

Visual Analytics



CS 7450 - Information Visualization
November 16, 2015
John Stasko

Agenda



- Overview of what the term means and how it relates to information visualization
- Some example VA research projects
- Specific example, Jigsaw, helping investigative analysis
- Related systems



Acknowledgment



Slides looking like this provided
courtesy of Jim Thomas

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Visual Analytics



- A new term for something that is familiar to all of us
- Informal description:
 - Using visual representations to help make decisions
 - Sounds like infovis, no?
 - Let's be more precise...

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Before there was VA



- Growing concern from some that infovis was straying from practical, real world analysis problems
- Infovis typically not applied to massive data sets
- Infovis “competes” with other computational approaches to data analysis
 - Statistics, data mining, machine learning

Important Paper



- Shneiderman suggests combining computational analysis approaches such as data mining with infovis – Discovery tools
 - Too often viewed as competitors in past
 - Instead, can complement each other
- Each has something valuable to contribute

Further Questions



- Are information visualizations helping with exploratory analysis enough?
- Are they attempting to accomplish the right goals?

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Another Important Paper



- Information visualization systems inadequately supported decision making:
 - Limited Affordances
 - Predetermined Representations
 - Decline of Determinism in Decision-Making
- “Representational primacy” versus “Analytic primacy”
 - Telling the truth about your data versus providing analytically useful visualizations

Covered earlier this term

Amar & Stasko
InfoVis '04 Best Paper
TVCG '05

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Task Level



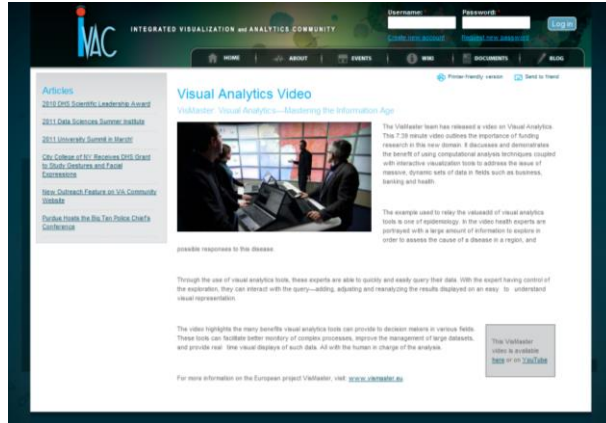
- Don't just help "low-level" tasks
 - Find, filter, correlate, etc.
- Facilitate analytical thinking
 - Complex decision-making, especially under uncertainty
 - Learning a domain
 - Identifying the nature of trends
 - Predicting the future

More Motivation



- Increasing occurrences of situations and areas with large data needing better analysis
 - DNA, microarrays
 - 9/11 security
 - Business intelligence
 - ...

Articulating the Motivation



Video

<http://videothèque.inria.fr/videothèque/doc/635>

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History



- 2003-04 Jim Thomas of PNNL, together with colleagues, develops notion of visual analytics
- Holds workshops at PNNL and at InfoVis '04 to help define a research agenda
- Agenda is formalized in book *Illuminating the Path*, shown on next slide

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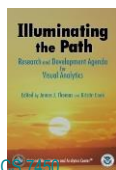
Visual Analytics Definition



Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces.

People use visual analytics tools and techniques to

- Synthesize information and derive insight from massive, dynamic, ambiguous, and often conflicting data
- Detect the expected and discover the unexpected
- Provide timely, defensible, and understandable assessments
- Communicate assessment effectively for action.



Thomas & Cook
2005

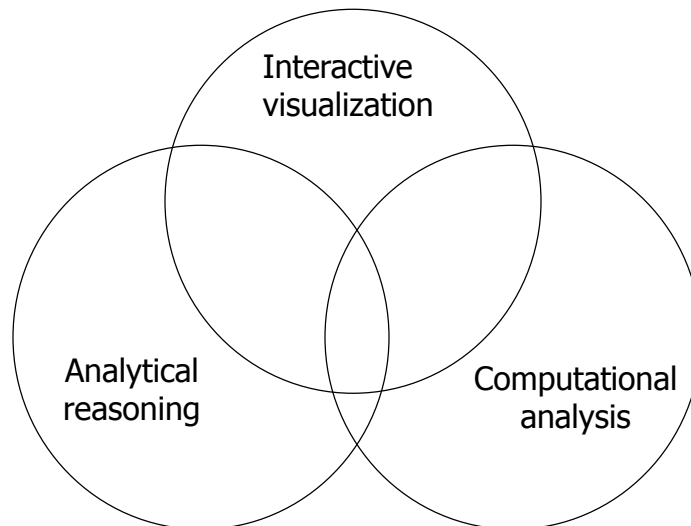
“The beginning of knowledge is the discovery of something we do not understand.”
~Frank Herbert (1920 - 1986)

