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MAPPING SCIENCE EXHIBIT

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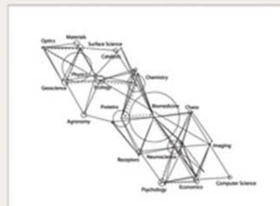
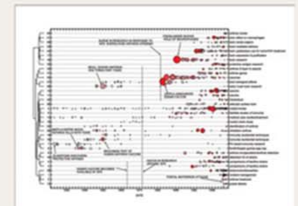
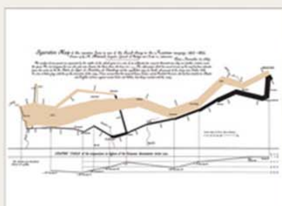
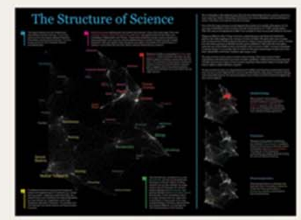
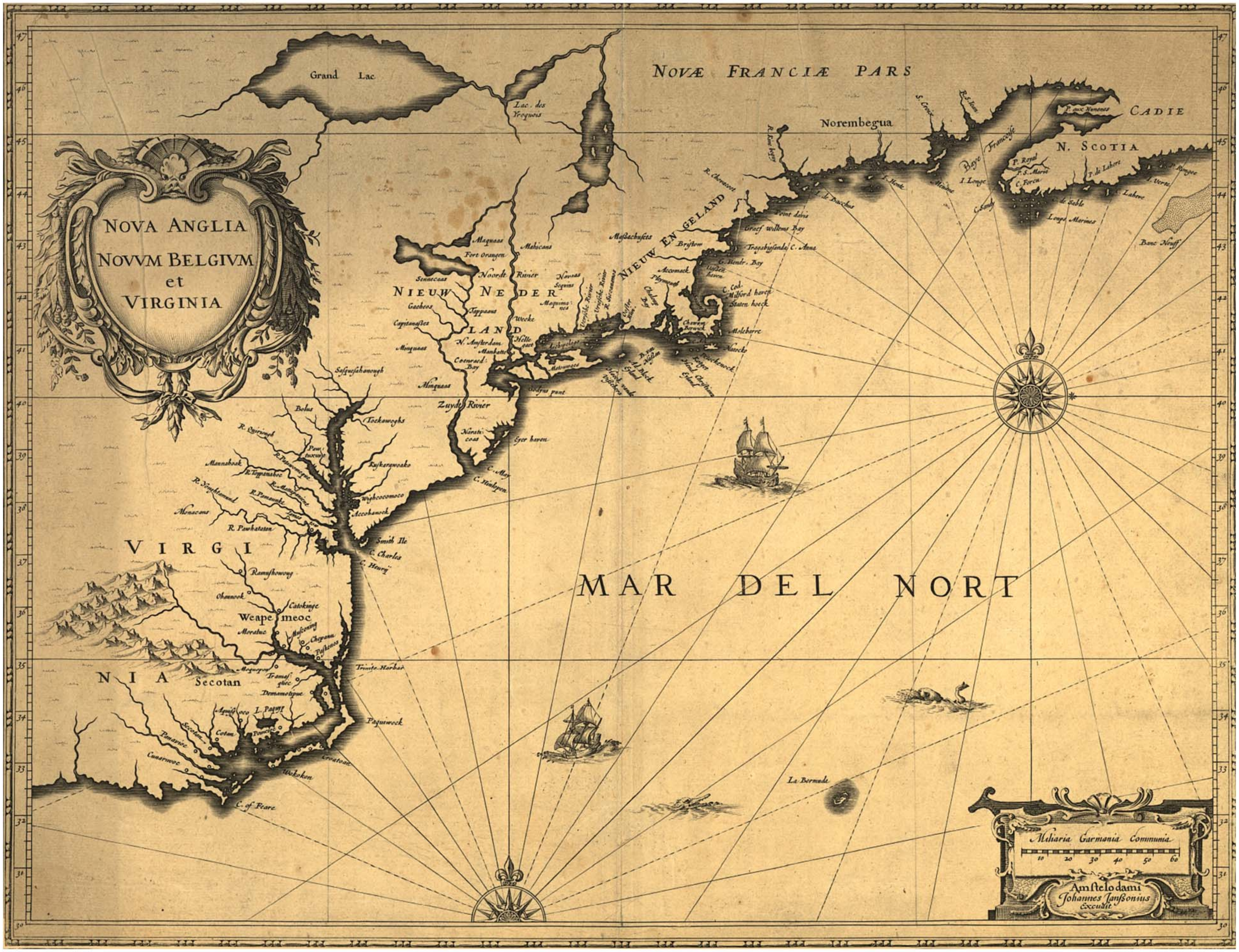






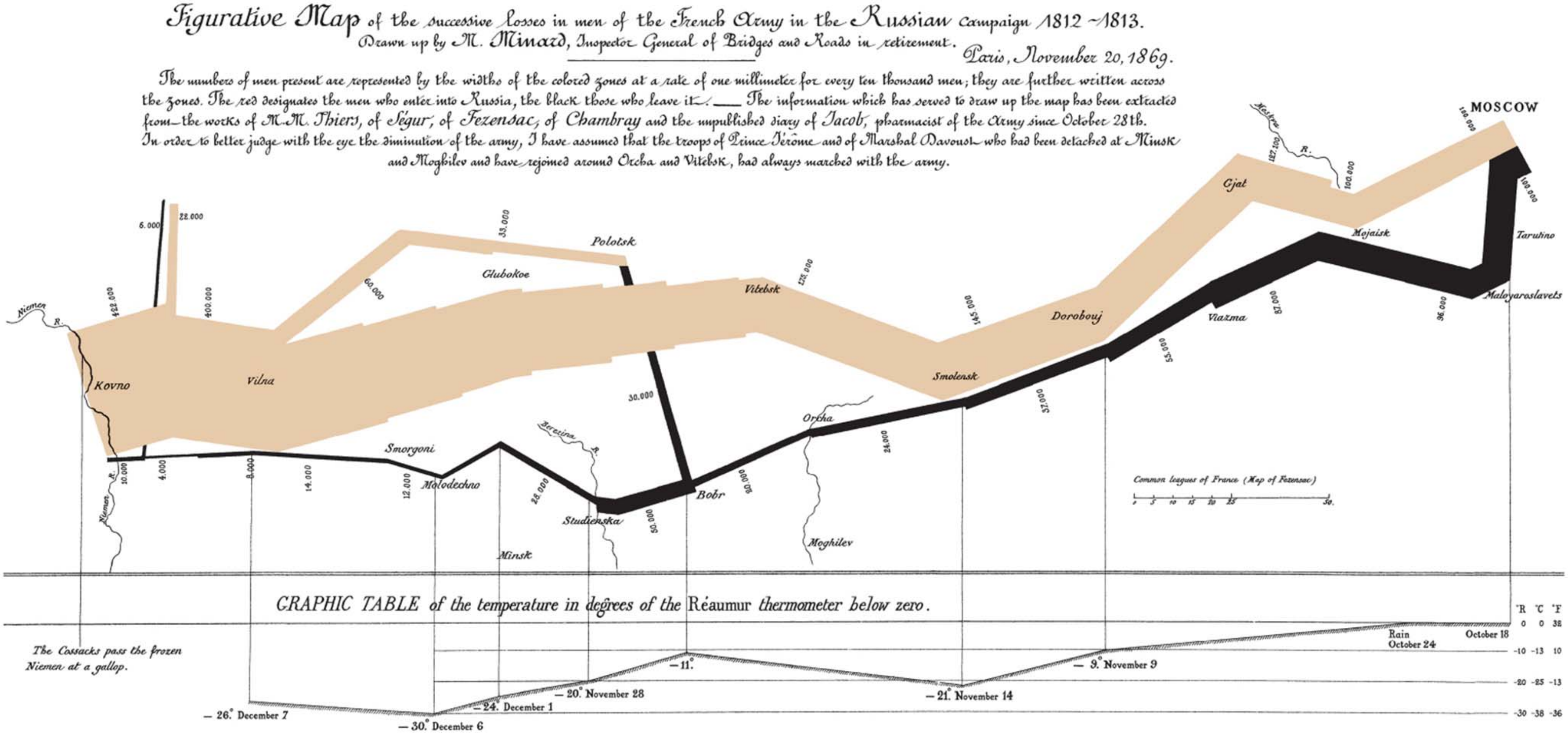


Cosmographia World Map - Claudius Ptolemy - 1482

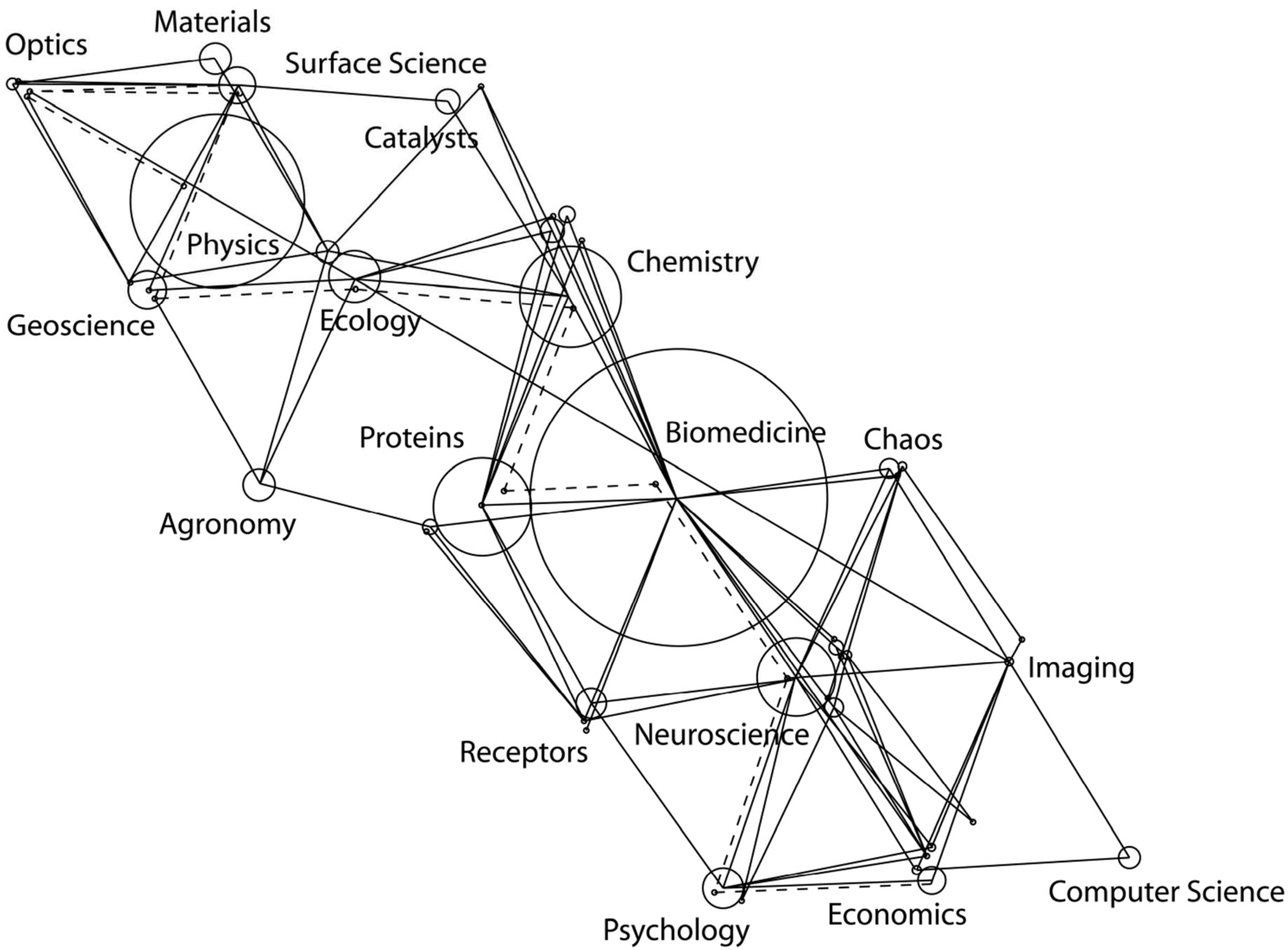


Nova Anglia, Novvm Belgivm et Virginia - Jan Jannson - 1642

A New Map of the Whole World with Trade Winds According to the Latest and Most Exact Observations - Herman Moll - 1736

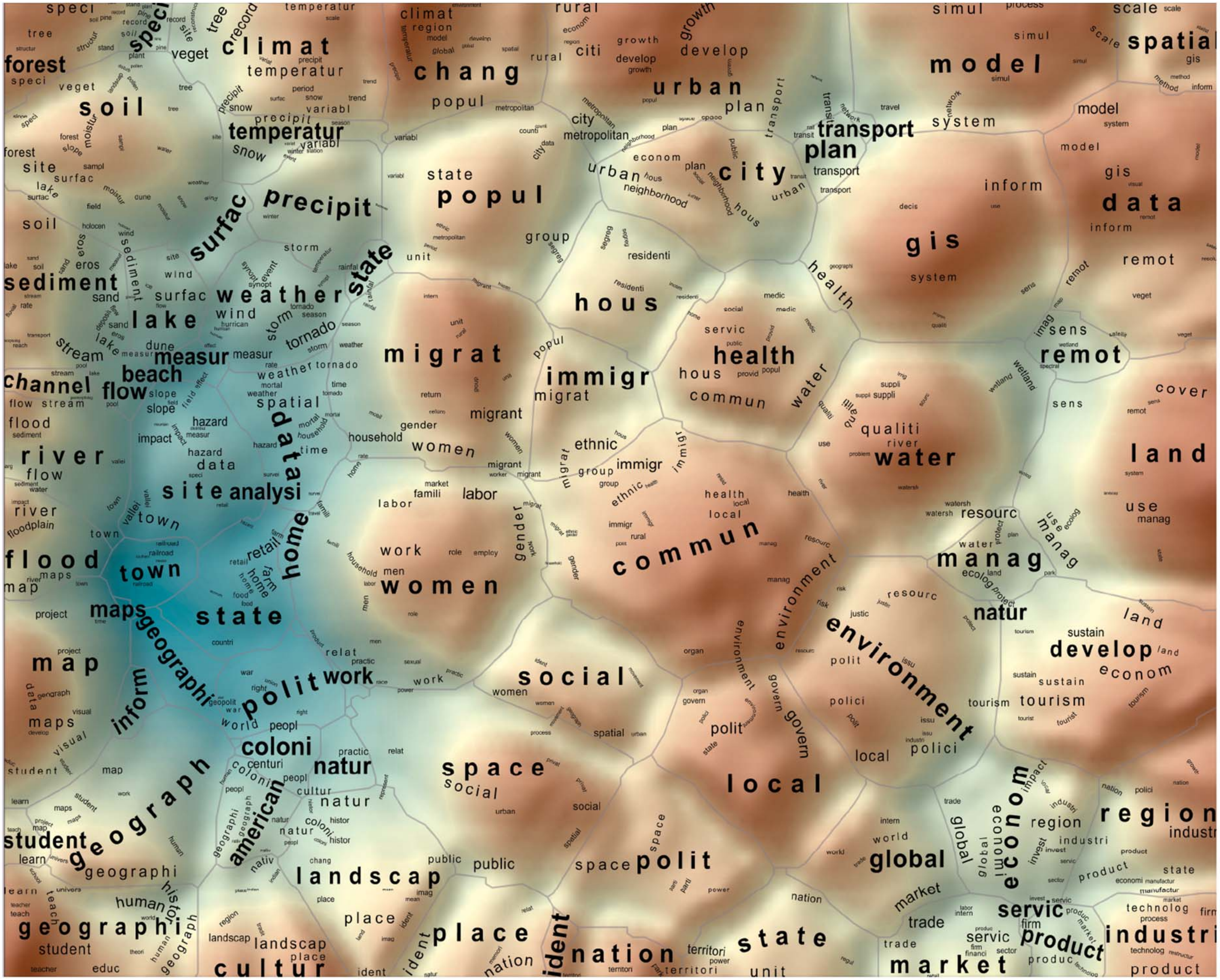


Napoleon's March to Moscow - Charles Joseph Minard - 1869

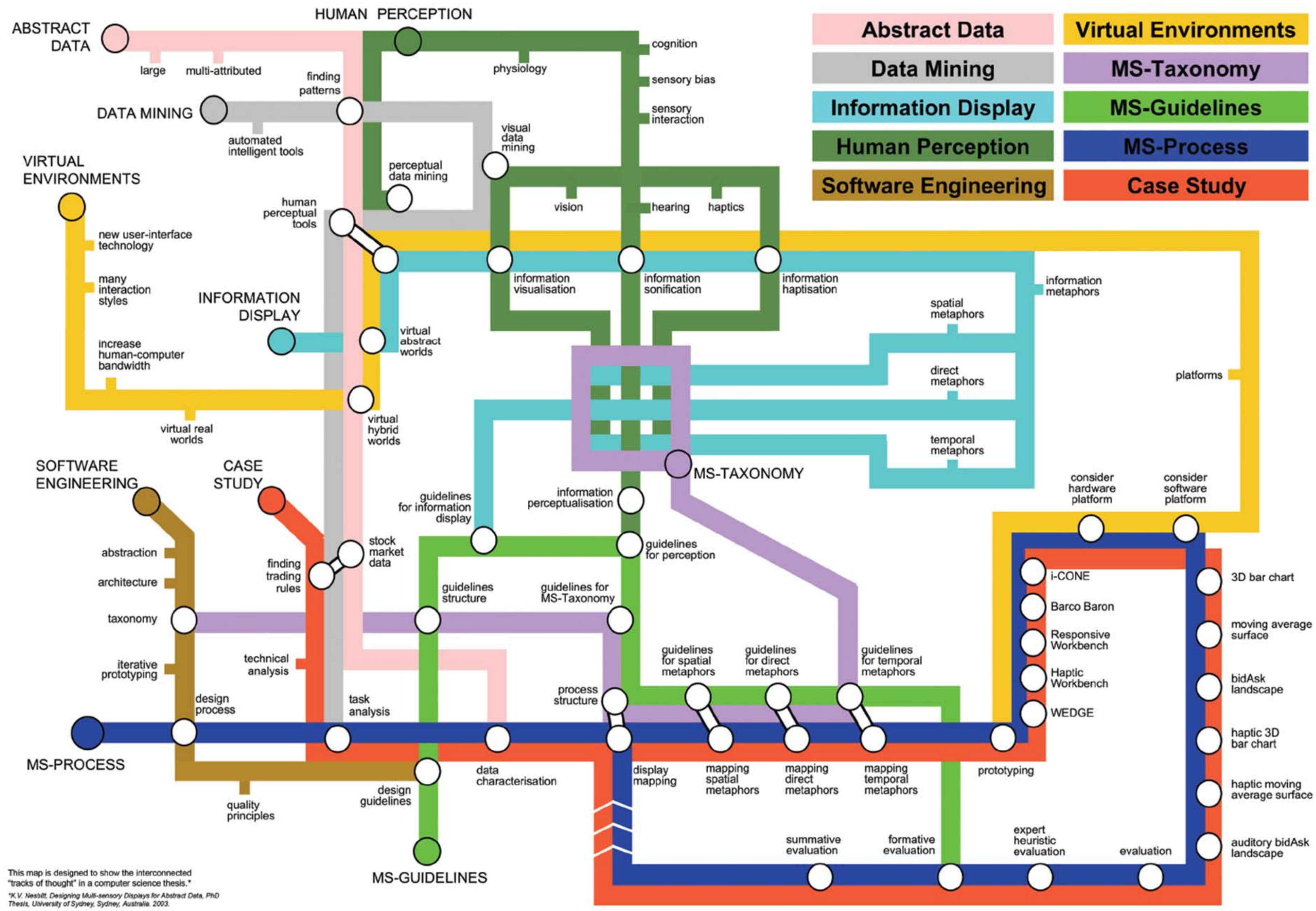


A Network Representation of the 43 Fourth Level Clusters Based on Data from the 1996 Science Citation Index - Henry Small - 1999

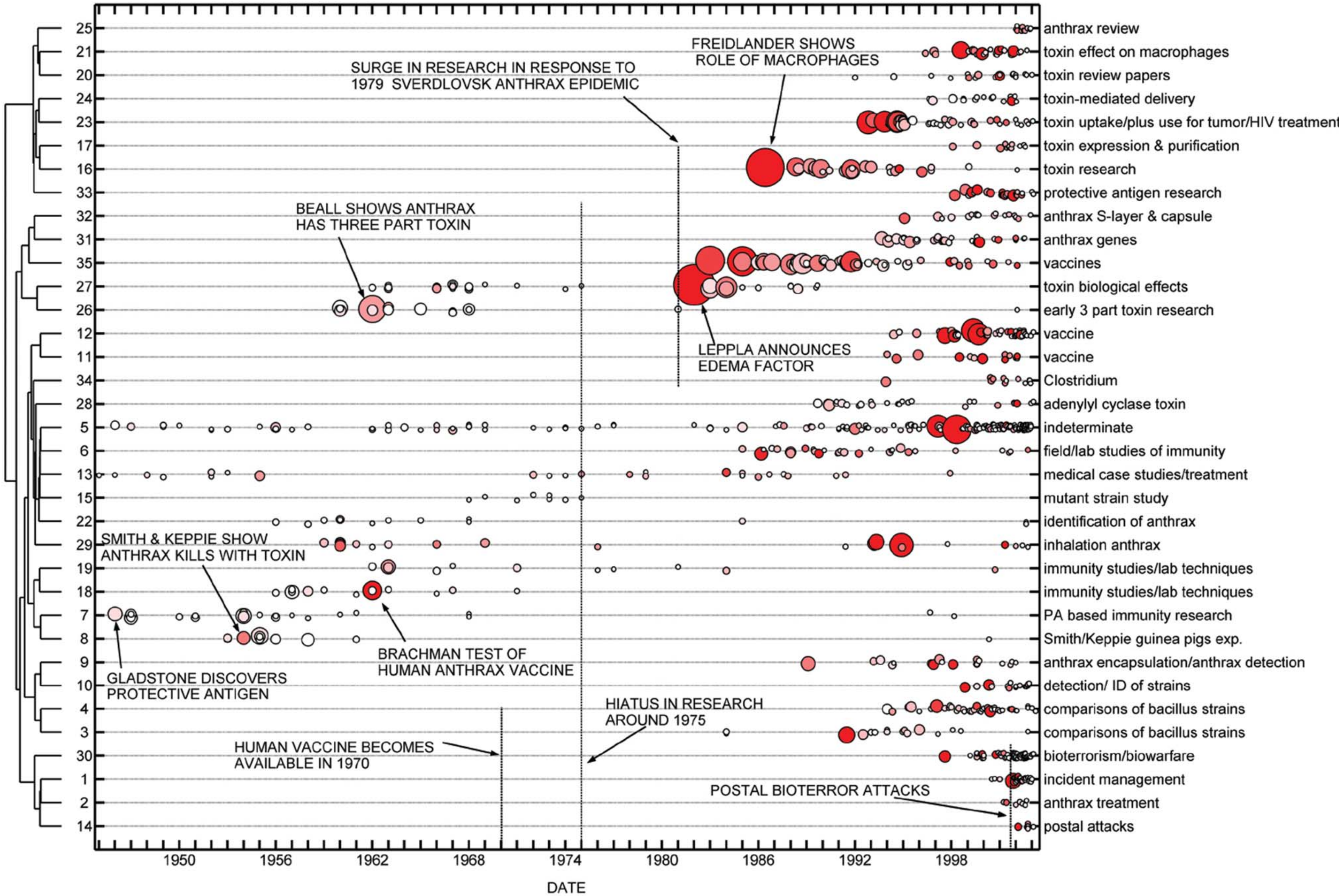
Treemap View of 2004 Usenet Returnees - Marc Smith, Danyel Fisher, Tony Capone - 2005



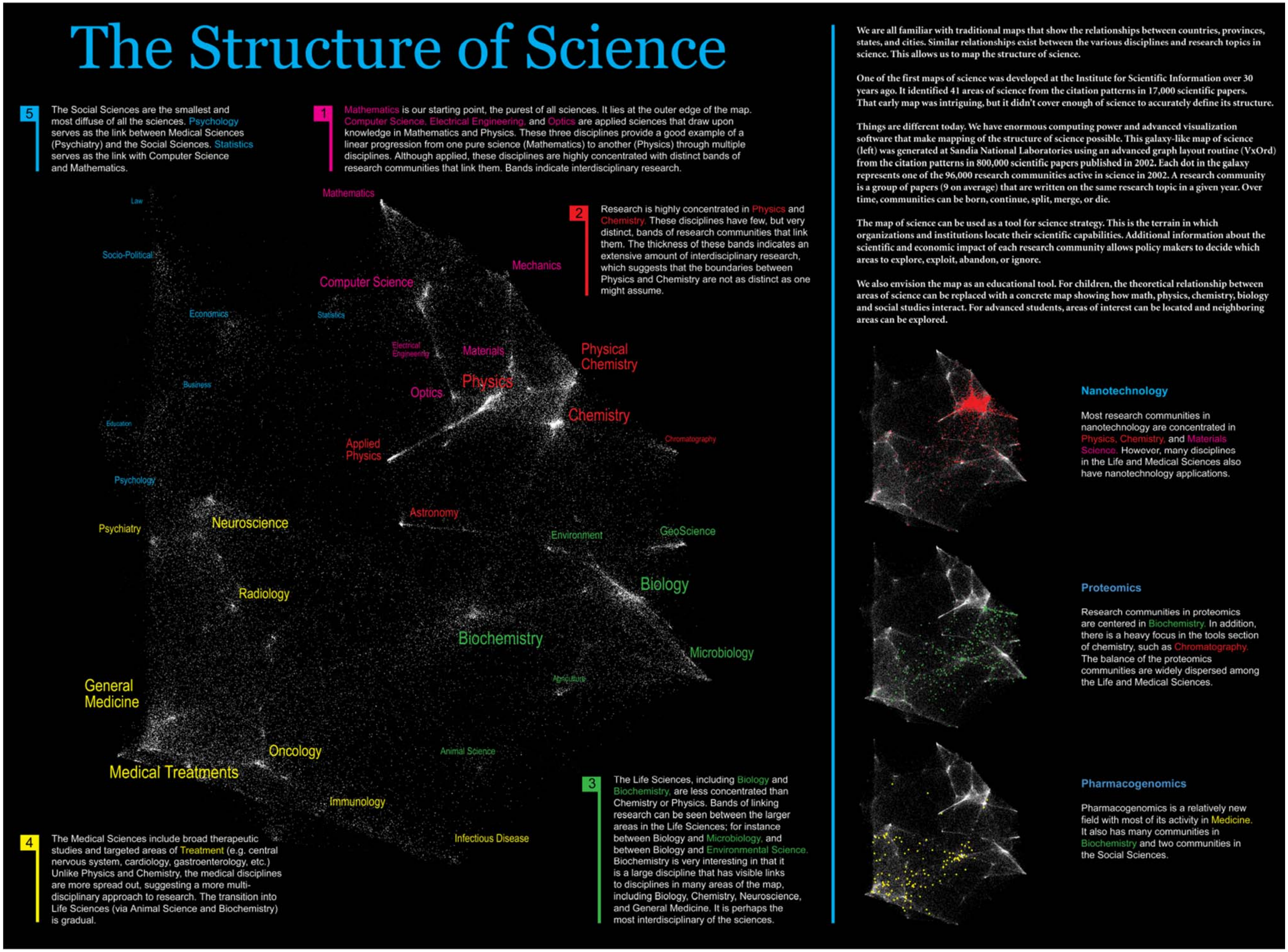
In Terms of Geography - Andre Skupin - 2005



Ph.D. Thesis Map - Keith B. Nesbitt - 2004



Timeline of 60 Years of Anthrax Research Literature - Steven Morris - 2005



The Structure of Science - Kevin Boyack, Richard Klavans - 2005

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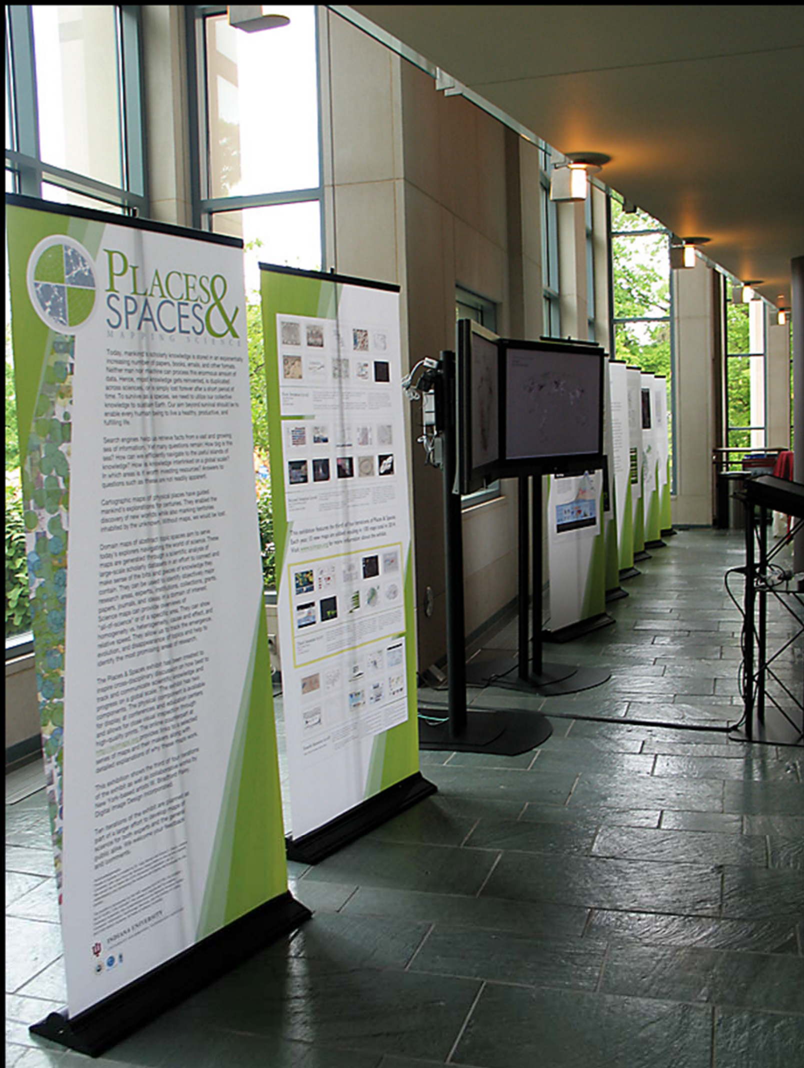

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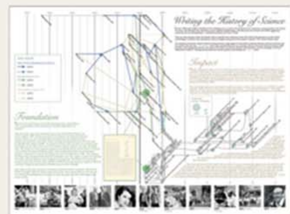
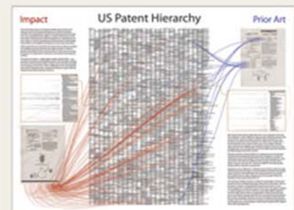
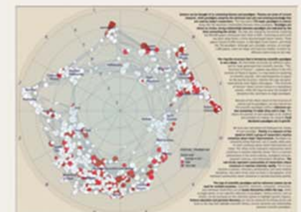
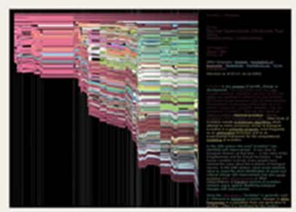
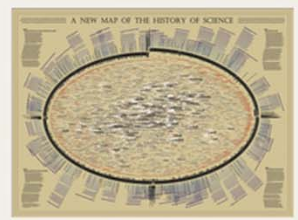
The *P*ower of Reference Systems 2006

