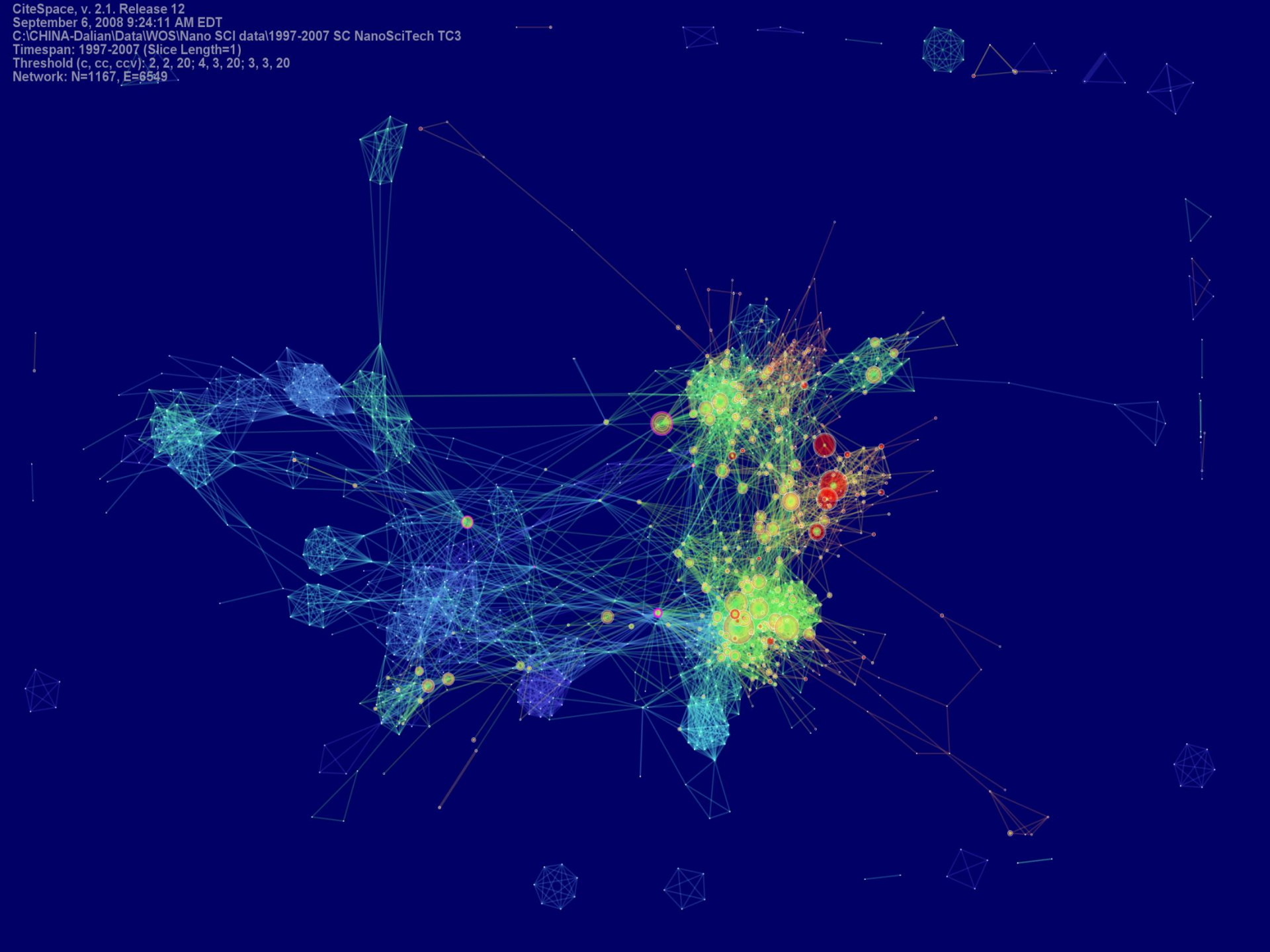
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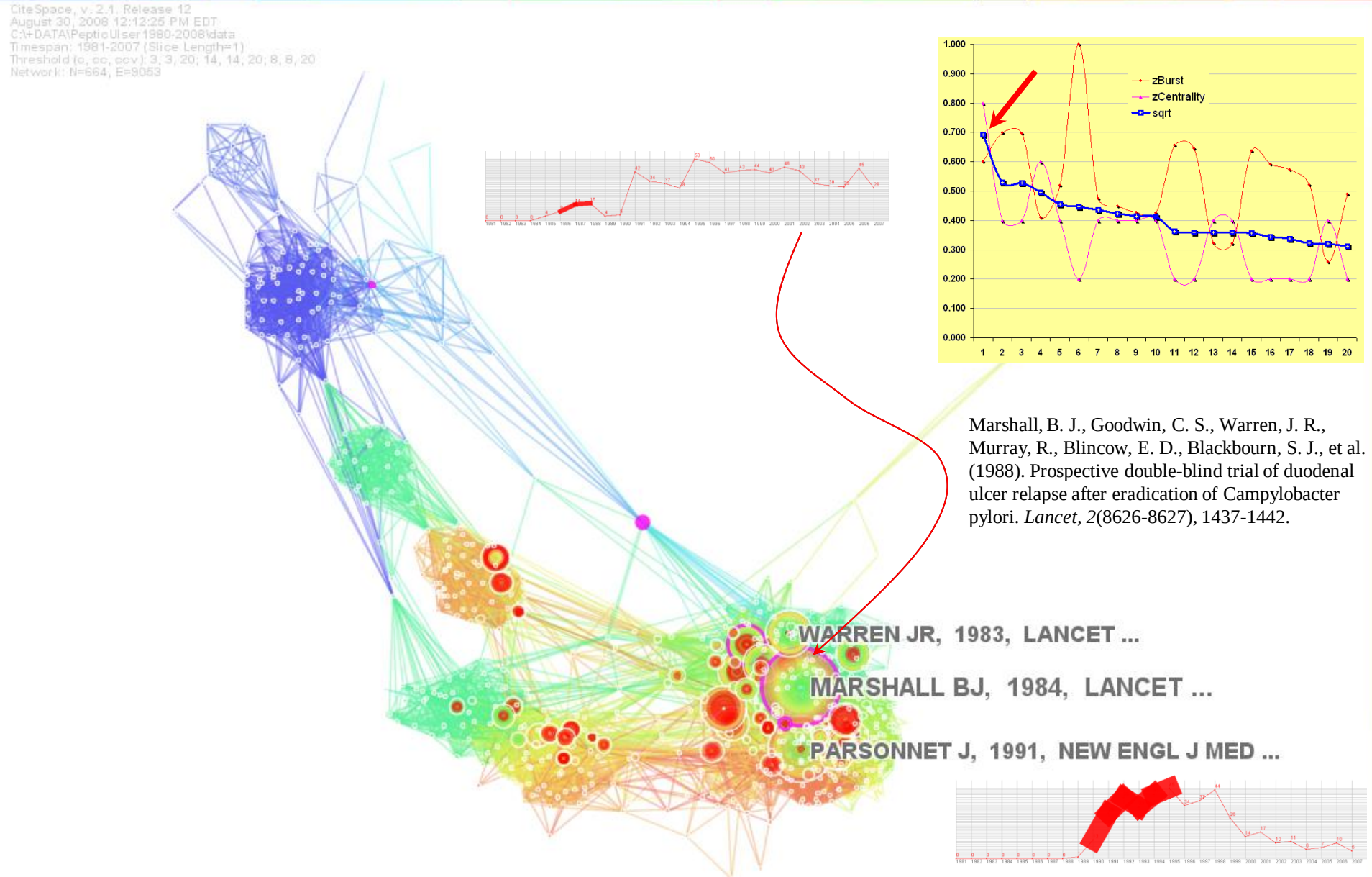
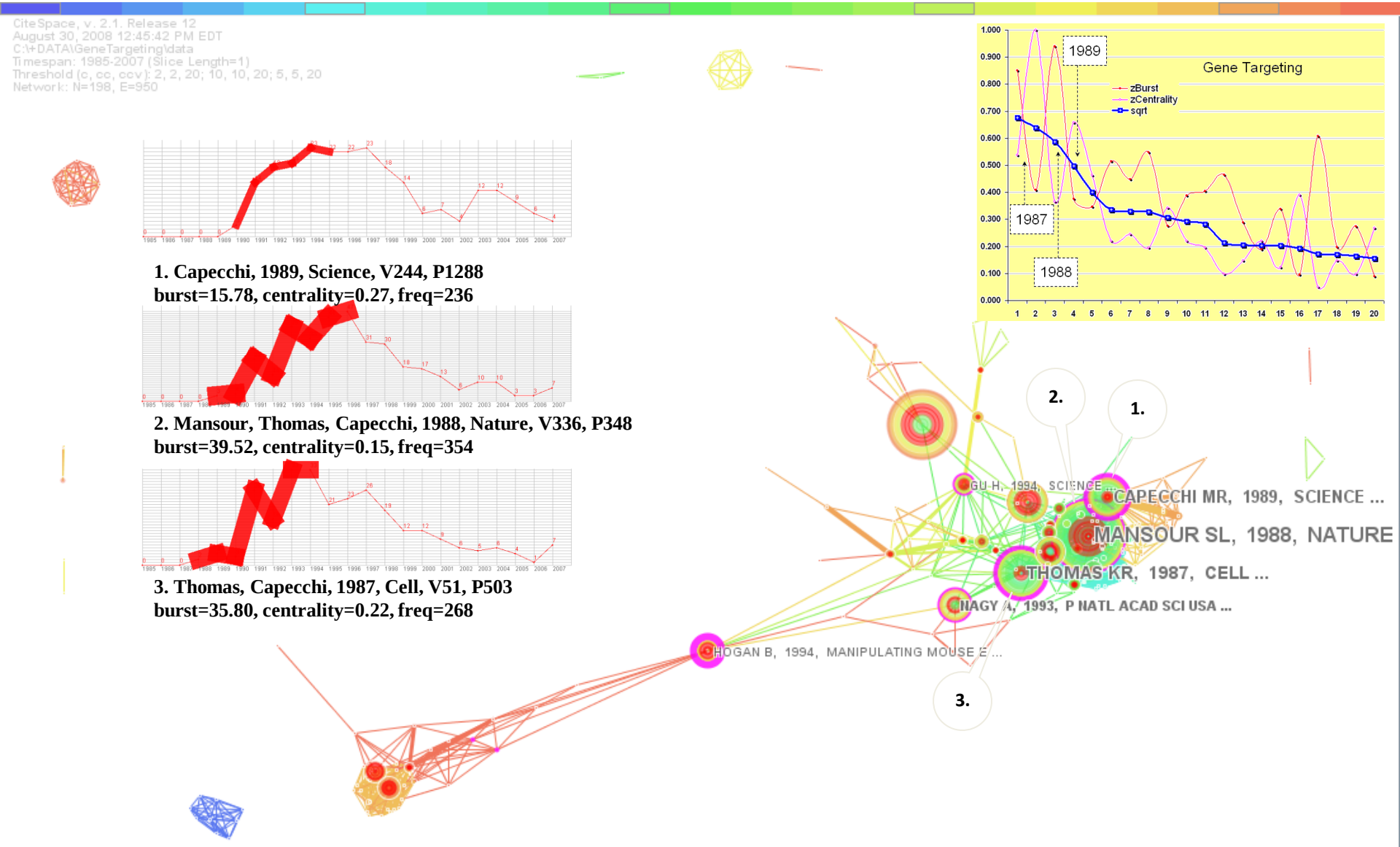
The 2005 Nobel Prize in Medicine to Barry