Visual Analytics



- Not really an “area” per se
 - More of an “umbrella” notion
- Combines multiple areas or disciplines
- Ultimately about using data to improve our knowledge and help make decisions

Main Components



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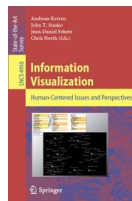
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Alternate Definition



- Visual analytics combines automated analysis techniques with interactive visualizations for an effective understanding, reasoning and decision making on the basis of very large and complex data sets



Keim et al, chapter in
*Information Visualization:
Human-Centered
Issues and Perspectives*, 2008

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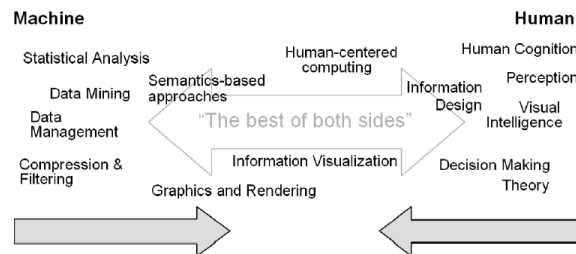
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Synergy



- Combine strengths of both human and electronic data processing
 - Gives a semi-automated analytical process
 - Use strengths from each



From Keim

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InfoVis Comparison



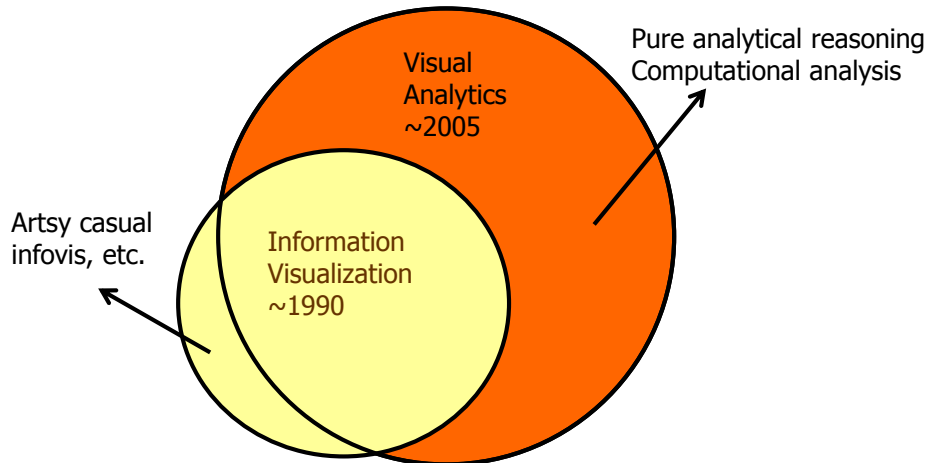
- Clearly much overlap
- Perhaps fair to say that infovis hasn't always focused on analysis tasks so much and that it doesn't always include advanced data analysis algorithms
 - Not a criticism, just not focus
 - InfoVis has a more narrow scope
 - (Some of us actually do believe that infovis has/should include those topics)

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Academic Context



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My interpretation

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Visual Analytics



- Encompassing, integrated approach to data analysis
 - Use computational algorithms where helpful
 - Use human-directed visual exploration where helpful
 - Not just “Apply A, then apply B” though
 - Integrate the two tightly

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Domain Roots



- Dept. of Homeland Security supported founding VA research
- Area has thus been connected with security, intelligence, law enforcement
- Should be domain-independent, however, as other areas need VA too
 - Business, science, biology, legal, etc.

VA-related Research Topics



- Visualization
 - InfoVis, SciVis, GIS
- Data management
 - Databases, information retrieval, natural language
- Data Analysis
 - Knowledge discovery, data mining, statistics
- Cognitive Science
 - Analytical reasoning, decision-making, perception
- Human-computer interaction
 - User interfaces, design, usability, evaluation



Visual Analytics Partnership Disciplines



- **Statistics, data representation and statistical graphics**
- **Geospatial and Temporal Sciences**
- **Applied Mathematics**
- **Knowledge representation, management and discovery**
 - Ontology, semantics, NLP, extraction, synthesis, ...
- **Cognitive and Perceptual Sciences**
- **Communications: Capture, Illustrate and present a message**
- **Decision sciences**
- **Information and Scientific Visualization**