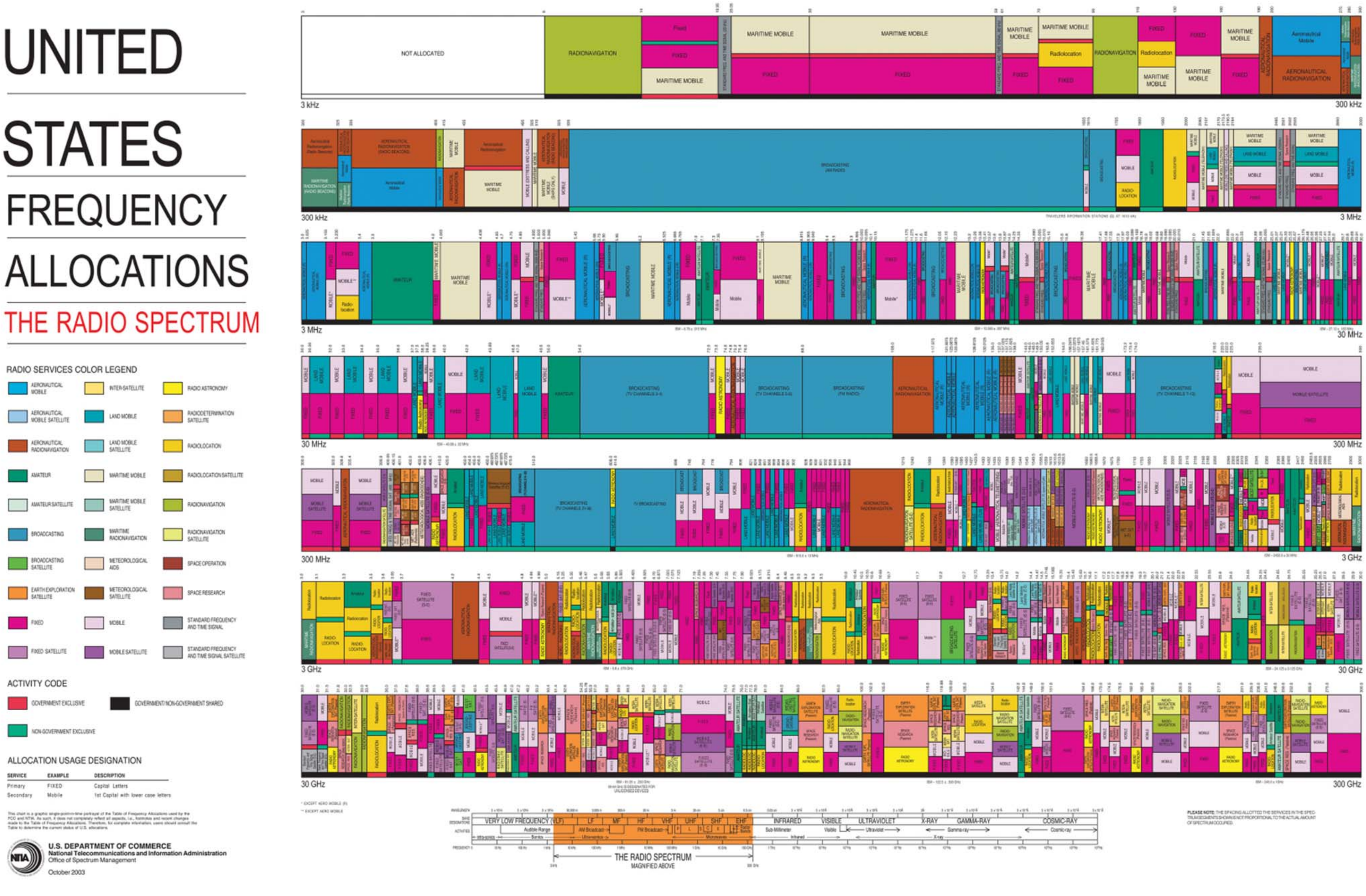




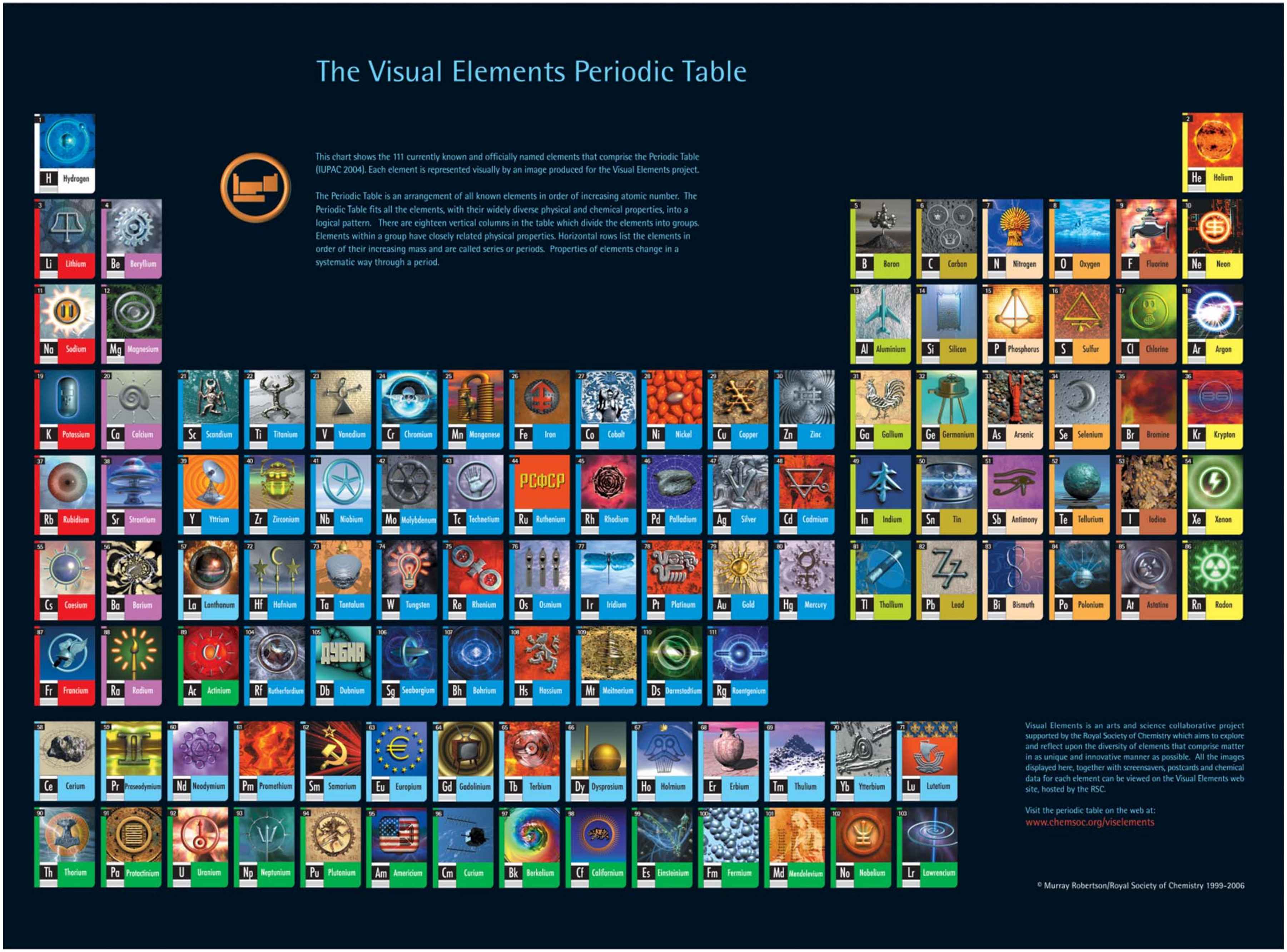




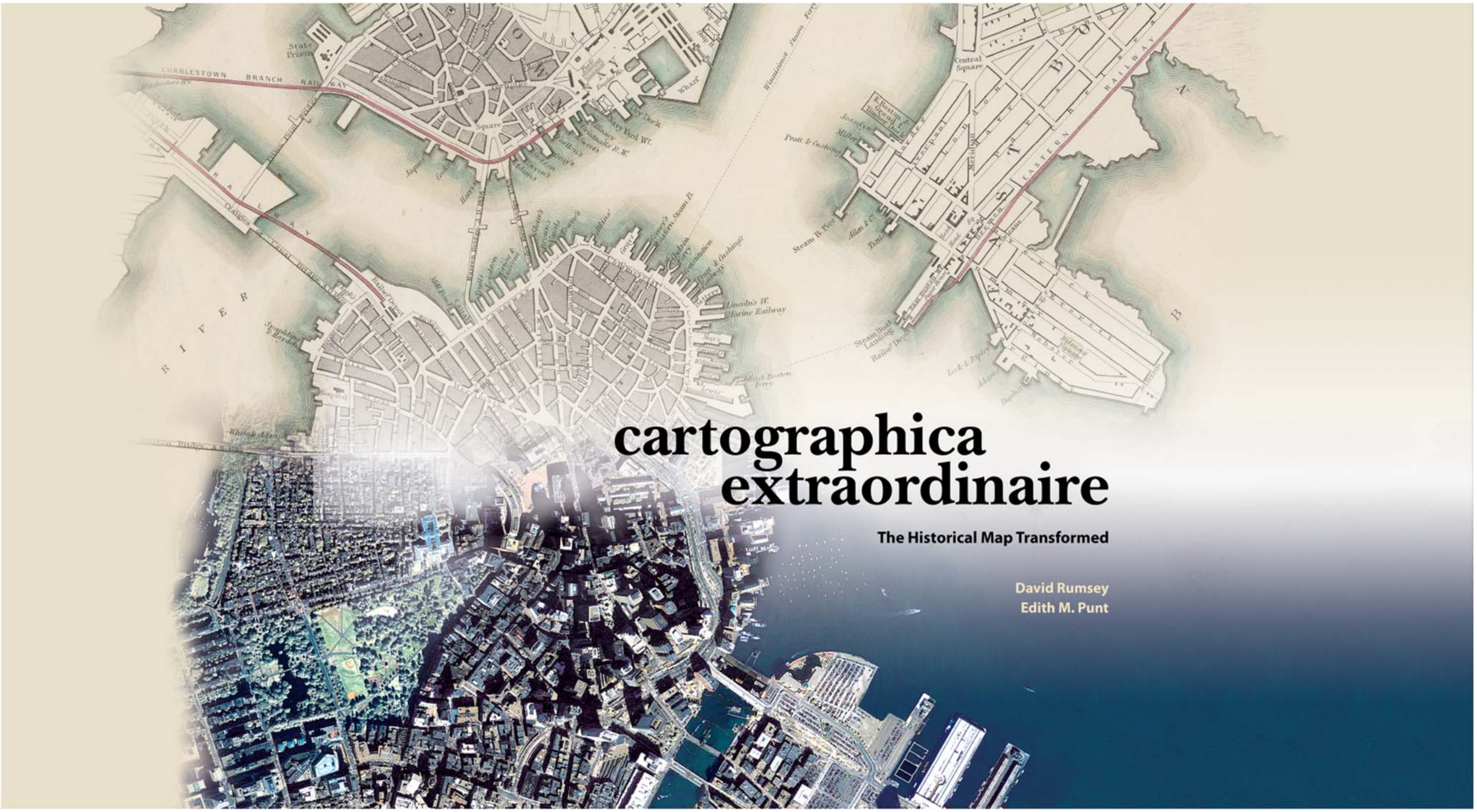




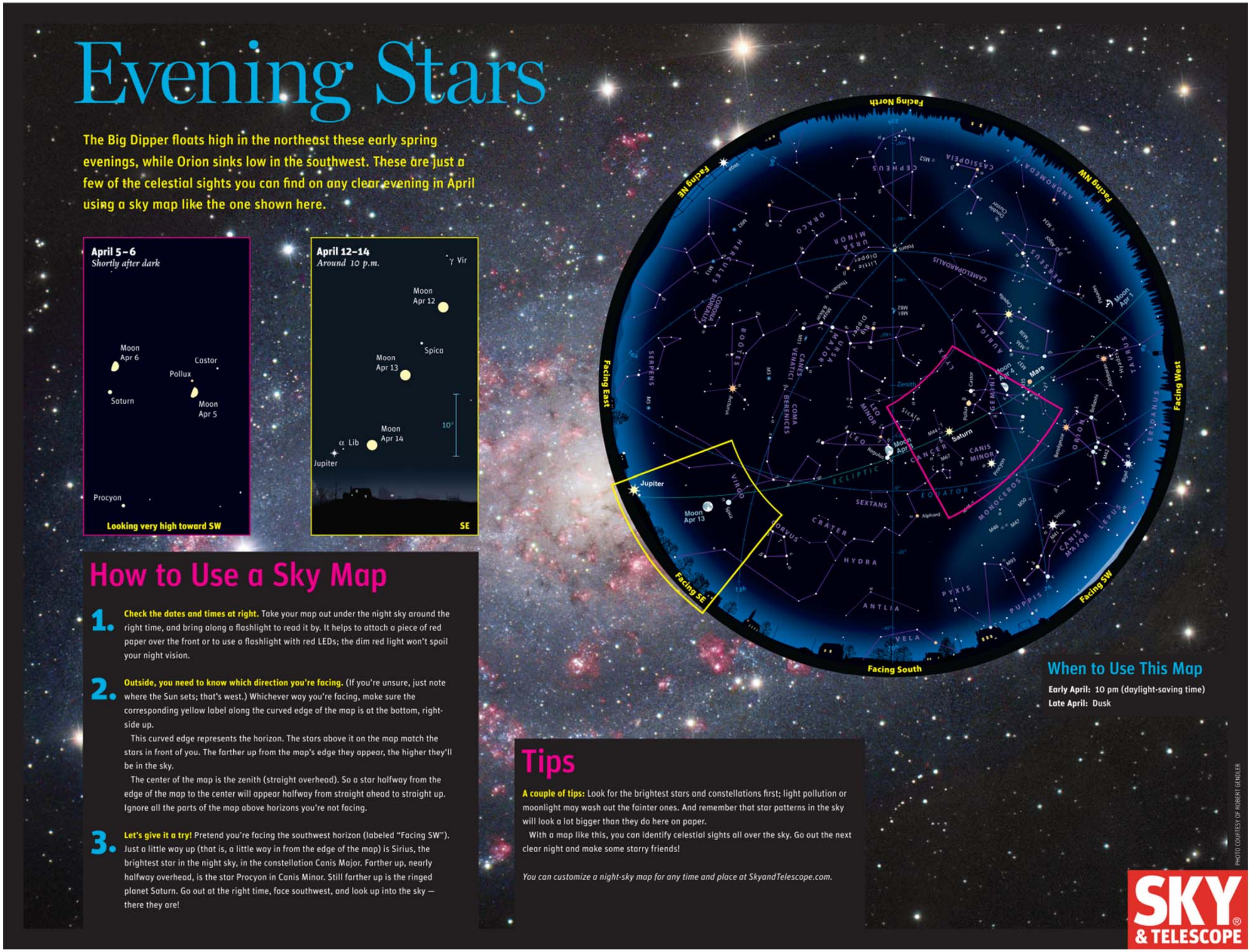
U.S. Frequency Allocations Chart - National Telecommunications and Information Administration - 2003



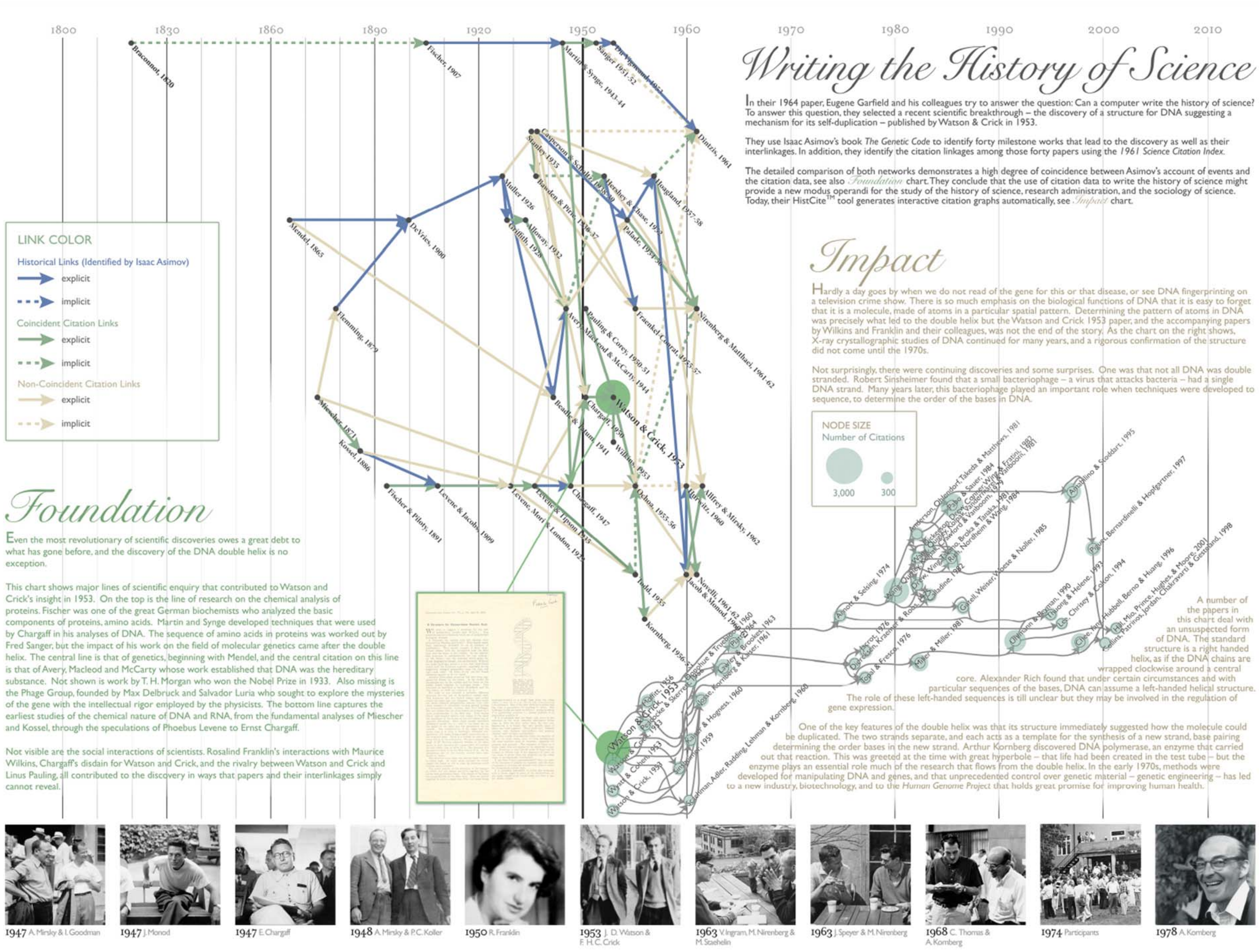
Visual Elements Periodic Table - Murray Robertson, John Emsley - 2005



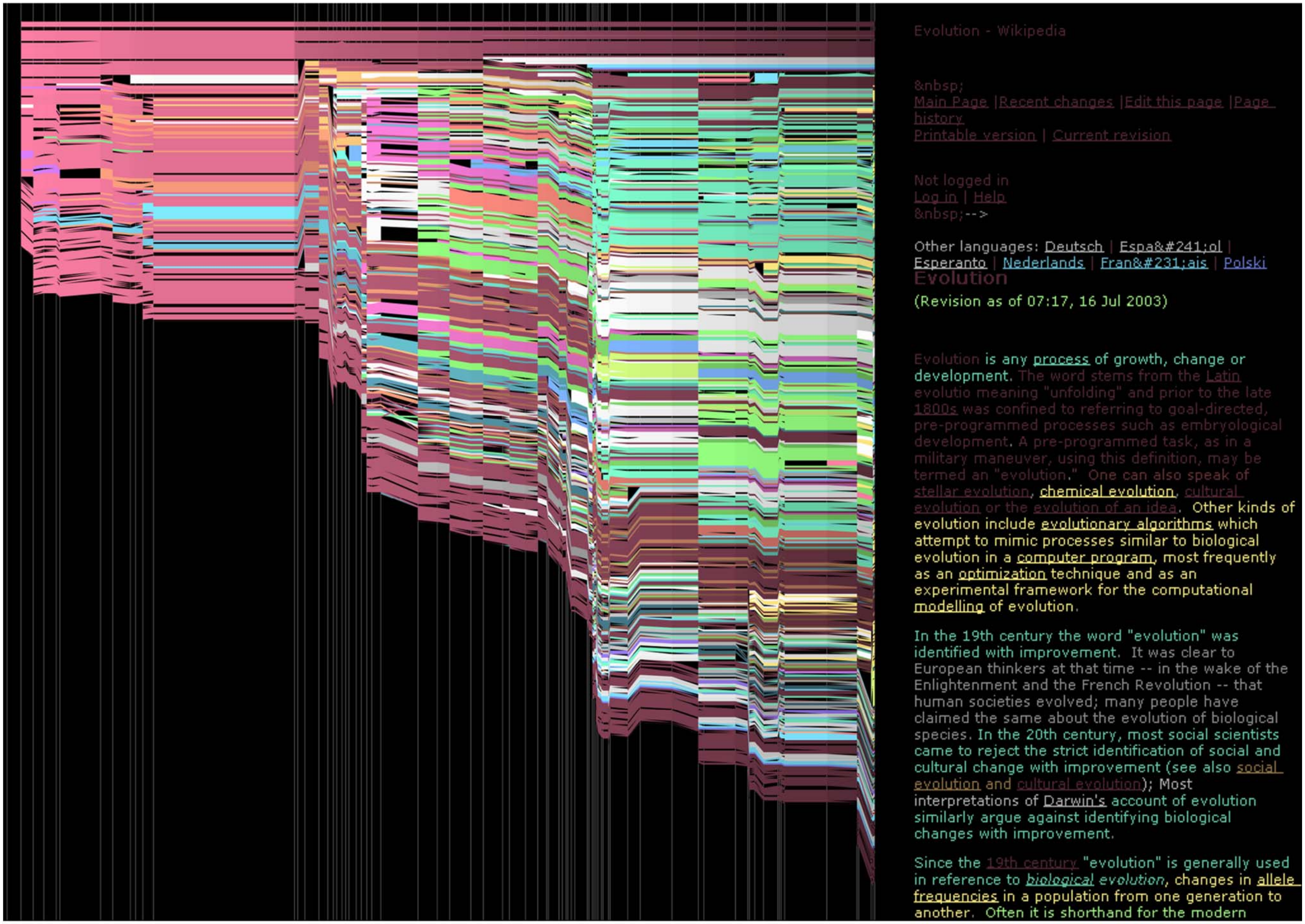
Cartographica Extraordinaire: The Historical Map Transformed - David Rumsey, Edith M. Punt - 2004



Sky Chart of New York City in April 2006 - Roger W. Sinnott, Interactive Factory - 2006



HistCite™ Visualization of DNA Development - Eugene Garfield, Elisha Hardy, Katy Borner, Ludmila Pollock, Jan Witkowski- 2006



History Flow Visualization of the Wikipedia Entry on Evolution - Martin Wattenberg, Fernanda Viegas - 2006

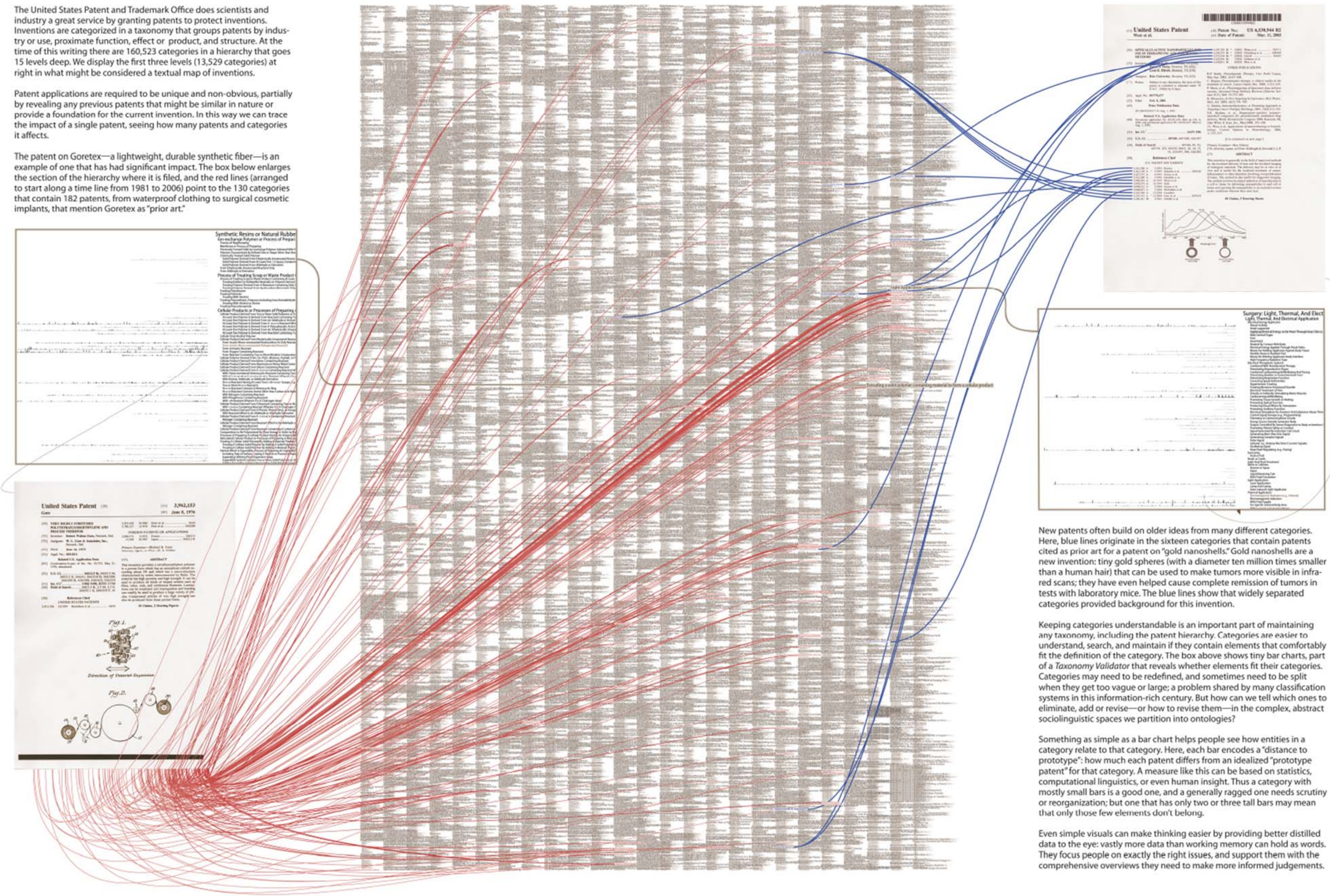
The US Patent Hierarchy

Impact

The United States Patent and Trademark Office does scientists and industry a great service by granting patents to protect inventions. Inventions are categorized in a taxonomy that groups patents by industry or use, proximate function, effect or product, and structure. At the time of this writing there are 160,523 categories in a hierarchy that goes 15 levels deep. We display the first three levels (13,529 categories) at right in what might be considered a textual map of inventions.

Patent applications are required to be unique and non-obvious, partially by revealing any previous patents that might be similar in nature or provide a foundation for the current invention. In this way we can trace the impact of a single patent, seeing how many patents and categories it affects.

The patent on Goretex—a lightweight, durable synthetic fiber—is an example of one that has had significant impact. The box below enlarges the section of the hierarchy where it is filed, and the red lines (arranged to start along a time line from 1981 to 2006) point to the 130 categories that contain 182 patents, from waterproof clothing to surgical cosmetic implants, that mention Goretex as "prior art."



Prior Art

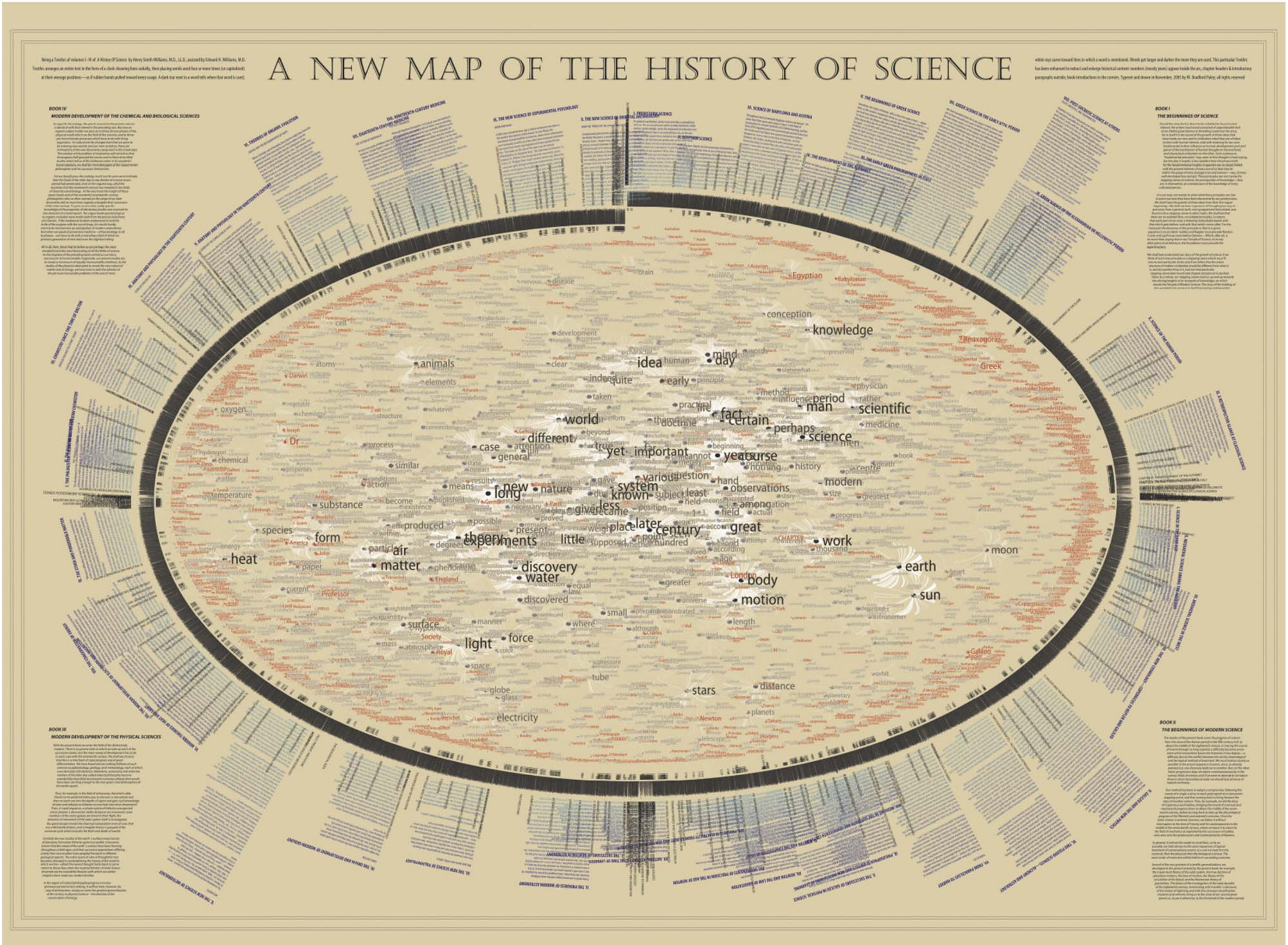
New patents often build on older ideas from many different categories. Here, blue lines originate in the sixteen categories that contain patents cited as prior art for a patent on "gold nanoshells." Gold nanoshells are a new invention: tiny gold spheres (with a diameter ten million times smaller than a human hair) that can be used to make tumors more visible in infrared scans; they have even helped cause complete remission of tumors in tests with laboratory mice. The blue lines show that widely separated categories provided background for this invention.

Keeping categories understandable is an important part of maintaining any taxonomy, including the patent hierarchy. Categories are easier to understand, search, and maintain if they contain elements that comfortably fit the definition of the category. The box above shows tiny bar charts, part of a *Taxonomy Validator* that reveals whether elements fit their categories. Categories may need to be redefined, and sometimes need to be split when they get too vague or large; a problem shared by many classification systems in this information-rich century. But how can we tell which ones to eliminate, add or revise—or how to revise them—in the complex, abstract sociolinguistic spaces we partition into ontologies?

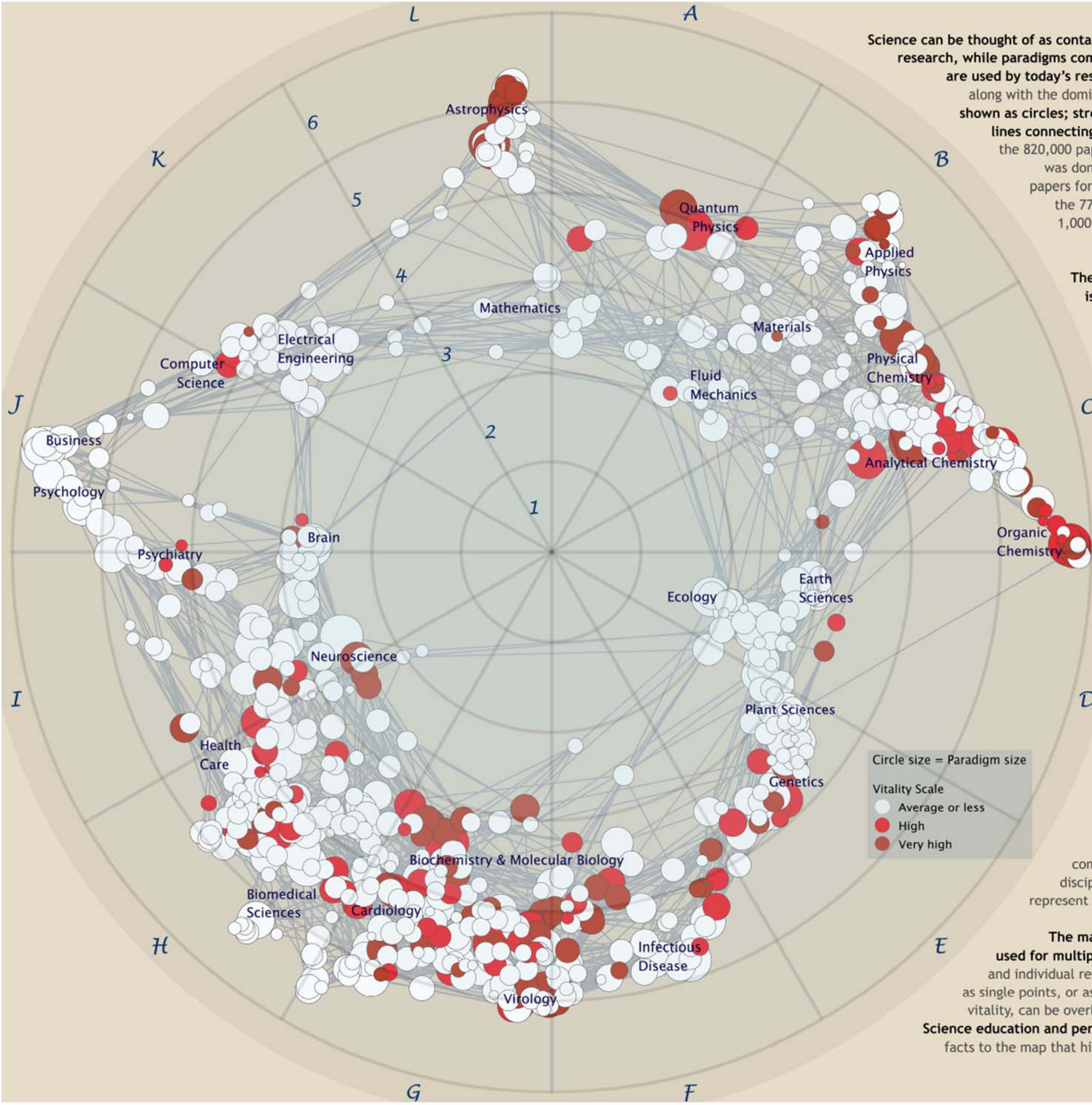
Something as simple as a bar chart helps people see how entities in a category relate to that category. Here, each bar encodes a "distance to prototype": how much each patent differs from an idealized "prototype patent" for that category. A measure like this can be based on statistics, computational linguistics, or even human insight. Thus a category with mostly small bars is a good one, and a generally ragged one needs scrutiny or reorganization; but one that has only two or three tall bars may mean that only those few elements don't belong.

Even simple visuals can make thinking easier by providing better distilled data to the eye: vastly more data than working memory can hold as words. They focus people on exactly the right issues, and support them with the comprehensive overviews they need to make more informed judgements.

Taxonomy Visualization of Patent Data - Katy Borner, Elisha Hardy, Bruce Herr, Todd Holloway, Bradford Paley - 2006



TexArc Visualization of "The History of Science" - W. Bradford Paley - 2006



Science can be thought of as containing themes and paradigms. Themes are areas of current research, while paradigms comprise the dominant tool sets and existing knowledge that are used by today's researchers. This map shows **776 major paradigms in science** along with the dominant relationships between these paradigms. **Paradigms are shown as circles; strong relationships between paradigms are indicated by the lines connecting the circles.** The map was created by recursively clustering the 820,000 papers referenced most often in 2003. Clustering at each level was done using VxOrd, a force-directed graph layout routine. These papers formed 53,000 clusters, 6,100 higher-level clusters, and finally the 776 paradigms. Although each paradigm contains, on average, 1,000 papers, some are larger and some are smaller, as shown by different sized circles on the map.

The ring-like structure that is formed by scientific paradigms is very robust. We find similar structures for different years, and for maps generated from scientific journals. "The Structure of Science", a galaxy map shown in the first iteration of Places & Spaces, is a map based on clustering of scientific journals, with superimposition of papers on the journal structure, whereas this map was generated directly from highly-cited papers. "The Structure of Science" shows current science in a disciplinary context, while this map can show the breadth of disciplines that contribute to single paradigms.

Because of the robust nature of the structure of science and its paradigms, we have placed our 776 scientific paradigms within a **reference system containing 12 radial slices and 6 rings.** This allows the position of each paradigm to be codified and available for lookup; for instance ***Fluid Mechanics* paradigms are in grid B3**.

We have also calculated and displayed the vitality of each paradigm. ***Vitality* is a measure of the speed at which a group of researchers reaches consensus about major improvements.** Paradigms are constantly being improved, but it usually takes years to reach consensus about which improvements are major. The white circles represent communities where consensus is reached relatively slowly. This is a common phenomenon in the social sciences, ecological sciences, computer sciences, and mathematics disciplines. **The red circles represent communities of researchers where consensus is reached relatively rapidly.** This is more common in physics, chemistry, biochemistry, and many medical disciplines. Very dark circles (such as those in *Astrophysics, L5-6*) represent communities where consensus is reached extremely quickly.

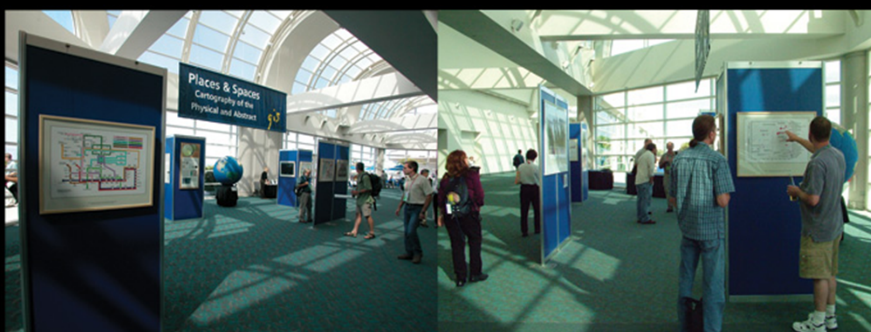
The map of scientific paradigms and its reference system can be used for multiple purposes. Countries, industries, companies, universities, and individual researchers can all **locate themselves within the map**, either as single points, or as a specific collection of paradigms. Various metrics, such as vitality, can be overlayed on this reference system to highlight specific impacts. **Science education and personal discovery** can also be enhanced by linking stories and facts to the map that highlight scientific history, current advances and relationships between scientific paradigms.