J. Marshall and J. Robin Warren for their discovery of "the bacterium *Helicobacter pylori* and its role in gastritis and peptic ulcer disease."



Marshall, B. J., Goodwin, C. S., Warren, J. R., Murray, R., Blincow, E. D., Blackbourn, S. J., et al. (1988). Prospective double-blind trial of duodenal ulcer relapse after eradication of Campylobacter pylori. *Lancet*, *2*(8626-8627), 1437-1442.

The 2007 Nobel Prize in Medicine to Mario R. Capecchi, Martin J. Evans and Oliver Smithies for their discoveries of "*principles for introducing specific gene modifications in mice by the use of embryonic stem cells.*"



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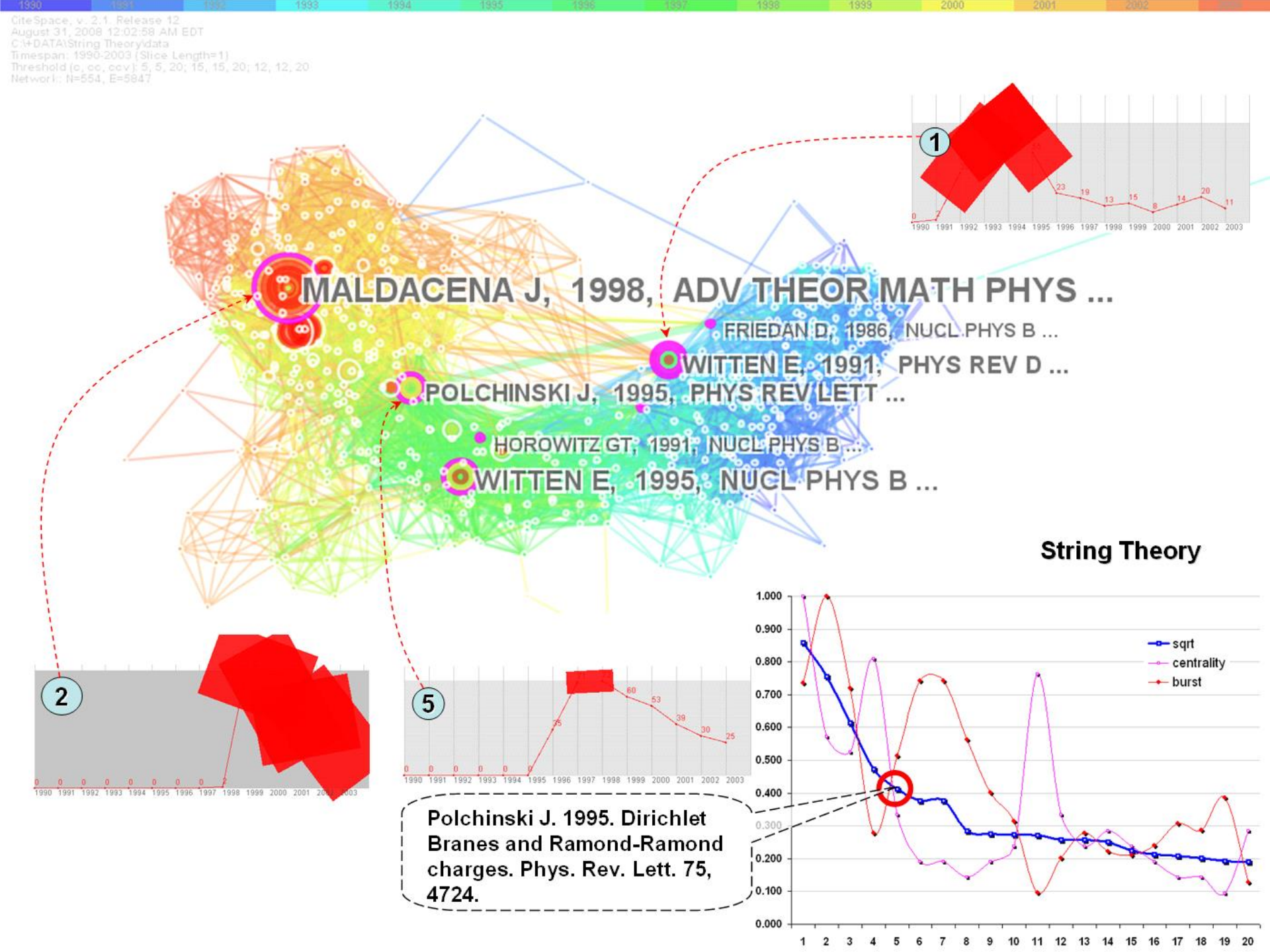
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‘Profitability’ of Information Contents

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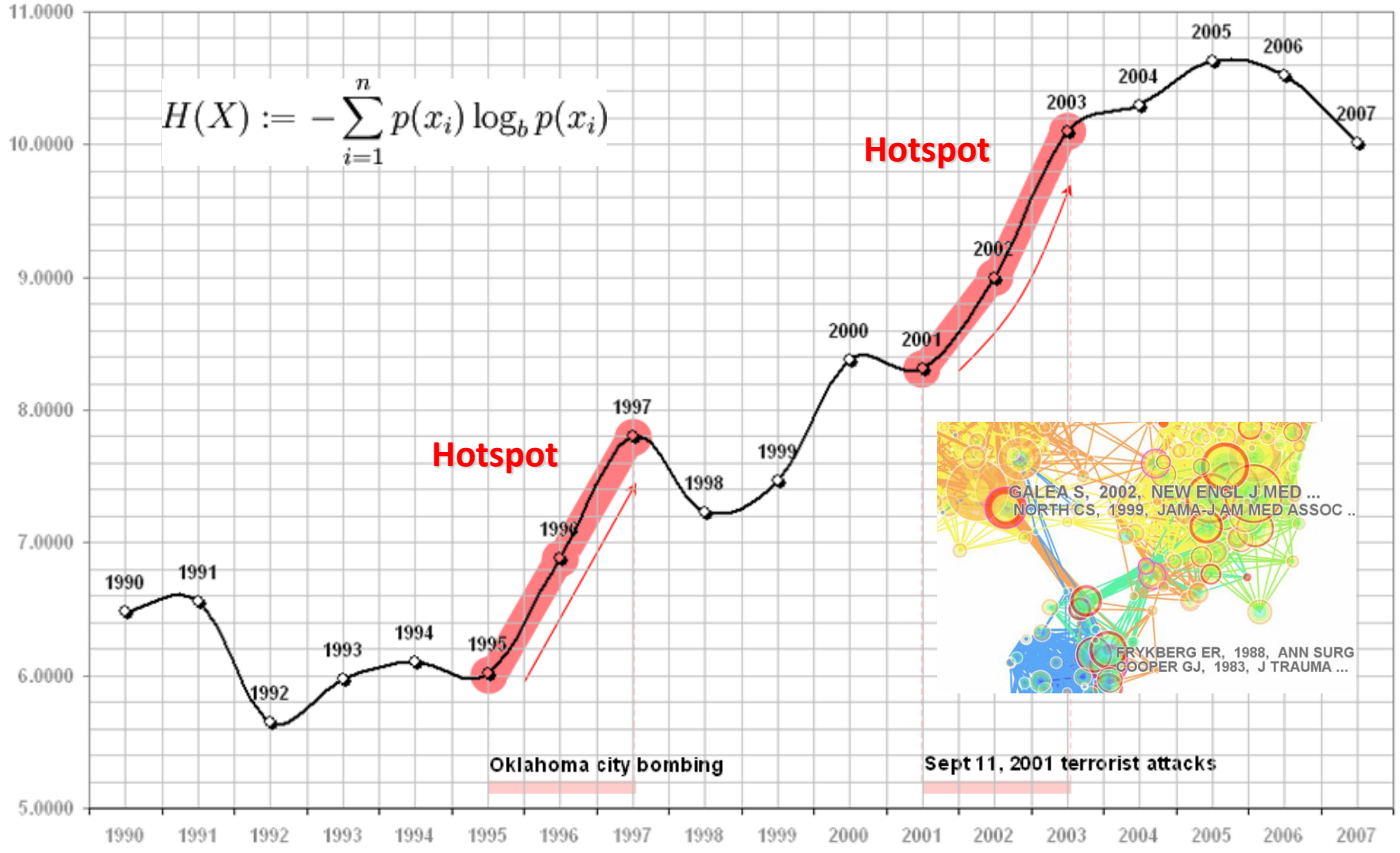