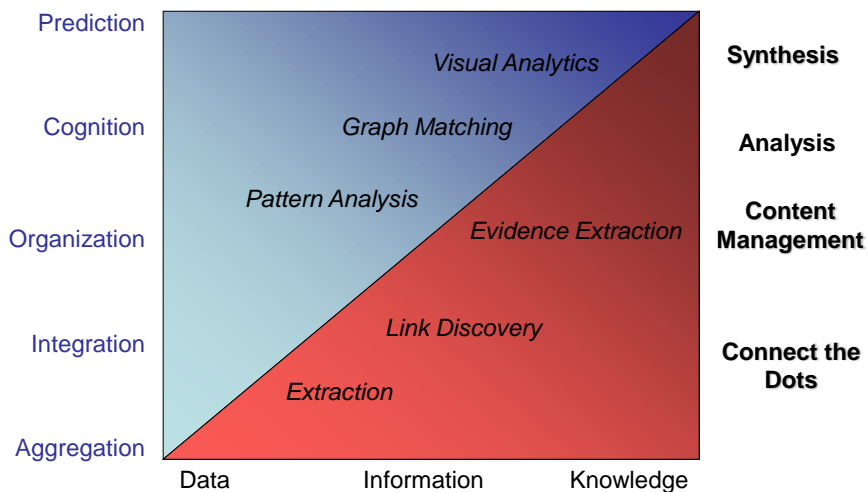
And far more than homeland security

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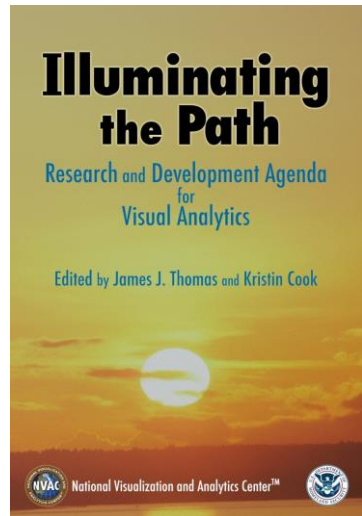
Multiple Techniques Contribute to Threat Assessment



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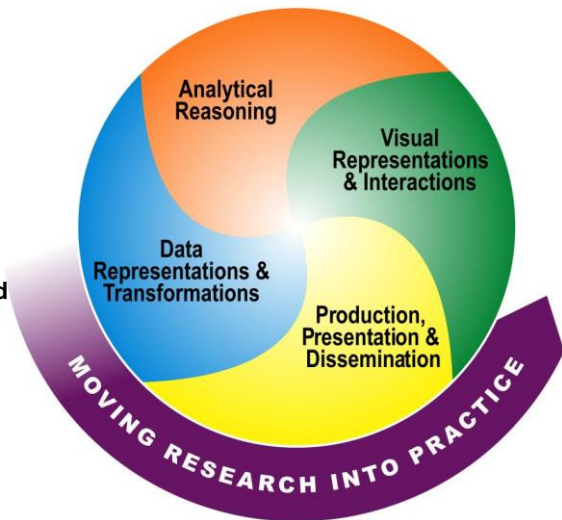
- Available at <http://nvac.pnl.gov/> in PDF form
- At IEEE Press in book form
- Special thanks to IEEE Technical Committee on Visualization and Graphics



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- Challenges
- Science of Analytical Reasoning
- Science of Visual Representations and Interactions
- Data Representations and Transformations
- Production, Presentation, and Dissemination
- Moving Research Into Practice
- Positioning for an Enduring Success



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More History



- European Union has become very active in visual analytics area
 - VisMaster project



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Vision of the Future



- PNNL Precision Info Environments (PIE) video
- Emergency response scenario



<http://precisioninformation.org>

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Application Area



- Investigative & Intelligence Analysis
 - Gather information from various sources then analyze and reason about what you find and know
 - Analyze situations, understand the particulars, anticipate what may happen

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- **Thinking**¹ - or reasoning - involves objectively connecting present beliefs with evidence in order to believe something else
- **Critical Thinking**¹ is a deliberate meta-cognitive(thinking about thinking) thinking act whereby a person reflects on the quality of the reasoning process simultaneously while reasoning to a conclusion.
- **Intelligence**¹ is a specialized form of knowledge, an activity, and an organization. As knowledge, intelligence informs leaders, uniquely aiding their judgment and decision-making. ...

1. *Critical Thinking and Intelligence Analysis: David Moore*

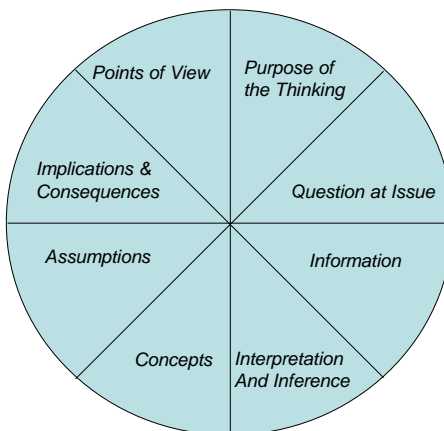
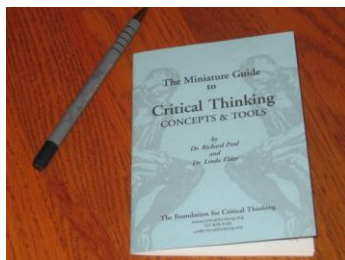


Critical Thinking*



“...the quality of our life and that of what we produce, make, or build depends precisely on the quality of our thoughts.”