Map of Scientific Paradigms - Kevin W. Boyack, Richard Klavans - 2006

Zones of Invention: Patterns of Patents - Ingo Gunther - 2006

Exhibit Venues

101st Annual Meeting of the Association of American Geographers, Denver, CO.
April 5th - 9th, 2005 (First showing of Places & Spaces)

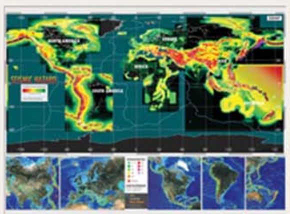


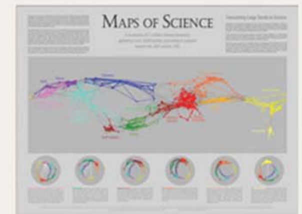
ESRI International User Conference, San Diego Convention Center in San Diego, CA.
July 25th - 29th, 2005

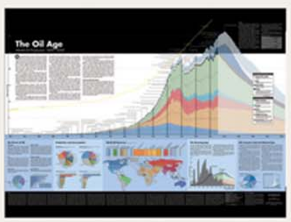
New York Hall of Science, Queens, NY
December 9th, 2006 - February 25th, 2007

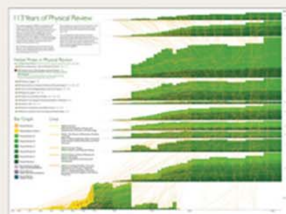
Science, Industry and Business Branch of The New York Public Library, New York City
April 3rd - August 30th, 2006

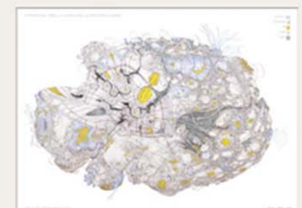
The Power of Forecasts 2007

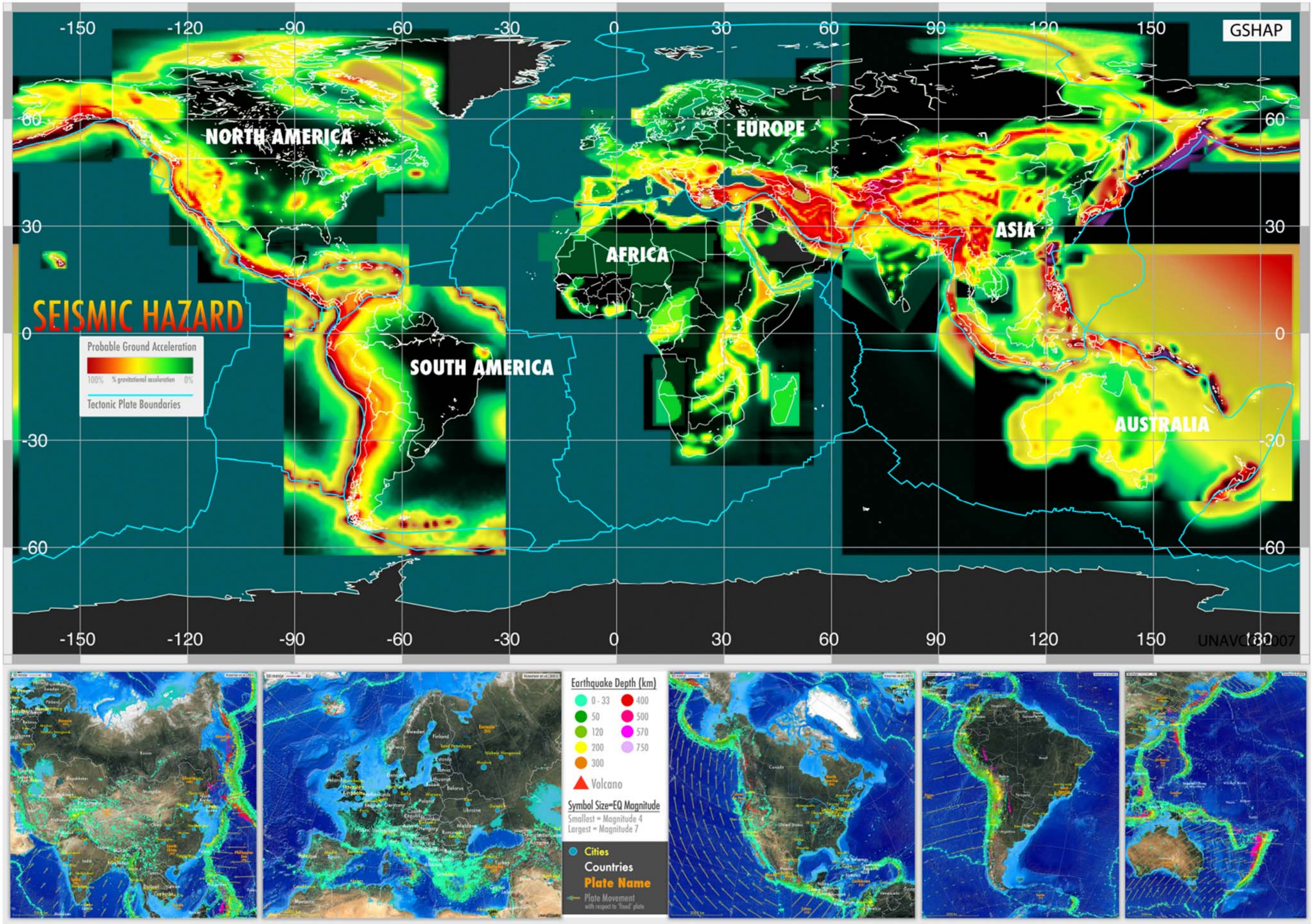




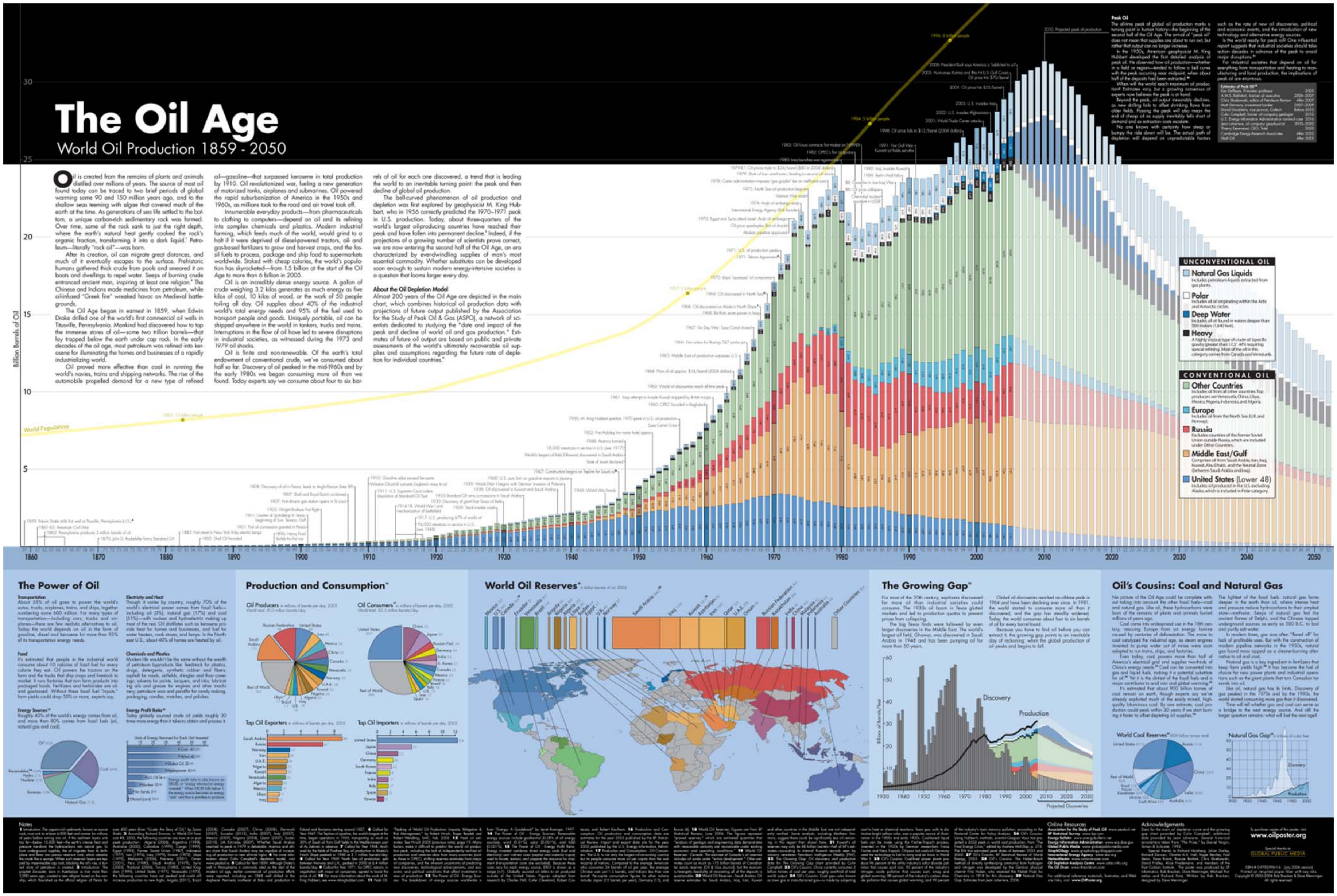








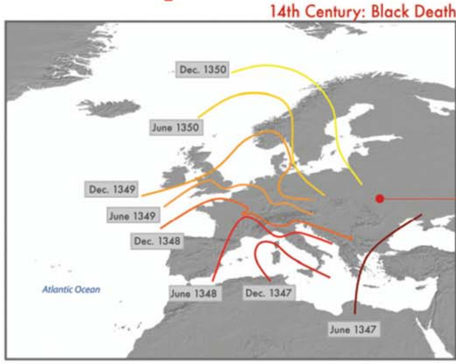
Tectonic Movements and Earthquake Hazard Predictions - Martin W. Hamburger, Lou Estey, Chuck Meertens, Elisha Hardy - 2005



The Oil Age: World Oil Production 1859-2050 - Rob Bracken, Dave Menninger, Michael Poremba, Richard Katz - 2005

Impact OF Air Travel ON Global Spread OF Infectious Diseases

14th Century: Black Death

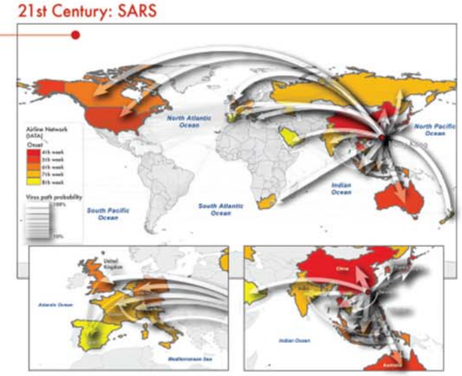


Epidemic spreading pattern changed dramatically after the development of modern transportation systems.

In pre-industrial times disease spread was mainly a spatial diffusion phenomenon. During the spread of Black Death in the 14th century Europe, only few traveling means were available and typical trips were limited to relatively short distances on the time scale of one day. Historical studies confirm that the disease diffused smoothly generating an epidemic front traveling as a continuous wave through the continent at an approximate velocity of 200-400 miles per year.

The SARS outbreak on the other hand was characterized by a patched and heterogeneous spatio-temporal pattern mainly due to the air transportation network identified as the major channel of epidemic diffusion and ability to connect far apart regions in a short time period. The SARS maps are obtained with a data-driven stochastic computational model aimed at the study of the SARS epidemic pattern and analysis of the accuracy of the model's predictions. Simulation results describe a spatio-temporal evolution of the disease (color coded countries) in agreement with the historical data. Analysis on the robustness of the model's forecasts leads to the emergence and identification of epidemic pathways as the most probable routes of propagation of the disease. Only few preferential channels are selected (arrows; width indicates the probability of propagation along that path) out of the huge number of possible paths the infection could take by following the complex nature of airline connections (light grey, source: IATA).

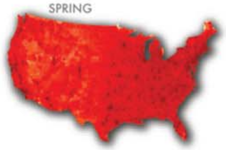
21st Century: SARS



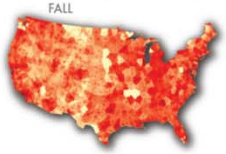
Forecasts OF THE Next Pandemic Influenza

Seasonal

SPRING



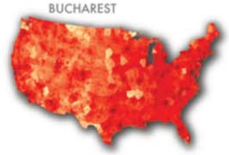
FALL



Geographical

CHICAGO

BUCHAREST



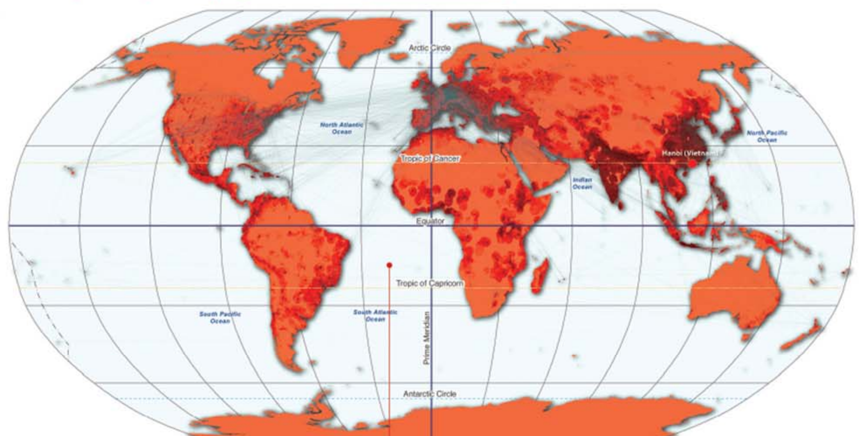
Forecasts are obtained with a stochastic computational model which explicitly incorporates data on worldwide air travel and detailed census data to simulate the global spread of an influenza pandemic.

The modeling approach considers infection dynamics (i.e., virus transmission, onset of symptoms, infectiousness, recovery, etc.) among individuals living in urban areas around the world, and assumes that individuals are allowed to travel fom one city to another by means of the airline transportation network.

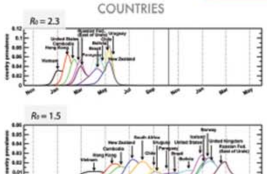
Numerical simulations provide results for the temporal and geographic evolution of the pandemic influenza in 3,100 urban areas located in 220 different countries. The model allows to study different spreading scenarios, characterized by different initial outbreak conditions, both **geographical** and **seasonal**.

The central map represents the cumulative number of cases in the world after the first year from the start of a pandemic influenza with R0=1.9 originating in Hanoi (Vietnam) in the Spring.

The US maps focus on the situation in the US after one year, and show the effect of changes in the original scenario analyzed. Different color coding is used for the sake of visualization.



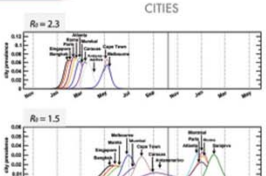
COUNTRIES



R_0=1.5 | R_0=1.9 | R_0=2.3

Time evolution of a pandemic starting in Hanoi (Vietnam) in the Fall in the no intervention scenario. Profiles of the fraction of infectious individuals in time (prevalence) are shown for some representative countries (left) and cities (right). Two different values of the reproductive number are considered: R_0=1.5, consistently with the values shown for the US map (top right), and R_0=2.3, in order to provide the comparison with faster spreading.

CITIES



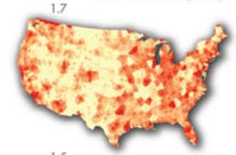
The model inlcudes the worldwide air transportation network (source: IATA) composed of 3,100 airports in 220 countries and E=17,182 direct connections, each of them associated to the corresponding passenger flow. This dataset accounts for 99% of the worldwide traffic and is complemented by the census data of each large metropolitan area served by the corresponding airport.

Additional spreading scenarios can be obtained by modeling different levels of infectiousness of the virus, as expressed in terms of the **reproductive number R_0**, representing the average number of infections generated by a sick person in a fully susceptible population.

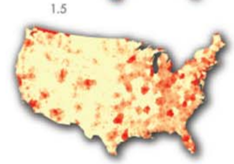
Intervention strategies modeling the use of antiviral drugs can be considered. Two scenarios are compared: an uncooperative strategy in which countries only use their own stockpiles, and a cooperative intervention which envisions a limited worldwide sharing of the resources.

Reproductive Number (R_0)

1.7



1.5

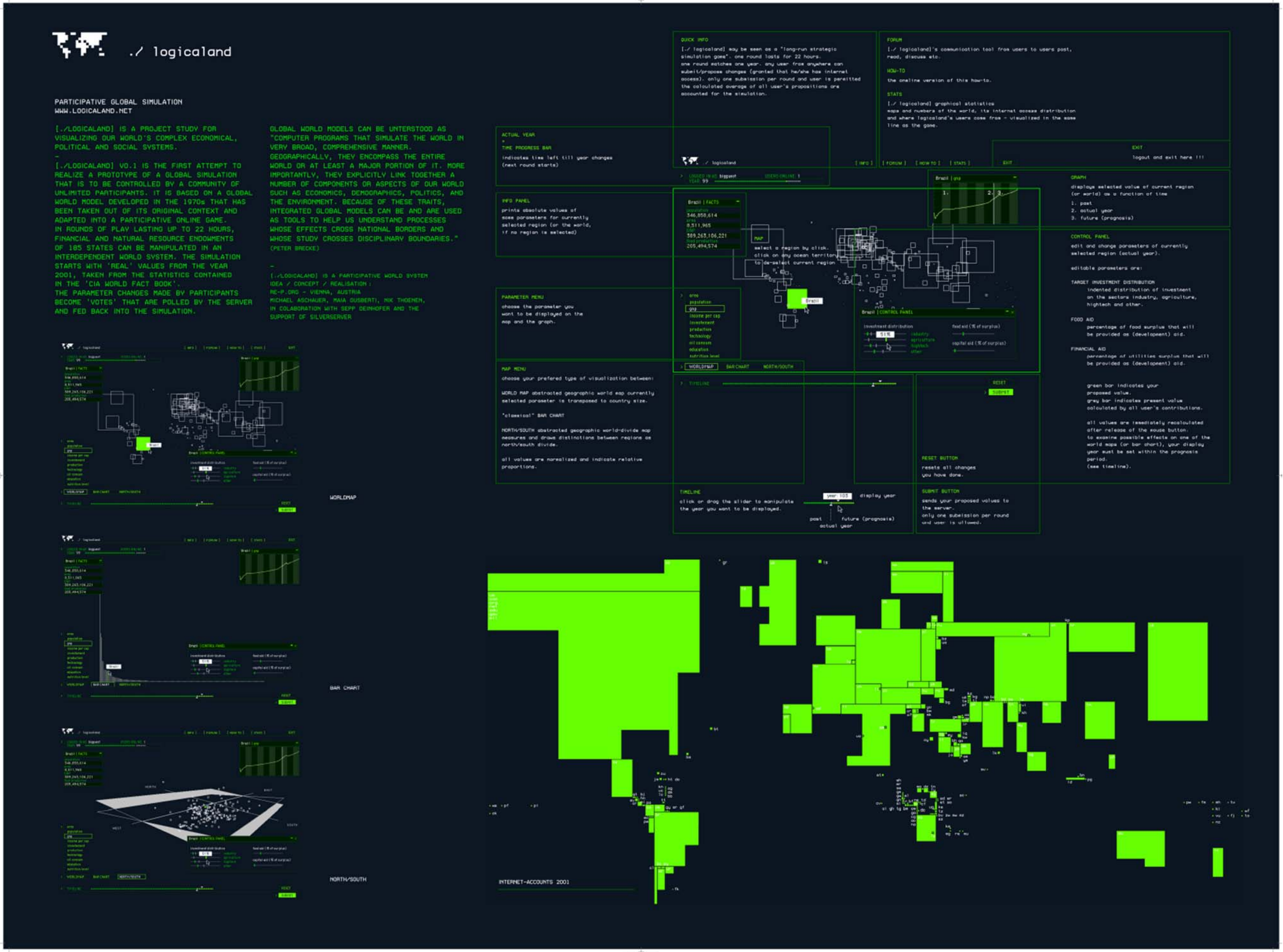


Intervention

UNCOOPERATIVE

COOPERATIVE

Impact of Air Travel on Global Spread of Infectious Diseases - Vittoria Colizza, Alessandro Vespignani - 2007



Logicland Participative Global Simulation - Michael Ashauer, Maia Gusberti, Nik Thoenen - 2002

Science & Technology Outlook: 2005–2055

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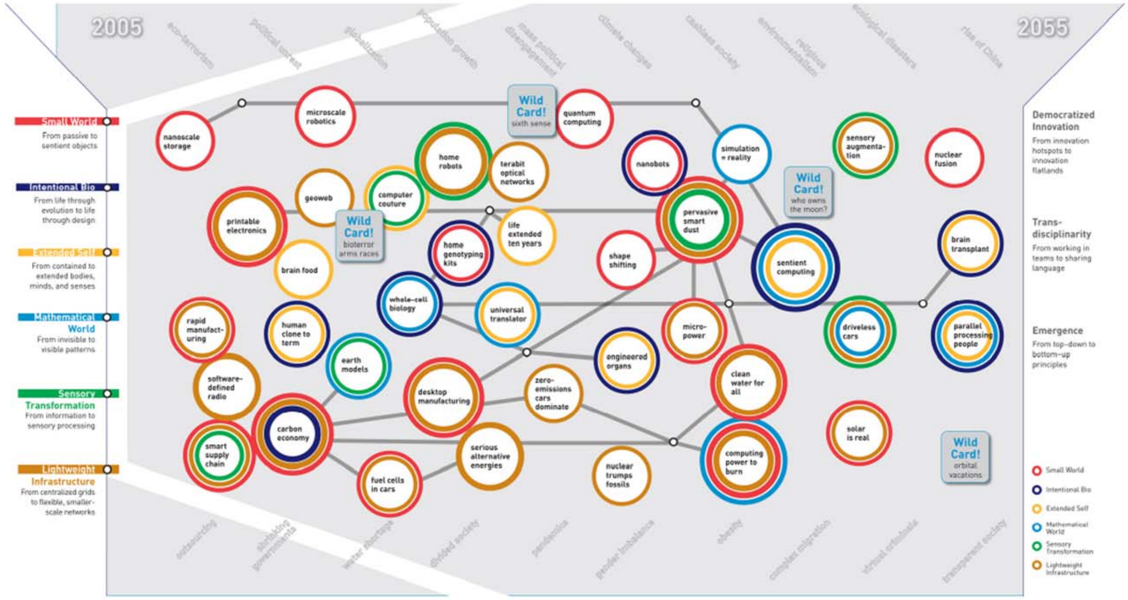


A map is a tool for navigating an unknown terrain. In the case of this map, **Science & Technology Outlook: 2005–2055,** the terrain we're navigating is the uncharted territory of science and technology (S&T) in the next 50 years. However, the map of the future is not a tool for prediction or, for that matter, the product of predictions. Nor is it comparable to modern navigation techniques in which we rely on a shrinking number of strong signals, like GPS coordinates, to show the right path. Rather, it's more akin to classical low-tech navigational techniques with their reliance on an array of weak signals such as wind direction, the look and feel of the water, and the shape of cloud formations. Taken together, these signals often prove more useful for navigation than high-tech methods because, in addition to aiding travelers in selecting the "right" path, the signals contextualize information and reveal interdependencies and connections between seemingly unrelated events, thus enriching our understanding of the landscape. That's precisely the intention of this map of the future of S&T—to give the reader a deeper contextual understanding of the landscape and to point to the intricacies and interdependencies between trends.

While developing the map, the **Institute for the Future (IFTF)** team listened for and connected a variety of weak signals, including those generated during interviews and workshop conversations involving more than 100 eminent U.K. and U.S. experts in S&T—academicians, policymakers, journalists, and corporate researchers. The IFTF team also compiled a database of outlooks on developments that are likely to impact the full range of S&T disciplines and practice areas over the next 50 years. We also relied on IFTF's 40 years of experience in forecasting S&T developments to create the map and an accompanying set of **S&T Perspectives** that discuss issues emerging on the S&T horizon and are important for organizations, policymakers, and society-at-large to understand.

On this map, six themes are woven together across the 50-year horizon, often resulting in important breakthroughs. These are supported by key technolgies, innovations, and discoveries. In addition to the six themes, three meta-themes—democratized innovation, transdisciplinarity, and emergence—will overlay the future S&T landscape influencing how we think about, learn about, and practice science. Finally, S&T trends won't operate in a vacuum. Wider social, demographic, political, economic, and environmental trends will both influence S&T trends and will be influenced by them. Some of these wider trends surround the map to remind us of the larger picture.

MAP THEMES

Small World

After 20 years of basic research and development at the 100-nanometer scale, the importance of nanotechnology as a source of innovations and new capabilities in everything from materials science to medicine is already well-understood. Three trends, however, will define how nanotechnology will unfold, and what impacts it will have. First, nanotechnology is not a single field with a coherent intellectual program; it's an opportunistic hybrid, shaped by a combination of fundamental research questions, promising technical applications, and venture and state capital. Second, nanotechnology is moving away from the original vision of small-scale mechanical engineering—in which assemblers build mechanical systems from individual atoms—toward one in which molecular biology and biochemistry contribute essential tools (such as proteins that build nanowires). Finally, nanotechnology will also serve as a model for transdisciplinary science. It will support both fundamental research and commercially oriented innovation; and it will be conducted not within the boundaries of conventional academic or corporate research departments, but in institutional and social milieux that emphasize heterogeneity.

Intentional Biology

For 3.6 billion years, evolution has governed biology on this planet. But today, Mother Nature has a collaborator. Inexpensive tools to read and rewrite the genetic code of life will bootstrap our ability to manipulate biology from the bottom up. We'll not only genetically re-engineer existing life but actually create new life forms with purpose. Still, we will not be blind to what nature has to teach us. Evolution's elegant engineering at the smallest scales will be a rich source of inspiration as we build the bio-nanotechnology of the next 50 years.

Extended Self

In the next 50 years, we will be faced with broad opportunities to remake our minds and bodies in profoundly different ways. Advances in biotechnology, brain science, information technology, and robotics will result in an array of methods to dramatically alter, enhance, and extend the mental and physical hand that nature has dealt us. Wielding these tools on ourselves, humans will begin to define a variety of different "transhumanist" paths—that is, ways of being and living that extend beyond what we today consider natural for our species. In the very long term, following these paths could someday lead to an evolutionary leap for humanity.

Mathematical World

The ability to process, manipulate, and ultimately understand patterns in enormous amounts of data will allow decoding of previously mysterious processes in everything from biological to social systems. Scientists are learning that at the core of many biological phenomena—reproduction, growth, repair, and others—are computational processes that can be decoded and simulated. Using techniques of combinatorial science to uncover such patterns—whether these are physical, biological, or social—will likely occupy an increasing share of computing cycles in the next 50 years. Such massive computation will also make simulation widespread. Computer simulation will be used not only to help make decisions about large complex scientific and social problems but also to help individuals make better choices in their daily lives.

Sensory Transformation

In the next ten years, physical objects, places, and even human beings themselves will increasingly become embedded with computational devices that can sense, understand, and act upon their environment. They will be able to react to contextual clues about the physical, social, and even emotional state of people and things in their surroundings. As a result, increasing demands will be placed on our visual, auditory, and other sensory abilities. Information previously encoded as text and numbers will be displayed in richer sensory formats—as graphics, pictures, patterns, sounds, smells, and tactile experiences. This enriched sensory environment will coincide with major breakthroughs in our understanding of the brain—in how we process sensory information and connect various sensory functions. Humans will become much more sophisticated in their ability to understand, create, and manage sensory information and ability to perform such tasks will become keys to success.

Lightweight Infrastructure

A confluence of new materials and distributed intelligence is pointing the way toward a new kind of infrastructure that will dramatically reshape the economics of moving people, goods, energy, and information. From the molecular level to the macroeconomic level, these new infrastructure designs will emphasize smaller, smarter, more independent components. These components will be organized into more efficient, more flexible, and more secure ways than the capital-intensive networks of the 20th century. These lightweight infrastructures have the potential to boost emerging economies, improve social connectivity, mitigate the environmental impacts of rapid global urbanization, and offer new future paths in energy.

META-THEMES

Democratized Innovation

Before the 20th century, many of the greatest scientific discoveries and technical inventions were made by amateur scientists and independent inventors. In the last 100 years, a professional class of scientists and engineers, supported by universities, industry, and the state, pushed amateurs aside as a creative force. At the national scale, the capital-intensive character of scientific research made world-class research the property of prosperous advanced nations. In the new century, a number of trends and technologies will lower the barriers to participation in science and technology again, both for individuals and for emerging countries. The result with be a renaissance of the serious amateurs, the growth of new scientific and technical centres of excellence in developing countries, and a more global distribution of world-class scientists and technologists.

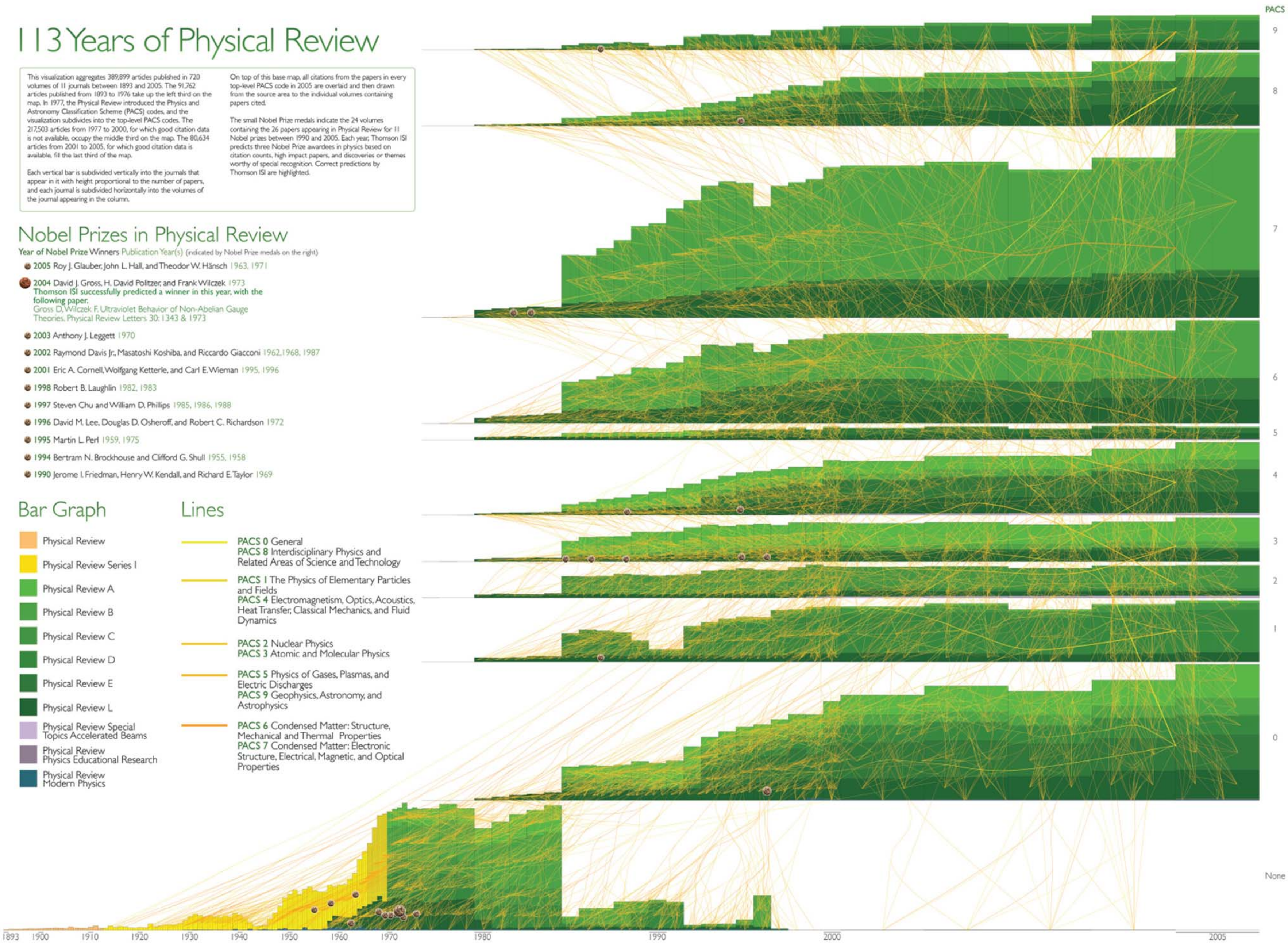
Transdisciplinarity

In the last two centuries, natural philosophy and natural history fractured into the now-familiar disciplines of physics, chemistry, biology, and so on. The sciences evolved into their current form in response to intellectual and professional opportunities, philanthropic priorities, and economic and state needs. Through most of the 20th century, the growth of the sciences, and academic and career pressures, encouraged ever-greater specialization. In the coming decades, transdisciplinary research will become an imperative. According to Howard Rheingold, a prominent forecaster and author, "transdisciplinarity goes beyond bringing together researchers from different disciplines to work in multidisciplinary teams. It means educating researchers who can speak languages of multiple disciplines—biologists who have understanding of mathematics, mathematicians who understand biology."

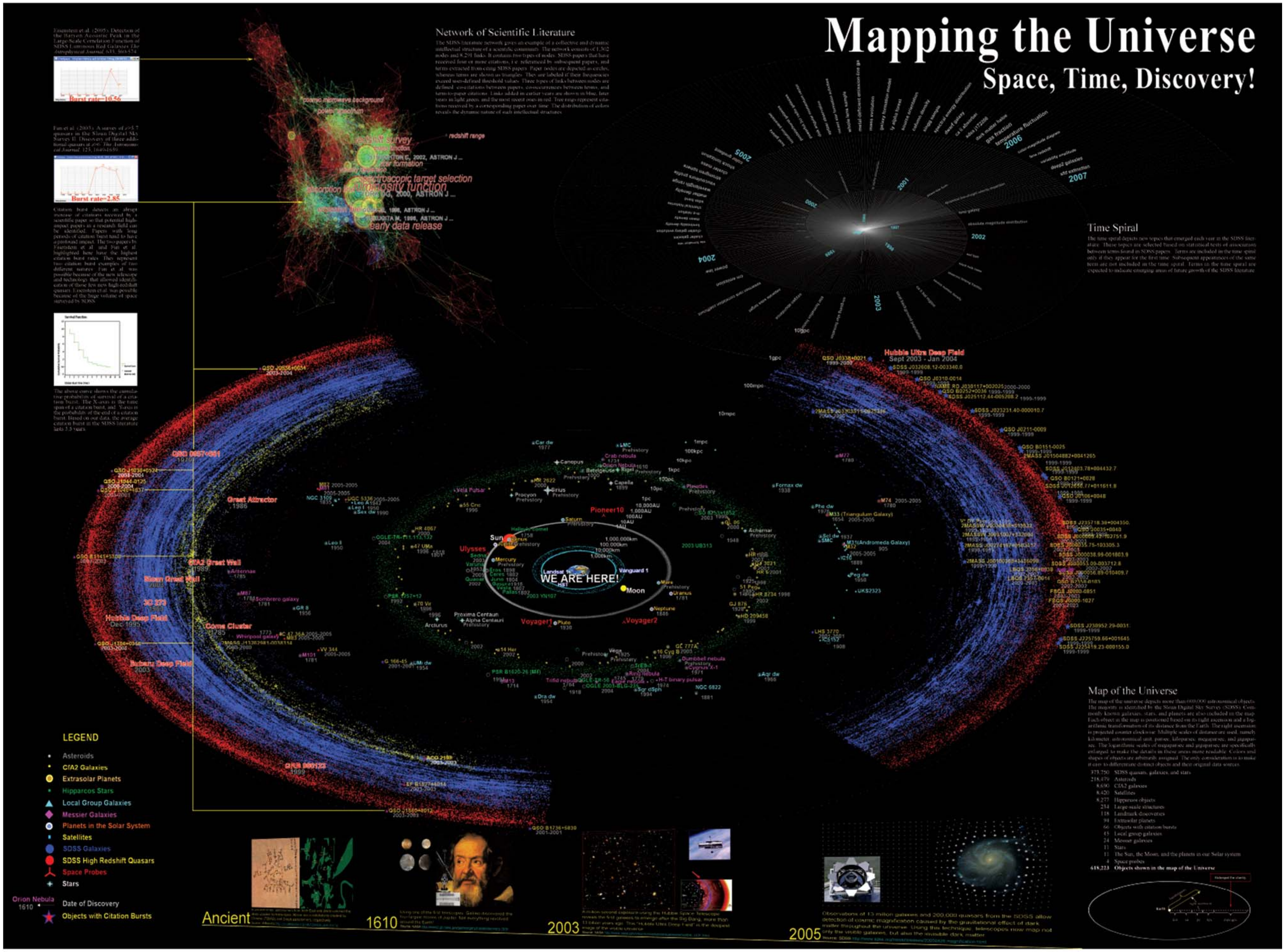
Emergence

The phenomenon of self-organizing swarms that generate complex behavior by following simple rules—will likely become an important research area, and an important model for understanding how the natural world works and how artificial worlds can be designed. Emergent phenomena have been observed across a variety of natural phenomena, from physics to biology to sociology. The concept has broad appeal due to the diversity of fields and problems to which it can be applied. It is proving useful for making sense of a very wide range of phenomena. Meanwhile, emergence can be modeled using relatively simple computational tools, although those models often require substantial processing power. More generally, it is a richly suggestive as a way of thinking about designing complex, robust technological systems. Finally, emergence is an accessible and vivid a metaphor for understanding nature. Just as classical physics profited from popular treatments of Newtonian mechanics, so too will scientific study and technical reproductions of emergent phenomena likely draw benefits from the popularization of its underlying concepts.