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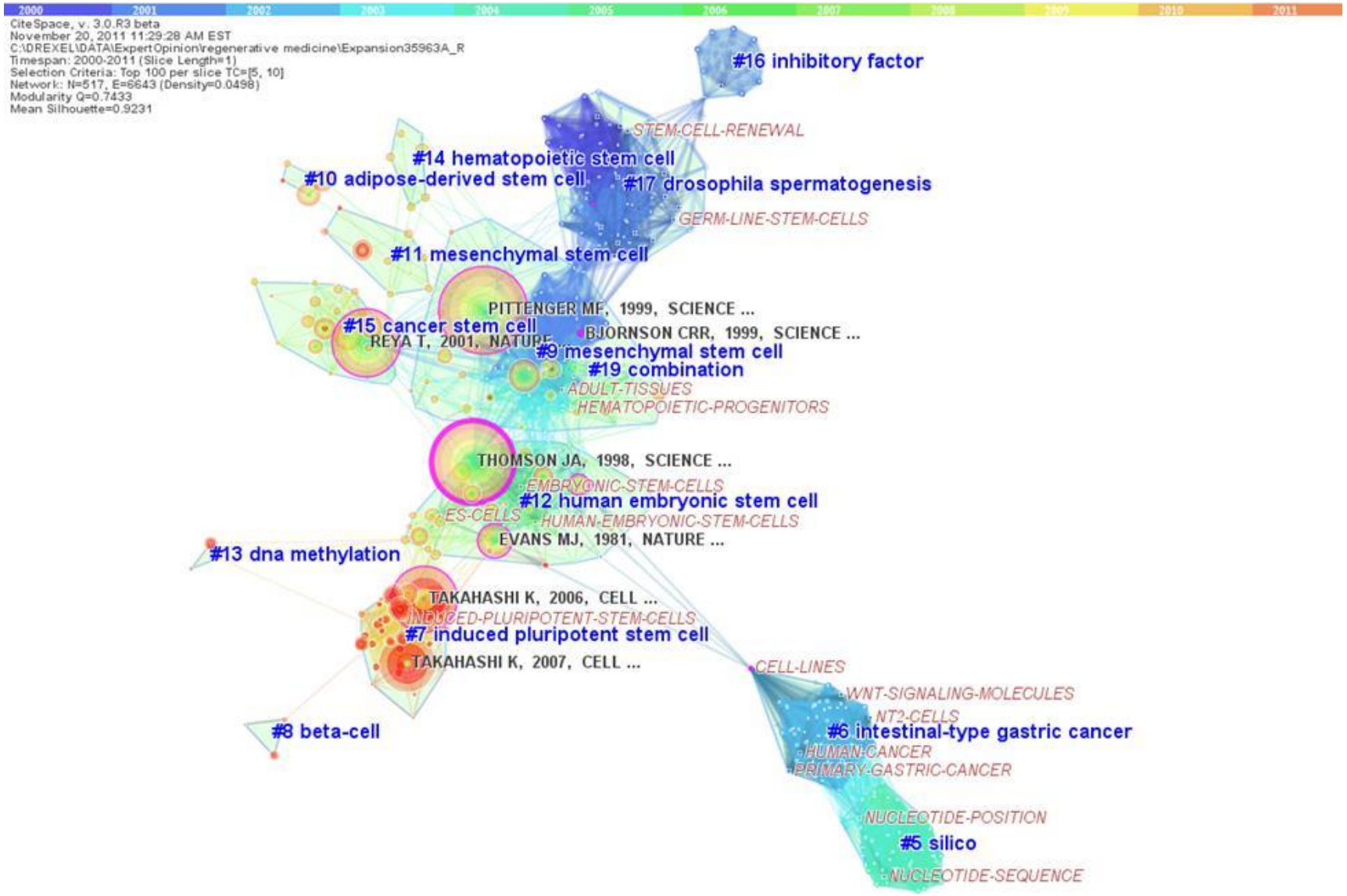

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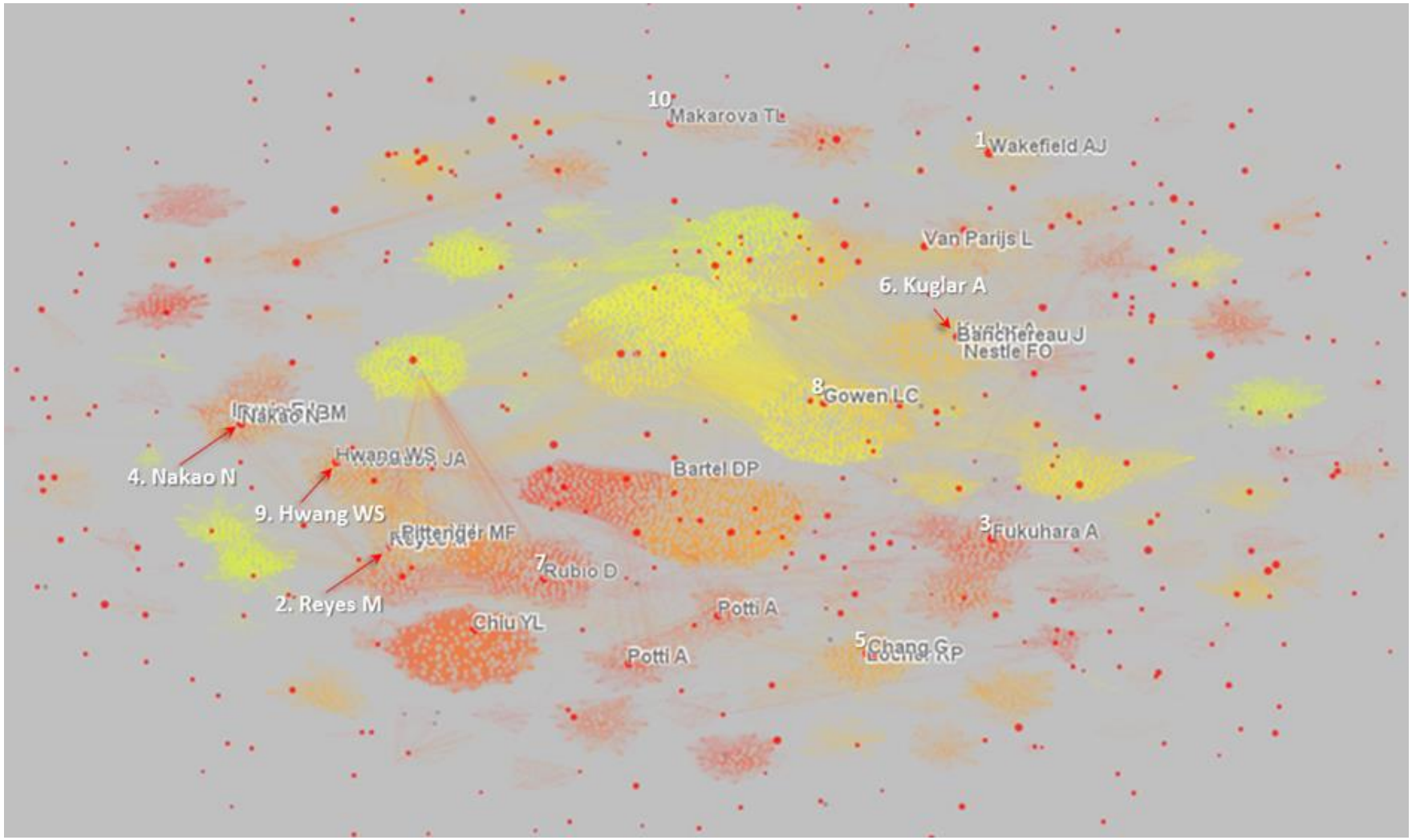