Elements of thought:



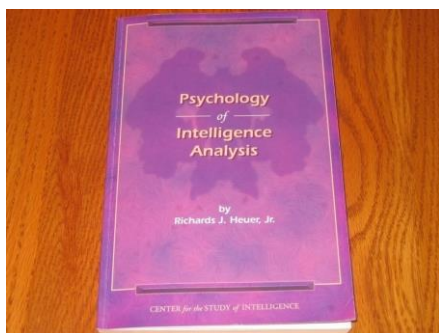
* Foundations of Critical Thinking www.criticalthinking.org

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Example: Heuer's Central Ideas



- “Tools and techniques that gear the analyst’s mind to apply higher levels of critical thinking can substantially improve analysis... structuring information, challenging assumptions, and exploring alternative interpretations.”

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Intelligence Process

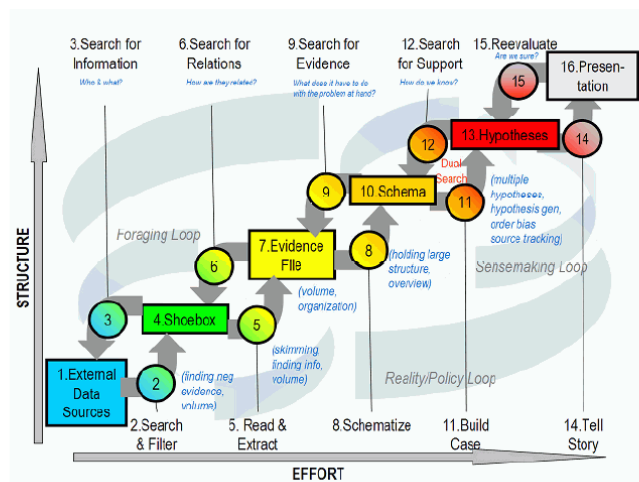


Figure 2.1. Notional model of sensemaking loop for intelligence analysis derived from CTA.

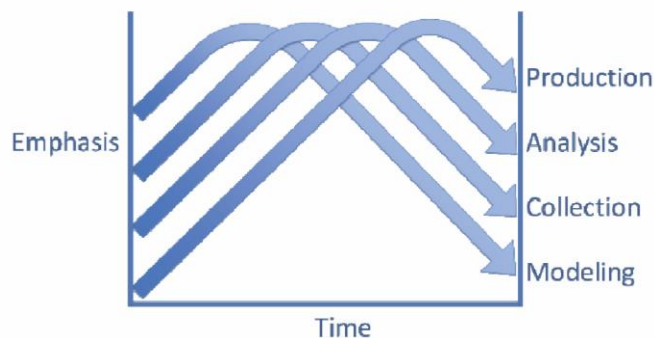
Pirolli & Card

Intl Conf Intelligence Analysis '05
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Intelligence Process



Wheaton
In preparation

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Pain Points



- Cost structure of scanning and selecting items for further attention
- Analysts' span of attention for evidence and hypotheses

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Jigsaw

Stasko, Görg, Liu
Information Visualization '08

Görg et al
TVCG '13



Visualization for Investigative Analysis across Document Collections

Law enforcement & intelligence community
Fraud (finance, accounting, banking)
Academic research
Journalism & reporting
Consumer research

"Putting the pieces together"



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The Jigsaw Team



Carsten Görg
Zhicheng Liu
Youn-ah Kang
Jaeyeon Kihm
Jaegul Choo
Chad Stolper
Anand Sainath
Sakshi Pratap

and many others

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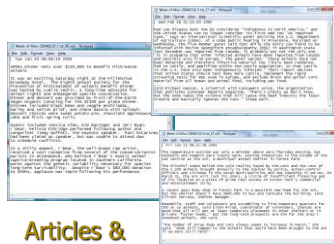
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Problem Addressed

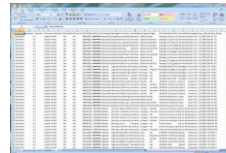
Analogy



Help “investigators” explore, analyze and understand large document collections



Articles & reports



Spreadsheets



XML documents



Blogs

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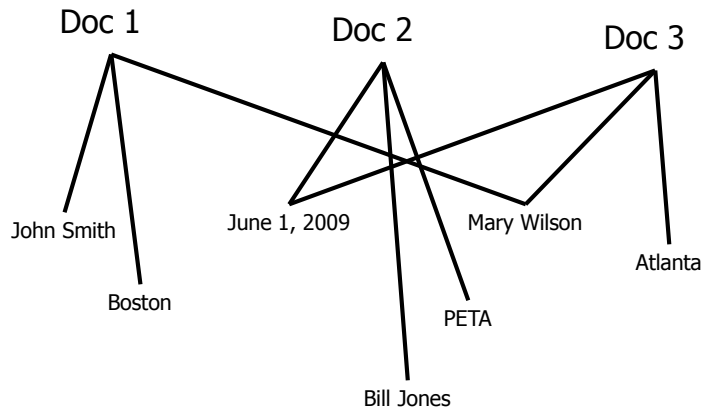
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Our Focus



