Network Analysis and Visualization for Understanding Social Computing

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Founding Director (1983-2000), Human-Computer Interaction Lab
Professor, Department of Computer Science
Member, Institute for Advanced Computer Studies

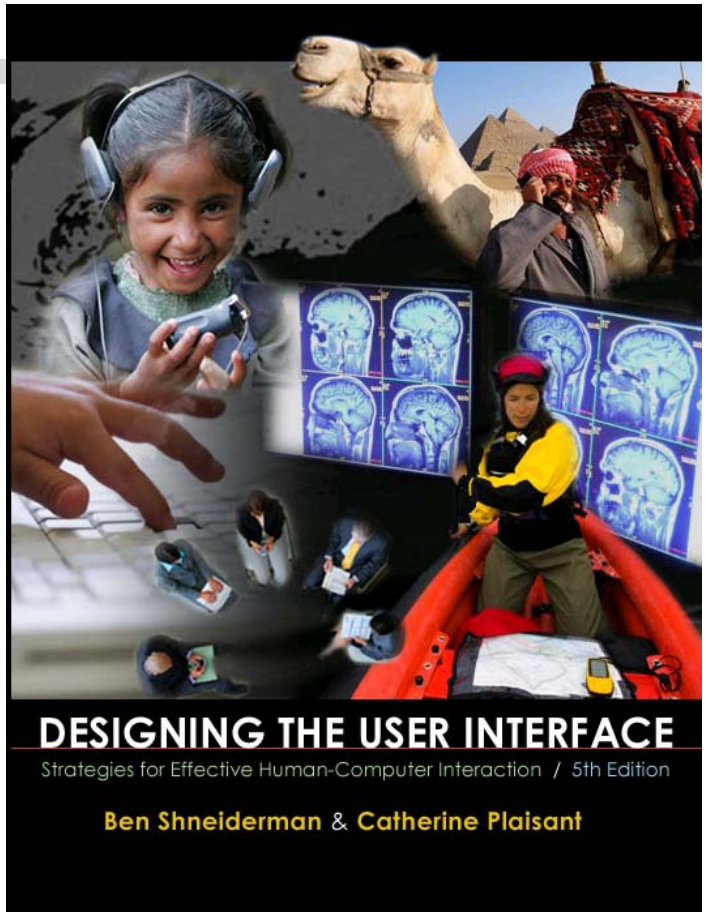
Interdisciplinary research community

- Computer Science & Info Studies
- Psych, Socio, Poli Sci & MITH

(www.cs.umd.edu/hcil)

Design Issues

- Input devices & strategies
  - Keyboards, pointing devices, voice
  - Direct manipulation
  - Menus, forms, commands
- Output devices & formats
  - Screens, windows, color, sound
  - Text, tables, graphics
  - Instructions, messages, help
- Collaboration & Social Media
- Help, tutorials, training
- Search
- Visualization



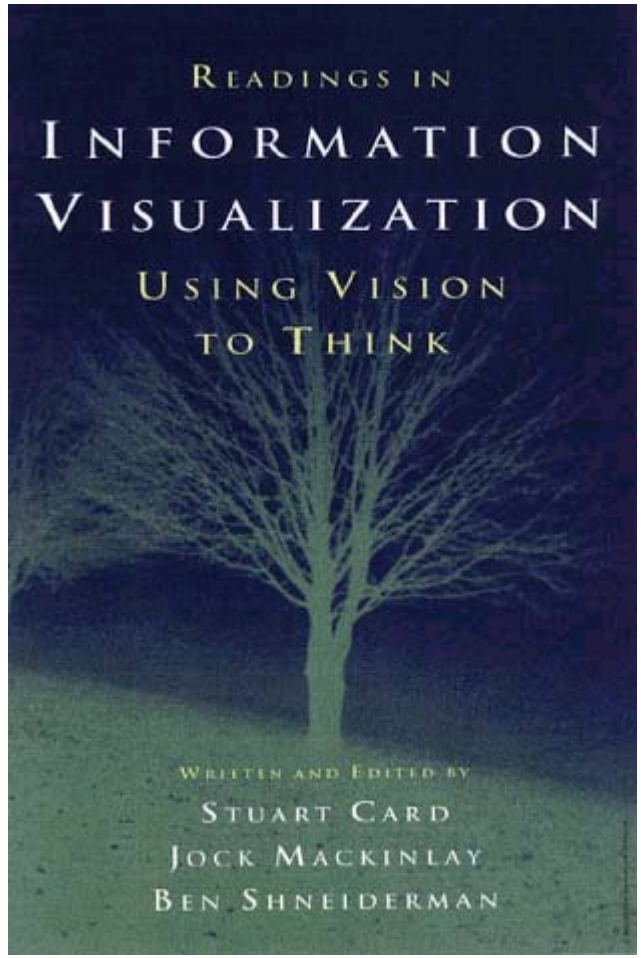
www.awl.com/DTUI

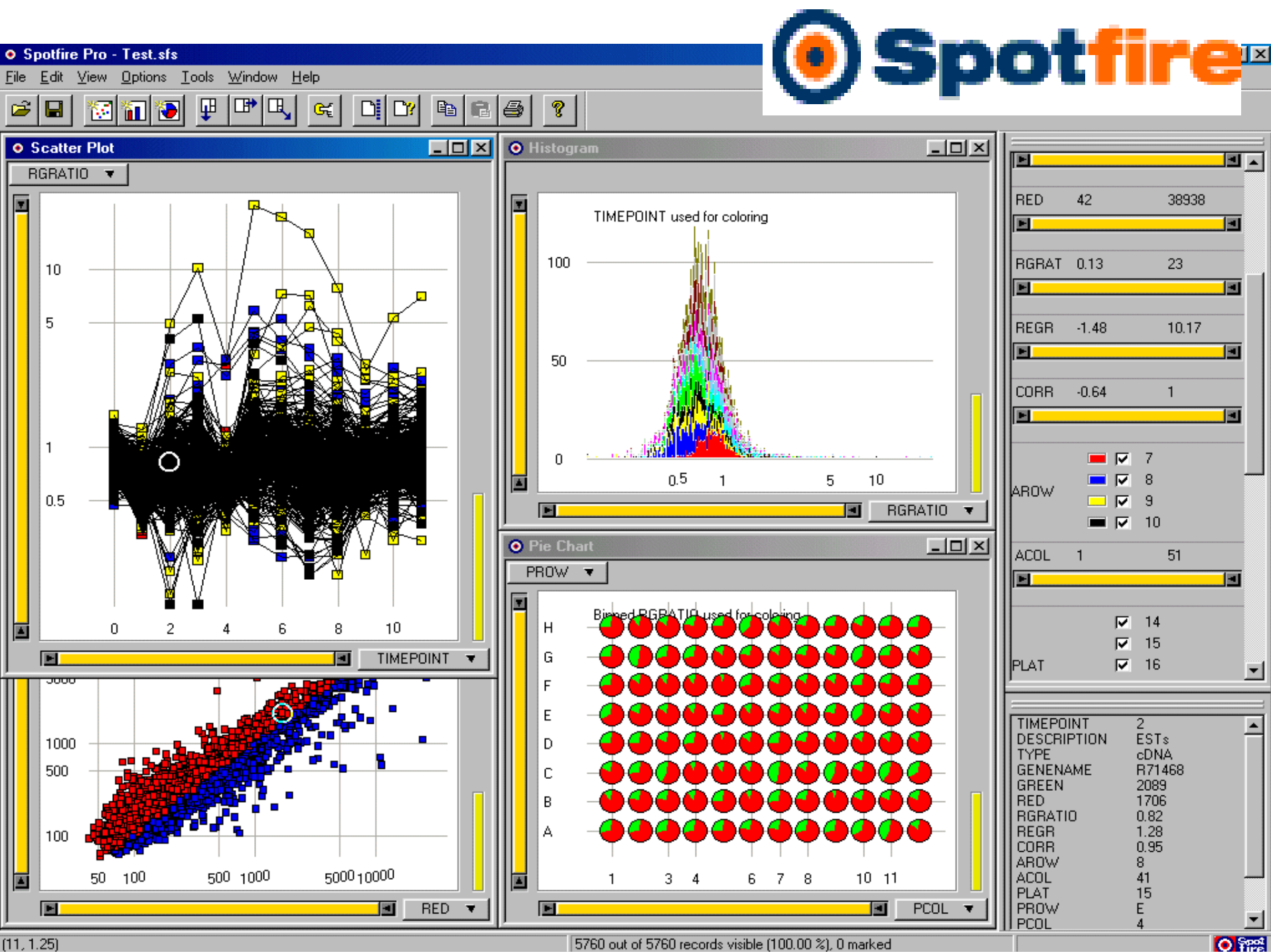
Fifth Edition: March 2009

Using Vision to Think

- **Visual bandwidth is enormous**
  - Human perceptual skills are remarkable
    - Trend, cluster, gap, outlier...
    - Color, size, shape, proximity...
  - Human image storage is fast and vast

- **Opportunities**
  - Spatial layouts & coordination
  - Information visualization
  - Scientific visualization & simulation
  - Telepresence & augmented reality
  - Virtual environments




Spotfire
Spotfire Pro - Test.sfs
File Edit View Options Tools Window Help
Scatter Plot
RGRATIO
10
5
1
0.5
0 2 4 6 8 10
TIMEPOINT
1000
500
100
50 100 500 1000 5000 10000
RED
Histogram
TIMEPOINT used for coloring
100
50
0
0.5 1 5 10
RGRATIO
Pie Chart
PROW
Binned RGRATIO used for coloring
H G F E D C B A
1 3 4 6 7 8 10 11
PCOL
RED 42 38938
RGRAT 0.13 23
REGR -1.48 10.17
CORR -0.64 1
AROW 7 8 9 10
ACOL 1 51
PLAT 14 15 16
TIMEPOINT 2
DESCRIPTION ESTs
TYPE cDNA
GENENAME R71468
GREEN 2089
RED 1706
RGRATIO 0.82
REGR 1.28
CORR 0.95
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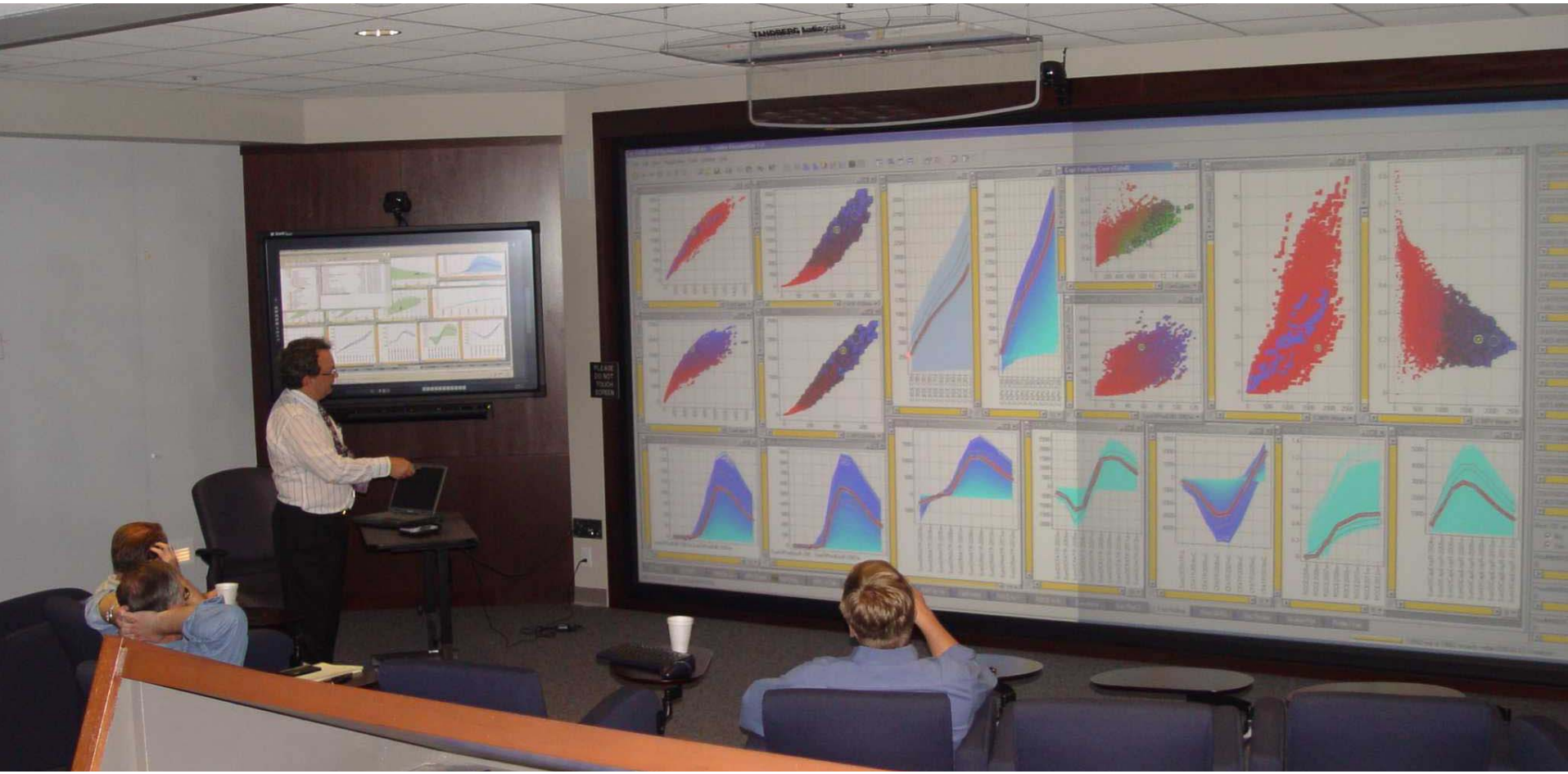
PCOL 4
(11, 1.25)
5760 out of 5760 records visible (100.00 %), 0 marked