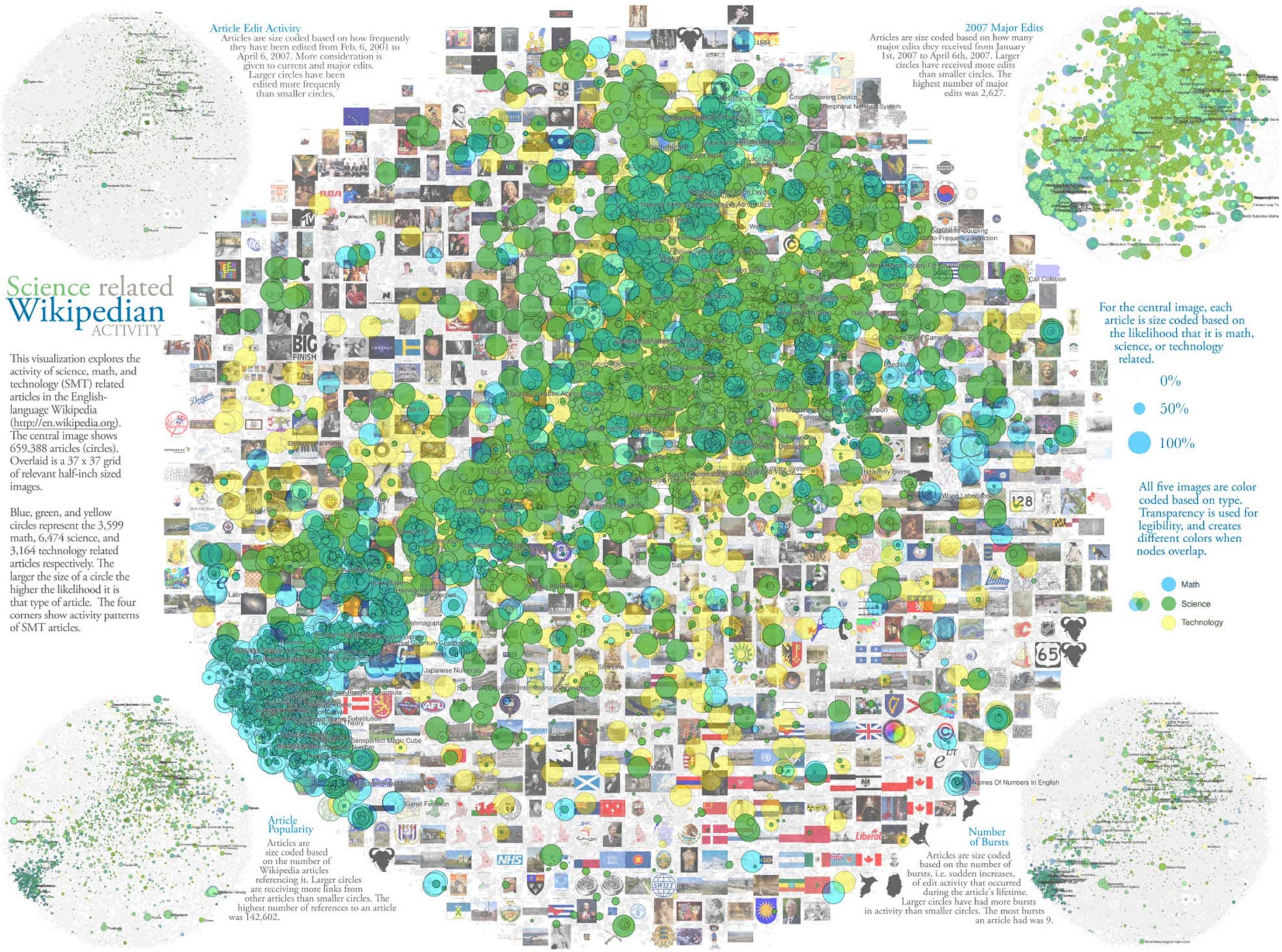
Science & Technology Outlook: 2005-2055 - Alex Soojung-Kim Pang, David Pescovitz, Marina Gorbis, Jean Hagan - 2006



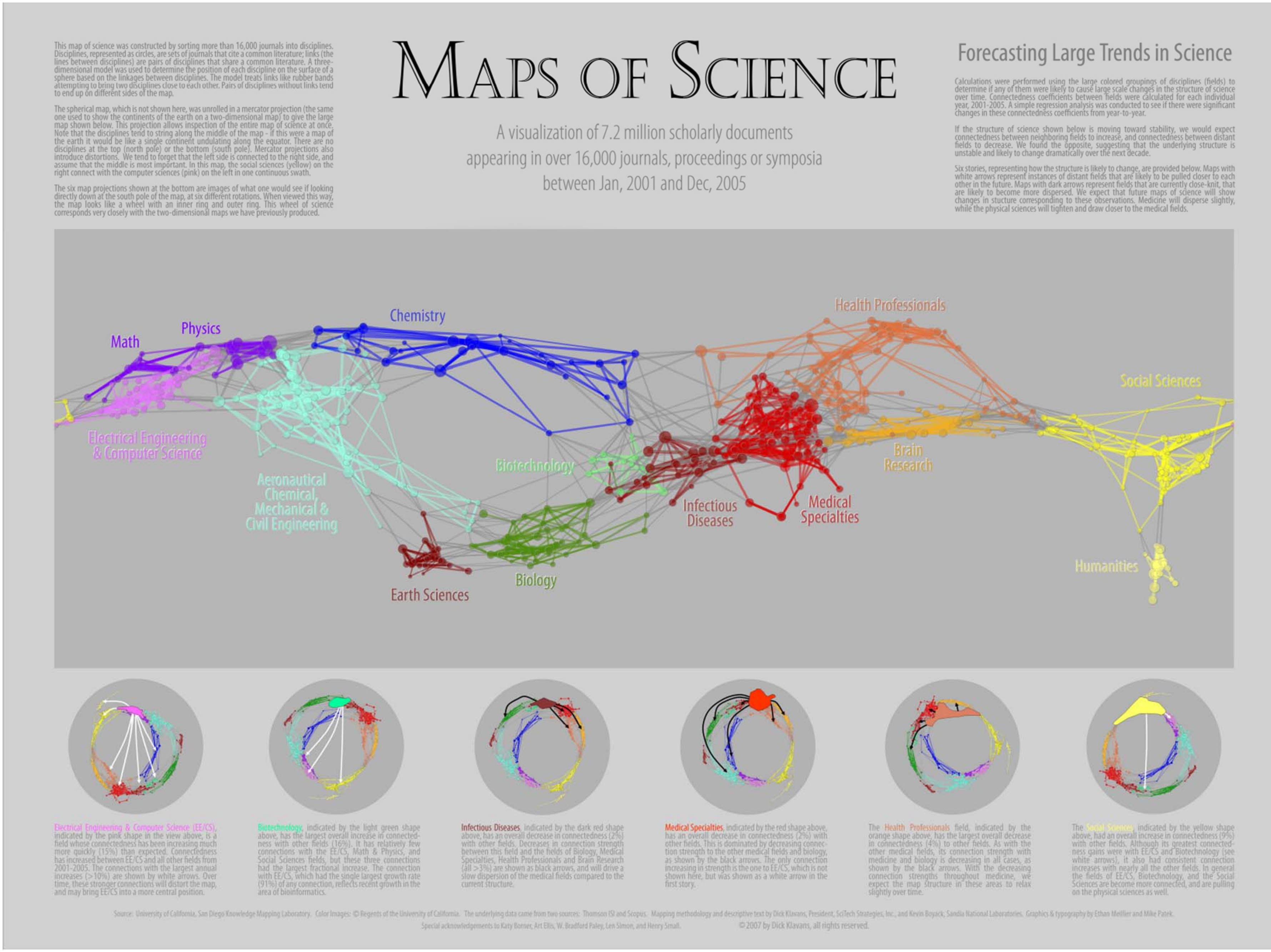
114 Years of Physical Review - Bruce W. Herr II, Russell Duhon, Katy Borner, Elisha Hardy, Shashikant Penumarthy - 2007



Mapping the Universe: Space, Time, Discovery! - Choumei Chen, Jian Zhang, Michael S. Vogeley, J. Richard Gott III, Mario Juric, Lisa Kershner - 2007



Science Related Wikipedian Activity - Bruce W. Herr II, Todd Holloway, Katy Borner, Elisha F. Hardy, Kevin Boyack - 2007

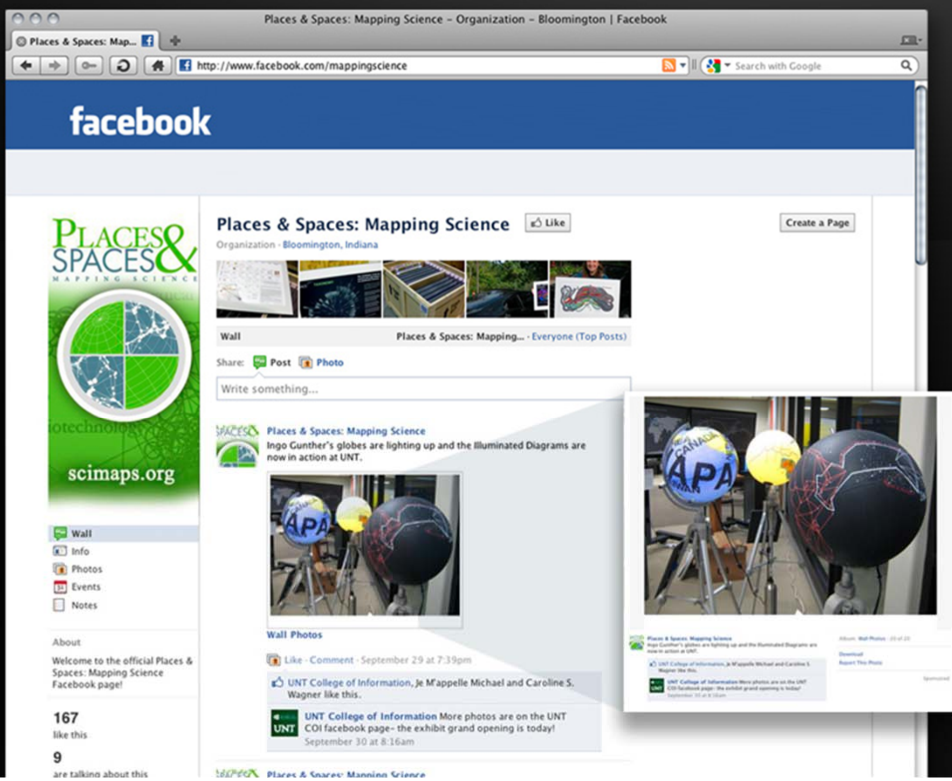


Maps of Science: Forecasting Large Trends in Science - Richard Klavans, Kevin Boyack - 2007

Hypothetical Model of the Evolution of Science - Daniel Zeller - 2007

PLACES & SPACES

MAPPING SCIENCE



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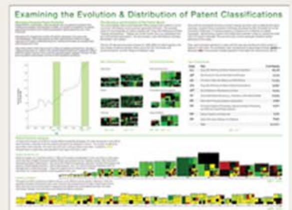
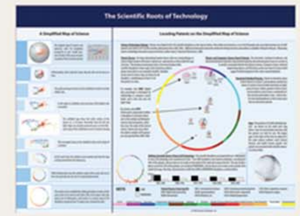
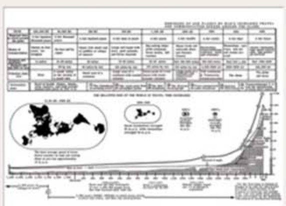
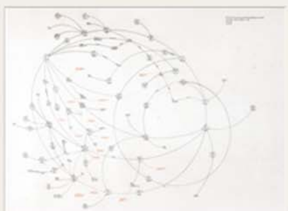
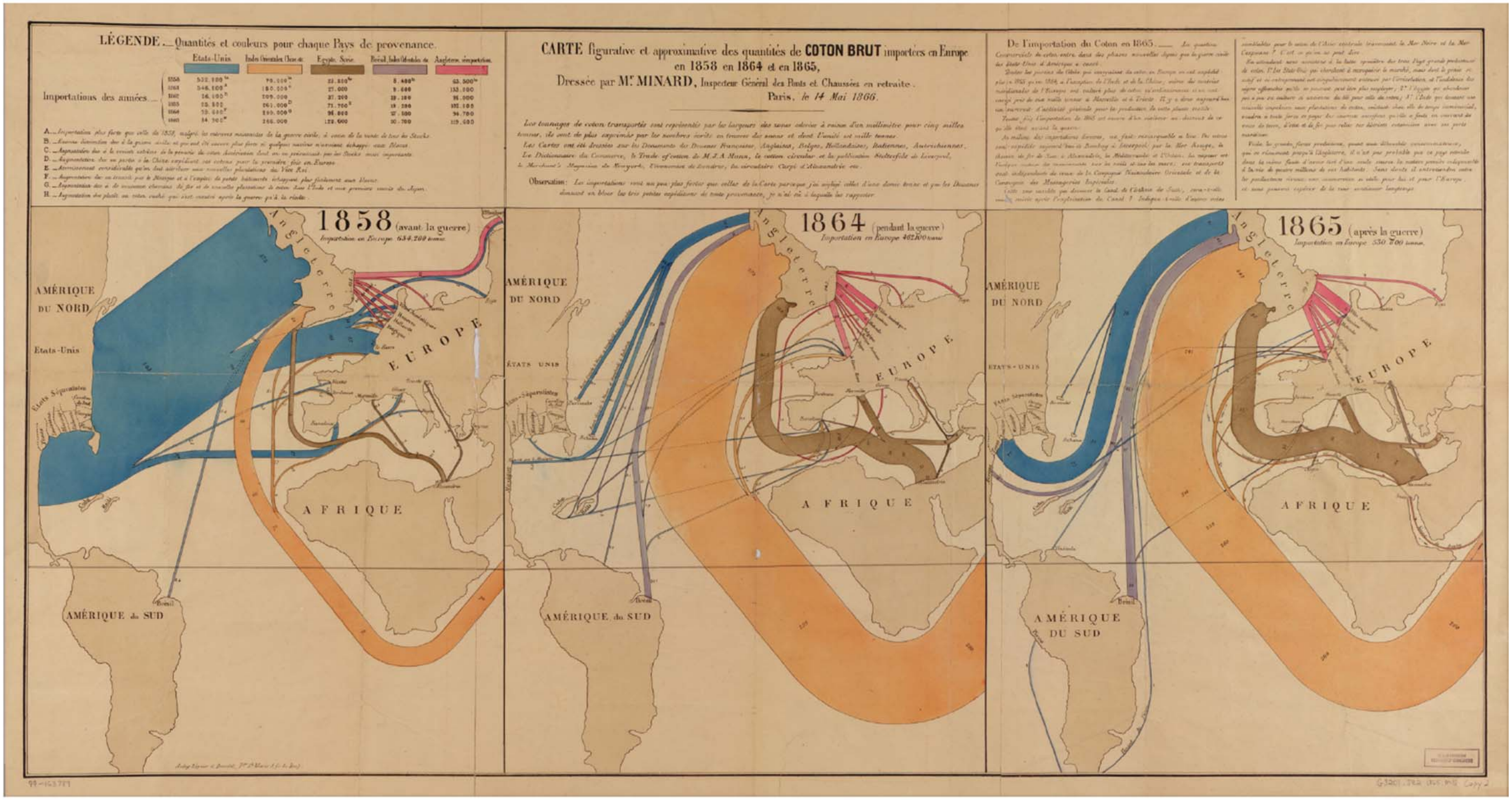
Science Maps for Economic Decision Makers 2008









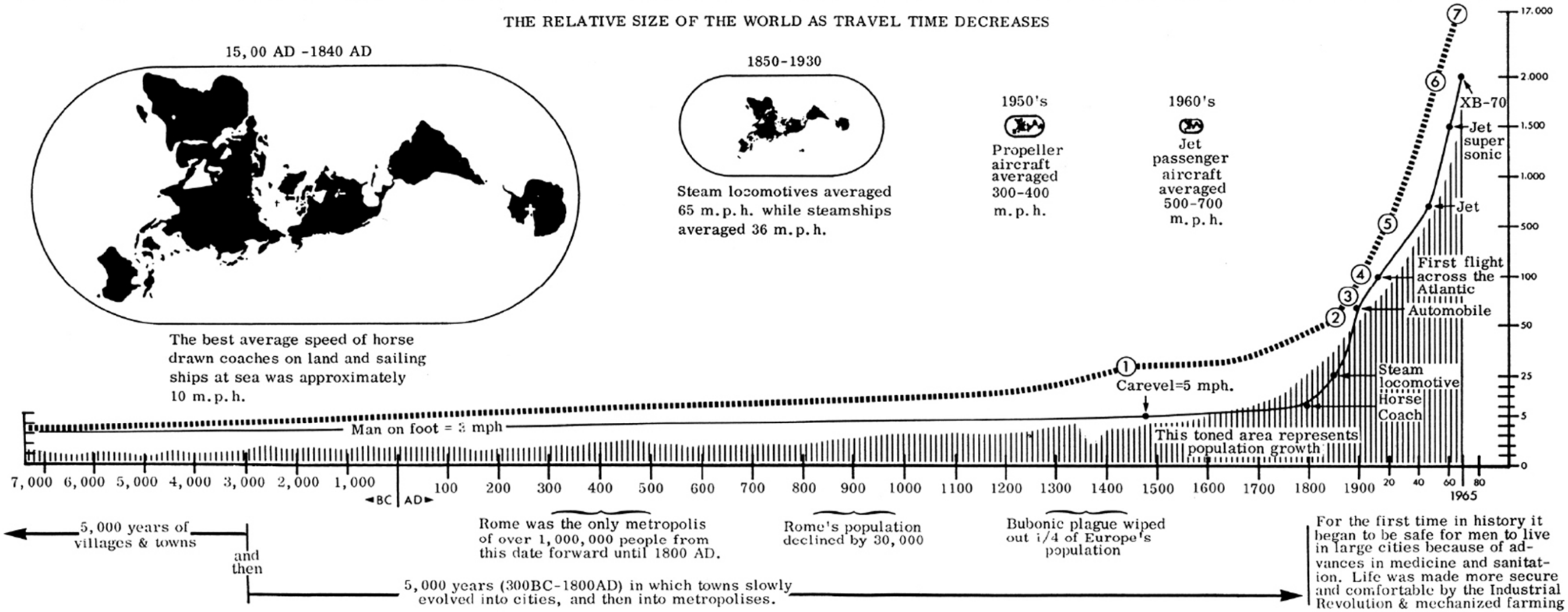


Europe Raw Cotton Imports in 1858, 1864 and 1865 - Charles Joseph Minard - 1866

SHRINKING OF OUR PLANET BY MAN'S INCREASED TRAVEL AND COMMUNICATION SPEEDS AROUND THE GLOBE

YEAR	500,000 BC	20,000 BC	300 BC	500 BC	1,500 AD	1900 AD	1925	1950	1965
Required time to travel around the globe	A few hundred thousand years	A few thousand years	A few hundred years	A few tens of years	A few years	A few months	A few weeks	A few days	A few hours
Means of transportation	Human on foot (over, ice bridges)	On foot and by canoe	Canoe with small sail or paddles or relays of runners	Large sail boats with oars, pack animals, and horse chariots	Big sailing ships (with compass), horse teams, and coaches	Steam boats and railroads (Suez and Panama Canals)	Steamships, transcontinental railways, autos, and airplanes	Steamships, railways, auto jet and rocket aircraft	Atomic steamship, high speed railway auto, and rocket-jet aircraft
Distance per day(land)	15 miles	15-20 miles	20 miles	15-25 miles	20-25 miles	Rail 300-900 miles	400-900 miles	Rail 500-1,500	Rail 1000-2000
Distance per day (sea or air)		20 by sea	40 miles by sea	135 miles by sea	175 miles by sea	250 miles by sea	3,000-6000 air	6000-9500 air	408,000 air
Potential state size	None	A small valley in the vicinity of a small lake	Small part of a continent	Large area of a continent with coastal colonies	Great parts of a continent with transoceanic colonies	Large parts of a continent with transoceanic colonies	Full continents & Transocean Commonwealths	The Globe	The globe and more

Communications	Word of mouth, drums, smoke, relay runners, and hand printed manuscripts prior to 1441 A.D.	① The Gutenberg 1441 printing press	② The rapid print Web 1863 newspaper press	③ The Bell 1876 telephone	④ The Marconi 1895 telegraph	⑤ First commercial 1920 radio broadcast	⑥ National 1950 Television	⑦ Transcontinental T.V. with the introduction 1965 of Early Bird satellite



Shrinking of Our Planet - R. Buckminster Fuller, John McHale - 1965

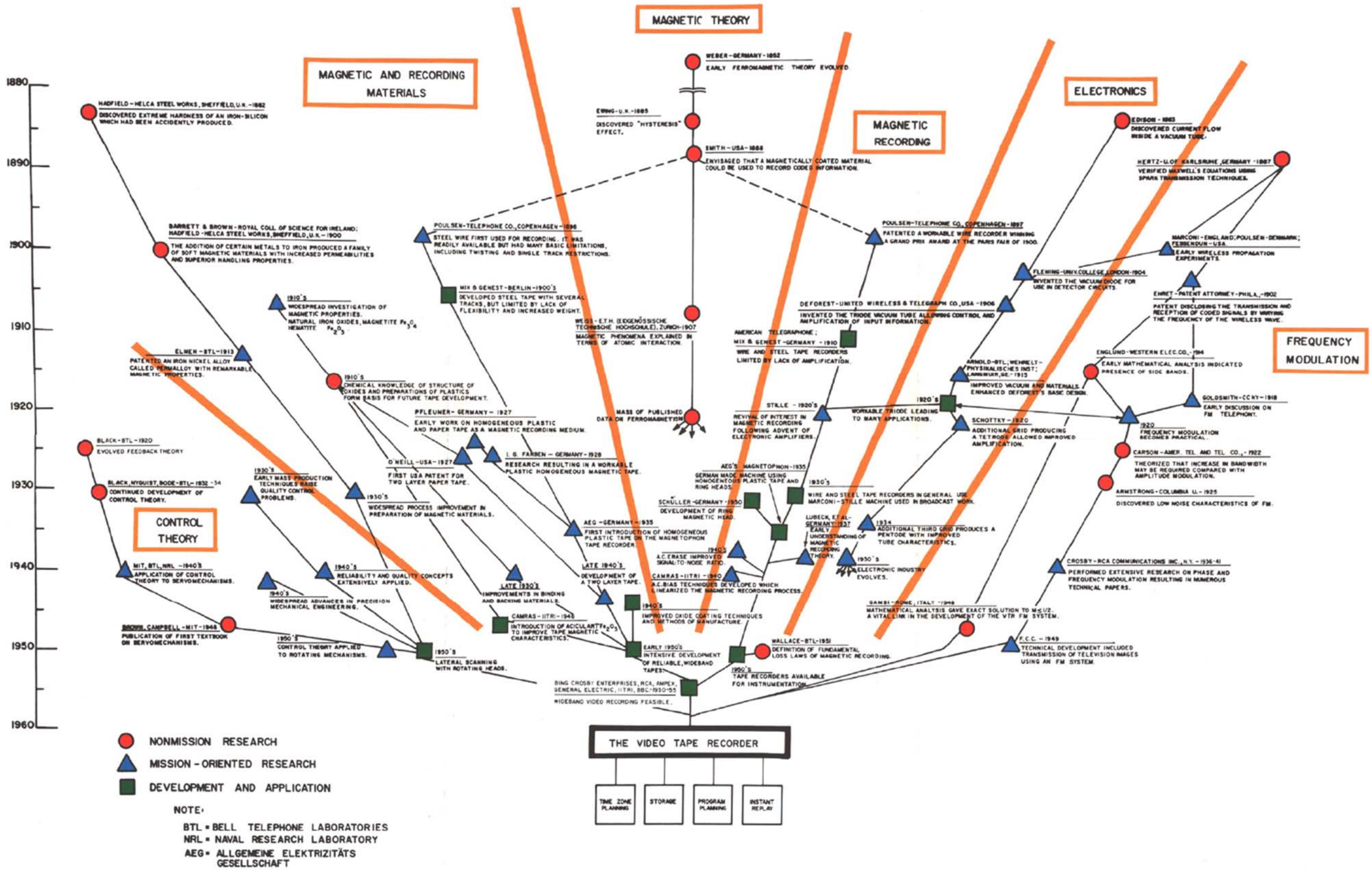
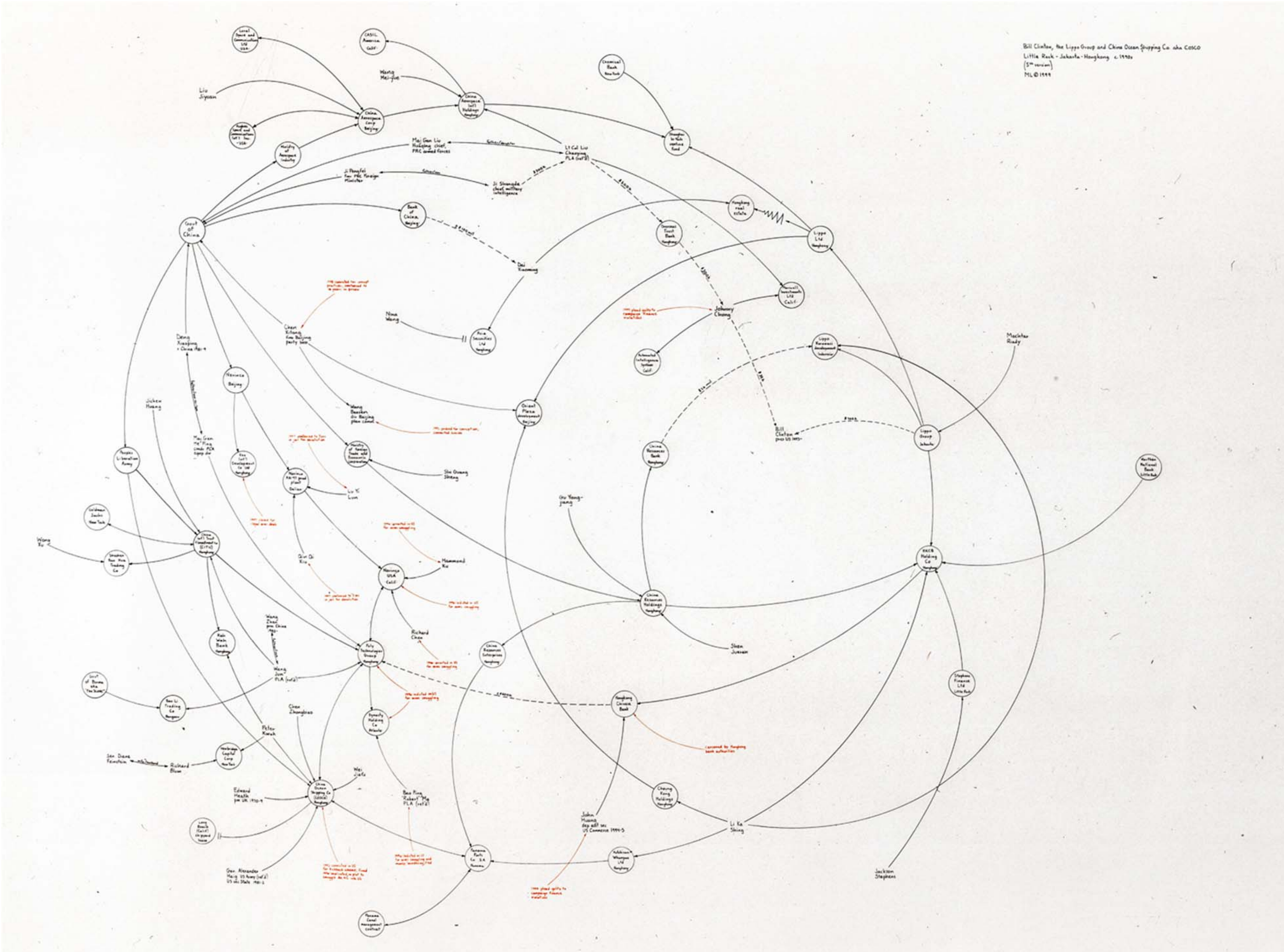


FIG. 7. THE VIDEO TAPE RECORDER

Tracing of Key Events in the Development of the Video Tape Recorder - Mr. G. Benn, Francis Narin - 1968



Bill Clinton, the Lippo Group, and China Ocean Shipping Co. a.k.a. COSCO, Little Rock—Jakarta—Hong Kong, ca. 1990s - Mark Lombardi - 1999

Examining the Evolution & Distribution of Patent Classifications

Managing Growing Patent Portfolios

Organizations, businesses, and individuals rely on patents to protect their intellectual property and business models. As market competition increases, patenting innovation and intellectual property rights becomes ever more important.

Managing the staggering number of patents demands new tools and methodologies. Grouping patents by their classifications offers an ideal resolution for better understanding how intellectual borders are established and change over time.

The charts below show the annual number of patents granted from January 1, 1976 to December 31, 2002 in the United States Patent and Trademark Office (USPTO) patent archive; slow and fast growing patent classes; the top-10 fast growing patent subclasses; and two evolving patent portfolios.

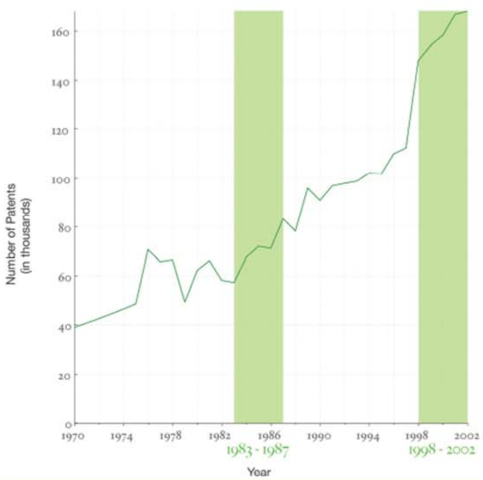
The Structure and Evolution of the Patent Space

The United States Patent and Trademark Office assigns each patent to one of more than 450 classes covering broad application domains. For example, class 514 encompasses all patents dealing with 'Drug, Bio-Affecting and Body Treating Compositions.' Classes are further broken down by subclasses that have hierarchical associations. As one example, class 455 features subclass 99 entitled "with vehicle."

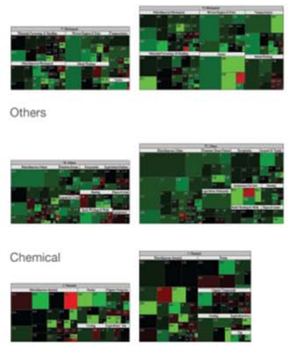
The top-10 fast growing patent classes for 1998-2002 are listed together with the number of patents granted. Most come from the 'Computer and Communications' and the 'Drugs and Medical' area.

The evolving hierarchical structure of patent classes and their sizes is represented using treemaps, a space-filling visualization technique developed by Ben Shneiderman at the University of Maryland. A treemap presents a hierarchy as a collection of nested rectangles—demarcating a parent-child relationship between nodes by nesting the child within the parent rectangle. The size and color of each rectangle represent certain attributes of the nodes.

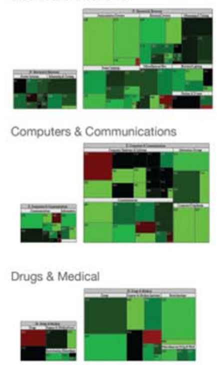
Here, each rectangle represents a class and the area size denotes the total number of patents in that class. The rectangle's color corresponds to percentage increase (**green**) or decrease (**red**) in the number of patent granted in that class from the previous interval.



Slow Growing Classes



Fast Growing Classes



Top-10 Subclasses

Class	Title	# of Patents
514	Drug, Bio-Affecting and Body Treating Compositions	18,778
438	Semiconductor Device Manufacturing:Process	17,775
435	Chemistry: Molecular Biology and Microbiology	17,474
424	Drug, Bio-Affecting and Body Treating Compositions	13,637
428	Stock Material or Miscellaneous Articles	13,314
257	Active Solid-State Devices (e.g., Transistors, Solid-State Diodes)	12,924
395	Information Processing System Organization	9,955
345	Computer Graphics Processing, Operator Interface Processing, and Selective Visual Display Systems	9,510
359	Optical: Systems and Elements	9,151
365	Static Information Storage and Retrieval	8,392
	Total	13,0910

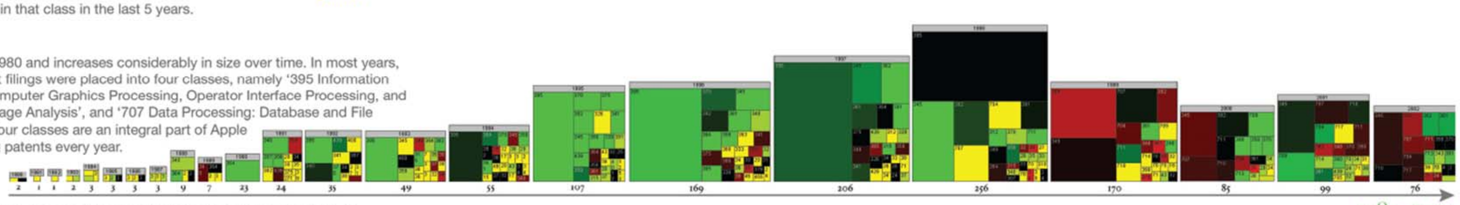
1998 - 2002

Patent Portfolio Analysis

A longitudinal analysis of portfolios reveals different patenting strategies. For each year (given in gray above each treemap), a treemap of all new patents granted to the assignee is shown. The number of patents is given below each treemap. The same size and color coding as above was used. In addition, **yellow** indicates that no patent has been granted in that class in the last 5 years.

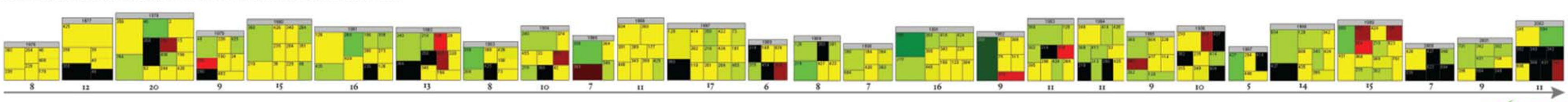
Apple Computer, Inc.

Apple Computer, Inc.'s portfolio starts in 1980 and increases considerably in size over time. In most years, more than half of Apple Computer's patent filings were placed into four classes, namely '395 Information Processing System Organization', '345 Computer Graphics Processing, Operator Interface Processing, and Selective Visual Display Systems', '382 Image Analysis', and '707 Data Processing: Database and File Management or Data Structures'. These four classes are an integral part of Apple Computer, Inc.'s patent portfolio, receiving patents every year.



Jerome Lemelson

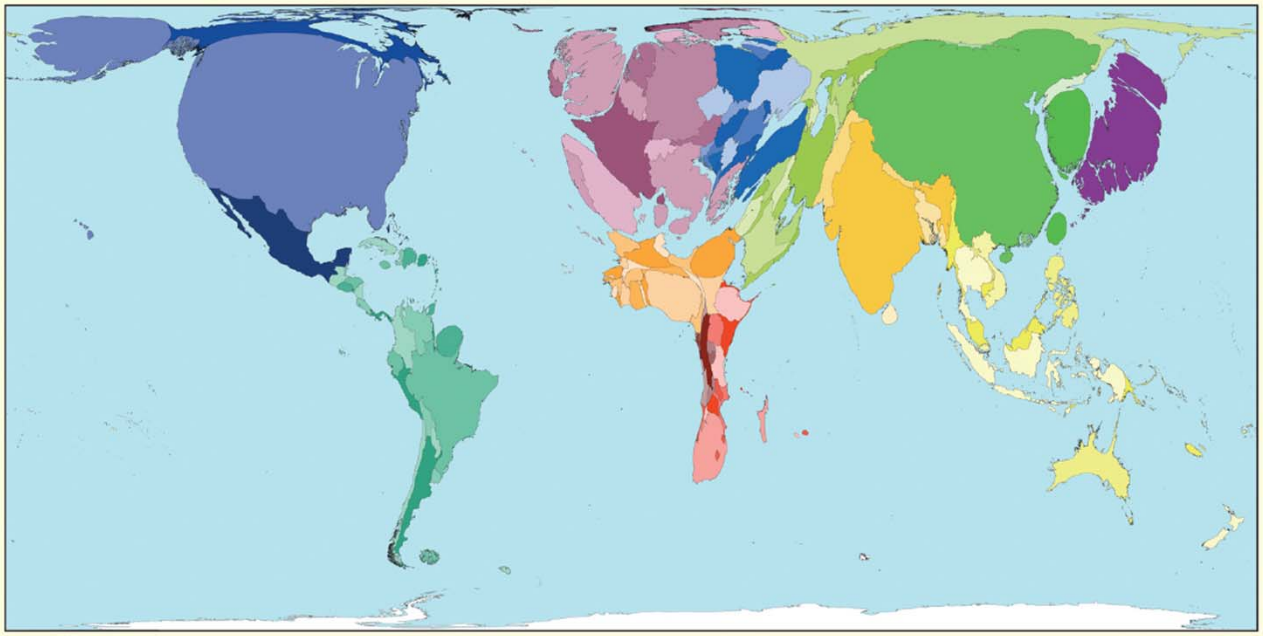
The patent portfolio of Jerome Lemelson shows a very different activity pattern. Starting in 1976, he publishes between 6-20 patents each year. However, the predominance of yellow shows that there is little continuity from previous years in regards to the classes into which patents are filed. No class dominates. Instead, more and more new intellectual space is claimed.



Examining the Evolution & Distribution of Patent Classifications - Daniel O. Kutz, Katy Borner, Elisha Hardy - 2004

Ecological Footprint

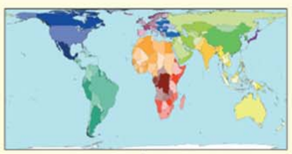
Produced by the SASI group (Sheffield) and Mark Newman (Michigan)



The ecological footprint is a measure of the area needed to support a population's lifestyle. This includes the consumption of food, fuel, wood, and fibres. Pollution, such as carbon dioxide emissions, is also counted as part of the footprint.

The United States, China and India have the largest ecological footprints. Without knowing population size we cannot understand what this means about individuals' ecological demands. Large populations live in China and India. In both territories resource use is below the world average. The per person footprint in the United States is almost five times the world average, and almost ten times what would be sustainable.

Territory size shows the proportion of the worldwide ecological footprint which is made there.



Land area

Technical notes

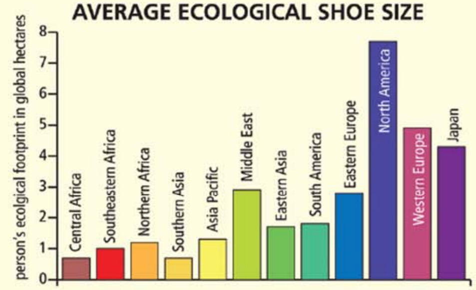
- Data are from the WWF (Worldwide Fund for Nature) International and Institute of Zoology.
- Ecological footprint is measured in global hectares. One global hectare is an area that has the world average biological productivity of one hectare.
- See website for further information.

LARGEST AND SMALLEST ECOLOGICAL SHOE SIZES

Rank	Territory	Value	Rank	Territory	Value
1	United Arab Emirates	10.6	191	Nepal	0.61
2	United States	9.7	192	Democratic Republic of Congo	0.58
3	Greenland	7.7	193	Zambia	0.58
3	Bahamas	7.7	194	Congo	0.58
5	Canada	7.5	195	Malawi	0.57
6	Kuwait	7.4	196	Haiti	0.57
7	Australia	7.0	197	Cambodia	0.55
8	Finland	6.8	198	Bangladesh	0.47
9	Estonia	6.1	199	Somalia	0.23
10	New Zealand	6.1	200	Afghanistan	0.11

*ecological footprint in global hectares per person, 2002**

AVERAGE ECOLOGICAL SHOE SIZE



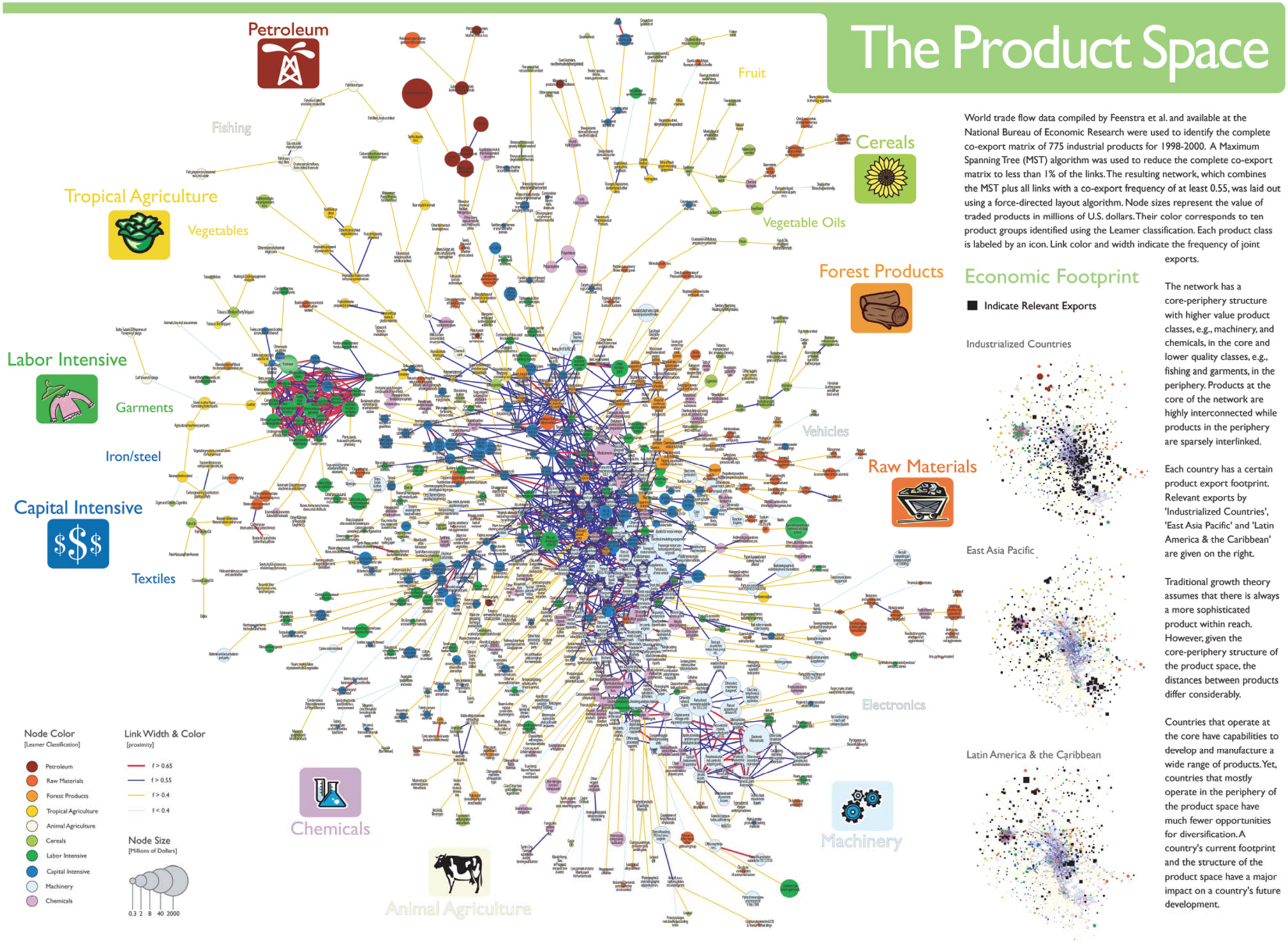
"People consume resources and ecological services from all over the world, so their footprint is the sum of these areas, wherever they may be on the planet."