- Entities within the documents
 - Person, place, organization, phone number, date, license plate, etc.
- Thesis: A story/narrative/plot/threat within the documents will involve a set of entities in coordination



Entity Identification



- Must identify and extract entities from plain text documents
 - Crucial for our work
- Not our main research focus – We use tools from others

Sample Document



```
Report: 20040510-4_16
May 14 2004

VANCOUVER, British Columbia - A Canadian immigration panel is considering whether accused environmental saboteur Tre Arrow can apply for refugee status in Canada.

Arrow, 30, who is wanted for fire bombing logging and cement trucks in Oregon, asked the Canadian authorities to remain in Canada as a political refugee at a hearing in Vancouver on Tuesday.

A key issue will be whether Arrow is affiliated with a terrorist group, which would immediately disqualify him from receiving refugee status in Canada, authorities said.

The Immigration and Refugee Board is scheduled to decide by May 31 whether Arrow is affiliated with the Earth Liberation Front, a group the FBI considers a terrorist organization responsible for scores of attacks on property over the past dozen years.
```

Entities Identified



Source:
Date: May 14, 2004

VANCOUVER, British Columbia - A Canadian immigration panel is considering whether accused environmental **saboteur Tre Arrow** can apply for refugee status in **Canada**.

Arrow, 30, who is wanted for fire bombing logging and cement trucks in **Oregon**, asked the Canadian authorities to remain in **Canada** as a political refugee at a hearing in **Vancouver** on **Tuesday**.

A key issue will be whether **Arrow** is affiliated with a terrorist group, which would immediately disqualify him from receiving refugee status in **Canada**, authorities said.

The **Immigration and Refugee Board** is scheduled to decide by **May 31** whether **Arrow** is affiliated with the **Earth Liberation Front**, a group the **FBI** considers a terrorist organization responsible for scores of attacks on property over the past dozen years.

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Sample Document 2



Title: Proving Columbus was Wrong
Abstract: In this work, we show the world is really flat. To do this, we build a bunch of ships. Then we...
PI: Amerigo Vespucci
Co-PI: Vasco de Gama, Ponce de Leon
Organization: Northwest Central Univ.
Amount: 123,456
Program Mgr: Ephraim Glinert
Division: IIS
ProgramElementCode: 2860

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Entities Already Identified



Title: Proving Columbus was Wrong

Abstract: In this work, we show the world is really flat. To do this, we build a bunch of ships. Then we...

PI: Amerigo Vespucci

Co-PI: Vasco de Gama, Ponce de Leon

Organization: Northwest Central Univ.

Amount: 123,456

Program Mgr: Ephraim Glinert

Division: IIS

ProgramElementCode: 2860

Entities

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Connections



- Entities relate/connect to each other to make a larger “story”
- Connection definition:
 - Two entities are connected if they appear in a document together
 - The more documents they appear in together, the stronger the connection

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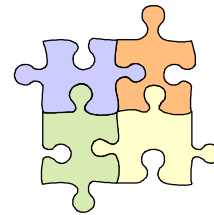
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Jigsaw

“Putting the pieces together”



- Computational analysis of document text
 - Entity identification, document similarity, clustering, summarization, sentiment
- Multiple visualizations (views) of documents, analysis results, entities and their connections
- Views are highly interactive and coordinated



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System Views

The collage displays several views from the Jigsaw system:

- Top Left:** A small overview window showing a network graph.
- Top Middle:** A large window with a hierarchical tree structure on the left and a list of items on the right.
- Top Right:** A network graph with nodes and edges, some highlighted in red.
- Middle Left:** A text view window showing a list of documents with search results and snippets.
- Middle Middle:** A window showing a grid of colored bars, likely representing a similarity matrix or clustering results.
- Middle Right:** A window showing a grid of text snippets, possibly a document similarity matrix.
- Bottom Left:** A window showing a hierarchical tree structure, similar to the top middle view.
- Bottom Middle:** A window showing a network graph with nodes and edges, some highlighted in red.
- Bottom Right:** A window showing a network graph with nodes and edges, some highlighted in red.

