Designing Effective Knowledge Management Systems for Scholars and (Science) Policy Makers

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The Problem:
Being Lost in Space

15th Century: One person can make major contributions to many areas of science

Mankind's Knowledge

use

Contribute

Human Brain

Amount of knowledge on brain can manage

Leonardo Da Vinci
(1452-1519)
**20th Century**: One person can make major contributions to a few areas of science

**Mankind’s Knowledge**

- use
- contribute

Amount of knowledge on brain can manage

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**21st Century**: One person can make major contributions to a specific area of science

**Mankind's Knowledge**

- use
- contribute

Amount of knowledge on brain can manage

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Albert Einstein (1879-1955)
21st Century: One person can make major contributions to a specific area of science

Mankind's Knowledge

Amount of knowledge on brain can manage

use

contribute

Human Brains

Manager

Domain Expert

Humanity's Knowledge
The Great Wave Off Kanagawa (Katsushika Hokusai, 1760-1849)

A Solution:
Science Maps
The Power of Maps

Four Early Maps of Our World
VERSUS
Six Early Maps of Science

(1st Iteration of Places & Spaces Exhibit - 2005)
How would a map of science look?

What metaphors would work best?
The Power of Reference Systems

Four Existing Reference Systems
VERSUS
Six Potential Reference Systems of Science

(2nd Iteration of Places & Spaces Exhibit - 2006)
How would a reference system for all of science look?

What dimensions would it have?
Synthetic Resins or Natural Rubbers
Ion-exchange Polymer or Process of Preparing
Process of Regenerating
Membrane or Process of Preparing
Previously Formed Solid Ion-exchange Polymer Admixed With a
Polymer Characterized By Defined Size or Shape Other than Beads
Chemically Treated Solid Polymer
Solid Polymer Derived From Ethylenically Unsaturated Reactant
Solid Polymer Derived From At Least One 1,2-epoxy Containing
Solid Polymer Derived From Alddehyde or Derivative
From Ethylenically Unsaturated Reactant Only
From Alddehyde or Derivative

Process of Treating Scrap or Waste Product
Process of Treating Scrap or Waste Product Containing At Least
Treating Rubber (or Rubberlike Materials) or Polymer Derived
Treating Polymer Derived From A Monomer Containing Only
Treating Polymer Derived From Hydrocarbon Monomers Only
Treating Polysiloxane
Treasint Polyester
Treasint With Alcohol
Treasint Polyurethane, Polyurea (excluding Urea-formaldehyde)
Treasint With Alcohol or Amine
Treasint Polyacrylamide

Cellular Products or Processes of Preparing
Cellular Product Derived From Two or More Solid Polymers of Different
At Least One Polymer Is Derived From Reactant Containing TV
At Least One Polymer Is Derived From An Alddehyde or Derivative
At Least One Polymer Is Derived From A \(-\text{CHO}\text{C}<_{x}\text{Reactant} \text{Wh}}
"Places & Spaces: Mapping Science" on display at the New York Hall of Science (5 mins from LaGuardia Airport)

The Power of Forecasts

Four Existing Forecasts
VERSUS
Six Potential Science ‘Weather’ Forecasts

(3rd Iteration of Places & Spaces Exhibit - 2007)
A Potential Future:
Science Maps in Action

KIDS first …

All maps of science are on sale
via [http://scimaps.org](http://scimaps.org)
This overlay shows the distribution of nanotechnology within the paradigms of science. The majority of current work in nanotechnology takes place in physics, chemistry, and materials science, at the upper right portion of the map. However, an interesting amount of nanotechnology is being applied in the biological and medical sciences, at the lower right.

Nanotechnology

All Topics
Science is the tiny scientific paradigm
Francis H. C. CRICK
Deciphered the DNA double helix
Albert EINSTEIN
Developed quantum theory and the theory of relativity
Michael E. FISHER
Models critical phase transitions of matter
Susan T. FISKE
Commits perception and stereotyping

Sustainability
The science backed our long-term hopes
Joshua LEDERBERG
Pioneered in bacterial genetic recombination
Derek J. de Solla PRICE
Known as the "Father of Scientometrics"
Richard N. ZARE
Inorganic chemistry in molecular dynamics
About this display
A single person's spreading influence is shown as a series of flow maps. First, we light only topics and authors from that person. Inferences: person is important. The second light covers everything that cites that original work. Note that this first generation map extends to the more topics than did the original work. The third light covers topics that cite the second, and the fourth light covers topics that cite the first.

Inventors & Inventions

Science Puzzle Map for Kids by Filer Palmer, Judee Smith, Editha Hardy, Katy Borner, Indiana University, 2006. (Base map taken from Illuminated Diagram display by Kevin Bayuch, Richard Klarman, and W. Bradford Paley.)
Activities:
Solve the puzzle.
Navigate to 'Earth Science'.
Identify major inventions.
Place major inventors.
Find your dream job on the map.
Why is mathematics important?

... my SPONSORS next ...
Latest ‘Base Map’ of Science

Kevin W. Boyack & Richard Klavans, unpublished work.

- Uses combined SCI/SSCI from 2002
  - 1.07M papers, 24.5M references, 7,300 journals
  - Bibliographic coupling of papers, aggregated to journals
- Initial ordination and clustering of journals gave 671 clusters
- Coupling counts were reaggregated at the journal cluster level to calculate the
  - \((x, y)\) positions for each journal cluster
  - by association, \((x, y)\) positions for each journal

Science map applications: Identifying core competency

Kevin W. Boyack & Richard Klavans, unpublished work.

Funding patterns of the US Department of Energy (DOE)
Science map applications: Identifying core competency
Kevin W. Boyack & Richard Klavans, unpublished work.

Funding Patterns of the National Science Foundation (NSF)

Science map applications: Identifying core competency
Kevin W. Boyack & Richard Klavans, unpublished work.

Funding Patterns of the National Institutes of Health (NIH)
... then SCIENTISTS ...
Mapping the Evolution of Co-Authorship Networks

Lab/Center Management System

https://irl.dil.indiana.edu
Data Entities and Interlinkages

... and INDUSTRY too.
Mapping Indiana's Intellectual Space

- Identify
- Pockets of innovation
- Pathways from ideas to products
- Interplay of industry and academia

Upcoming Conferences, Workshops, and Competitions

May 15-20, 2007
Network Science Workshop and Conference, New York Hall of Science, Queens, NY.
“Visualizing Network Dynamics” Competition
http://vw.indiana.edu/07netsci/

June 25-27, 2007
11th International Conference of the International Society for Scientometrics and Informetrics, which will be held on June at the Serrano Central Campus of the Spanish Research Council (CSIC) in Madrid can be found at https://issi2007.cindoc.csic.es/.

July 3-6, 2007
InfoVis Software Infrastructures Workshop at the Visualization Summit and subsequent IV Conference at the ETH Zurich, Switzerland.
The End.