The Living Planet Report, 2006

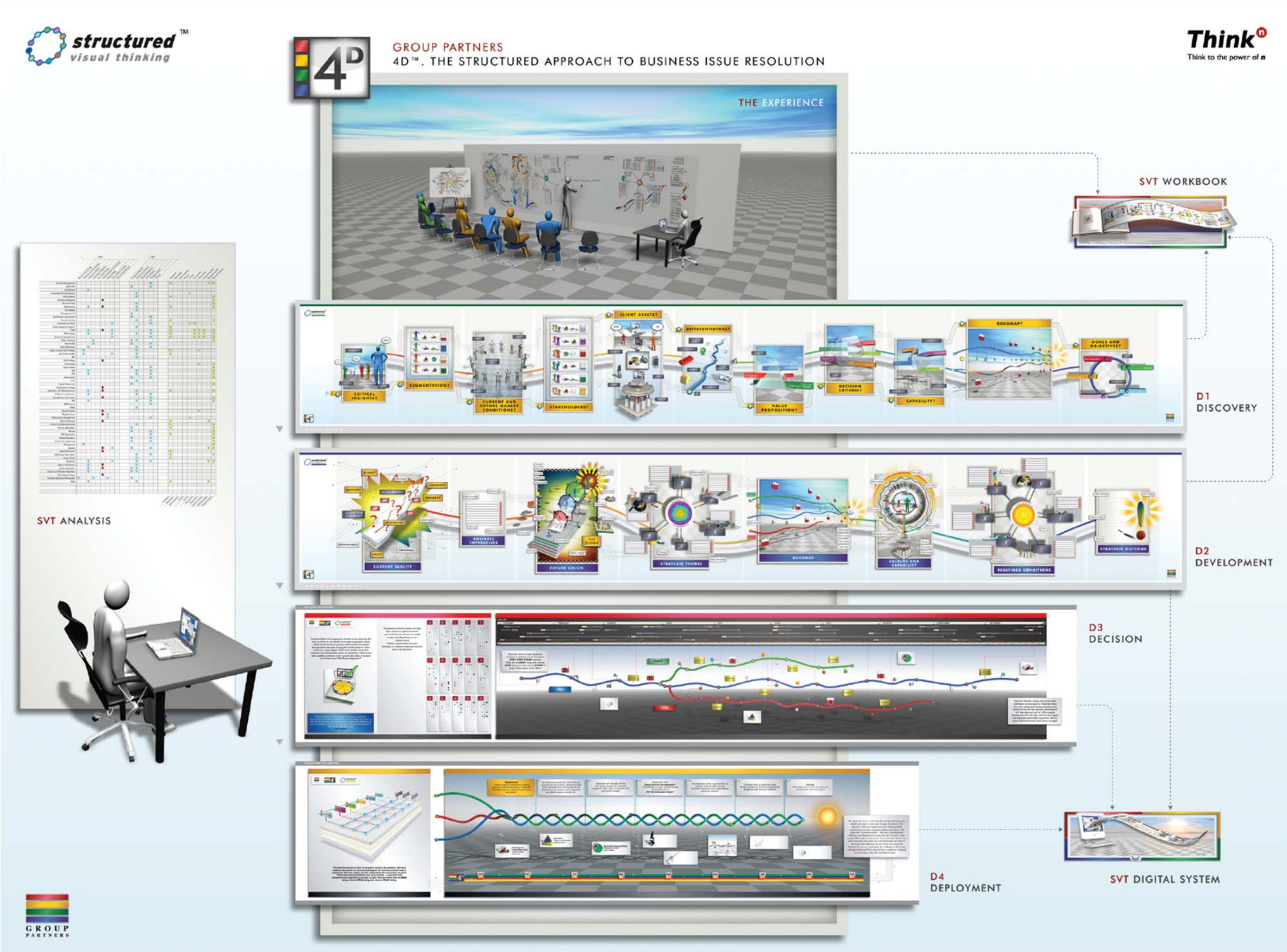
www.worldmapper.org

Map 322

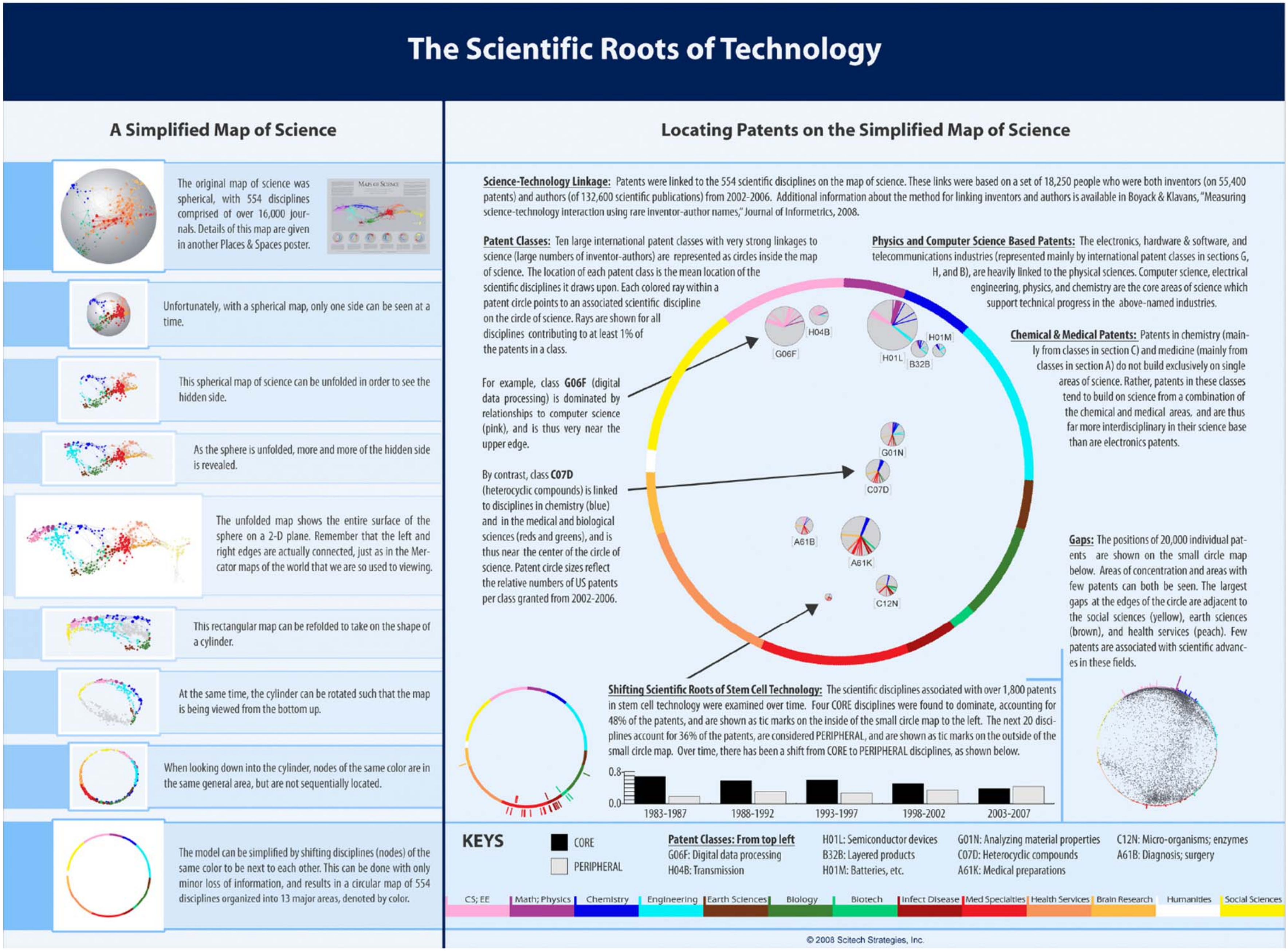
Ecological Footprint - Danny Dorling, Mark Newman, Graham Alisopp, Anna Barford, Ben Wheeler, John Pritchard, David Dorling - 2007



The Product Space - Cesar A. Hidalgo, Bailey Klinger, Albert-Laszlo Barabasi, Ricardo Hausmann - 2007



4D[TM] The Structured Visual Approach to Business Issue Resolution - Don Caswell, Hazel Tiffany, Ian Francis - 2008



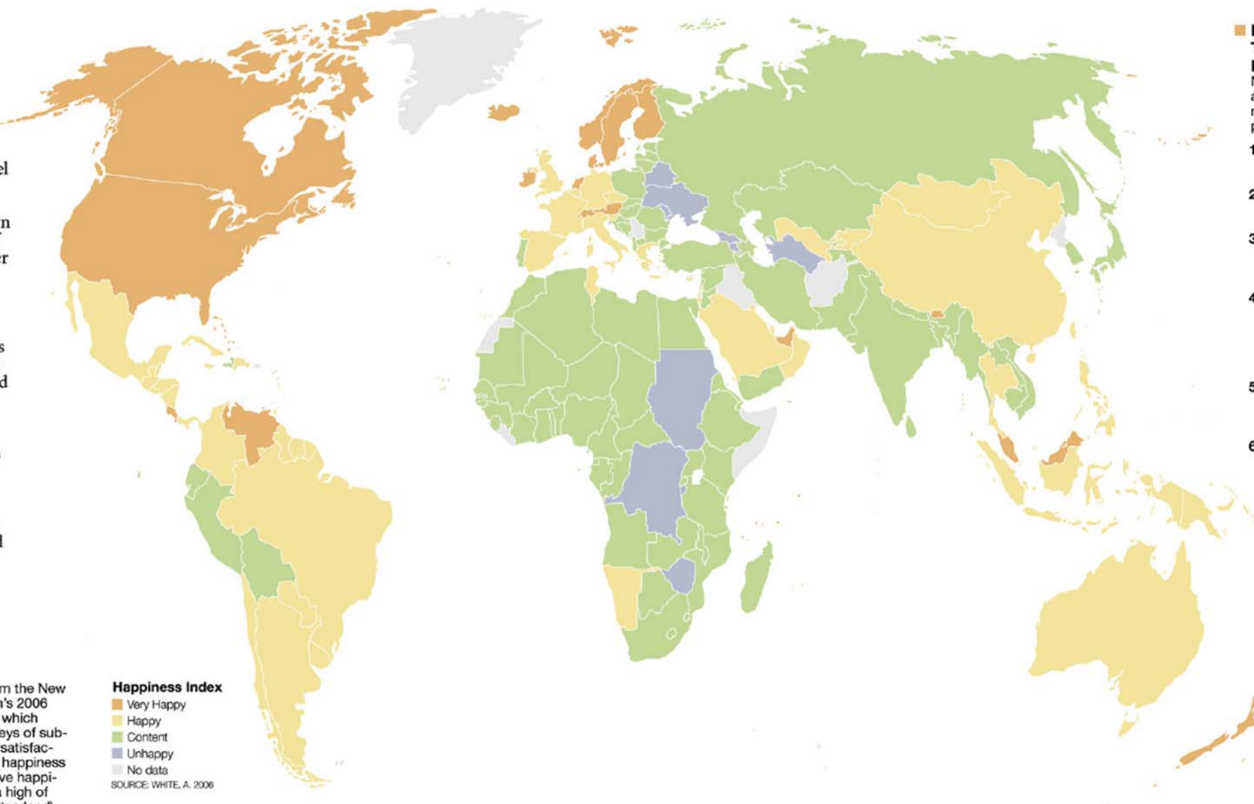
The Scientific Roots of Technology - Kevin Boyack, Richard Klavans - 2008

Happiness Depends on Various Factors

"It's time we admitted there's more to life than money."
- David Cameron, U.K. leader of the opposition, 2006

Social scientists are starting to include relative happiness with hard data on economic status, health, and other factors as they assess quality of life. They rely on surveys of "subjective well-being"—how good people feel about their lives. A world map of one "happiness index" shows many, but not all, wealthy northern countries faring well. Residents of sub-Saharan Africa and the former Soviet Union, meanwhile, report particularly low levels of contentment.

Any attempt to measure happiness will fall short—each life is a series of joys, struggles, and sorrows, and satisfaction can depend as much on outlook as on circumstances. Averages obscure the happy moments in struggling nations, as well as people who suffer from poor health, poverty, or discrimination in countries that rank high. Still, happiness indices can help researchers move beyond simple economics as they track progress—or backsliding—over time.



RANKING THE WORLD'S HAPPIEST PLACES
Northern Europe, North America, and several wealthy countries make the list, but so do many less prosperous island nations.

1 DENMARK
SWITZERLAND

2 AUSTRIA
ICELAND

3 BAHAMAS
FINLAND
SWEDEN

4 BHUTAN
BRUNEI
CANADA
IRELAND
LUXEMBOURG

5 COSTA RICA
MALTA
NETHERLANDS

6 ANTIGUA AND BARBUDA
MALAYSIA
NEW ZEALAND
NORWAY
SEYCHELLES
ST. KITTS AND NEVIS
UNITED ARAB EMIRATES
UNITED STATES
VANUATU
VENEZUELA

MEASURING THE INTANGIBLE
The map is derived from the New Economics Foundation's 2006 "Happy Planet Index," which drew on over 100 surveys of subjective well-being. Its "satisfaction with life scale"—a happiness index—ranks the relative happiness of nations, from a high of 273 (Denmark and Switzerland) to a low of 100 (Burundi).

DEFINING WELL-BEING
By comparing the happiness index to data from the UN, the CIA, and other sources, a U.K. psychologist determined that good health and health care, enough money for fundamental needs, and access to basic education are the most important factors for subjective well-being. European countries top all three measures.

HEALTH
Japan boasts the world's longest life expectancy—one measure of overall health. Swaziland, at the other end of the scale, is plagued by poverty, disease, and violence. Disparities in access to health care divide many countries into haves and have-nots.

WEALTH
Money still can't buy love, or happiness, and wealthier people aren't always more content. Still, tiny Luxembourg, which takes top rank in per capita Gross Domestic Product (GDP), also rates a 253 on the happiness index. Real poverty means real misery, a fate shared by billions.

EDUCATION
Residents of Australia can expect to spend more time in school—an average of almost 21 years—than citizens of any other country. But only a basic education is needed to see a significant jump in overall happiness. Around the world, hundreds of millions lack even that.

*Photos different than those used in EarthPulse publication

The Global Projection of Subjective Well-being - Adrian White, National Geographic EarthPulse Team - 2008

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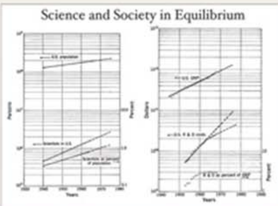
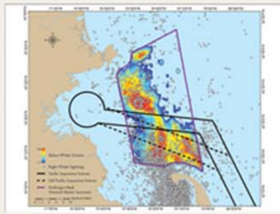
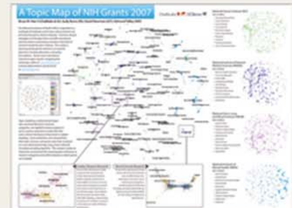
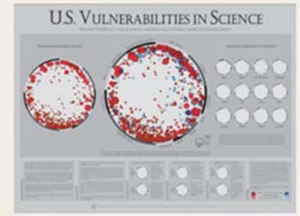
Visit **scimaps.org** and check out all our maps in stunning detail!

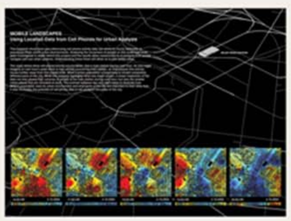
Science Maps for Science Policy Makers 2009

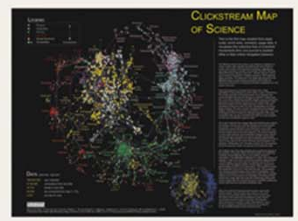




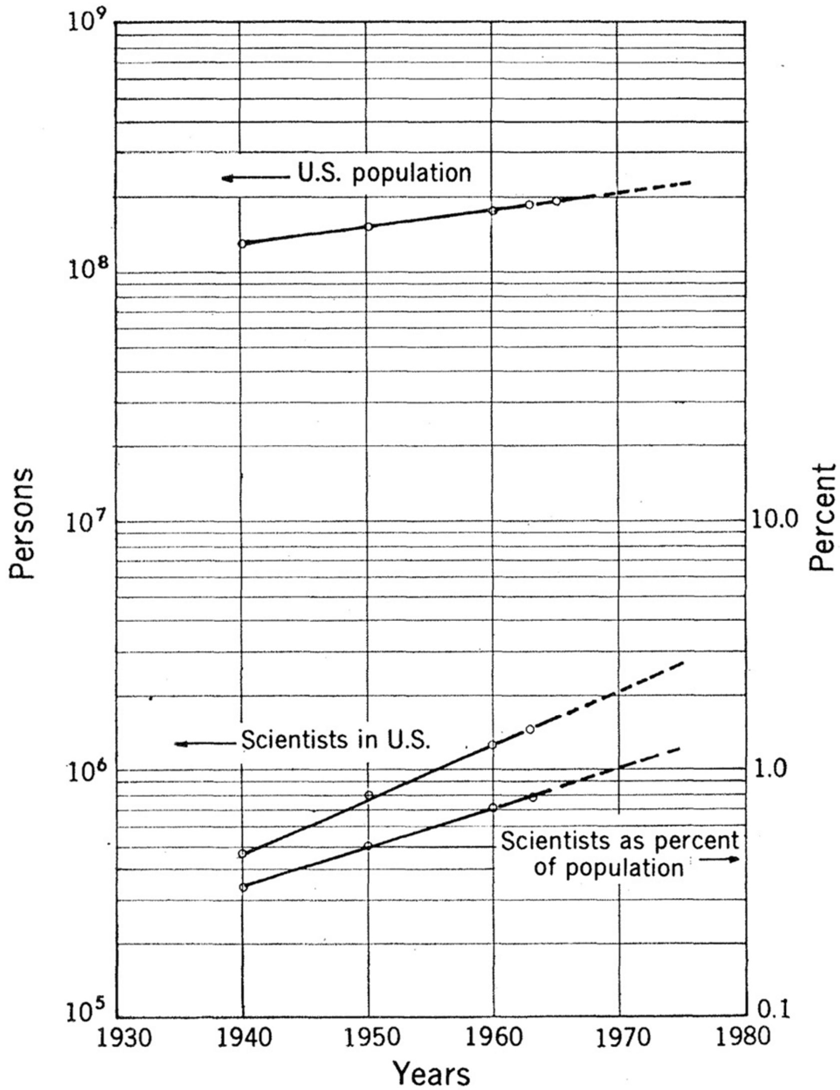


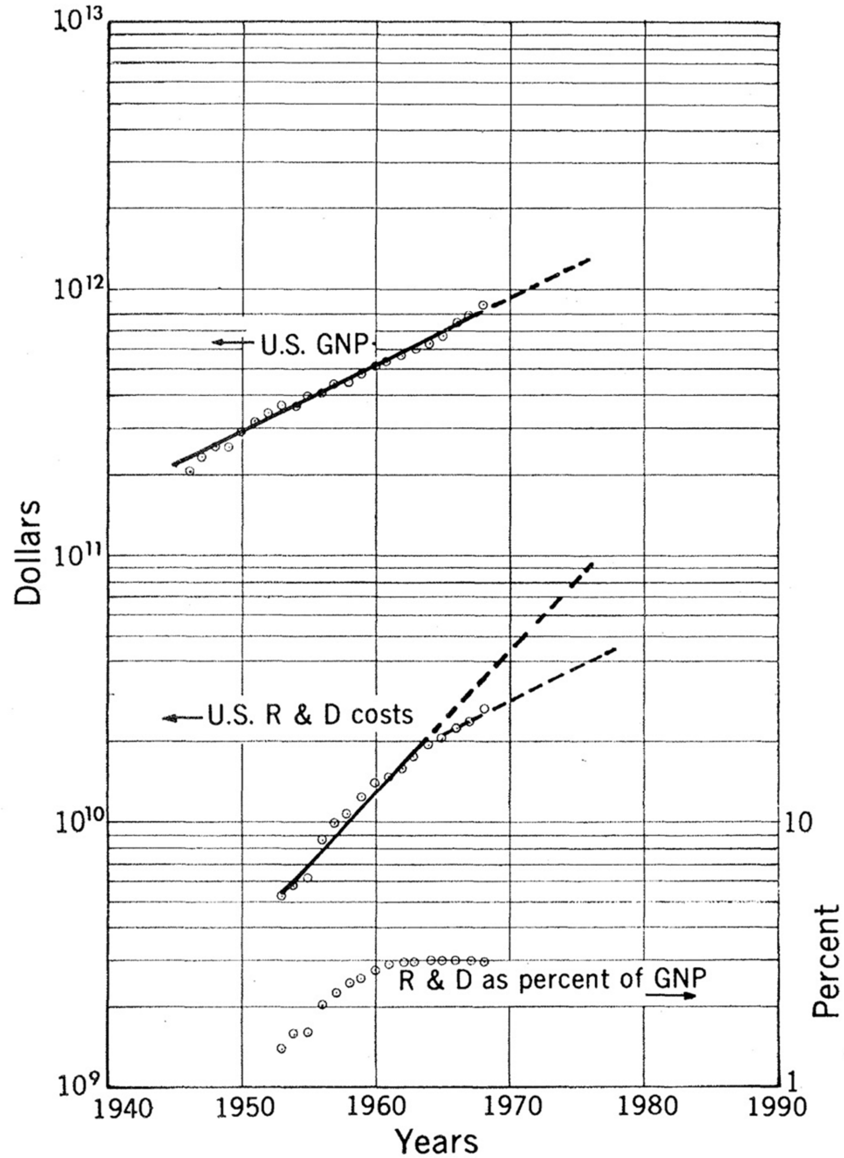




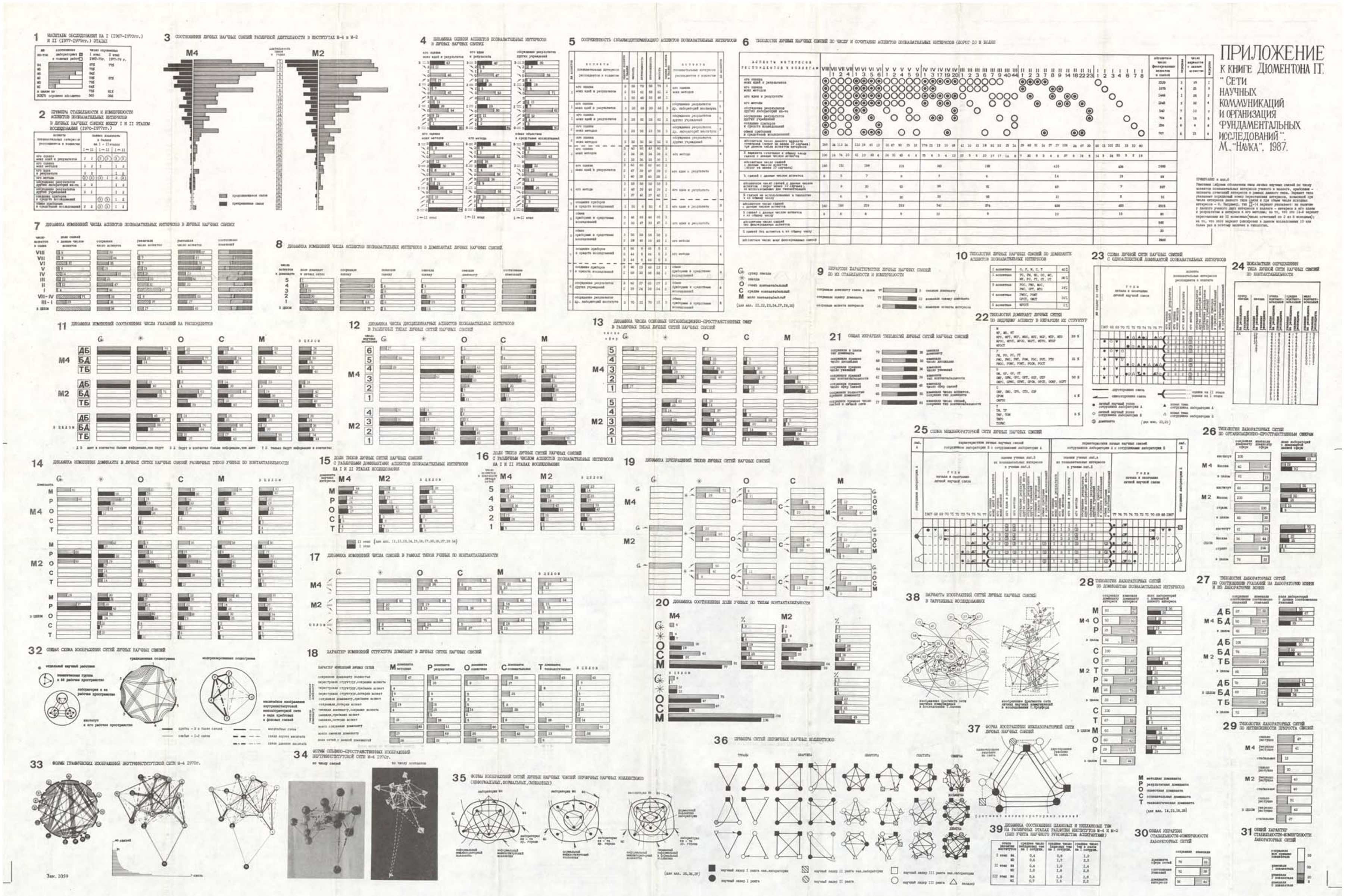


Science and Society in Equilibrium

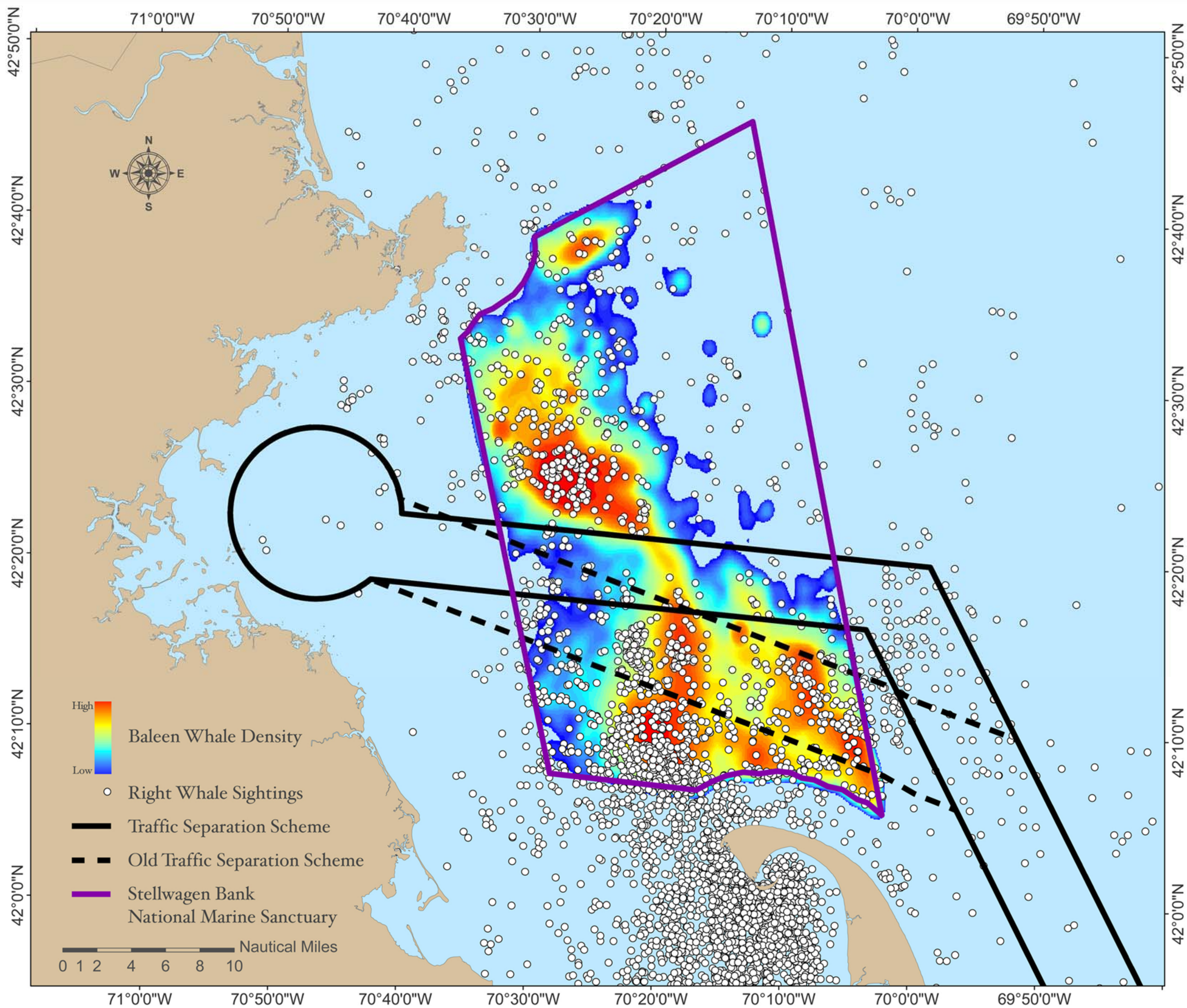




Science and Society in Equilibrium - Joseph P. Martino - 1969



Networks of Scientific Communications - Georgiy G. Dumenton - 1987



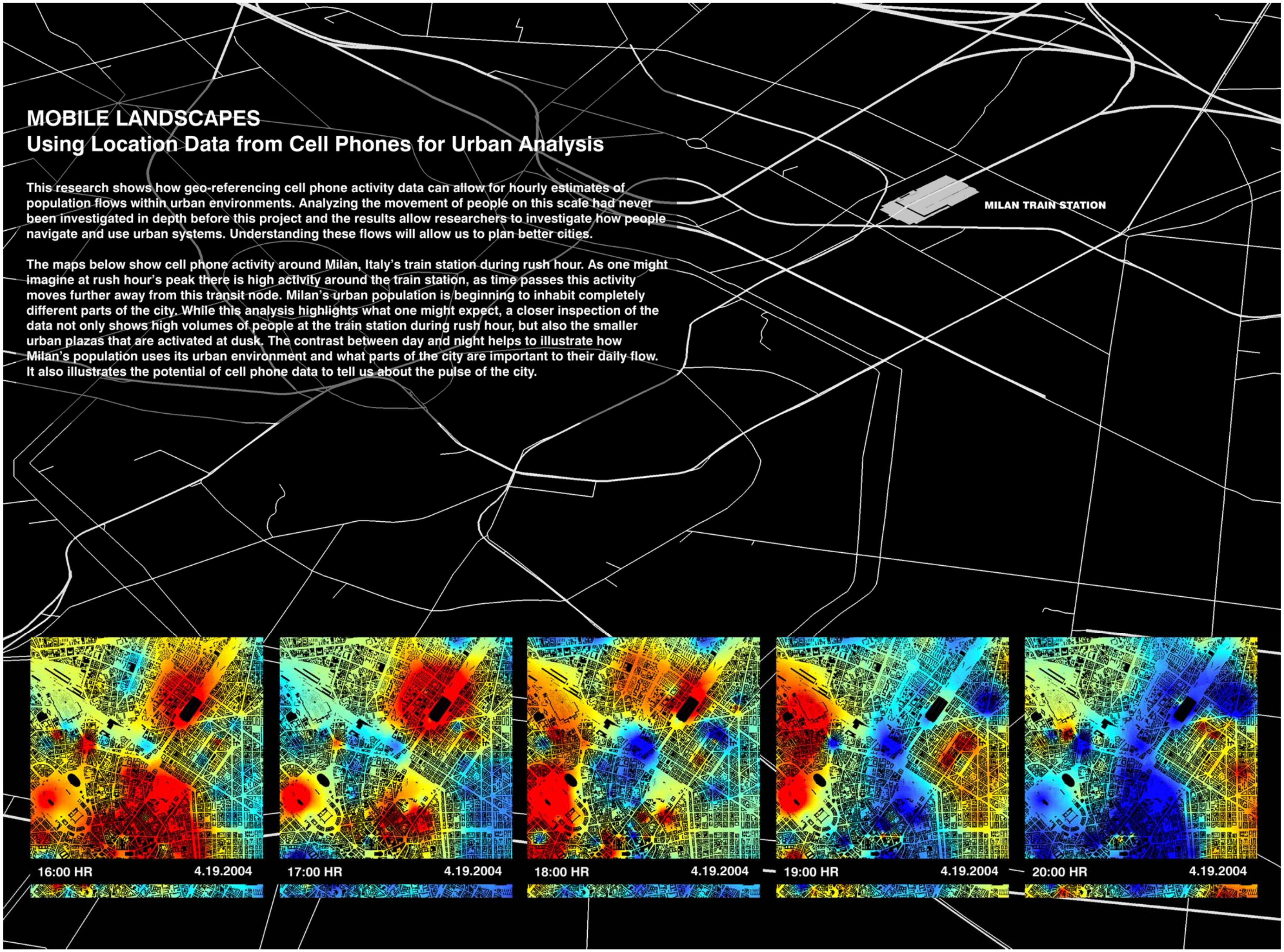
Realigning the Boston Traffic Separation Scheme to Reduce the Risk of Ship Strike to Right and Other Baleen Whales

David N. Wiley, Michael A. Thompson, and Richard Merrick - 2006

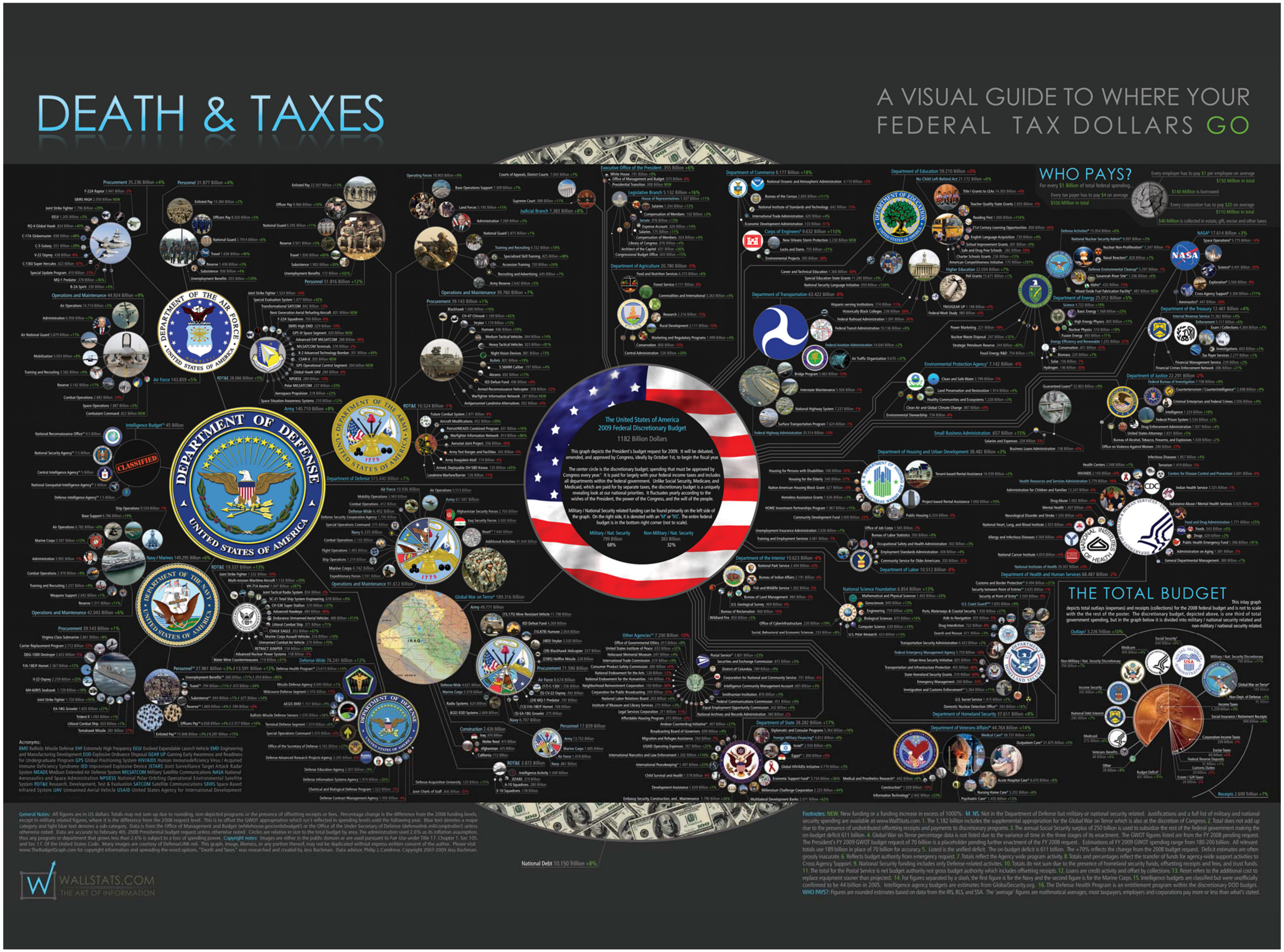
MOBILE LANDSCAPES
Using Location Data from Cell Phones for Urban Analysis

This research shows how geo-referencing cell phone activity data can allow for hourly estimates of population flows within urban environments. Analyzing the movement of people on this scale had never been investigated in depth before this project and the results allow researchers to investigate how people navigate and use urban systems. Understanding these flows will allow us to plan better cities.