Spotfire



HCIL

100M-pixels & more

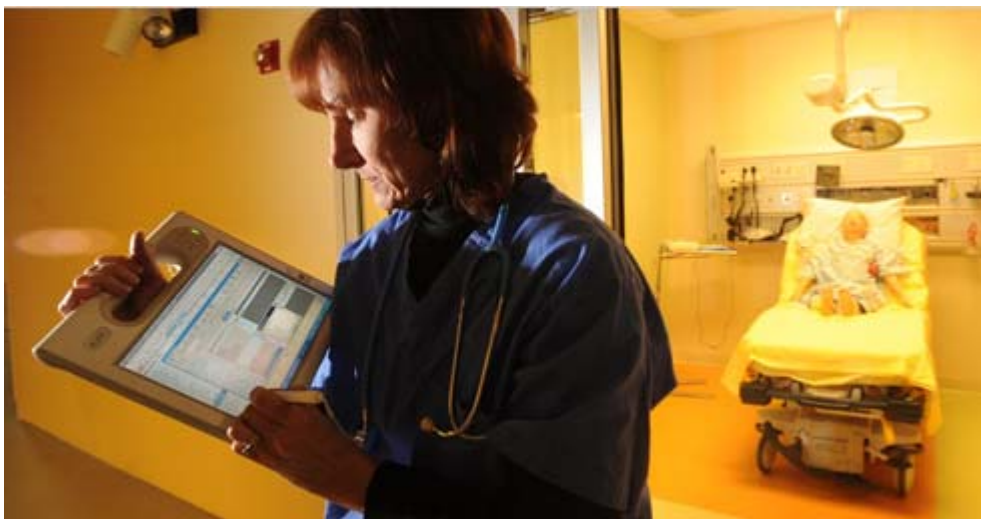
Large displays
for single users

infovis.cs.vt.edu/gigapixel

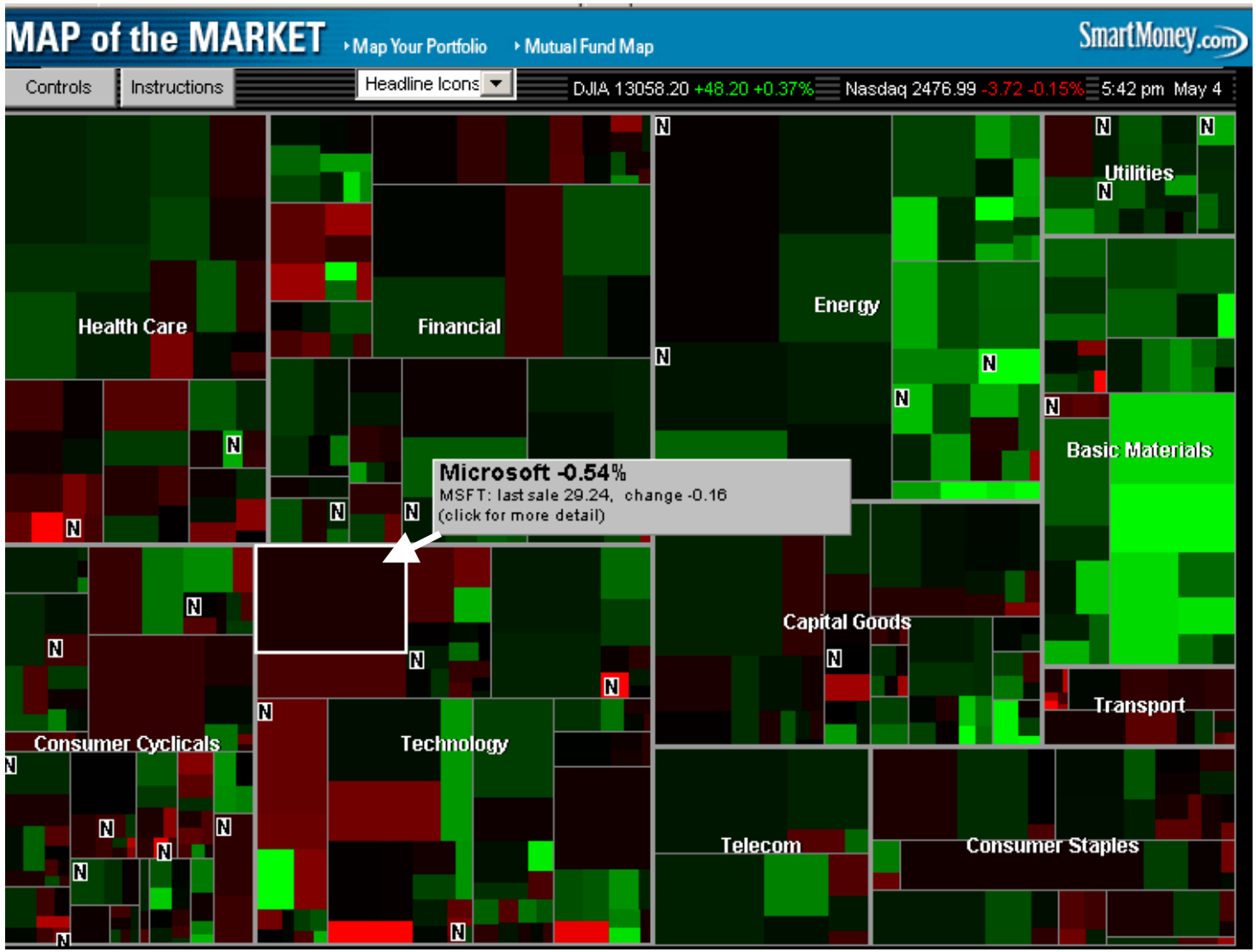
100M-pixels & more

1M-pixels & less

Small mobile devices

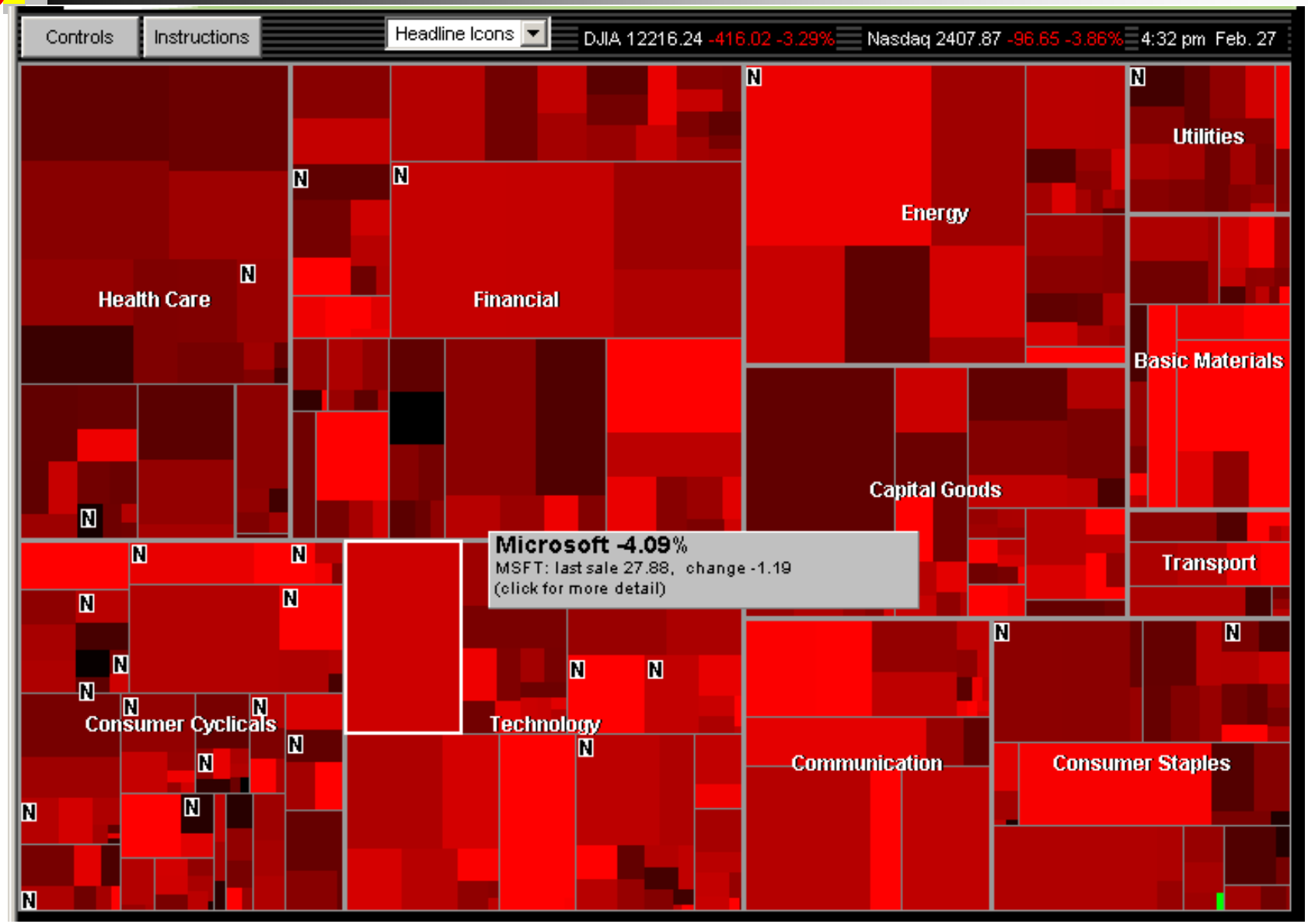


Treemap: Smartmoney MarketMap



www.smartmoney.com/marketmap

Market falls steeply Feb 27, 2007, with one exception



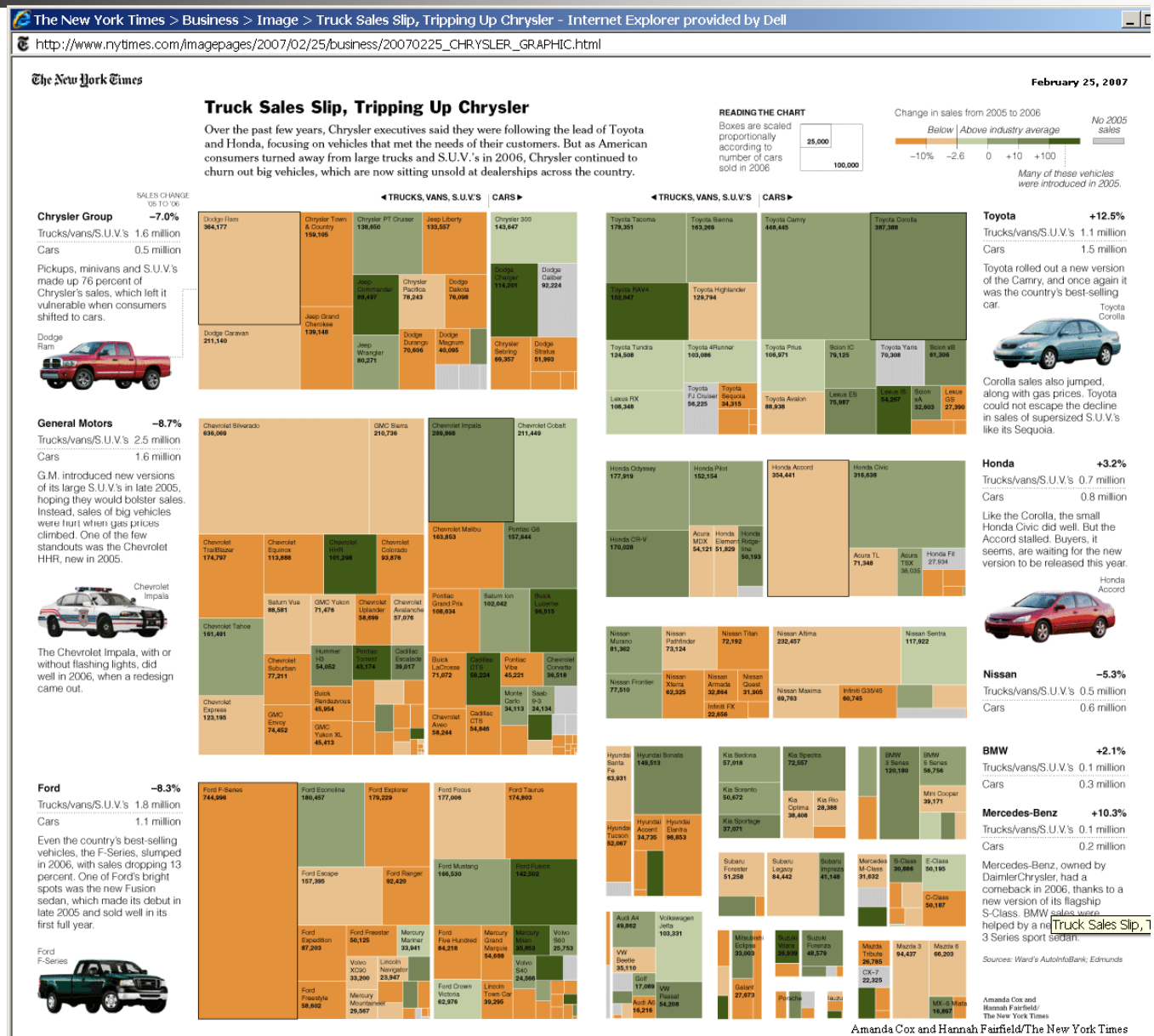
Treemap: Supply Chain

MERIT
MARINE CORPS EQUIPMENT READINESS INFORMATION TOOL

www.hivegroup.com

HCIL

Treemap: NY Times – Car&Truck Sales



Information Visualization: Mantra

- Overview, zoom & filter, details-on-demand
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- Overview, zoom & filter, details-on-demand
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Information Visualization: Data Types

SciViz

- **1-D Linear** — Document Lens, SeeSoft, Info Mural
- **2-D Map** — GIS, ArcView, PageMaker, Medical imagery
- **3-D World** — CAD, Medical, Molecules, Architecture

InfoViz

- **Multi-Var** — Spotfire, Tableau, GGobi, TableLens, ParCoords,
- **Temporal** — LifeLines, TimeSearcher, Palantir, DataMontage
- **Tree** — Cone/Cam/Hyperbolic, SpaceTree, Treemap
- **Network** — Pajek, JUNG, UCINet, SocialAction, NodeXL

Social Computing Conference

Computing
Social
Networks
Applications
Analysis
Intelligence
Network
Online
Mobile
Networking
Chen
Kim
Using
Data
Modeling
Mining
Lee
Based
Phones
Sensors
Systems
Learning
Wang
King
Collaborative
Workshop
Approach
Music
Media
Community
Michael
David
Research
Behavior
Web
Education
Information
Management
Algorithm
Structure
Semantic
Social
Network
International
Towards
Detection
Human
Group
Support
Dynamics
Model
Wu
Zhang
Luo
Contractor
Whitman
James
Irwin
Manuel
Collective
Study
User
van
Talk
Exploring
Informing
Application
Tags
Richards
Zhu
Involved
Discovery
Environments
Reputation
Portland
Mobility
Business
Relationship
Development
Games
Steve
Sangki
Eric
Hsien
Tian
Design
Algorithm
Complex
Marc
Communities
Large
Intersection
Filtering
Crowdsourcing
Crowdfunding
Crowdsourcing
World
Williams
Brian
Smith
Ting
Tiejian
Peter
Nashir
Justin
Knowledge
Analyzing
Open
Shneiderman
Tagging
Zhu
Groups
Invited
Discovery
Ben
Lin
Xiang
Sensor
Spam-Bots
Jiebo
Yang
Ma
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Liu
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Lin
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Social Computing Conference

wordle.net

Wikipedia

Log in / create account

article | discussion | edit this page | history

WIKIPEDIA
The Free Encyclopedia

navigation
- Main page
- Contents
- Featured content
- Current events
- Random article

search
Go Search

interaction
- About Wikipedia
- Community portal
- Recent changes
- Contact Wikipedia
- Donate to Wikipedia
- Help

toolbox
- What links here
- Related changes
- Upload file
- Special pages
- Printable version
- Permanent link
- Cite this page

languages
- Deutsch
- Español
- Français
- 한국어
- Italiano
- Македонски

Social media

From Wikipedia, the free encyclopedia

Communication

- **Blogs**: Blogger, LiveJournal, TypePad, WordPress, V
- **Internet forums**: vBulletin, phpBB
- **Micro-blogging / Presence applications**: Twitter, Pl Pownce, Jaiku
- **Social networking**: Bebo, Facebook, LinkedIn, MySpace, Orkut, Skyrock, Hi5
- **Social network aggregation**: FriendFeed, Youmeo
- **Events**: Upcoming, Eventful, Meetup.com
- **Discussion Groups**: Google Groups, Yahoo! Groups, Windows Live Groups

Collaboration

- **Wikis**: Wikipedia, PBwiki, wetpaint
- **Social bookmarking** (or Social tagging) (Golder & Huberman 2006): Delicious, StumbleUpon, Stumpedia, Google Reader, CiteULike
- **social news**: Digg, Mixx, Reddit
- **Opinion sites**: epinions, Yelp