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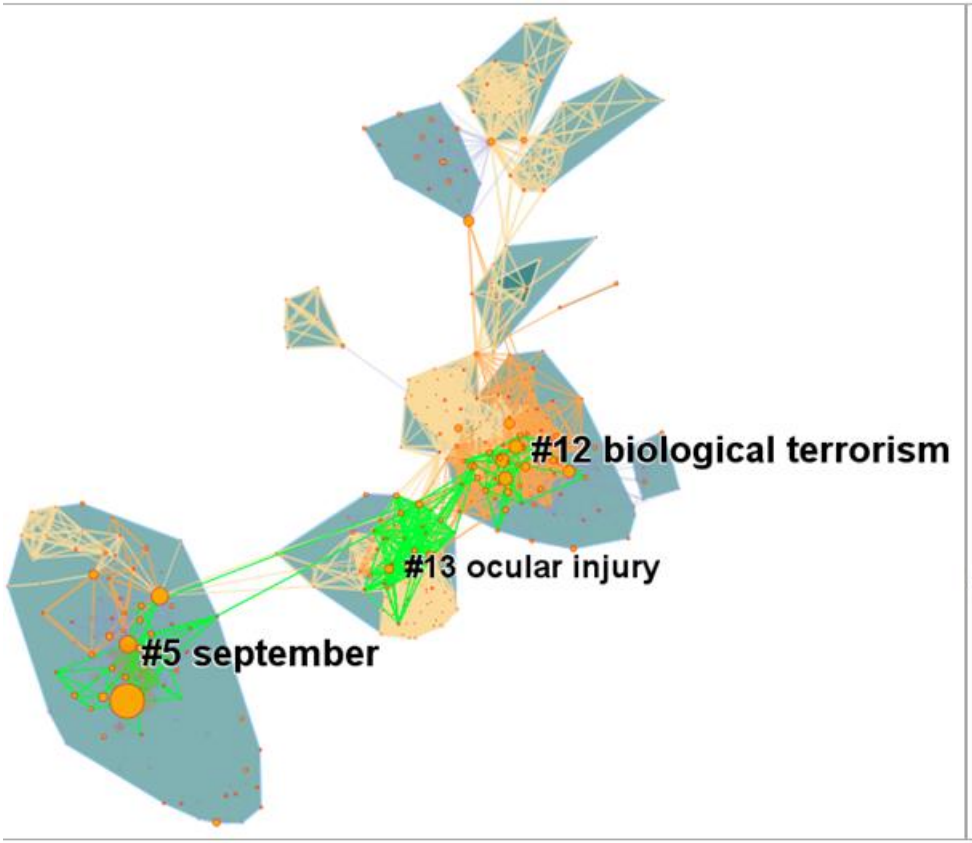

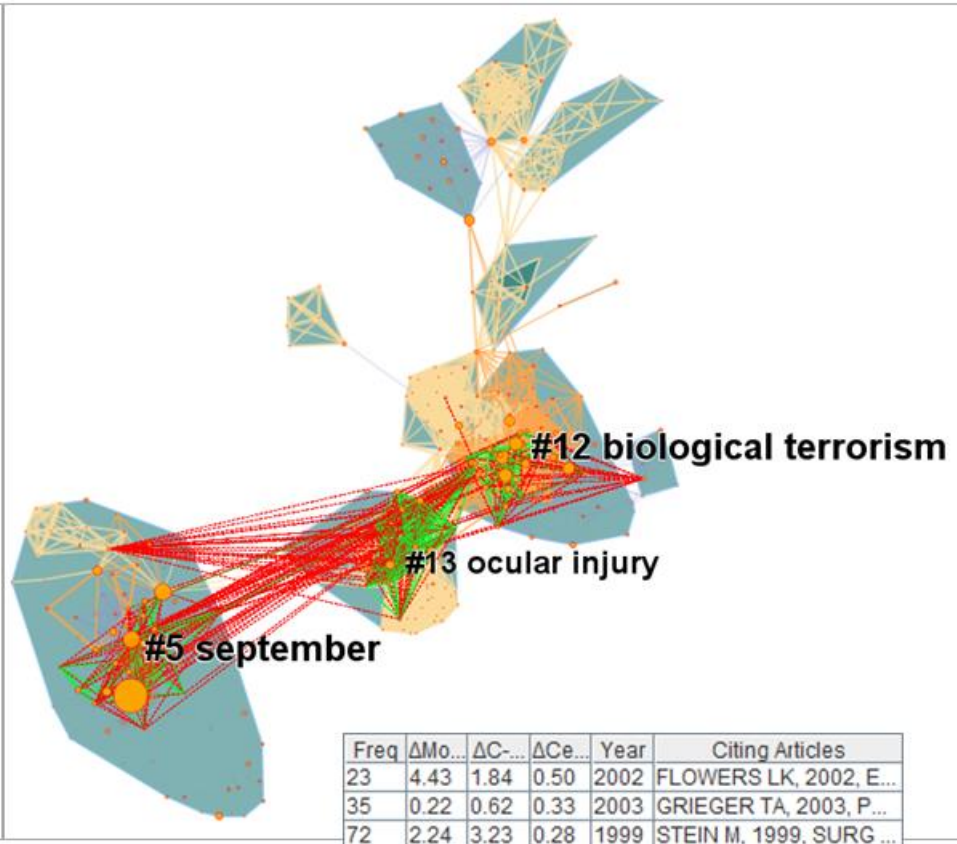

Freq	ΔMo...	ΔC-...	ΔCe...	Year	Citing Articles
23	4.43	1.84	0.50	2002	FLOWERS LK, 2002, E...