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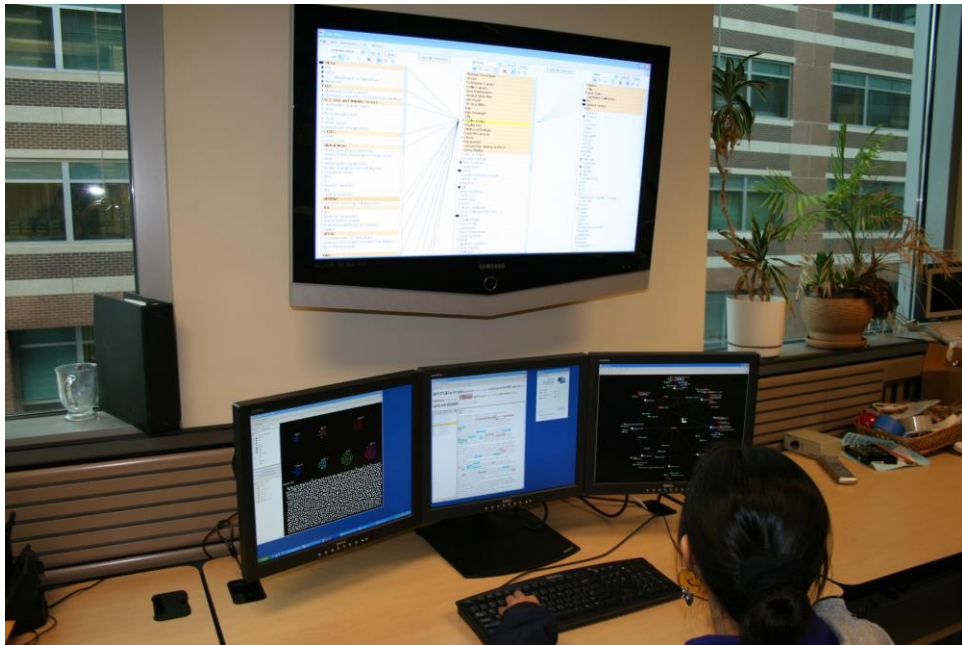
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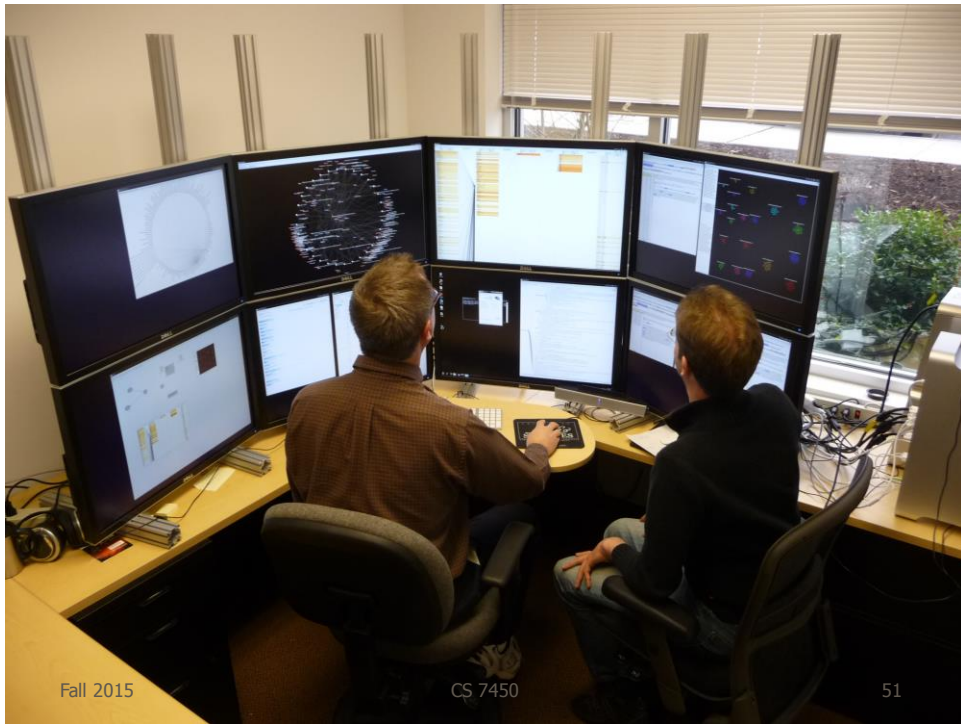
Pixels Help



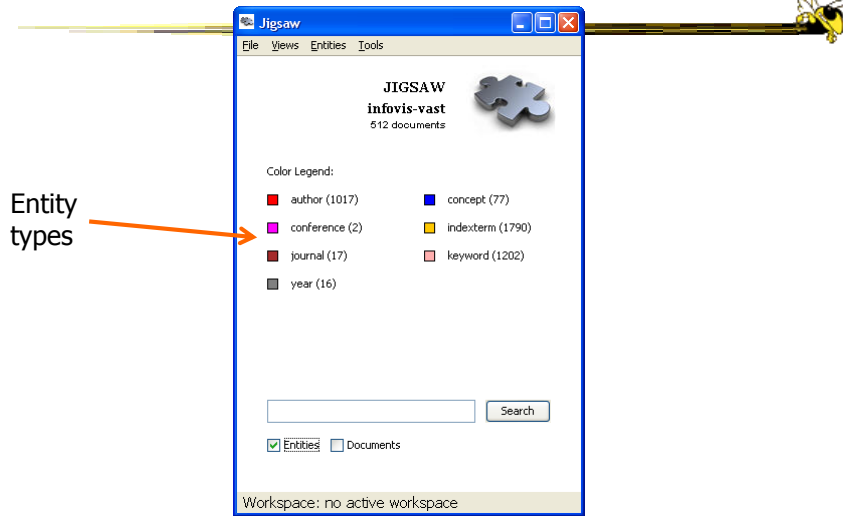
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Console