Multimedia

- **Photo sharing**: Flickr, Zooomr, Photobucket, SmugMug
- **Video sharing**: YouTube, Vimeo, Revver
- **Art sharing**: deviantART
- **Livecasting**: Ustream.tv, Justin.tv, Skype
- **Audio and Music Sharing**: imeem, The Hype Machine, Last.fm, ccMixter

Reviews and Opinions

- **Product Reviews**: epinions.com, MouthShut.com
- **Q&A**: Yahoo! Answers, WikiAnswers

Entertainment

- **Virtual worlds**: Second Life, The Sims Online
- **Online gaming**: World of Warcraft, EverQuest, Age of Conan, Spore (2008 video game)
- **Browser games**: OGame, Omertà, Travian, Hattrick
- **Game sharing**: Miniclip

Social Computing: Transformative Movement

- Restructuring
  - Economies, political structures, social systems
  - Scientific disciplines & methods
  - Academic curricula & teaching strategies
  - Government agendas

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  - Government agendas

  - Crime, terrrorism, racial hatred, dictatorships

Can Computing Evolve?

- Human-Computer Interaction
- Web Science
- Social Computing/Social Informatics
- Information: I-Schools
- Business: B-Schools
- Design: D-Schools

- Social Physics (Auguste Comte, 1830)
- Social Sciences
- Complexity, Chaos & Network Theory

Vision: Social Computing

1) Focus on National Priorities & Impact

- Health, energy, education, business innovation
- Disaster response, community safety
- Environmental awareness, biodiversity

2) Develop Theories of Social Computing

- How do networks evolve? Can we predict areas of growth, stability, decline, infections, disruptions?
- Can we guide intervention to stop terrorists, slow epidemics, increase sales, promote health?

3) Provide Technology Infrastructure

- Scalable, reliable, universal, manageable
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Health & Healthcare

patientslikeme™

Username or Email | Remember me | Forgot password?

Patients | Treatments | Symptoms | Research

Search this site | Search

Find Patients Just Like You »

Do you have a life-changing condition? Learn from the real-world experiences of other patients like you.

Join Now! (It's free!)

CURRENT DISEASE COMMUNITIES

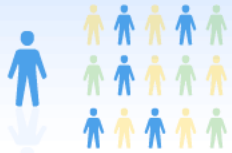
Prevalent Diseases

- ALS/MND
- Epilepsy (Coming Soon)
- Fibromyalgia
- HIV/AIDS
- Mood Conditions
  - Anxiety
  - Bipolar
  - Depression

See how PatientsLikeMe can help you **take control of your hea**

Share your health profile »

Answer simple questions to create a shared health profile to see how you're doing over time.



Find patients like you »

Search by gender, age, treatments, symptoms, and time since diagnosis to easily connect with patients like you.

Lea

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Google health | Search the web

Read about health topics »

ben.shneiderman

- Notices
- Drug interactions
- Profile details
- Age, sex, height...
- Conditions
- Medications
- Allergies
- Procedures
- Test results
- Immunizations
- Insurance

Add to this Google Health profile
Learn about your health issues and find help

Import medical records
Copy and get automatic updates of your rec

Explore online health services
Find online tools for managing your health

Find a doctor
Search by name, location, and specialty

Microsoft HealthVault

Learn about Devices

Welcome to Microsoft HealthVaul

Take charge of your family's health and make more informed health decisions for yourself and your loved ones. Learn more

HealthVault lets you ...

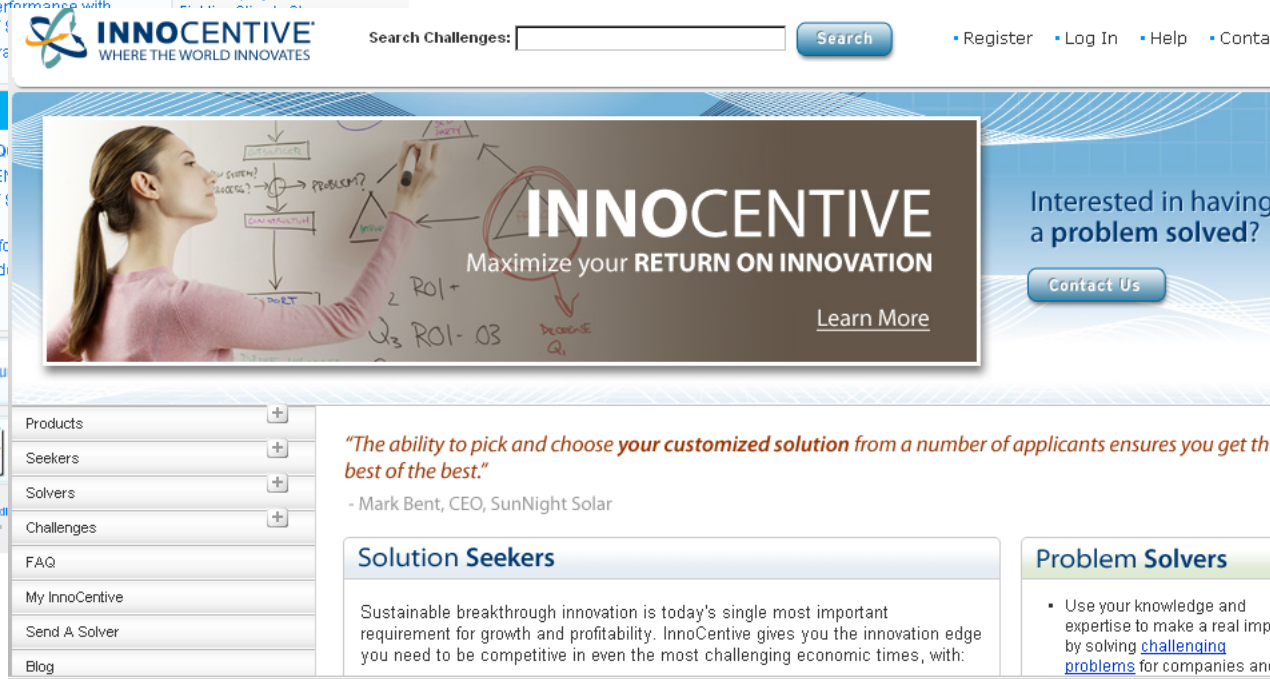
- **Organize** your health information, with everything in one place
- **Simplify** your life: enter health info once, use it in many ways
- **Gain insight** with data that helps you make informed decisions

Create a free HealthVault account

Already have an account? Sign in.