The maps below show cell phone activity around Milan, Italy's train station during rush hour. As one might imagine at rush hour's peak there is high activity around the train station, as time passes this activity moves further away from this transit node. Milan's urban population is beginning to inhabit completely different parts of the city. While this analysis highlights what one might expect, a closer inspection of the data not only shows high volumes of people at the train station during rush hour, but also the smaller urban plazas that are activated at dusk. The contrast between day and night helps to illustrate how Milan's population uses its urban environment and what parts of the city are important to their daily flow. It also illustrates the potential of cell phone data to tell us about the pulse of the city.



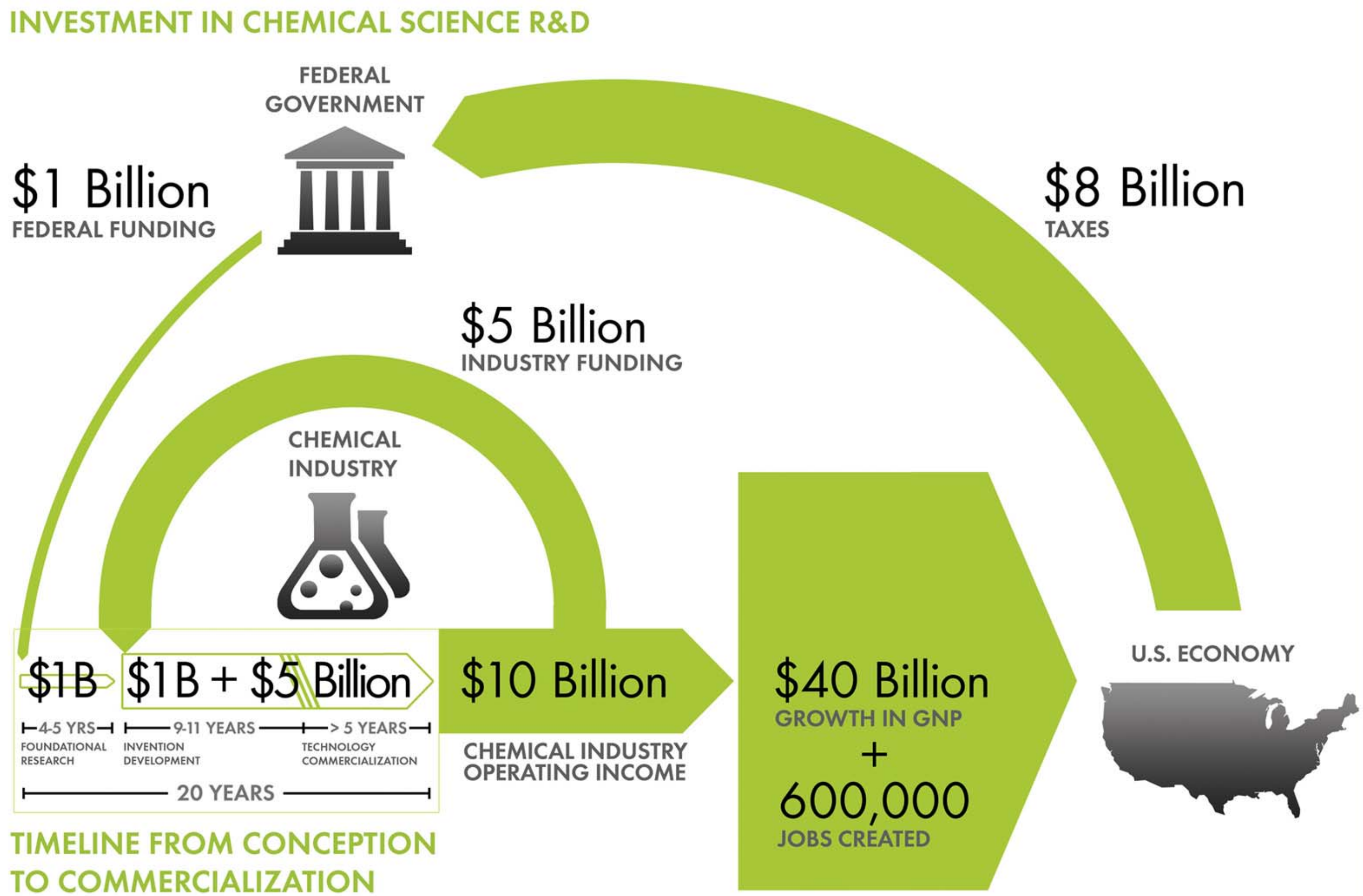
Mobile Landscapes: Using Location Data from Cell Phones for Urban Analysis - Sarah Williams, Carlo Ratti, and Riccardo Maria Pulselli - 2006



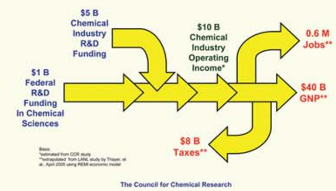
Death and Taxes 2009 - Jess Bachman - 2009

Chemical Research & Development
Powers the U.S. Innovation Engine

Macroeconomic Implications of Public and Private R&D Investments in Chemical Sciences



The Council for Chemical Research (CCR) has provided the U.S. Congress and government policy makers with important results regarding the impact of Federal Research & Development (R&D) investments on U.S. innovation and global competitiveness through its commissioned 5-year two phase study. To take full advantage of typically brief access to policy makers, CCR developed the graphic below as a communication tool that distills the complex data produced by these studies in direct, concise and clear terms.



The design shows that an input of $1B in federal investment, leveraged by $5B industry investment, brings new technologies to market and results in $10B of operating income for the chemical industry, $40B growth in the Gross National Product (GNP) and further impacts the US economy by generating approximately 600,000 jobs, along with a return of $8B in taxes. Additional details, also reported in the CCR studies, are depicted in the map to the left. This map clearly shows the two R&D investment cycles; the shorter industry investment at the innovation stage to commercialization cycle; and the longer federal investment cycle which begins in basic research and culminates in national economic and job growth along with the increase tax base that in turn is available for investment in basic research.

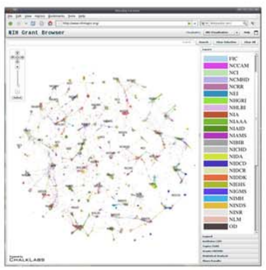
Chemical R&D Powers the U.S. Innovation Engine - The Council for Chemical Research - 2009

A Topic Map of NIH Grants 2007

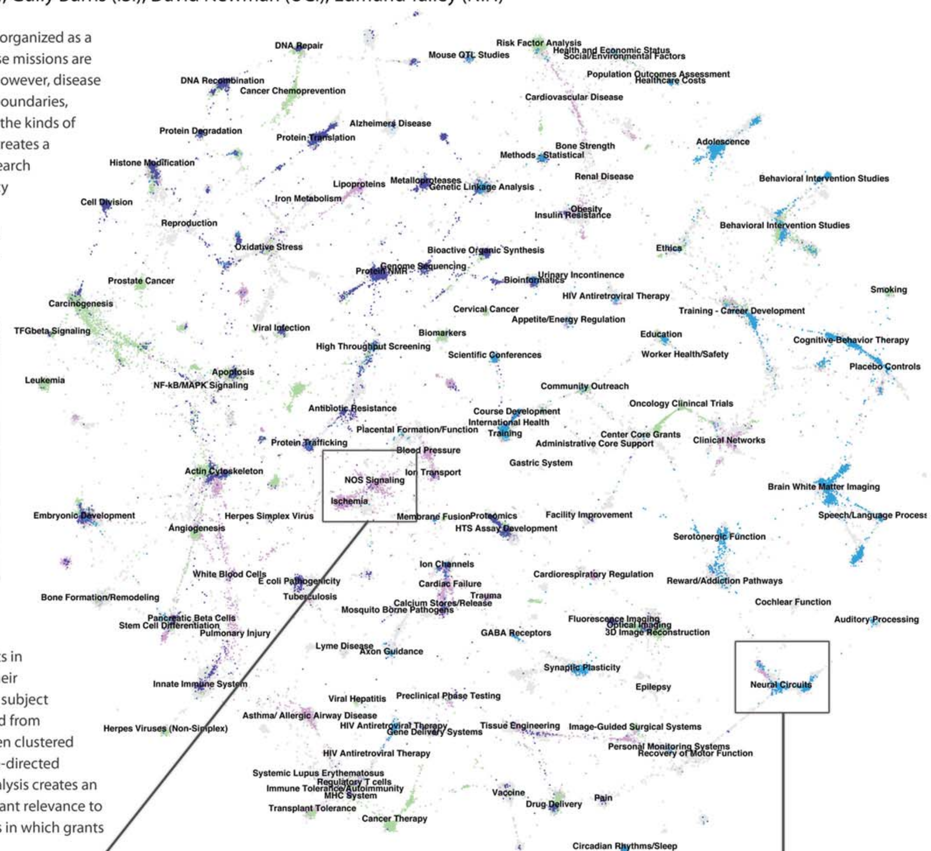
ChalkLabs ISI UCIrvine

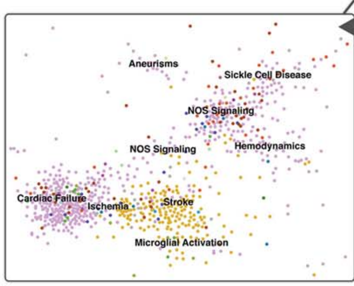
Bruce W. Herr II (Chalklabs & IU), Gully Burns (ISI), David Newman (UCI), Edmund Talley (NIH)

The National Institutes of Health (NIH) is organized as a multitude of Institutes and Centers whose missions are primarily focused on distinct diseases. However, disease etiologies and therapies flout scientific boundaries, and thus there is tremendous overlap in the kinds of research funded by each Institute. This creates a daunting landscape for decisions on research directions, funding allocations, and policy formulations. Shown here is devised an interactive topic map for navigating this landscape, online at www.nihmaps.org. Institute abbreviations can be found at www.nih.gov/icd.



Topic modeling, a statistical technique that automatically learns semantic categories, was applied to assess projects in terms used by researchers to describe their work, without the biases of keywords or subject headings. Grant similarities were derived from their topic mixtures, and grants were then clustered on a two-dimensional map using a force-directed simulated annealing algorithm. This analysis creates an interactive environment for assessing grant relevance to research categories and to NIH Institutes in which grants are localized.



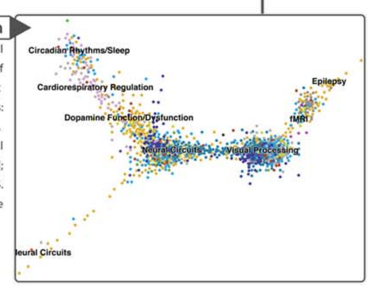


Cardiac Diseases Research

An area of the map focused on cardio-vascular function and dysfunction. Cardiac Failure (primarily funded by NHLBI) is topically clustered next to Stroke (NINDS), since these are the two major medical emergencies associated with ischemia, which results from a re-stricted blood supply. Also localized in this area are grants focused on Nitric Oxide (NOS) Signaling, a major biochem-ical pathway for vasodilation, and grants on Hemodynamics, Sickle Cell Disease and Aneurysms.

Neural Circuits Research

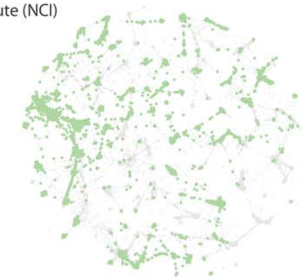
An area of the map focused on neural circuits, which shows the diversity of topics and NIH Institutes that fund research in this area, such as: Cardiorespiratory Regulation, primarily funded by NHLBI; Visual Processing, primarily funded by NEI and; Epilepsy, primarily funded by NINDS. For color coding, see legend in the upper left inset.



National Cancer Institute (NCI)

TOP 10 TOPICS

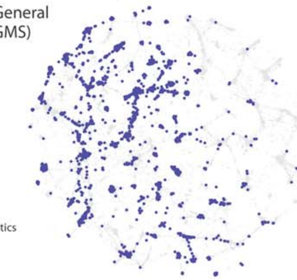
1. Oncology Clinincal Trials
2. Cancer Treatment
3. Cancer Therapy
4. Carcinogenesis
5. Risk Factor Analysis
6. Cancer Chemotherapy
7. Metastasis
8. Leukemia
9. Prediction/Prognosis
10. Cancer Chemoprevention



National Institute of General Medical Sciences (NIGMS)

TOP 10 TOPICS

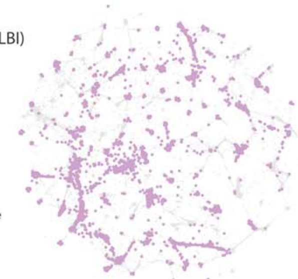
1. Bioactive Organic Synthesis
2. X-ray Crystallography
3. Protein NMR
4. Computational Models
5. Yeast Biology
6. Metalloproteases
7. Enzymatic Mechanisms
8. Protein Complexes
9. Invertebrate/Zebrafish Genetics
10. Cell Division



National Heart, Lung, and Blood Institute (NHLBI)

TOP 10 TOPICS

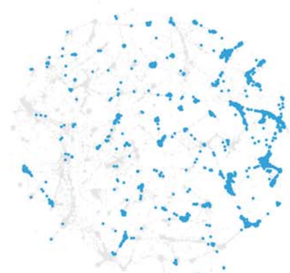
1. Cardiac Failure
2. Pulmonary Injury
3. Genetic Linkage Analysis
4. Cardiovascular Disease
5. Atherosclerosis
6. Hemostasis
7. Blood Pressure
8. Asthma/ Allergic Airway Disease
9. Gene Association
10. Lipoproteins



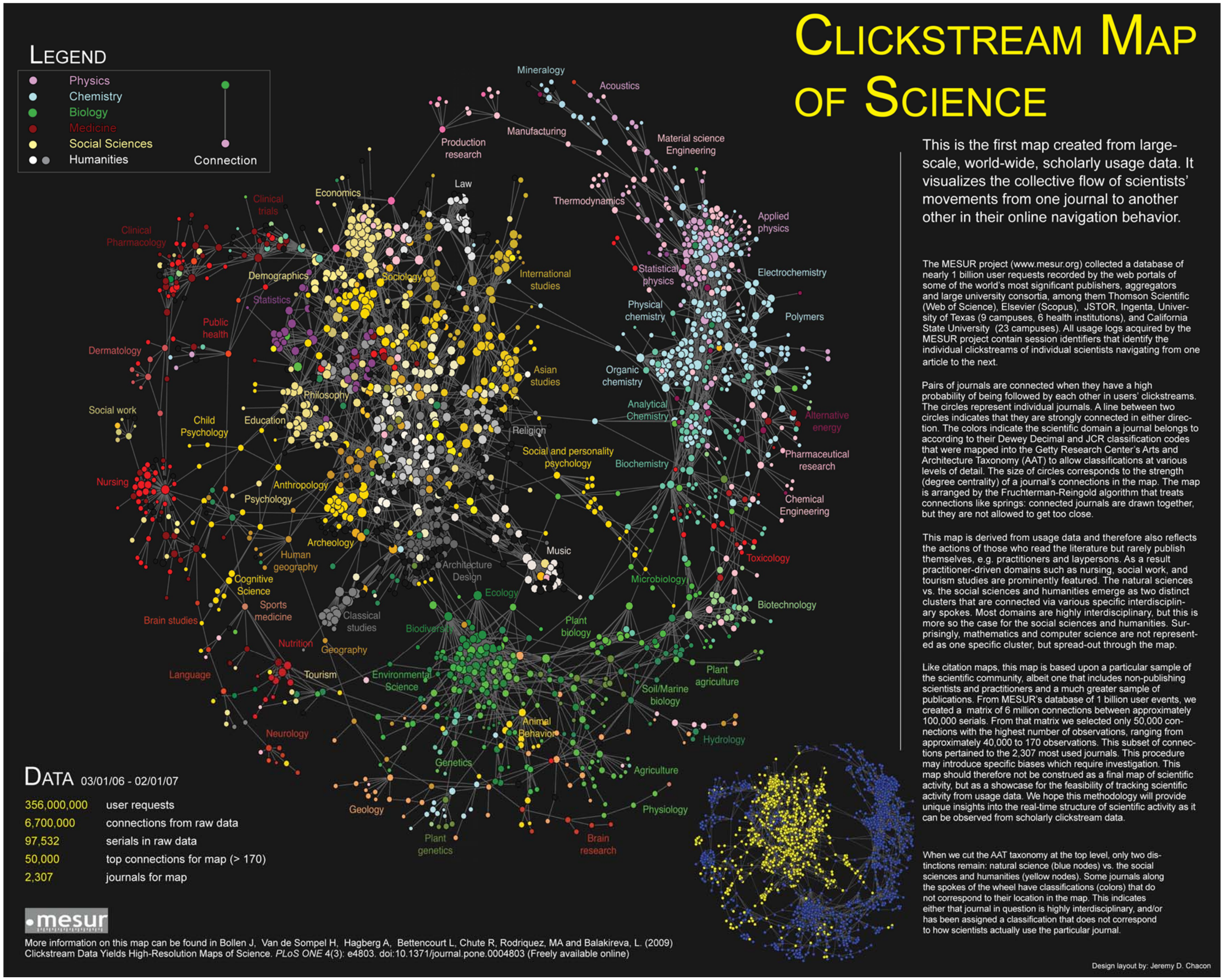
National Institute of Mental Health (NIMH)

TOP 10 TOPICS

1. Mood Disorders
2. Schizophrenia
3. Behavioral Intervention Studies
4. Mental Health
5. Depression
6. Cognitive-Behavior Therapy
7. AIDS Prevention
8. Genetic Linkage Analysis
9. Adolescence
10. Childhood

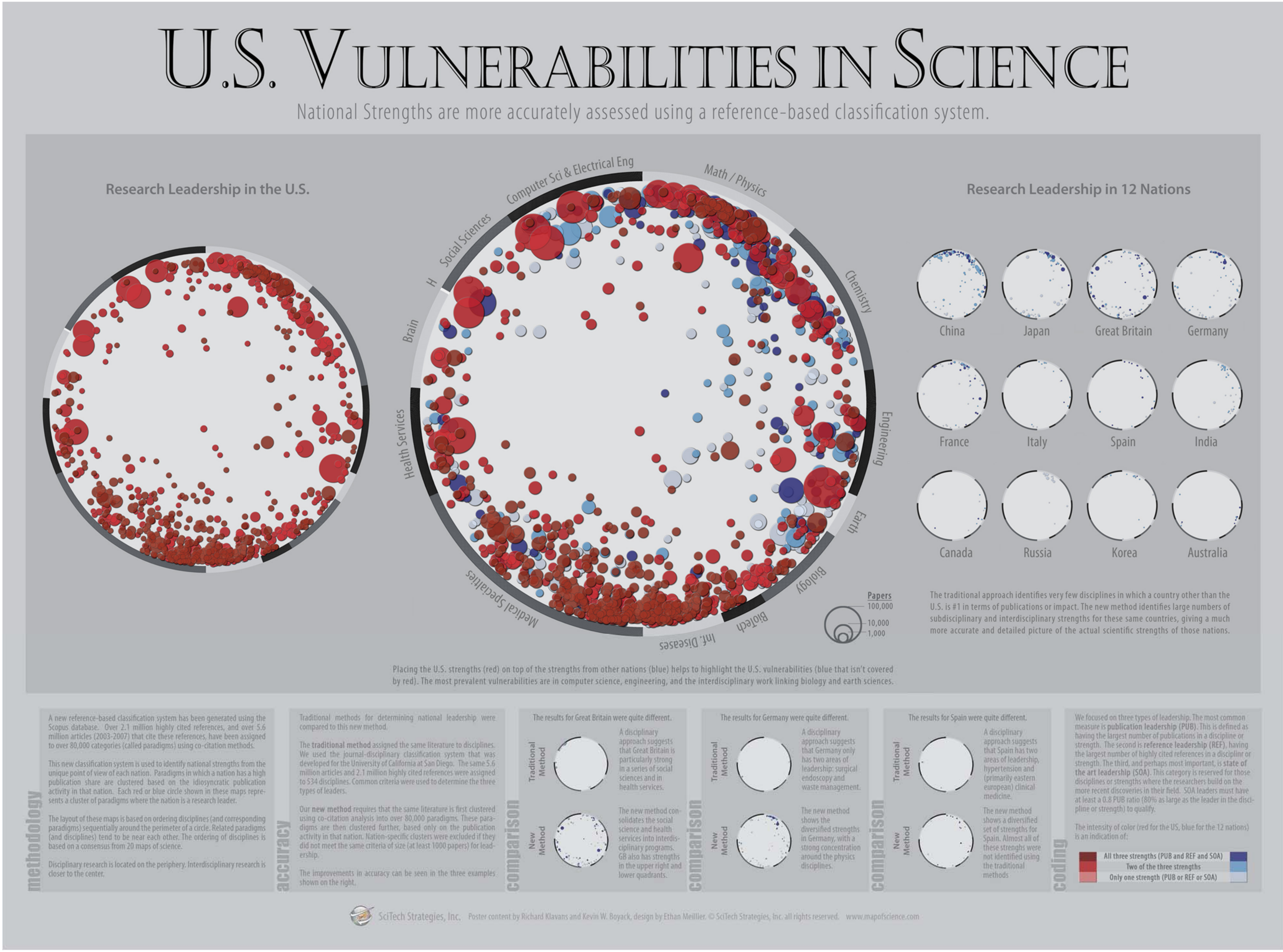


A Topic Map of NIH Grants 2007 - Bruce W. Herr II, Gully Burns, David Newman, and Edmund Talley - 2007

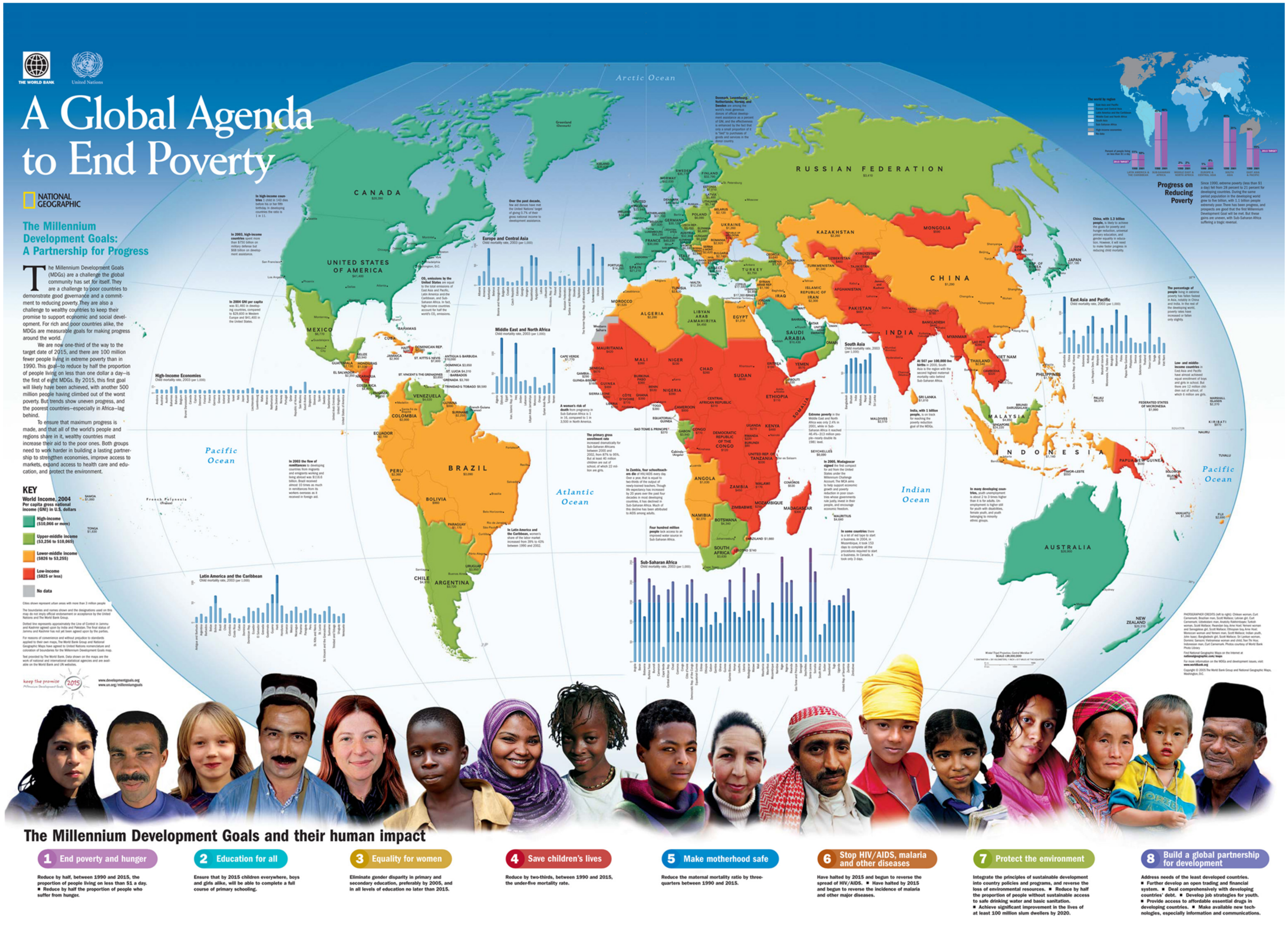


A Clickstream Map of Science

Johan Bollen, Herbert Van de Sompel, Aric Hagberg, Luís M. A. Bettencourt, Ryan Chute, Marko A. Rodriguez, and Lyudmila Balakireva - 2008

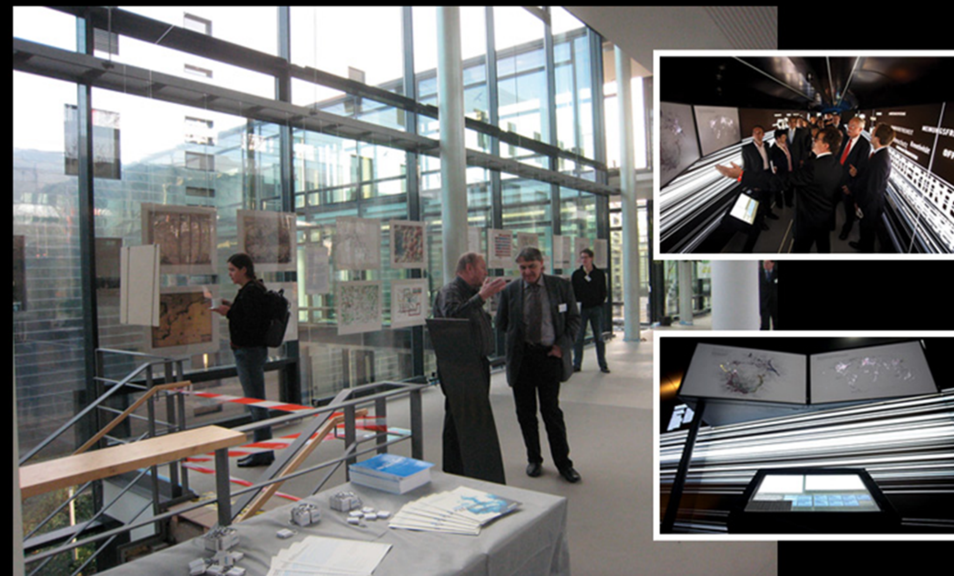


U.S. Vulnerabilities in Science - Kevin W. Boyack and Richard Klavans - 2008



The Millennium Development Goals Map - The World Bank and National Geographic - 2006

Exhibit Venues

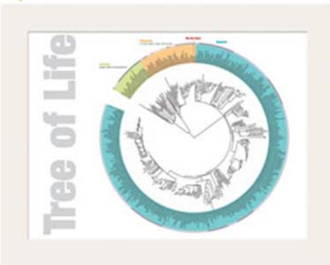


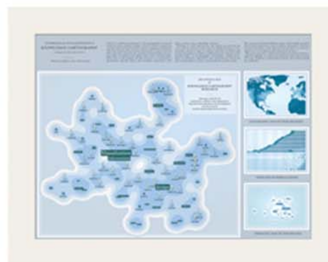
December 11-19, 2008, Center of Advanced European Studies and Research, Bonn, Germany

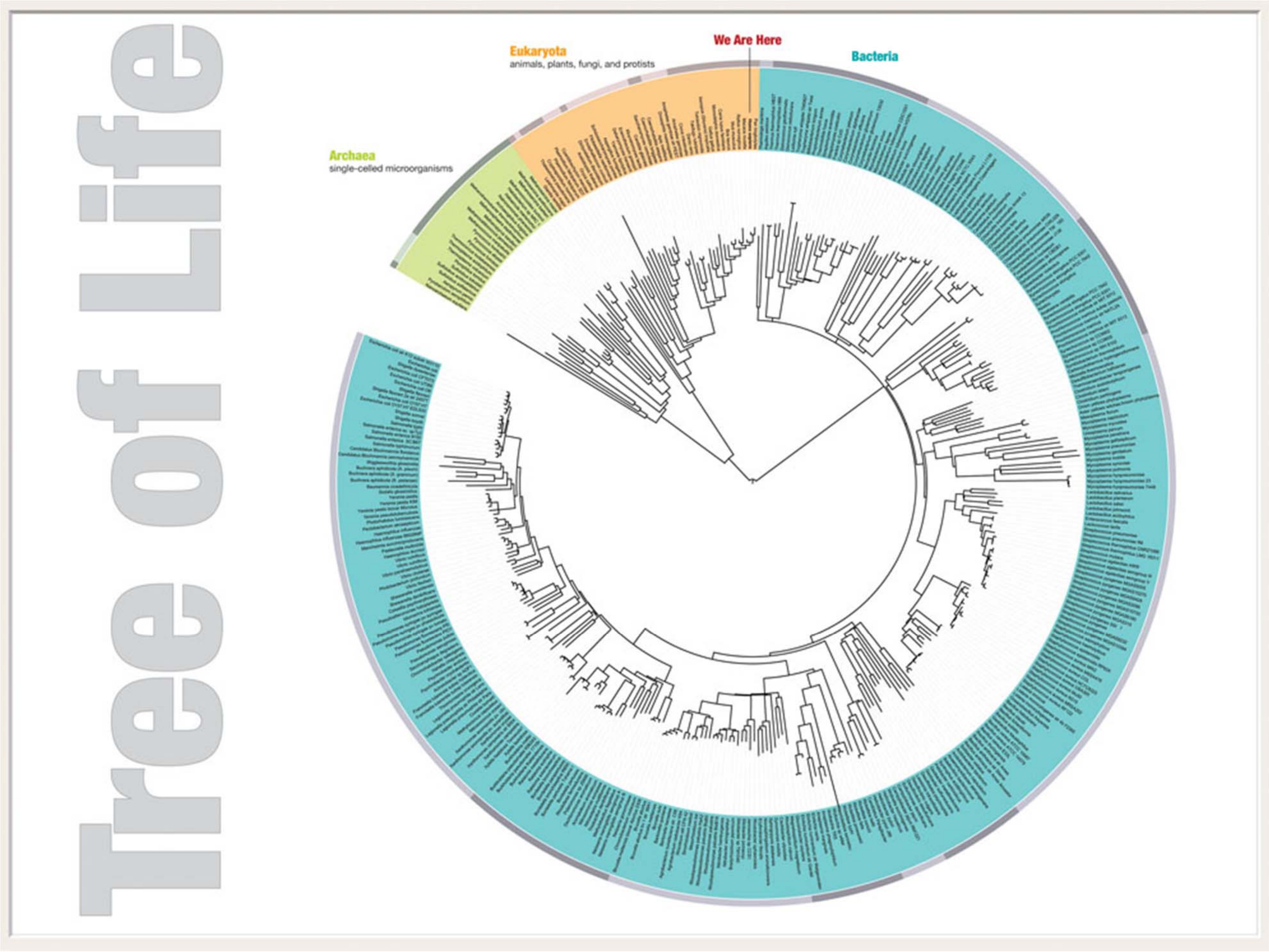
April 15 - December 18, Stanford University, Stanford, CA. May 18 - debut of 5th iteration.
Courtesy of Media X, Stanford University

2005 - Present
1st iteration on display at NSF, Washington, D.C.

Science Maps for Scholars 2010

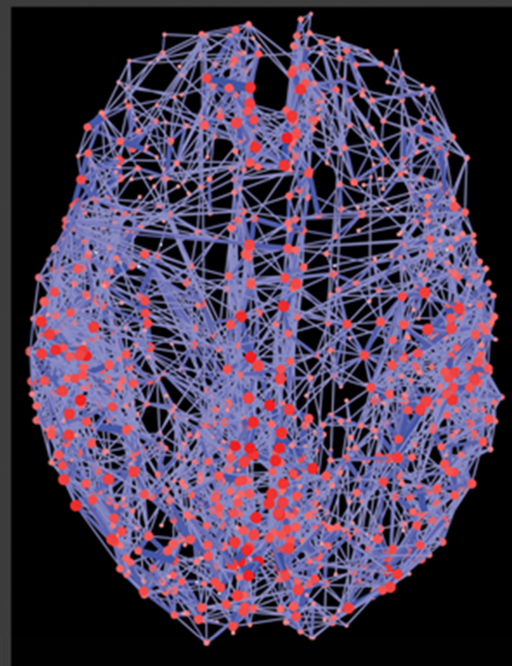


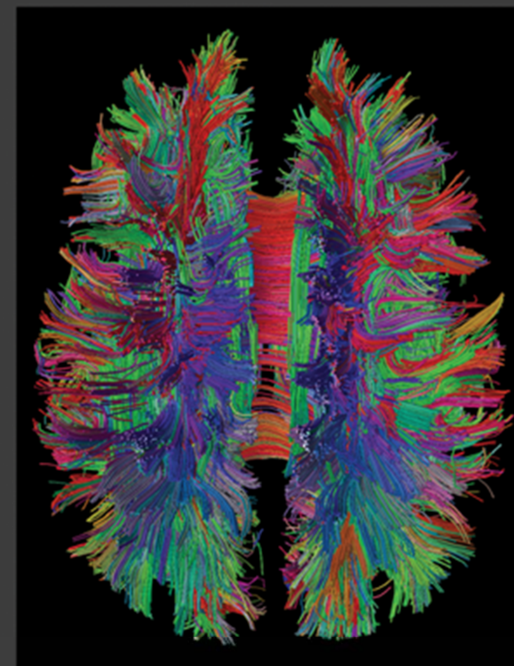




Tree of Life - Peer Bork, Francesca Ciccarelli, Chris Creevey, Berend Snel & Christian von Mering - 2006

The Human Connectome



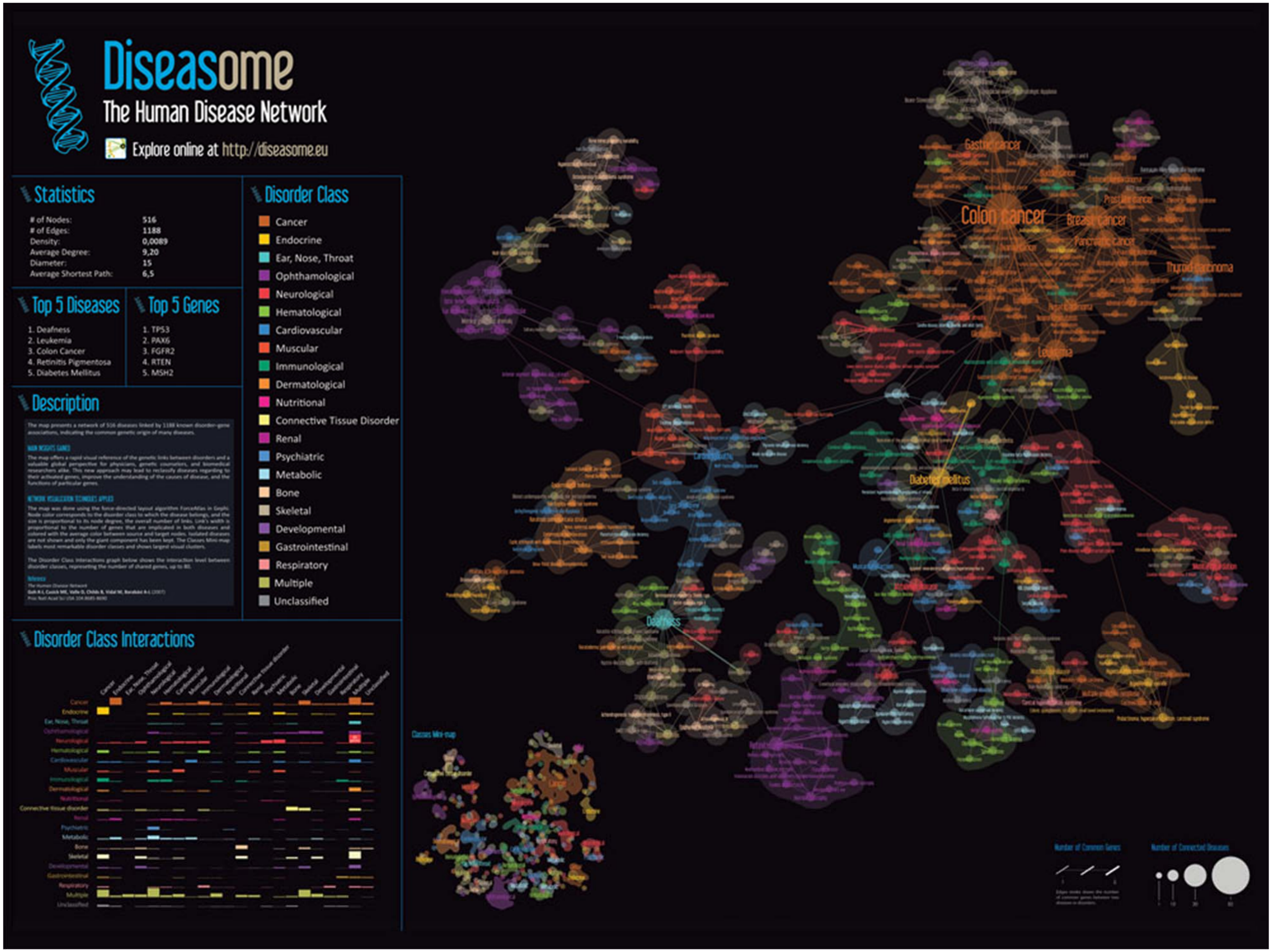


Anatomy
Klingler's method for fiber tract dissection uses freezing of brain matter to spread nerve fibers apart. Afterwards, tissue is carefully scratched away to reveal a relief-like surface in which the desired nerve tracts are naturally surrounded by their anatomical brain areas.