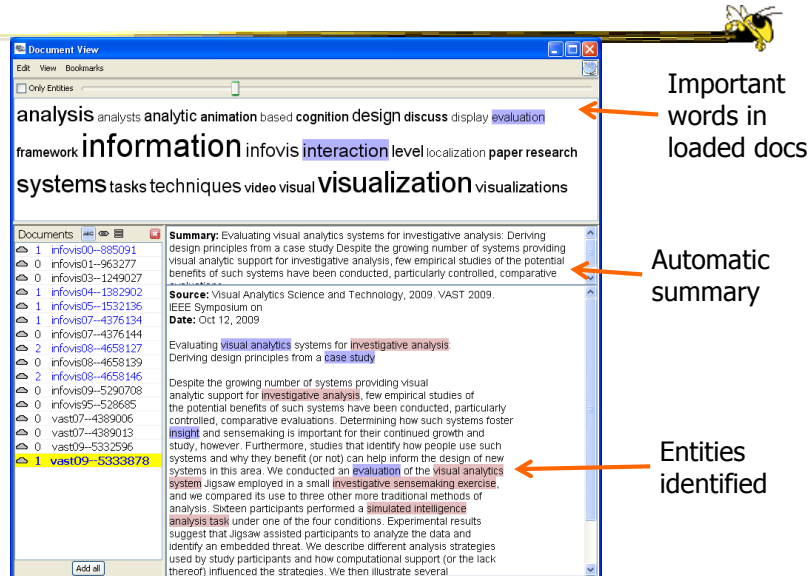


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Document View



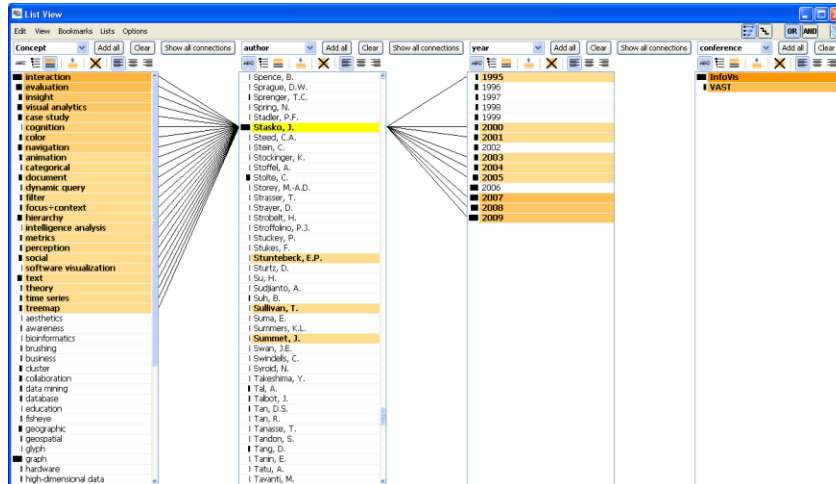
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List View

Lists of entities by type
Connections highlighted



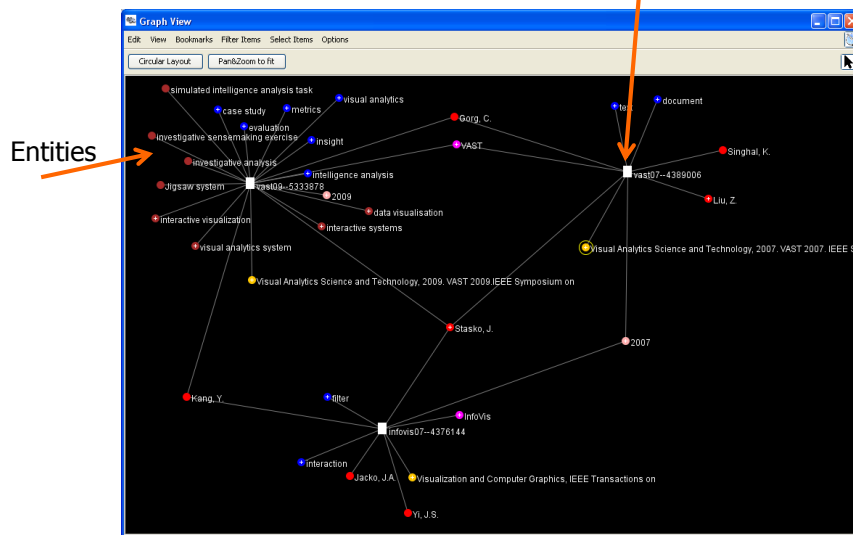
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Graph View