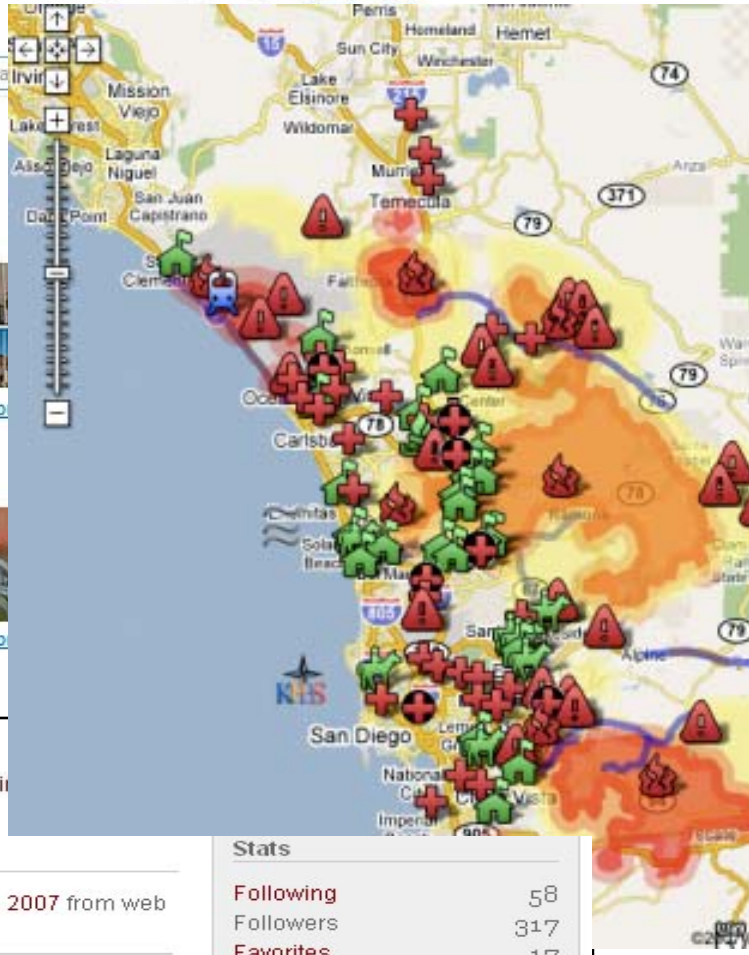
Energy, Education, Business Innovation

Energystar.gov

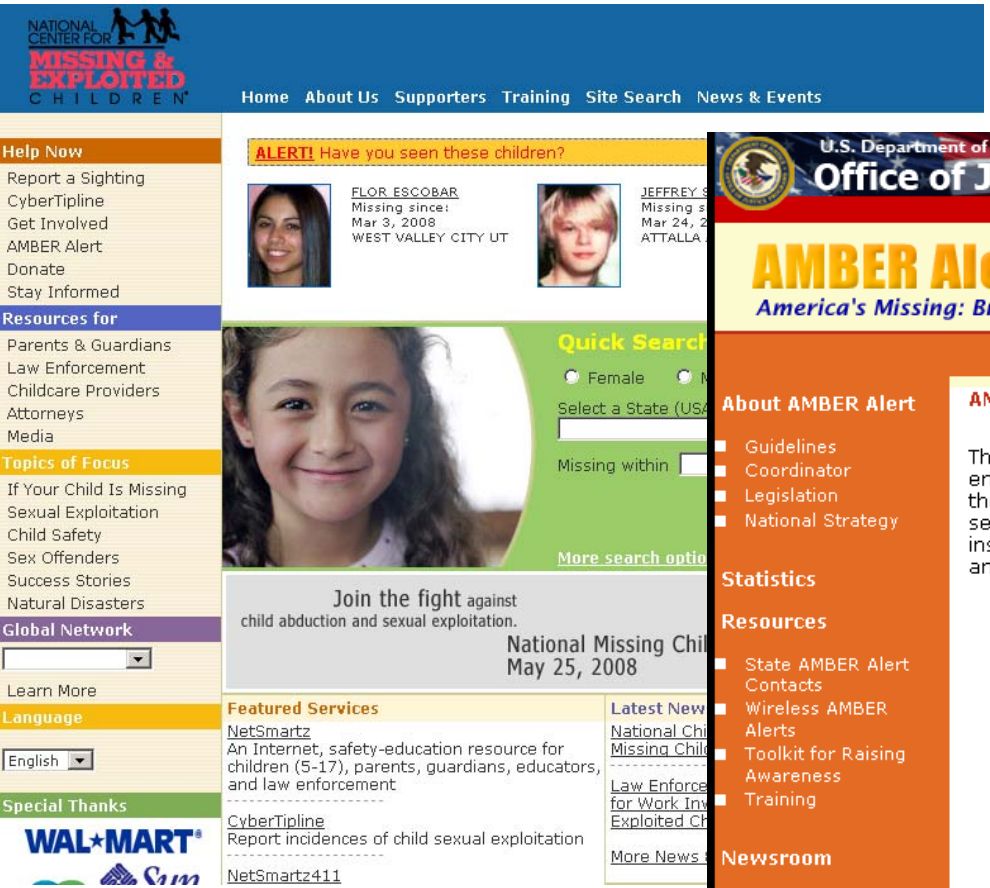


innocentive.com

Disaster Response: Wildfires



Community Safety: Abducted Children

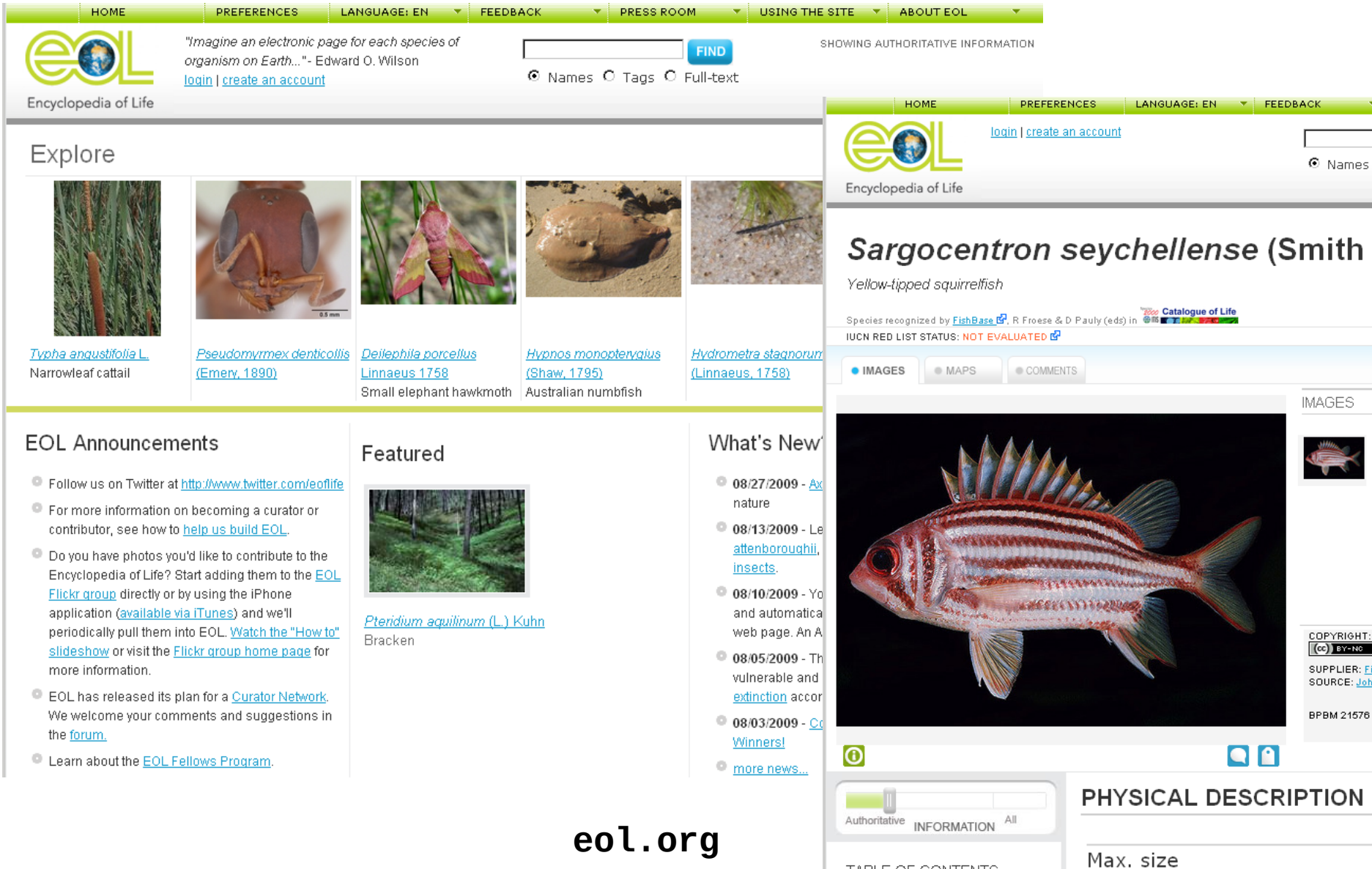


www.ncmec.org
www.missingkids.com

www.amberalert.gov

HCIL

Biodiversity: Encyclopedia of Life



eol.org

UN Millennium Development Goals

keep the promise
Millennium Development Goals
2015

The Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

What are the Millennium Development Goals?

The eight Millennium Development Goals (MDGs) – which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015 – form a blueprint agreed to by all the world's countries and all the world's leading development institutions. They have galvanized unprecedented efforts to meet the needs of the world's poorest.

> "We will have time to reach the Millennium Development Goals – worldwide and in most, or even all, individual countries – but only if we break with business as usual. We cannot win overnight. Success will require sustained action across the entire decade between now and the deadline. It takes time to train the teachers, nurses and engineers; to build the roads, schools and hospitals; to grow the small and large businesses able to create the jobs and income needed. So we must start now. And we must more than double global development assistance

NEWS FLASH

Millennium Development Goals Report 2006

UN ACTION

2005 World Summit United Nations Headquarters, NY 14-16 September 2005

Millennium Project

World Summit outcome

Millennium Development Goals: Civil Society Takes Action 58th Annual DPI/NGO Conference, 7-9 September 2005, NY

Regional Reports

Economic and Social

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Network Theories: Evolution models

- Random, preferential attachment, triangles…
- Monotonic, bursty, 3-phase…
- Power law for degree (hubs & indexes)
- Small-world property
- Forest fire, spreading activation …
- Matures, collapses, decays, fragments, …

Watts & Strogatz, *Nature 1998*; Barabasi, *Science 1999, 2009*;
Newman, *Phys.Rev.Lett 2002*
Kumar, Novak & Tomkins, *KDD2006*
Leskovec, Faloutsos & Kleinberg, *TKDD2007*

Motivations for participation

- Fear, imminent threat
  (Rogers, 1975)
- Revenge, response to tragedy, guilt
  (Hanson, 2008)
- Egoism, altruism, collectivism, principlism
  (Batson, Ahmad & Tseng, 2002)

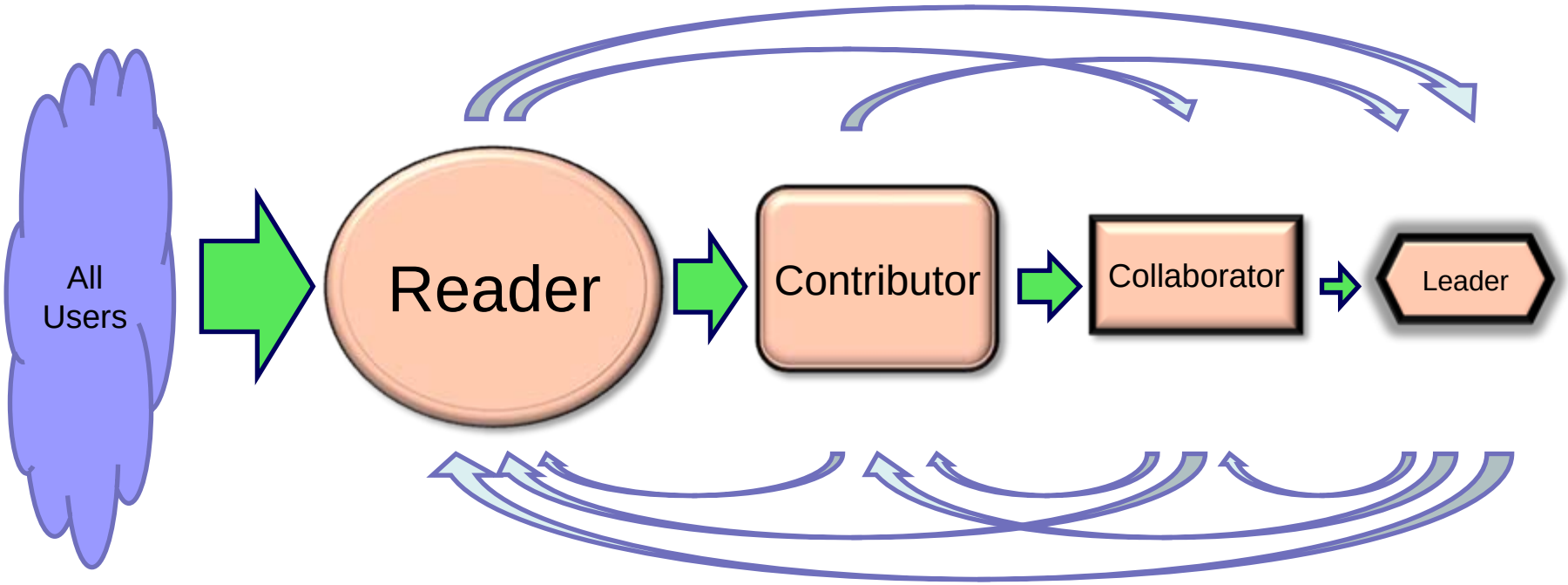
Stages of participation

Wikipedia & Reporting sites

- Reader
- First-time Contributor
  (Legitimate Peripheral Participation)
- Returning Contributor
- Frequent Contributor