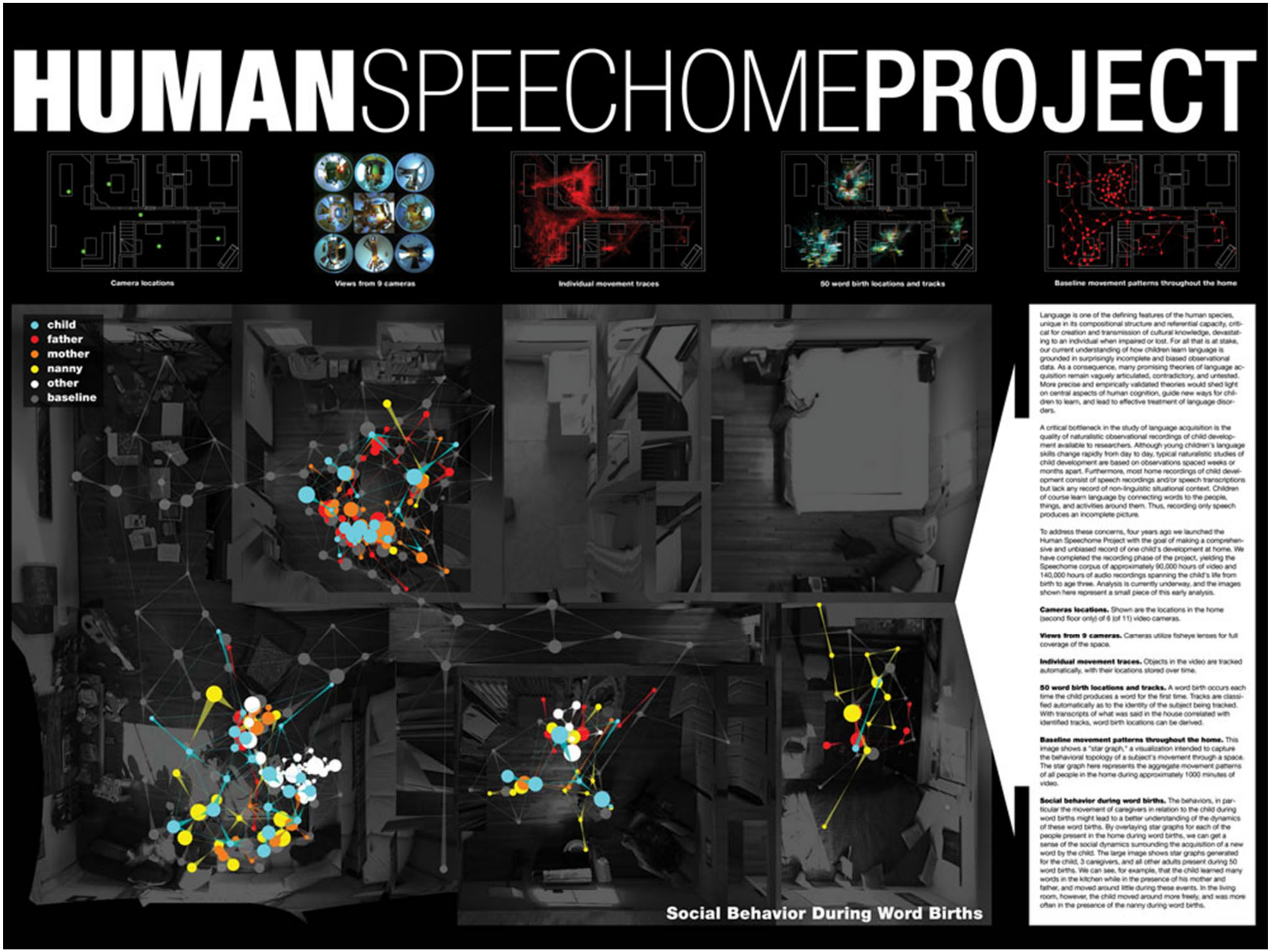
Connectome
Shown are the connections of brain regions together with "hubs" that connect signals among different brain areas and a central "core" or backbone of connections, which relays commands for our thoughts and behaviors.

Neuronal Pathways
A new MRI technique called diffusion spectrum imaging (DSI) analyzes how water molecules move along nerve fibers. DSI can show a brain's major neuron pathways and will help neurolo-gists relate structure to function.

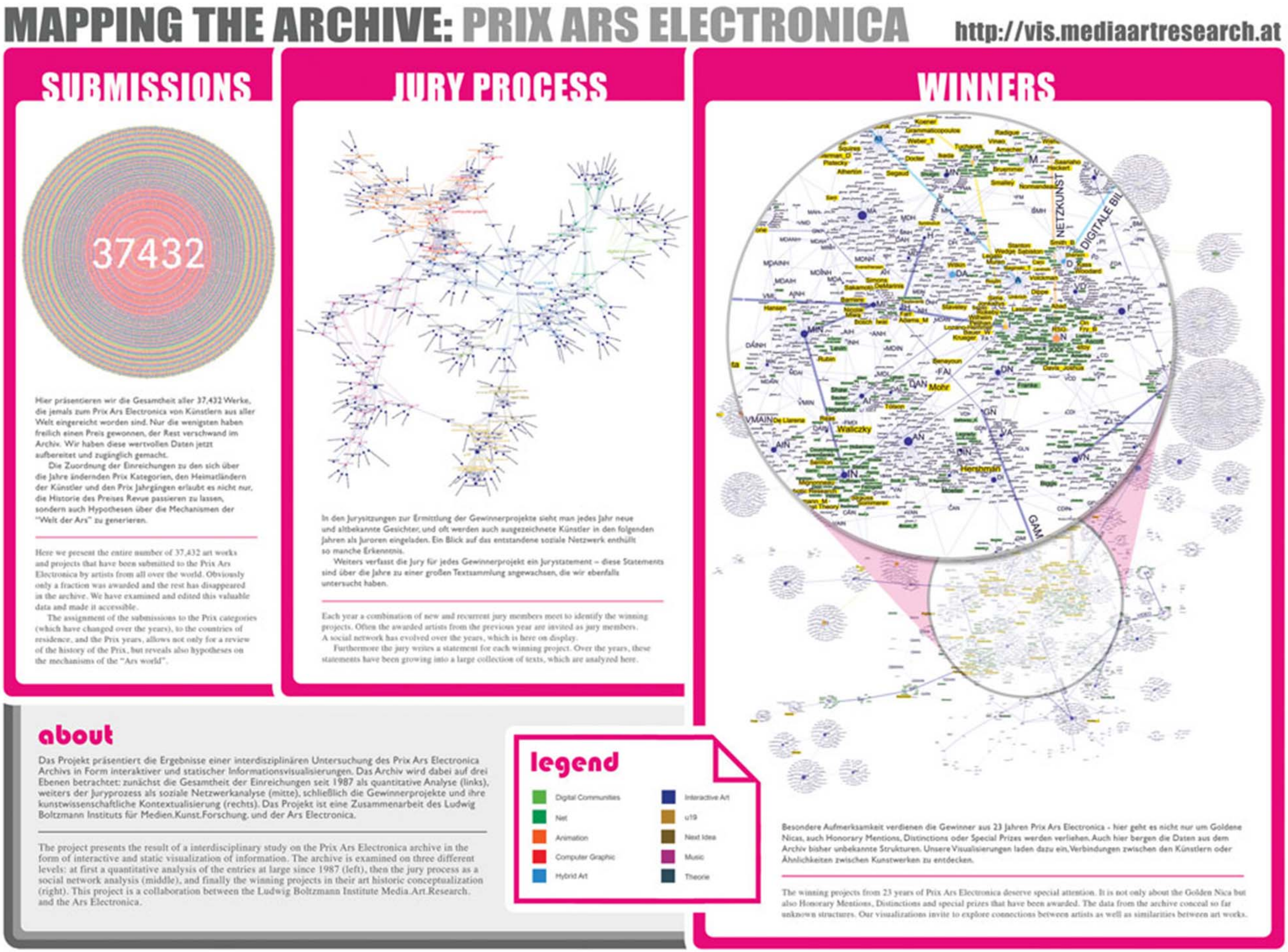
The Human Connectome - Eugen Ludwig, Josef Klingler, Patric Hagmann & Olaf Sporns - 1956, 2008



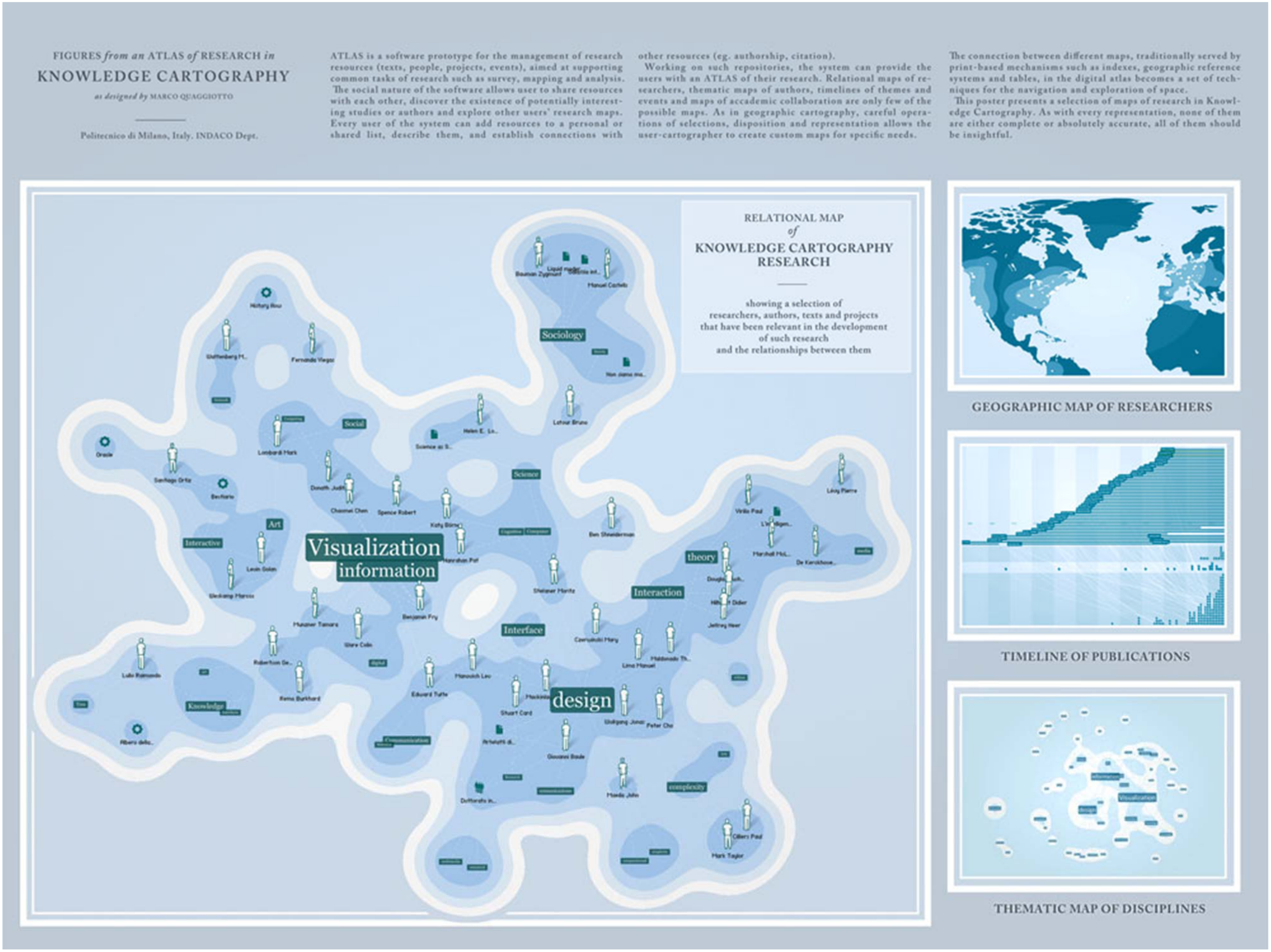
Diseasome - Mathieu Bastian & Sebastien Heymann - 2009



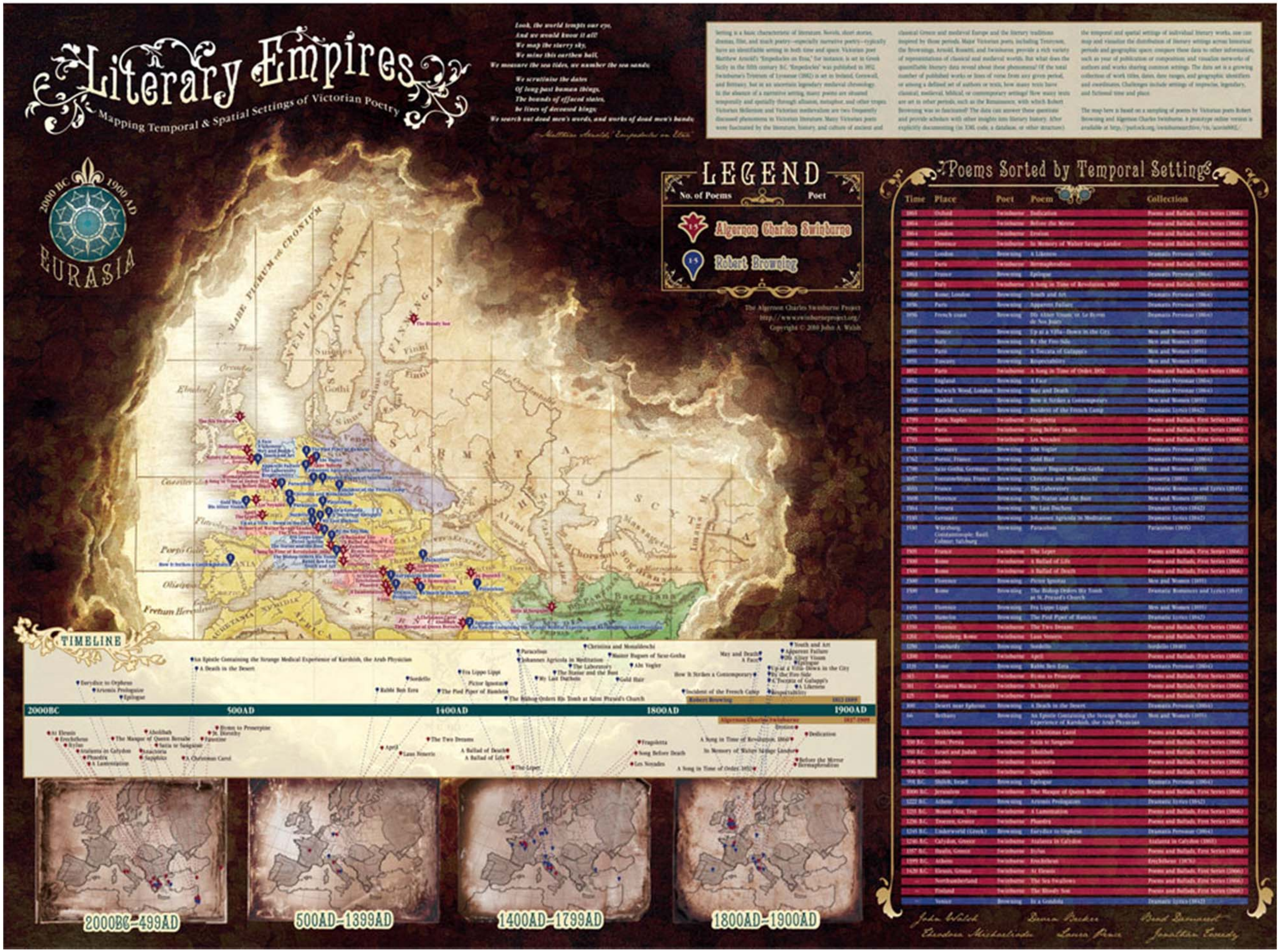
Speechome - George Shaw, Philip James DeCamp & Deb Roy - 2010



Mapping the Archive: Prix Ars Electronica - Dietmar Offenhuber, Moritz Stefaner, Evelyn Münster, Jaume Nualart & Gerhard Dirmoser - 2008

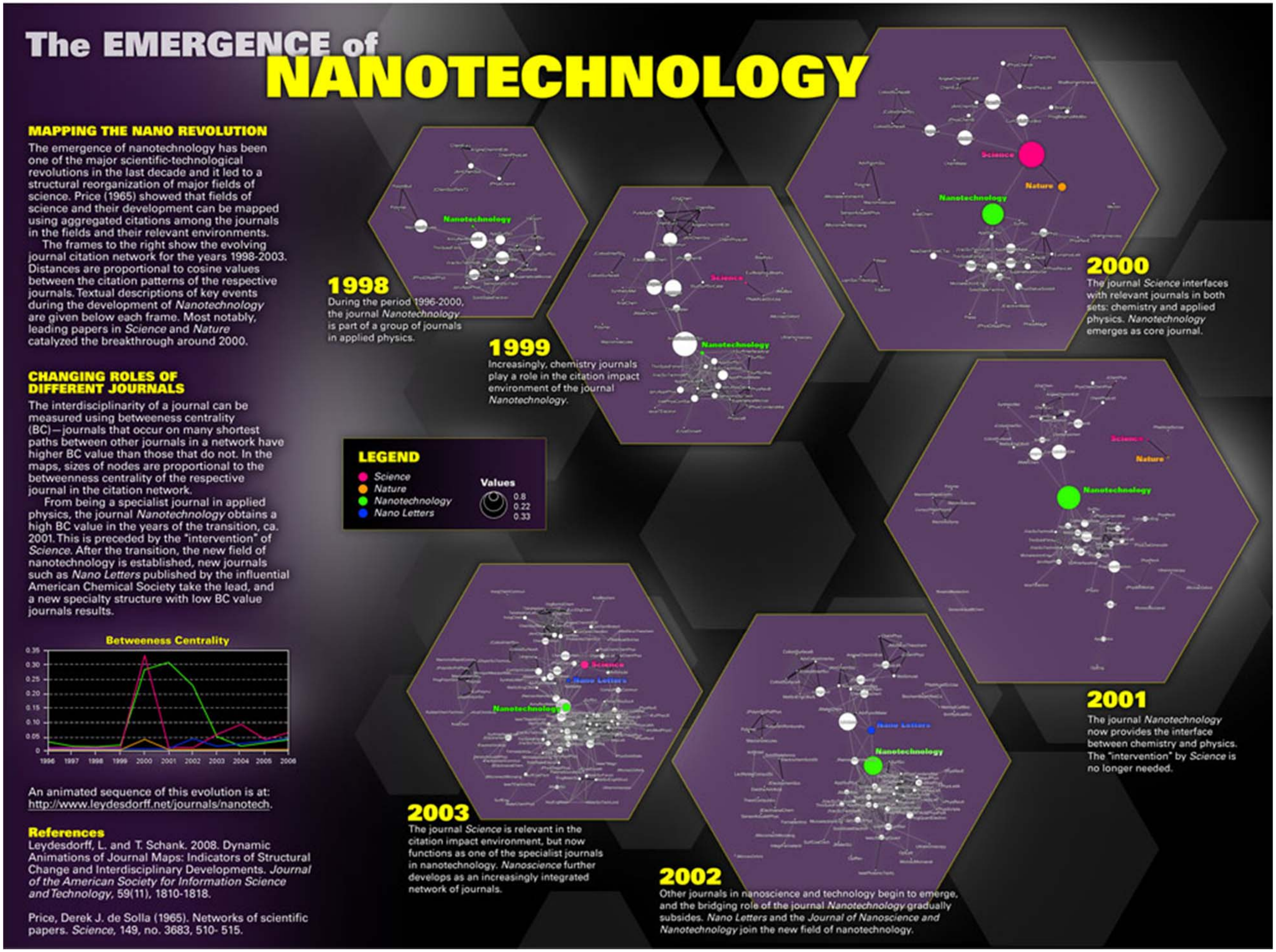


Knowledge Cartography - Marco Quaggiotto - 2008

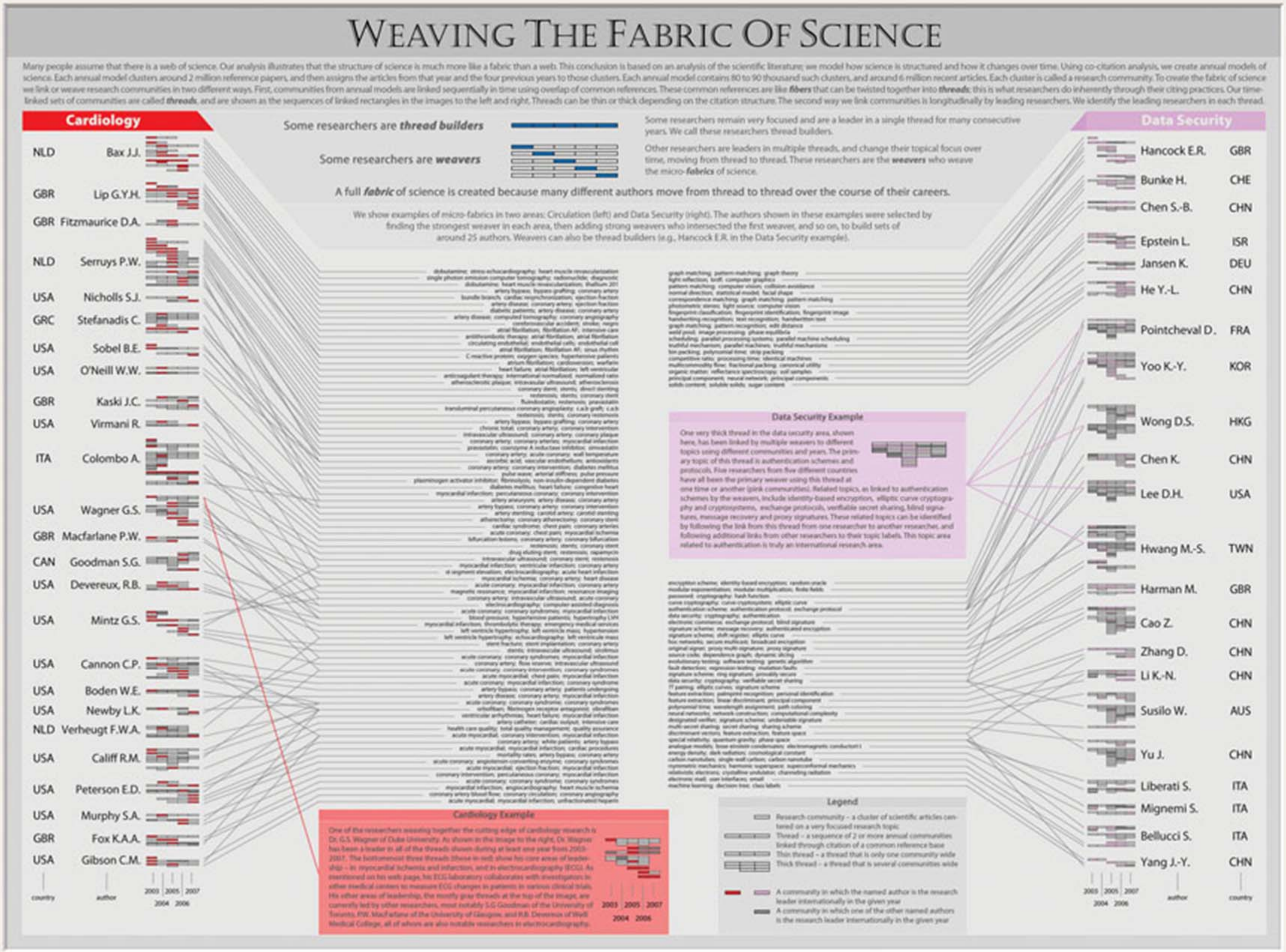


Literary Empires: Mapping Temporal and Spatial Settings of Victorian Poetry

John A. Walsh, Devin Becker, Bradford Demarest, Jonathan Tweedy, Theodora Michaelidou & Laura Pence - 2010



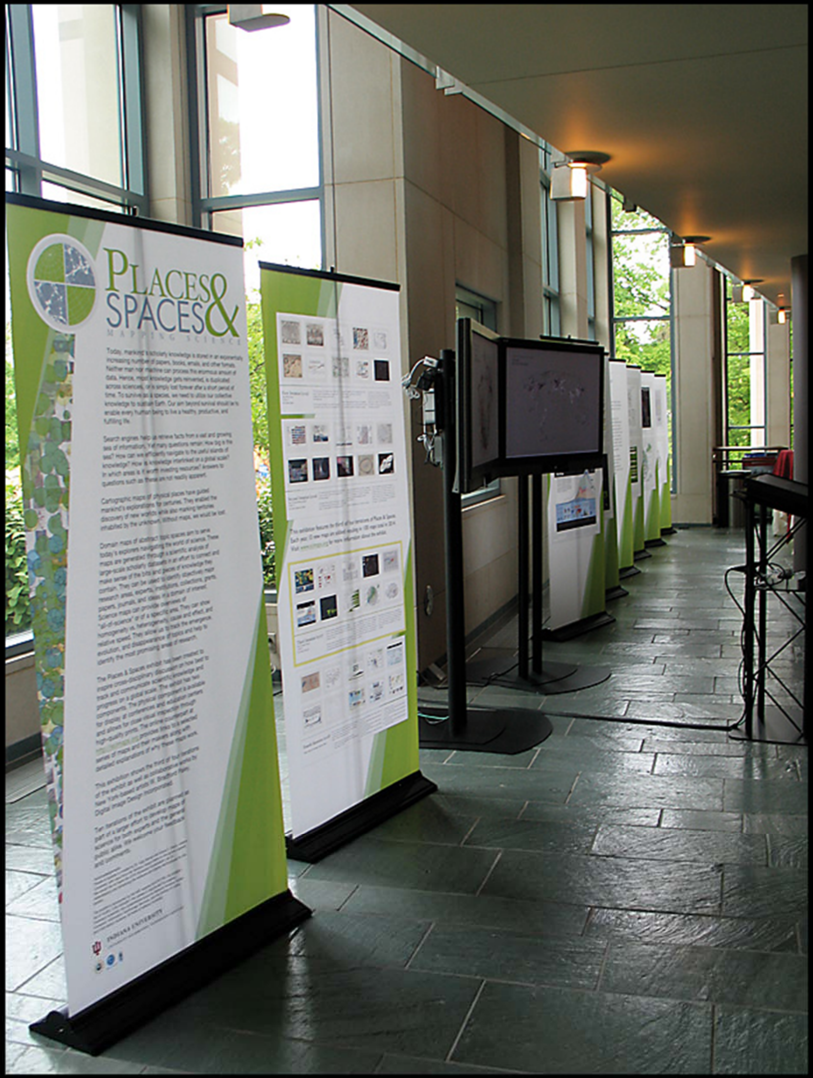
The Emergence of Nanoscience & Technology - Loet Leydesdorff - 2010



Weaving the Fabric of Science - Richard Klavans & Kevin W. Boyack, SciTech Strategies, Inc. - 2010

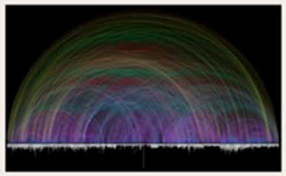
U.S. Job Market: Where are the Academic Jobs? - Angela M. Zoss & Katy Börner - 2010

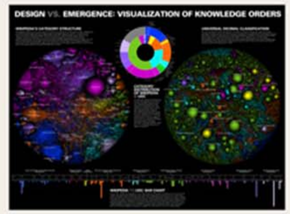
Want to host the **Places & Spaces** Exhibit?

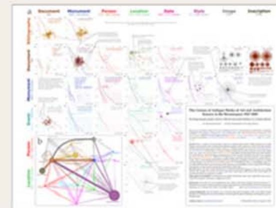


Visit Exhibit Info at
scimaps.org for
more information.

Science Maps as Visual Interfaces to Digital Libraries 2011







MONDOTHÈQUE

A MULTIMEDIA DESK IN A GLOBAL INTERNET

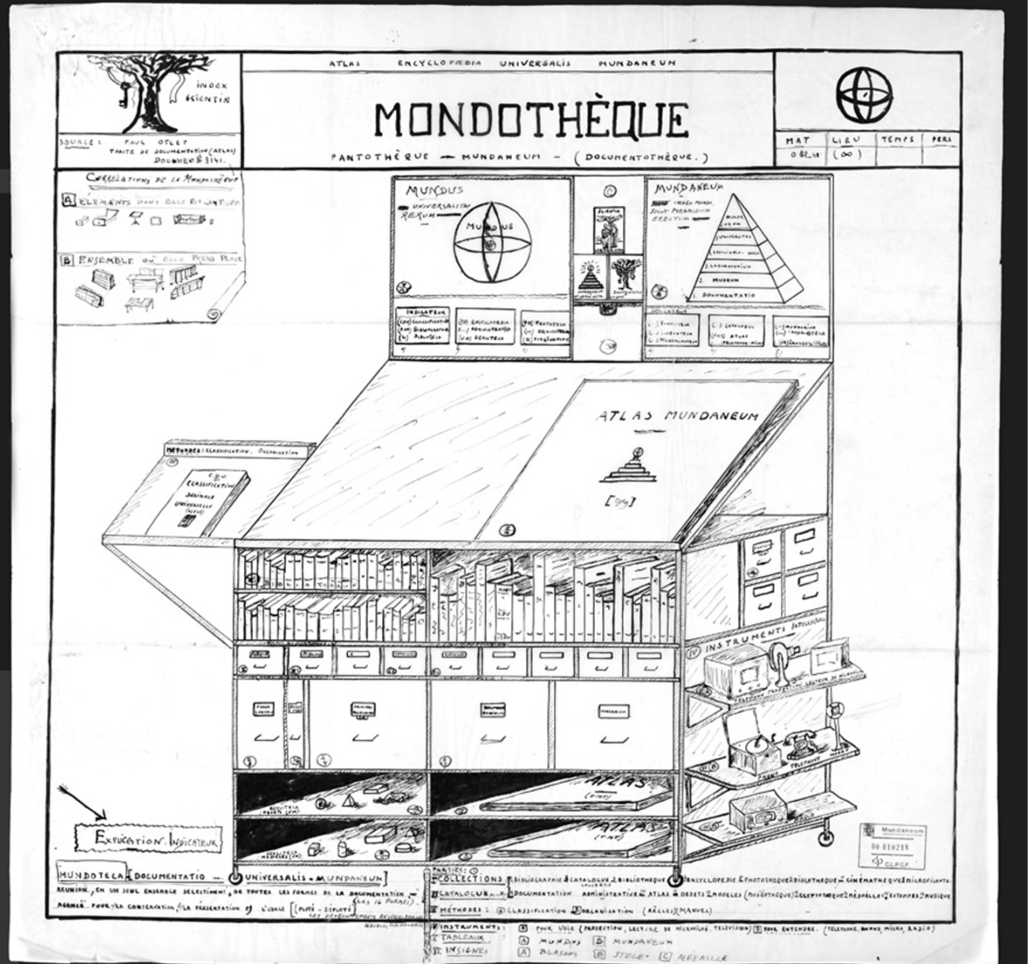
Paul Otlet (1868-1944), visionary Belgian lawyer fascinated by the problems of access to global knowledge, is often acknowledged as a pioneer of the Internet. His design of 1936 for a multimedia desk for home use, the Mondothèque, integrated access to new documentary formats including multimedia substitutes for traditional books involving all available communications technologies such as microfilm, gramophone, radio and TV. A major resource was a new form of visual encyclopedia, the Encyclopedia Universalis Mundaneum. Connected by the Mondothèque to a network of global collections (Species Mundaneum), the user could access and engage in the international production and dissemination of knowledge.

Paul Otlet
Mondothèque
June 8, 1936 | 64 x 67 cm
Pen and ink on transparent paper*
EUM Affiches 8141
© Mundaneum Mons Belgium

The Mondothèque is a multimedia desk with spaces for essential books, with atlases in the form of visual encyclopedia, for small (museum) objects and with drawers for bibliographical cards and microfilms ordered according to the rules of his Universal Decimal Classification system. On its shelves sit communication and broadcasting instruments, such as radio, telephone, television and film equipment.

*Otlet's original drawing is on light grey tracing paper. It has been lightened here for legibility and printing purposes.

Paul Otlet
Species Mundaneum
January 16, 1937 | 21 x 28 cm
pen and ink on transparent paper
EUM 8504
© Mundaneum Mons Belgium



MUNDOTECA [Documentatio-Universalis-Mundaneum]

BRINGING TOGETHER OF ALL KINDS OF DOCUMENTATION - (THE 16 KINDS) IN A SINGLE ORDERED GROUPING

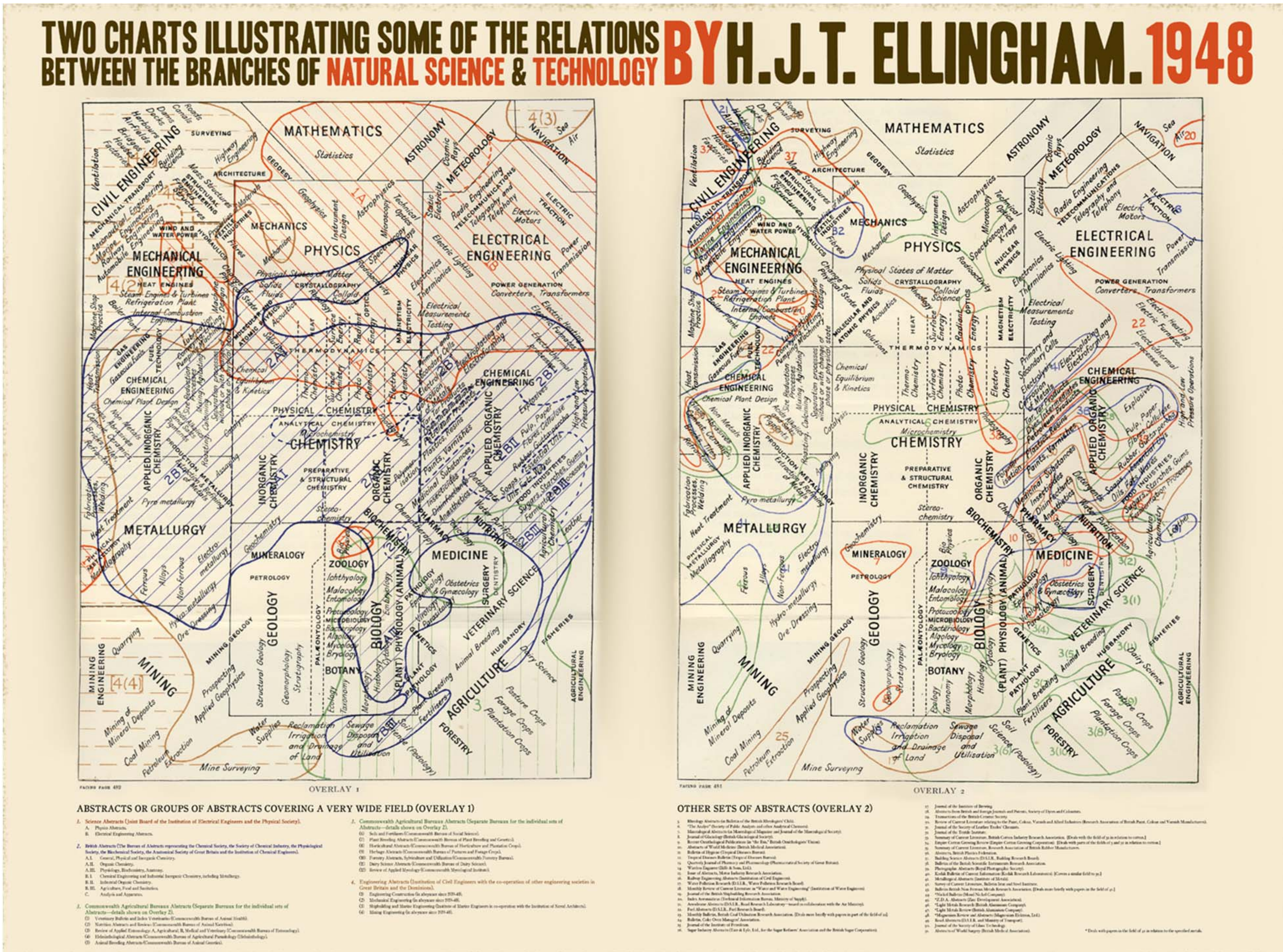
An agency for a) conservation, b) presentation, c) use (specific or general) – systematic developments in furniture, buildings, galleries.