35	0.22	0.62	0.33	2003	GRIEGER TA, 2003, P...
72	2.24	3.23	0.28	1999	STEIN M, 1999, SURG ...
80	0.63	4.14	0.27	2002	AHERN J, 2002, PSYC...
23	-0.20	1.45	0.26	2003	FORD CA, 2003, ARCH...

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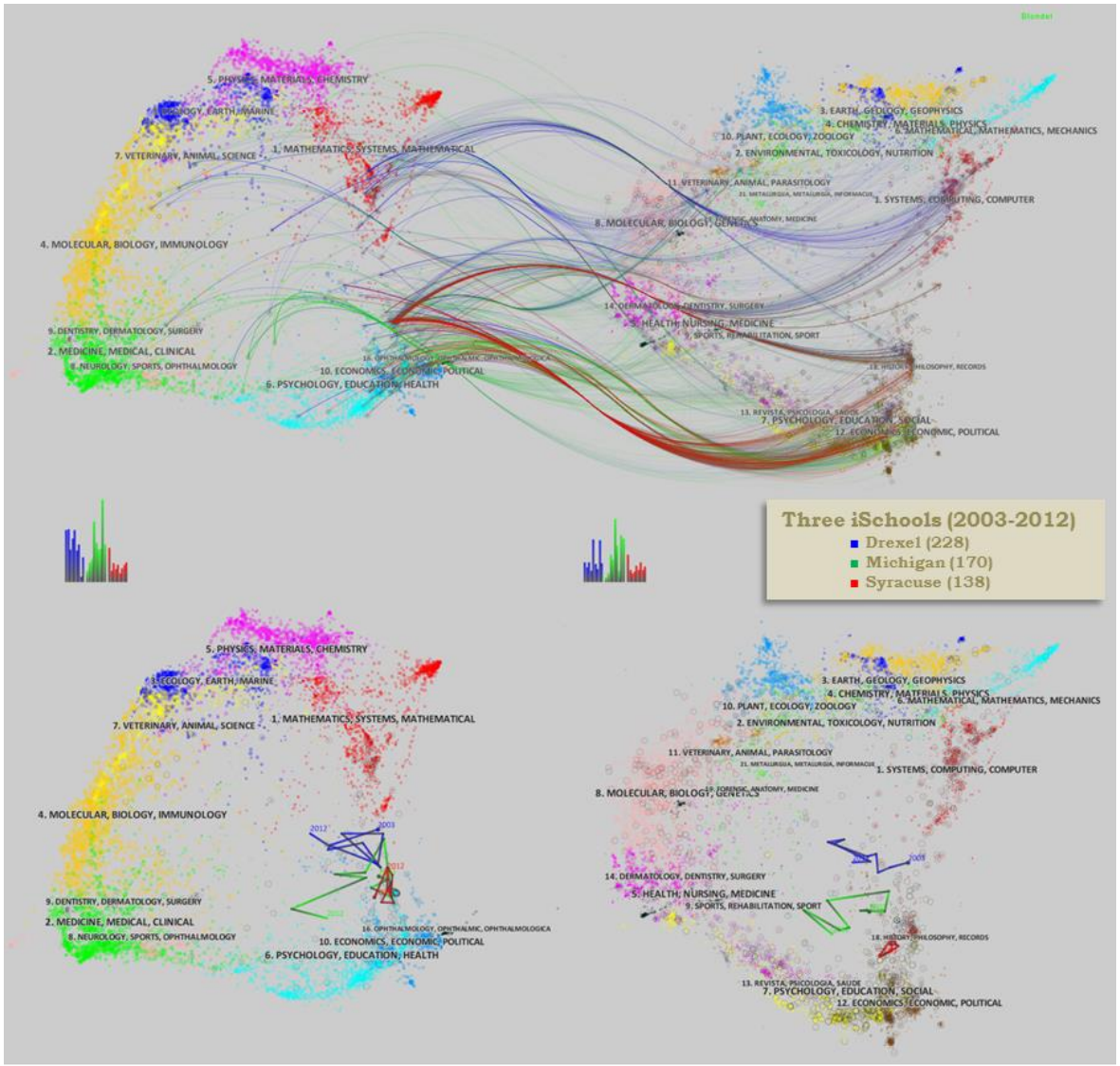

QUESTIONS AND DISCUSSIONS