Preece, Nonnecke & Andrews, *CHB2004*
Forte & Bruckman, *SIGGROUP2005;* Hanson, 2008
Porter: *Designing for the Social Web, 2008*
Vassileva, 2002, 2005; Ling et al., *JCMC 2005*; Rashid et al., *CHI2006*

From Reader to Leader:
Motivating Technology-Mediated Social Participation



Preece & Shneiderman, *AIS Trans. Human-Computer Interaction1* (1), July 2009
aisel.aisnet.org/thci/vol1/iss1/5/

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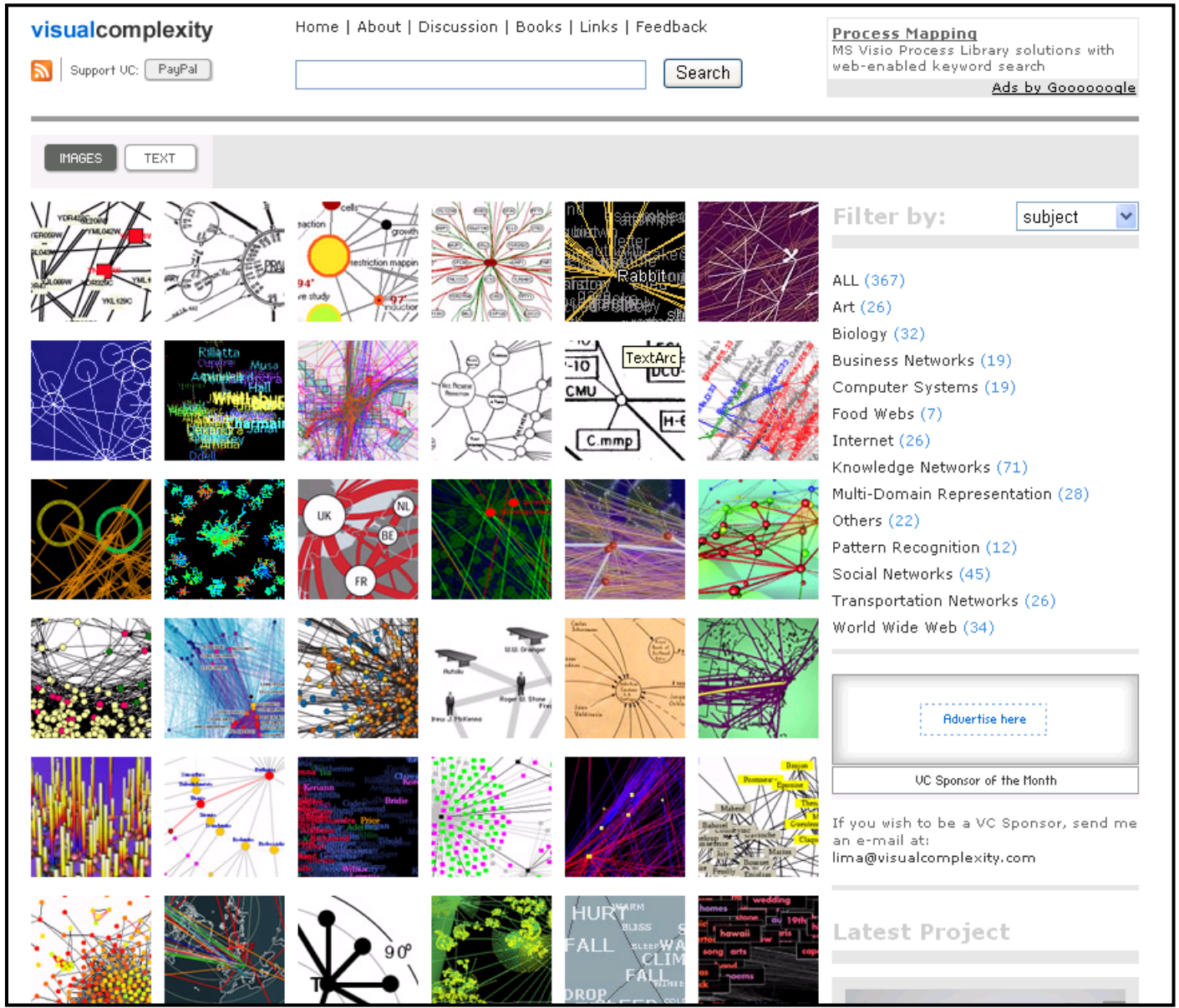
Technology Infrastructure

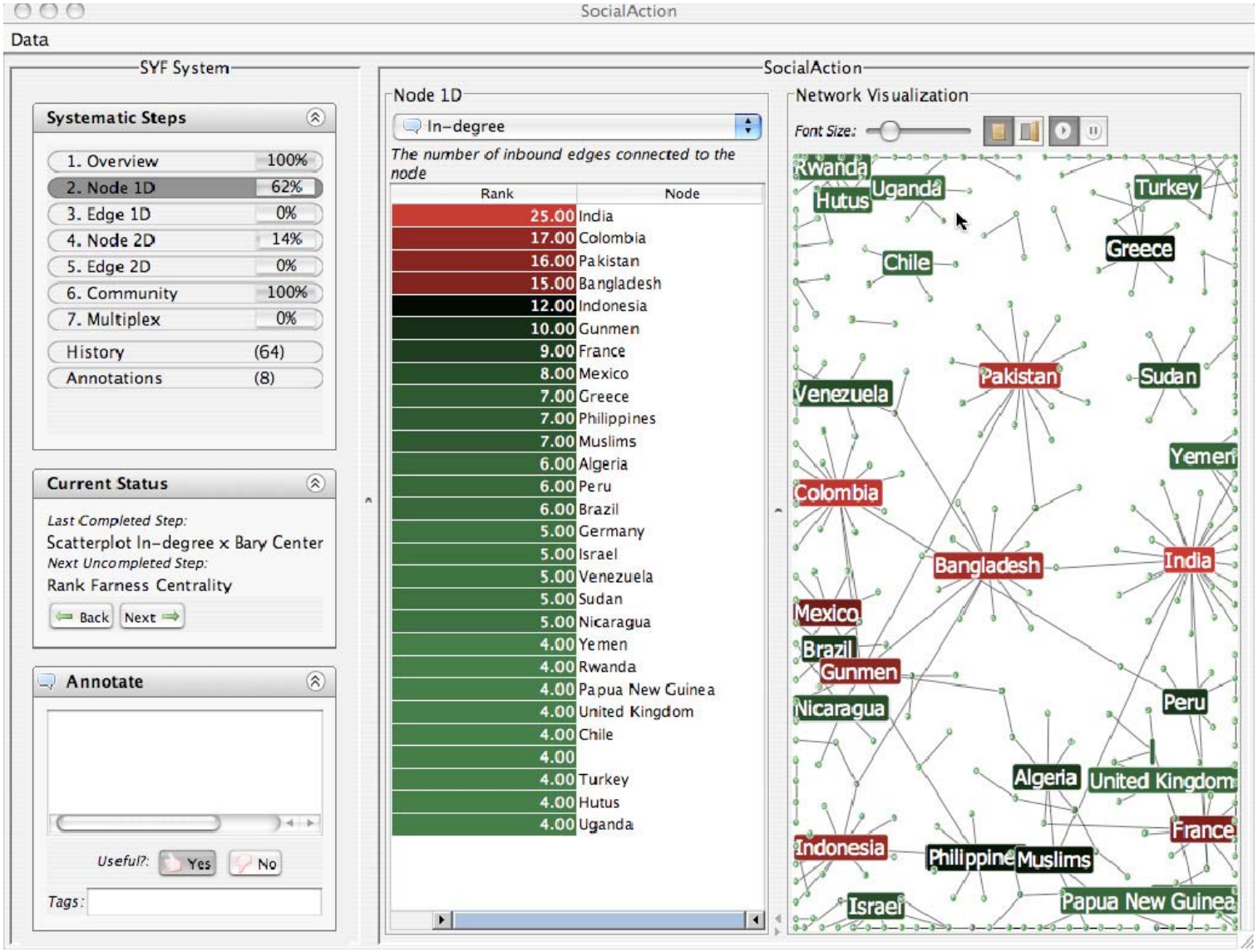
- Platform & browser independent
- Desktop, Web, Mobile
- Petabytes, Tera-contribs, Giga-collabs
- 24/7, 100% uptime, secure, private

- Universal access & usability
- Trust, empathy, responsibility
- Enables leaders to manage activity
- Supports continuous improvement