COMPONENTS

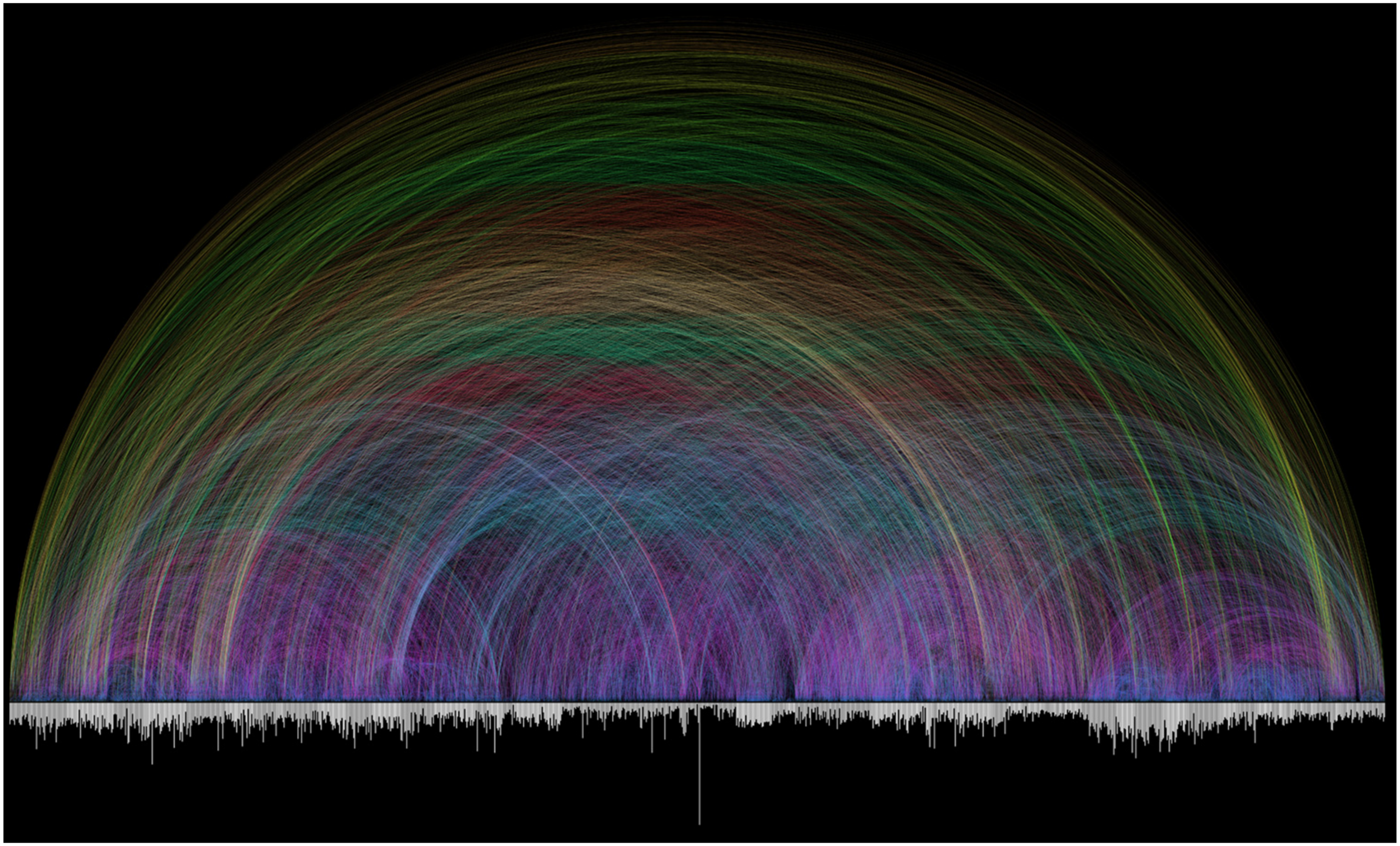
- I. COLLECTIONS: 1 Bibliography • 2 Union Catalogue • 3 Library • 4 Encyclopedia • 5 Photographic library • 6 Music library • 7 Film library • 8 Microfilm library • 9 Administrative Documentation • 10 Atlas [collection of maps, engravings, charts, graphic representations] • 11 Objects • 12 Models [library of museum objects] • 13 Sculpture collection • 14 Medals • 15 Prints • 16 Music
- II. CATALOGUE: of the Mundaneum for all 16 kinds of documentation
- III. METHODS: A Classification • B Organisation (Rules, Manual)
- IV. INSTRUMENTS: A To see with (Projection, Microfilm reader, Television) • B To hear with (Telephone, Phonograph, Microphone, Radio)
- V. CHARTS and TABLES: A Mundus • B Mundaneum
- VI. INSIGNIA: A Coats of Arms • B Stele [Stone monuments] • C Coins

Text: Mondothèque. A multimedia desk in a global internet
Charles van den Heuvel, Huygens ING (KNAW), The Hague & W. Boyd Rayward, University of Illinois, Urbana-Champaign
Acknowledgment: Stéphanie Manfroid, Mundaneum, Mons
Graphic Design: Janet Armstrong BNO| Armstrong Design, Maastricht, NL with the collaboration of Michael J. Stamper

Mondothèque. Multimedia Desk in a Global Internet - Paul Otlet - 1936/37



A Chart Illustrating Some of the Relations between the Branches of Natural Science and Technology - H.J.T. Ellingham - 1948



Visualizing Bible Cross-References - Chris Harrison and Christoph Römhild - 2008

Finding RESEARCH LITERATURE on Autism

A Comparison of Four Bibliographic Databases

PubMed® (PM)

Records: 19 million

Scope: Emphasis on biomedicine and health journals. Primarily MEDLINE database plus selected other records. 1949–present.

Producer: National Center for Biotechnology Information, National Library of Medicine, NIH

Selected features: Free. Links to other NCBI resources (e.g., Entrez Gene). MeSH indexing. Automatic mapping of queries to MeSH terms and narrower concepts.

Scopus™ (SCO)

Records: 38 million

Scope: Multi–disciplinary, primarily life, health, social, and physical sciences. Journals, books, conferences, et al. back to 1823.

Producer: Elsevier

Selected features: References and citation counts (post–1996). Searches scientific web sites and patents. Proximity search. Author and affiliation identifier tools. Author details page with citations, affiliations, h–index, etc.

Web of Science® (WOS)

Records: 39 million*

Scope: Wide variety of sciences and social sciences*. Journals, book reviews, meeting abstracts, etc.

Producer: Thomson Reuters

Selected features: References and citation counts and h–index. Integration with EndNote Web, ResearcherID, and search of scientific web sites. Proximity searching. Author Finder and Cited Reference searching.

** Sci. Cit. Index Expanded (1900–) and Social Sci. Cit. Index (1956–)*

PsycINFO® (PSY)

Records: 2.7 million

Scope: Psychological literature. Journals, books, dissertations, et al. 1806 to present.

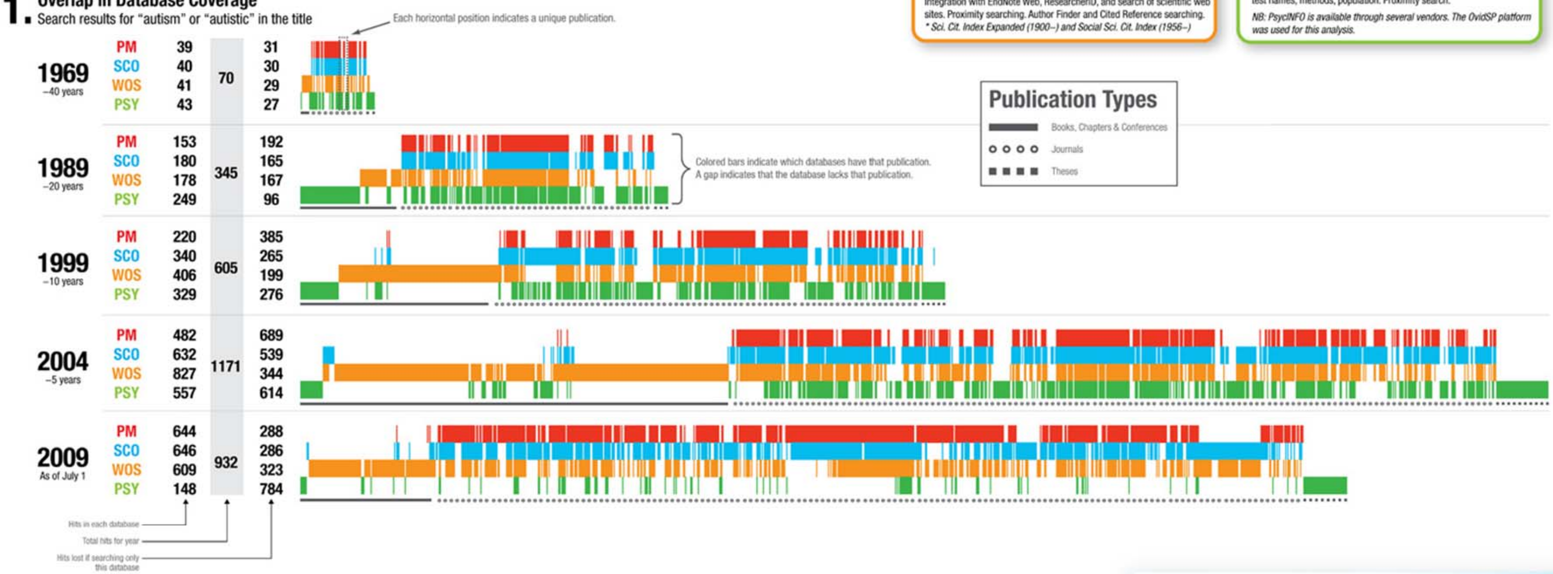
Producer: American Psychological Association produces the database and Wolters Kluwer Health produces the Ovid interface.

Selected features: Mapping to thesaurus of terms. Specialized fields: test names, methods, population. Proximity search.

NB: PsycINFO is available through several vendors. The OvidSP platform was used for this analysis.

1. Overlap in Database Coverage

Search results for "autism" or "autistic" in the title



2. Differences in Journal Coverage

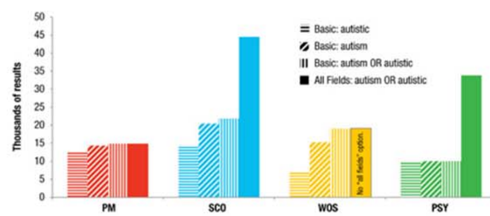
Portion of journals' autism publications in each database. Journals ≥ 1% of the total research publications

	Articles	PM (%)	SCO (%)	WOS (%)	PSY (%)
Journal of autism & developmental disorders (1979–)	151	93	98	91	85
Journal of child psychology & psychiatry, & allied disciplines (1960–)	54	98	94	98	98
Autism (1997–)	48	52	94	52	85
Focus on autism & other developmental disabilities (1996–)	31	0	0	0	100
Journal of the American Academy of Child & Adolescent Psychiatry (1987–)	27	93	96	96	85
Mental retardation & developmental disabilities research reviews (1995–2007)	21	90	100	95	90
Developmental medicine & child neurology (1962–)	21	100	100	100	76
The American journal of psychiatry (1921–)	18	94	100	100	94
American journal of medical genetics. Part B, Neuropsychiatric genetics (2003–)	15	100	93	100	0
European child & adolescent psychiatry (1992–)	14	100	100	100	86
Infants & young children (1992–)	14	0	100	100	0

The four databases were compared in their coverage of the 11 journals with the most publications in Part 1. Although each database had most of the publications in these journals, there were gaps. Databases may exclude some types of publications (e.g., editorials, letters) or may have indexed the journal in different years.

3. How Search Terms Are Processed

Word variants and "Basic search"

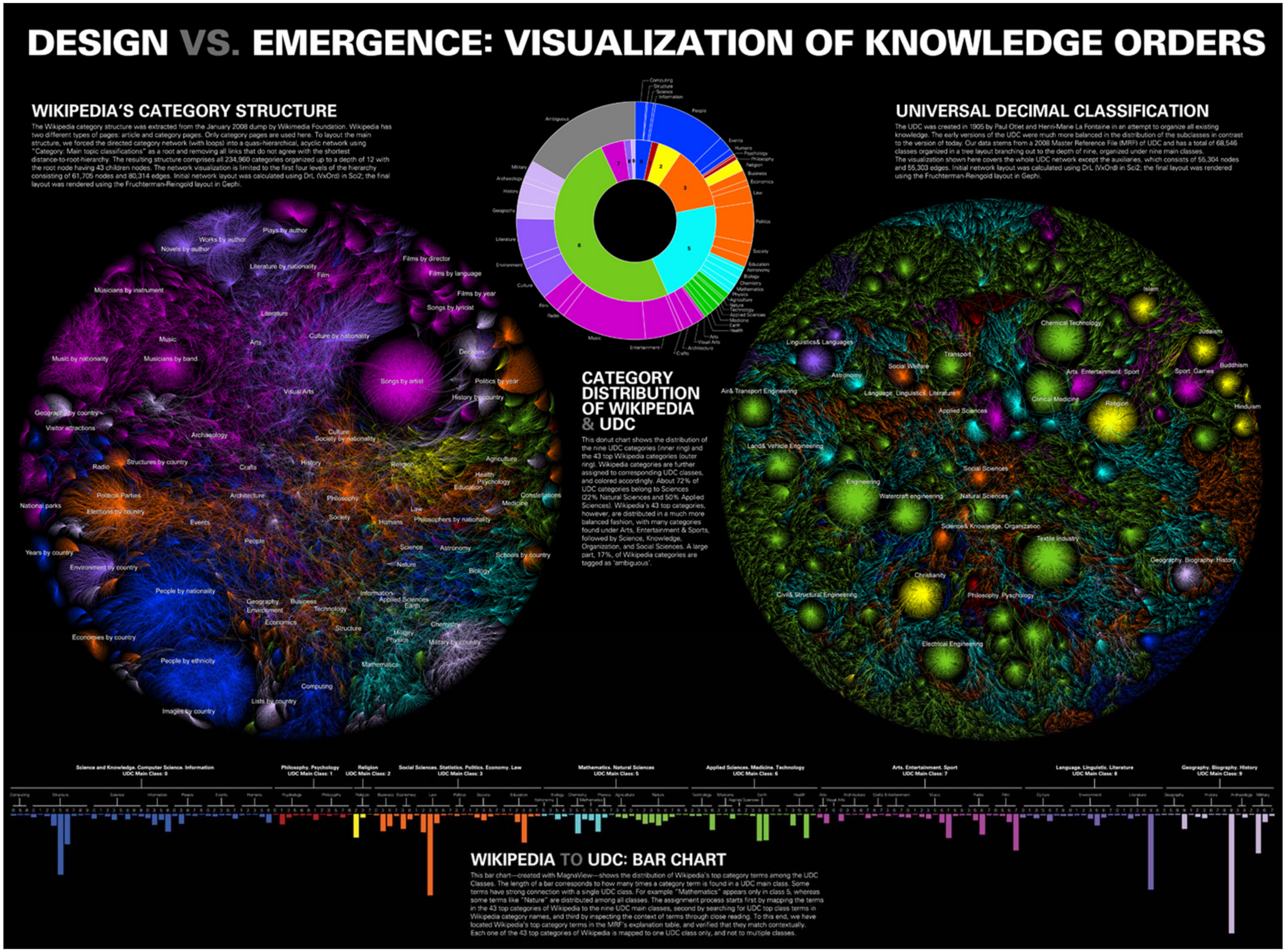


The basic, default search in each database was used for the terms *autistic*, *autism*, and *autism OR autistic*. The latter search was repeated in all searchable fields. Some databases search for word variations but others do not. The default search may not include all possible fields though not all fields may be relevant.

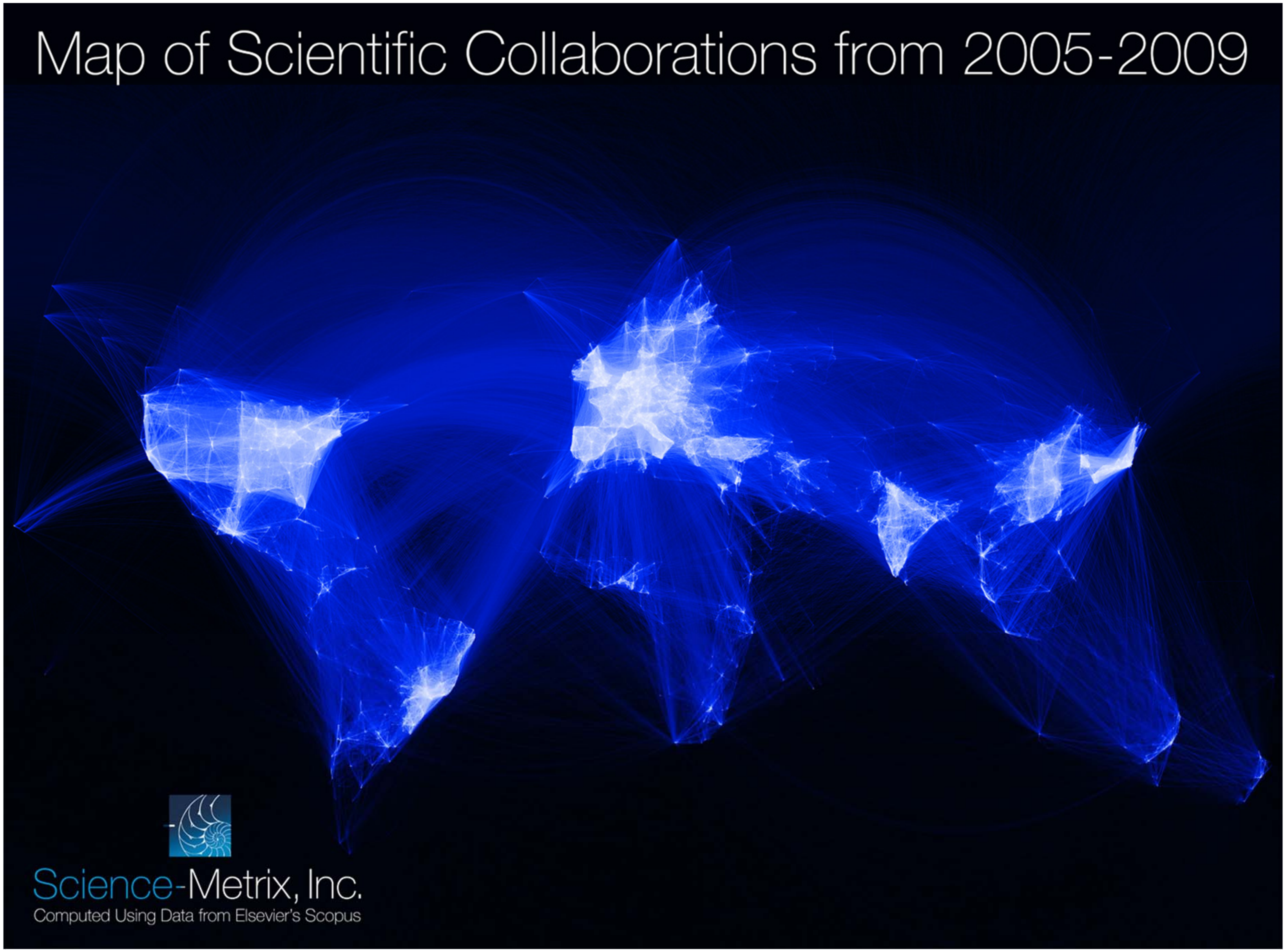
4. Conclusions

- No one database contains everything. Similar numbers of results is no indication of how similar the search results themselves are. Using multiple databases is important for doing a comprehensive search.
- Databases have different results because they include different journals, different years, and different types of publications.
- They also process a search differently, by looking in different fields or whether they automatically search for word variations and synonyms.
- Despite their differences, each database includes nearly all the journals that publish the most autism publications.
- This comparison is merely a broad overview of the content and one aspect of functionality of the databases. It cannot say which one is "best" for all purposes. Learn which resources are available to you, which tool fits which job, and how to use them.

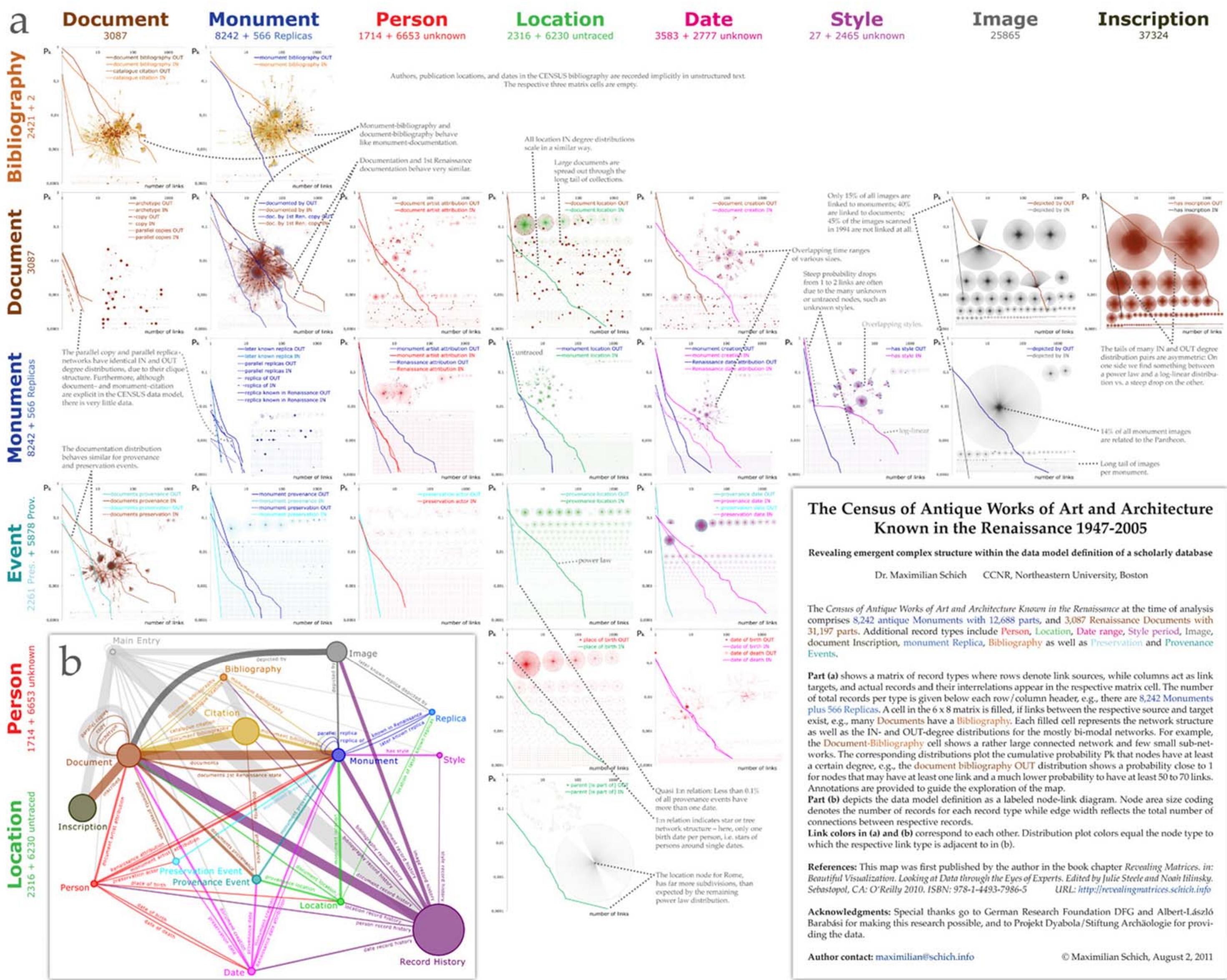
Finding Research Literature on Autism - Rex Robison - 2009



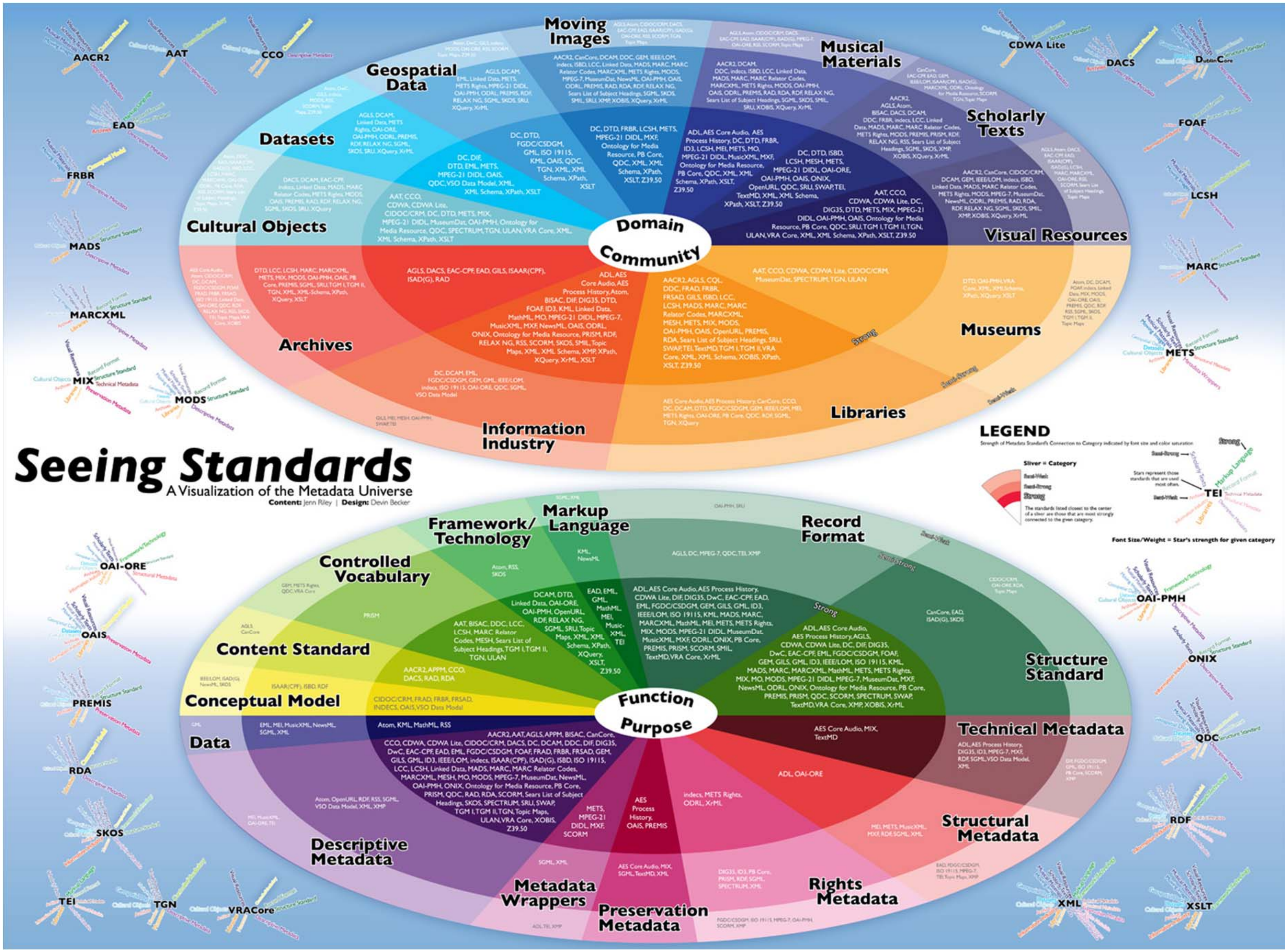
Design vs. Emergence: Visualization of Knowledge Orders - Alkim Almila Akdag Salah, Cheng Gao, Krzysztof Suchecki, and Andrea Scharnhorst - 2011



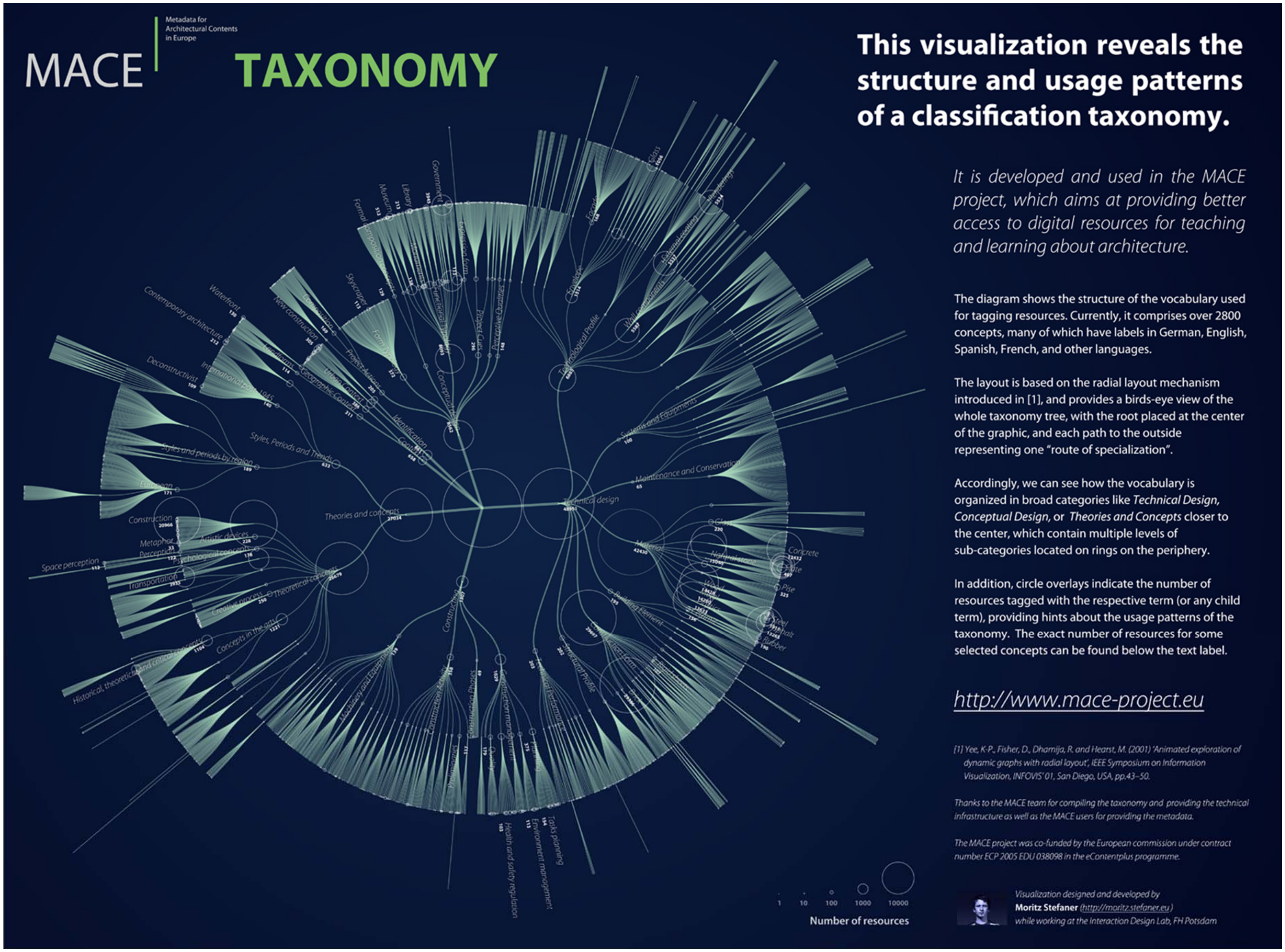
Stream of Scientific Collaborations between World Cities - Olivier H. Beauchesne - 2011



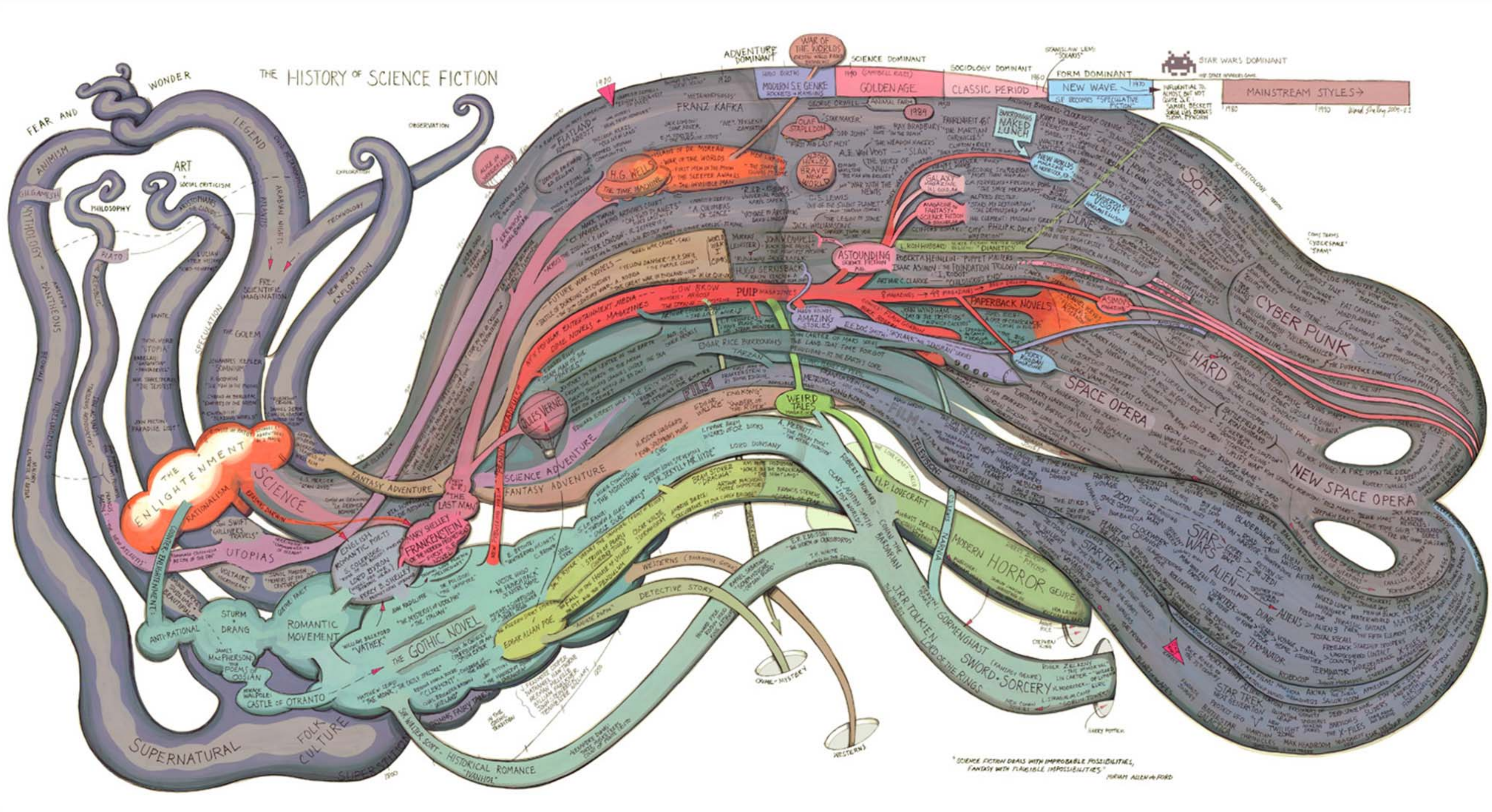
The Census of Antique Works of Art and Architecture Known in the Renaissance, 1947-2005 - Maximilian Schich - 2011



Seeing Standards: A Visualization of the Metadata Universe - Devin Becker and Jenn Riley - 2009-2010



MACE Classification Taxonomy - Moritz Stefaner - 2011



History of Science Fiction - Ward Shelley - 2011

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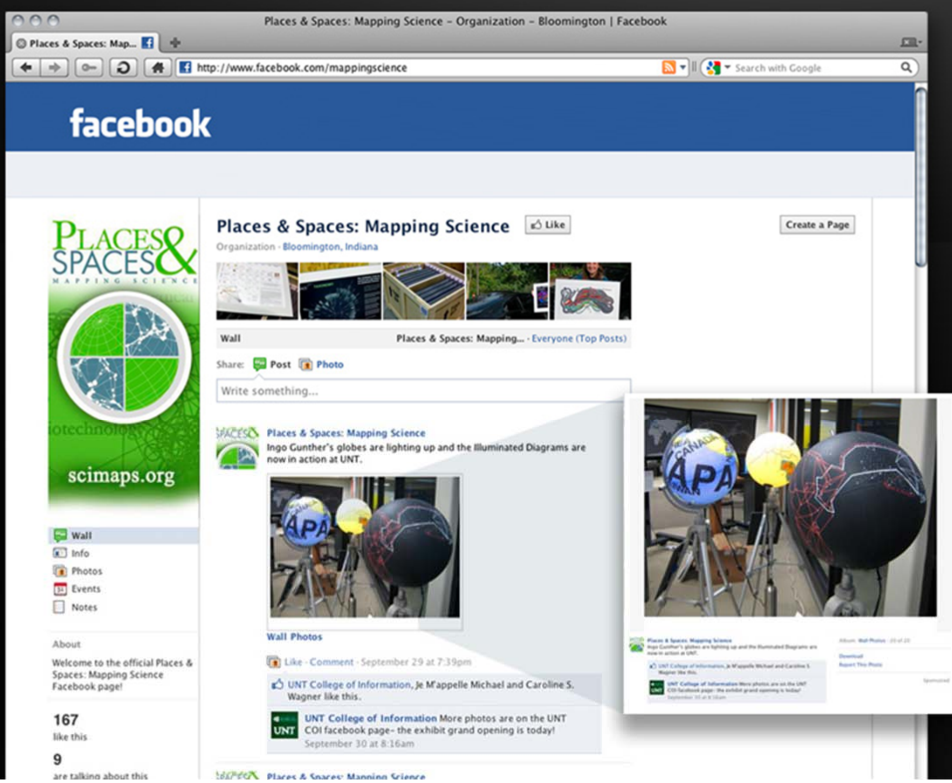

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