Network Visualization: Research & Control

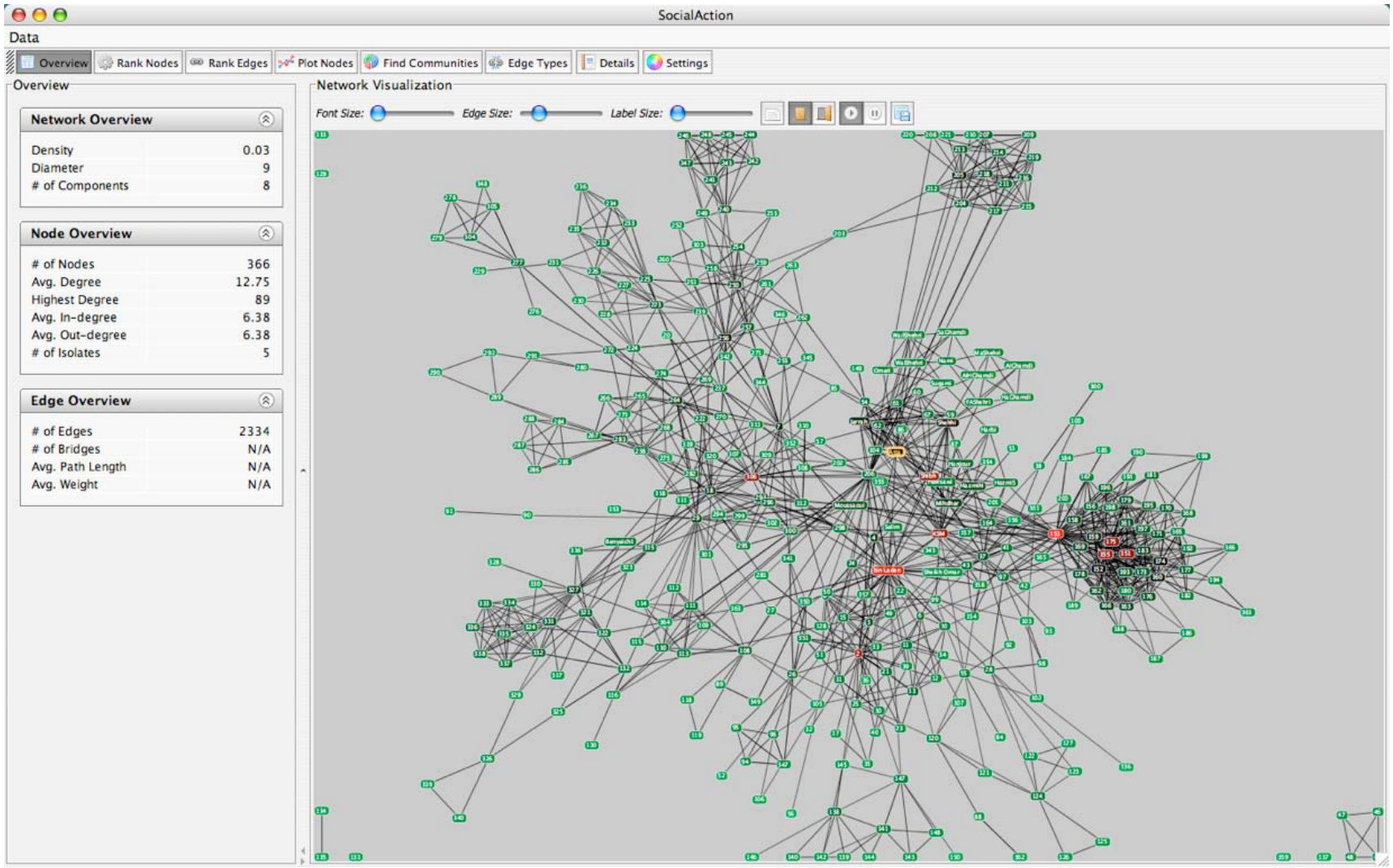


SocialAction: Systematic Yet Flexible

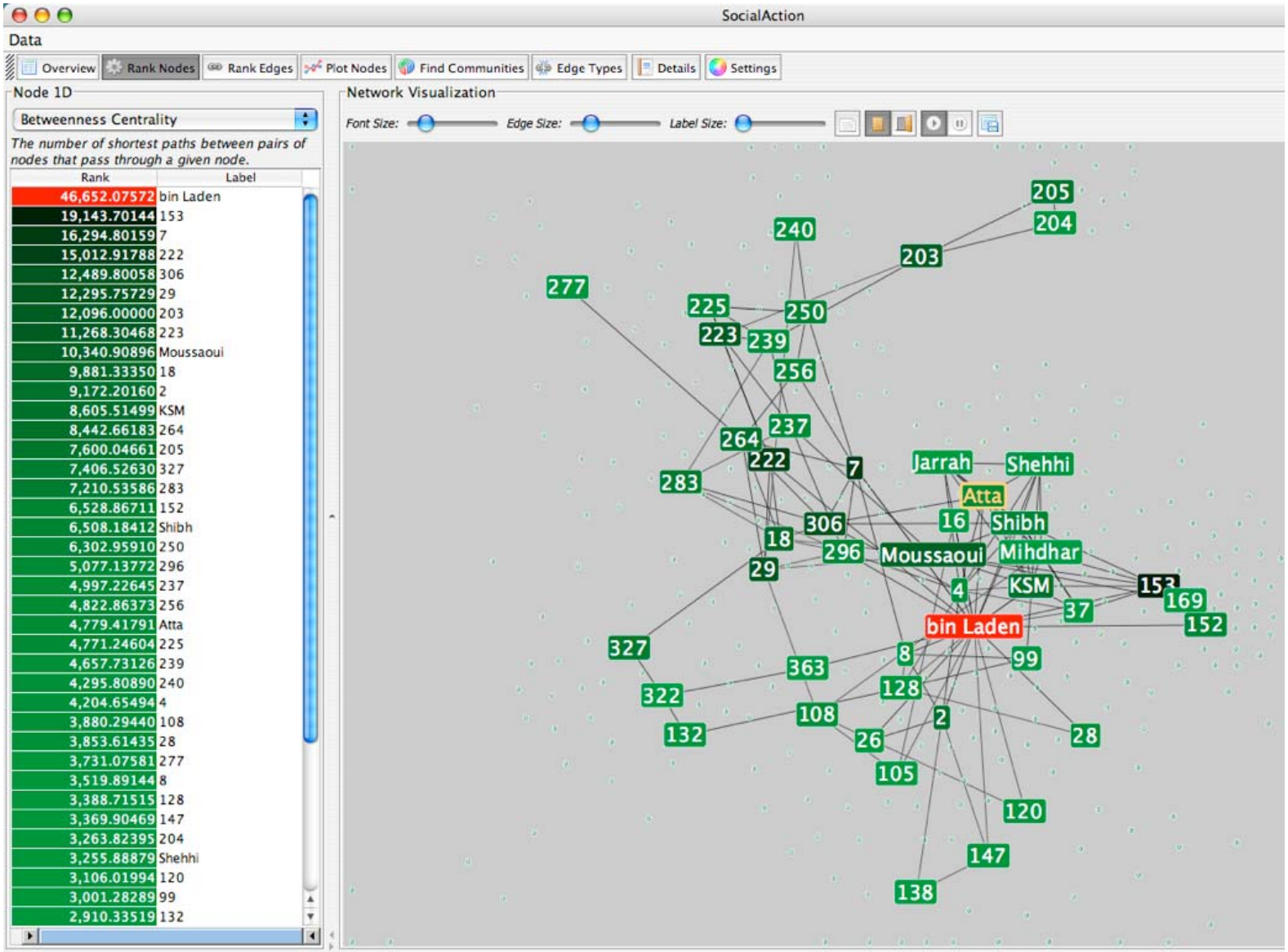


Perer & Shneiderman, IUI 2008; CGA 2009

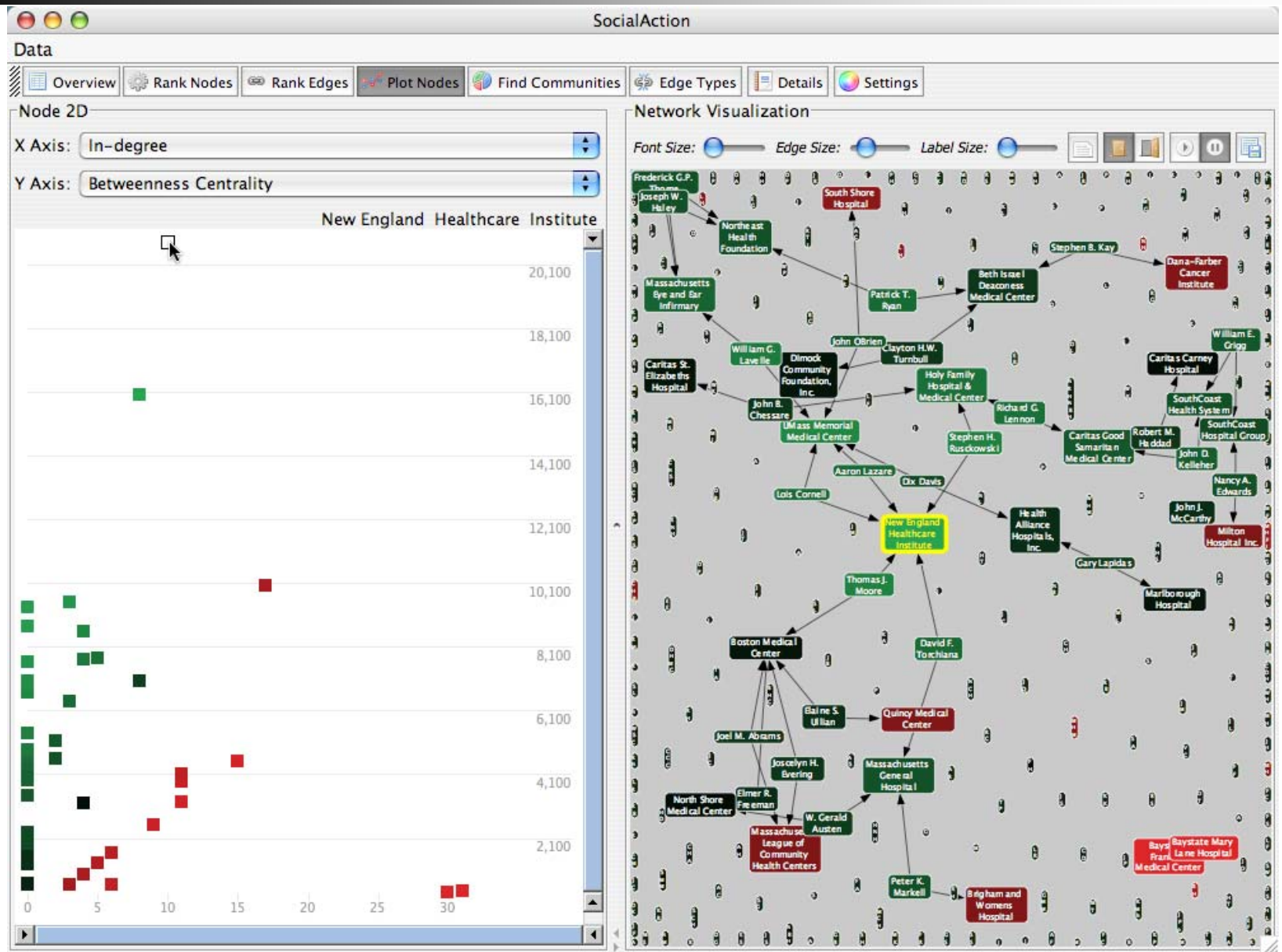
SocialAction: Overview of Global Jihad Network



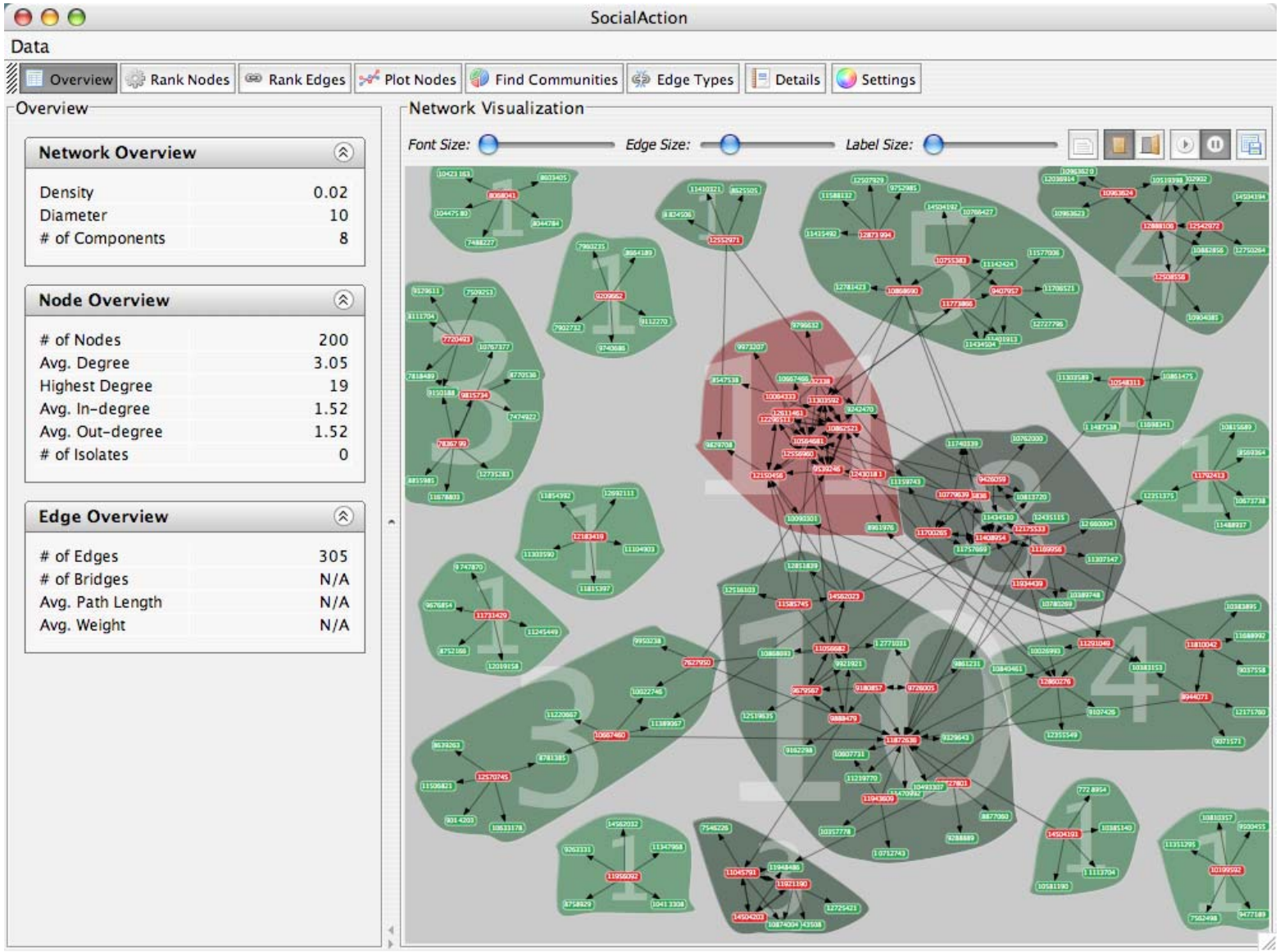
Filtering by Betweenness (“Gatekeepers”)



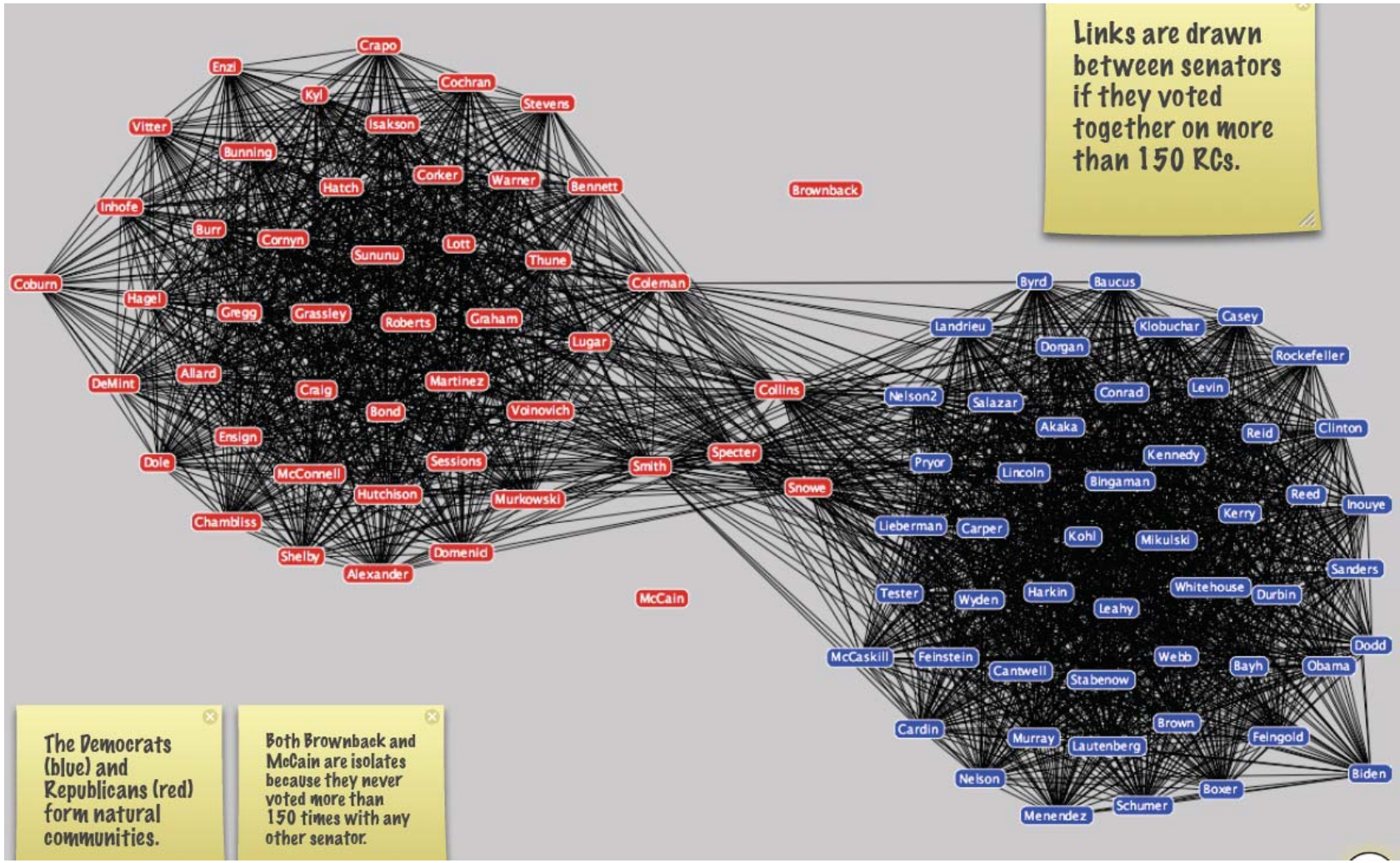
Social Action: HealthCare Directors



Social Action: PubMed related refs



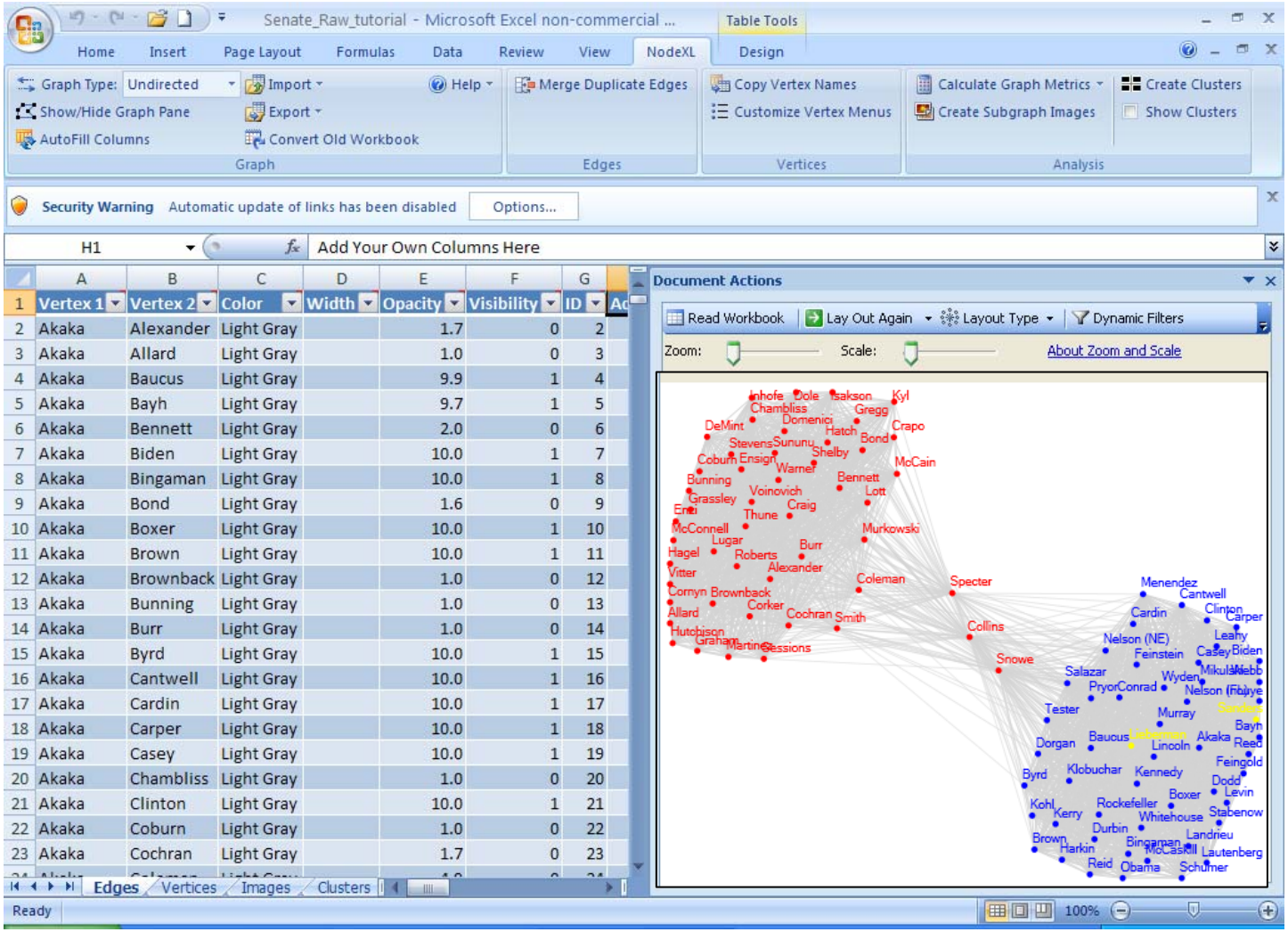
SocialAction: Senate Vote Patterns



Perer & Shneiderman, CHI 2008

NodeXL:

Network Overview for Discovery & Exploration in Excel



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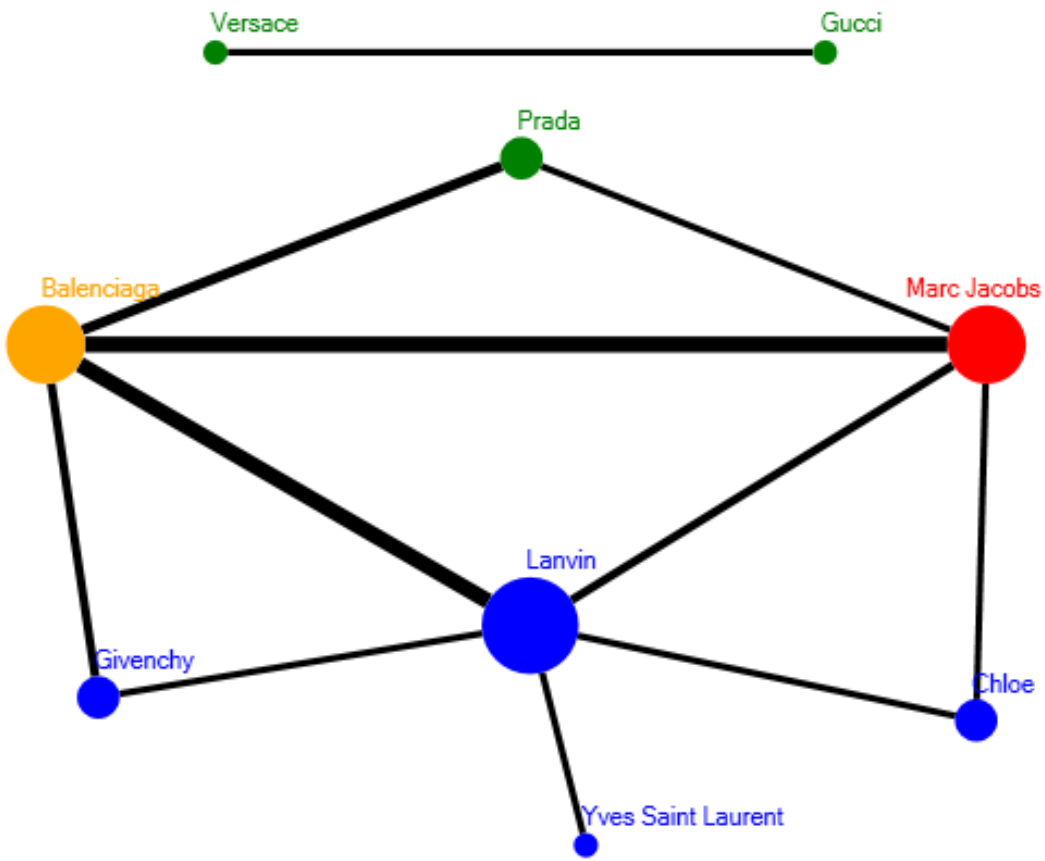
Akaka	Allard	Light Gray		1.0	0	3
Akaka	Baucus	Light Gray		9.9	1	4
Akaka	Bayh	Light Gray		9.7	1	5
Akaka	Bennett	Light Gray		2.0	0	6
Akaka	Biden	Light Gray		10.0	1	7
Akaka	Bingaman	Light Gray		10.0	1	8
Akaka	Bond	Light Gray		1.6	0	9
Akaka	Boxer	Light Gray		10.0	1	10
Akaka	Brown	Light Gray		10.0	1	11
Akaka	Brownback	Light Gray		1.0	0	12
Akaka	Bunning	Light Gray		1.0	0	13
Akaka	Burr	Light Gray		1.0	0	14
Akaka	Byrd	Light Gray		10.0	1	15
Akaka	Cantwell	Light Gray		10.0	1	16
Akaka	Cardin	Light Gray		10.0	1	17
Akaka	Carper	Light Gray		10.0	1	18
Akaka	Casey	Light Gray		10.0	1	19
Akaka	Chambliss	Light Gray		1.0	0	20
Akaka	Clinton	Light Gray		10.0	1	21
Akaka	Coburn	Light Gray		1.0	0	22
Akaka	Cochran	Light Gray		1.7	0	23

www.codeplex.com/nodexl
casci.umd.edu/NodeXL_Teaching

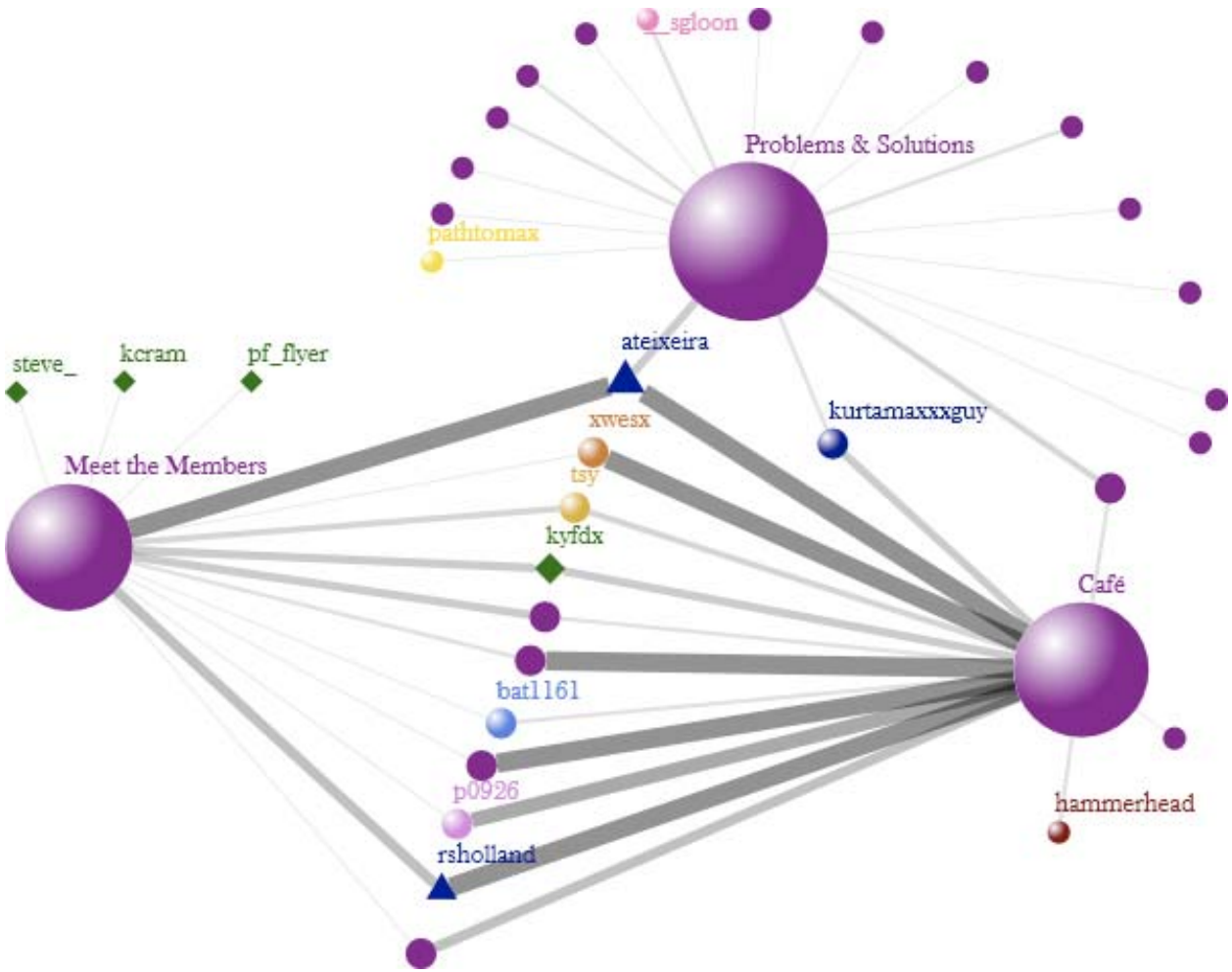
Fashionistas:



Size = Mentions
Edge thickness = Ties
Color = Country

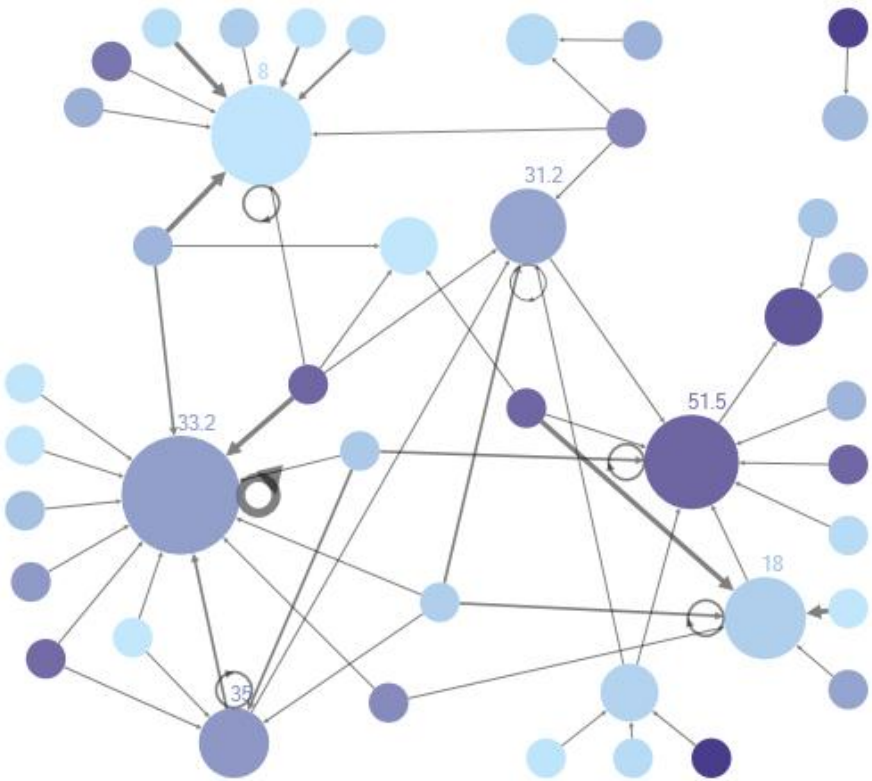
(Kate Lanahan)

Subaru Owners: Groups and Bridges

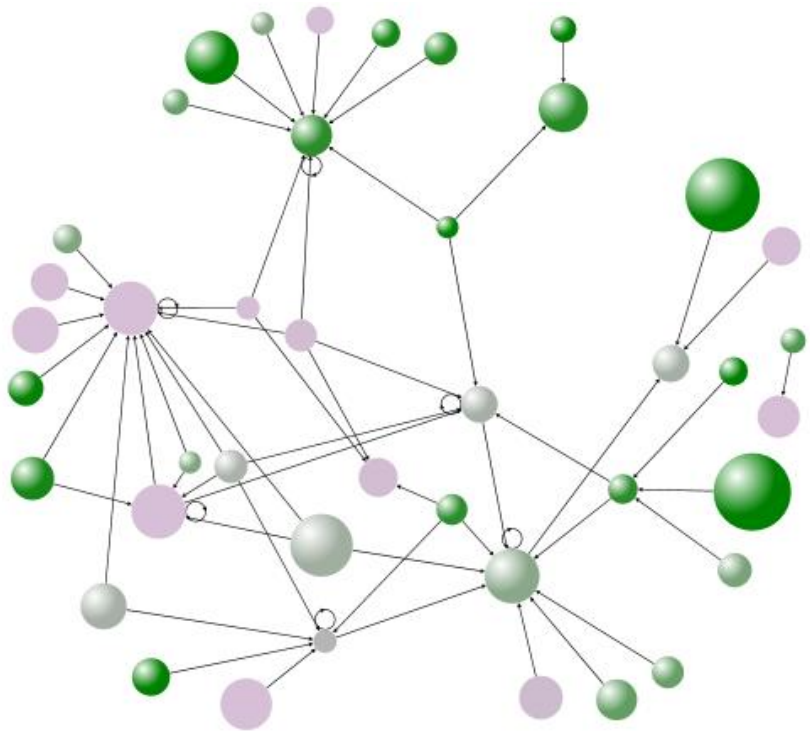


(Thakar)

Weight Watchers Support Group



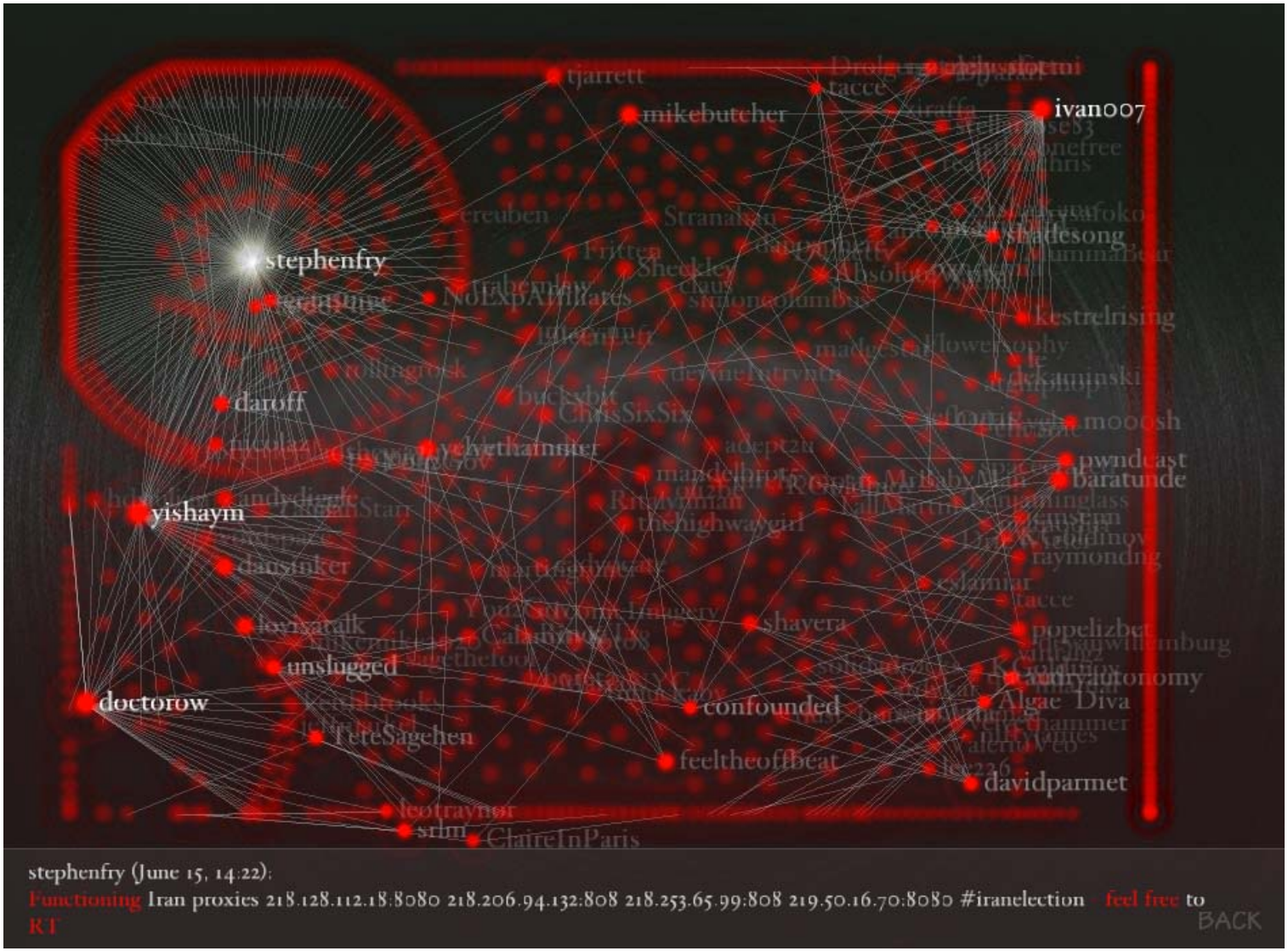
Size = Weight loss
Color = Questions answered



Size = Weight loss
Color = Membership length

(Theresa Burlas)

Iran Election: Massive Dispersal



giladlotan.org/viz/iranelection/

Social Media Analytics

Telligent/Analytics (Harvest)

Sentiment Analysis

User Types

Influencer, Answerer, Originator, Spectator, Asker, Connector, Commenter, Moderator

Autonomy Interwoven/Social Media

Understand the meaning of social media, user generated content, customer sentiment, context and behavior - even video

Discover new customer segments, trends, and business opportunities from this understanding

Optimize customer engagement, navigation, offers, conversion rates, and customer value

Vision: Social Computing

1) Focus on National Priorities & Impact

- Health, energy, education, business innovation
- Disaster response, community safety
- Environmental awareness, biodiversity

2) Develop Theories of Social Computing

- How do networks evolve? Can we predict areas of growth, stability, decline, infections, disruptions?
- Can we guide intervention to stop terrorists, slow epidemics, increase sales, promote health?

3) Provide Technology Infrastructure

- Scalable, reliable, universal
- Protect privacy, stop attacks, resolve conflicts

Road ahead

- Much work to be done
- Difficult to attain all our goals
- But we can make important contributions

Road ahead

- Much work to be done
- Difficult to attain all our goals
- But we can make important contributions

- Shift public policy
  - National Institutes for Social Computing
  - National Initiative for Social Participation
- Change our research community
- Restructure our academic curricula

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