Document



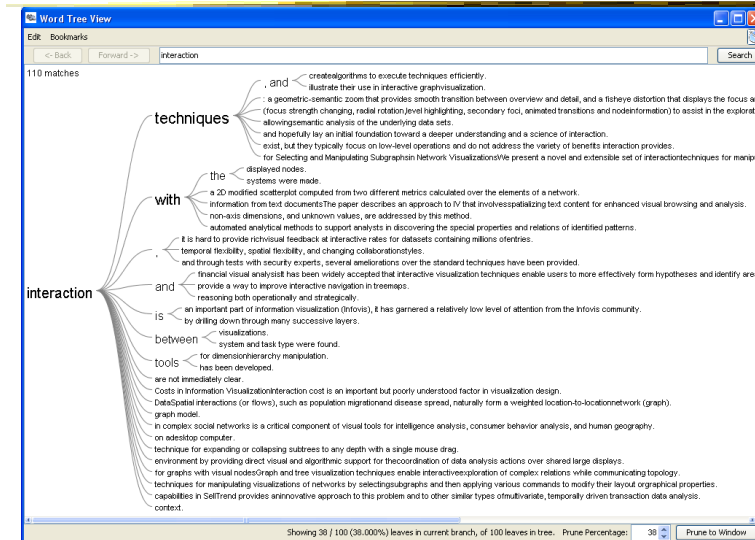
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WordTree View

Context of a word in the collection



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Document Cluster View

Clustered by document text or by entities

Summarized by three words

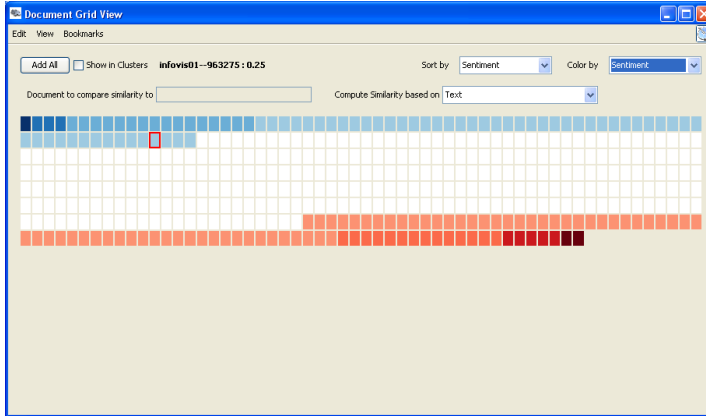


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Document Grid View



User controls order and color

Sentiment analysis shown here

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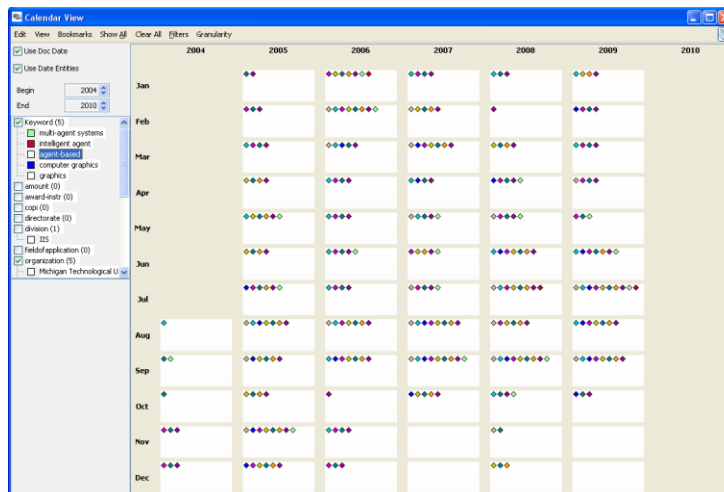
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Calendar View



Showing connections between entities and dates



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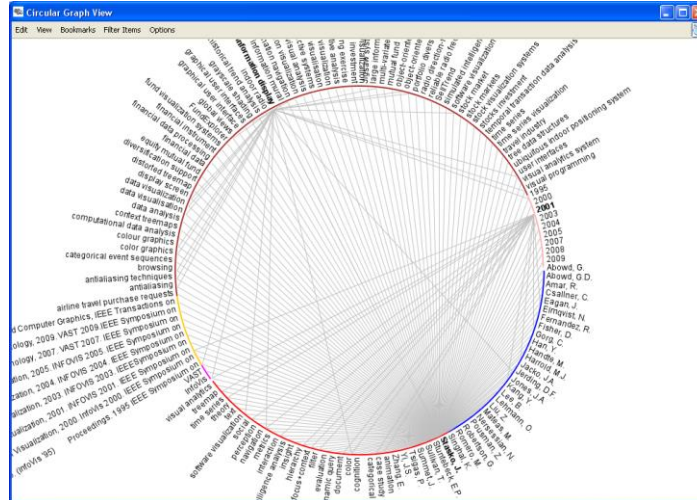
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Circular Graph View



Connections between entities



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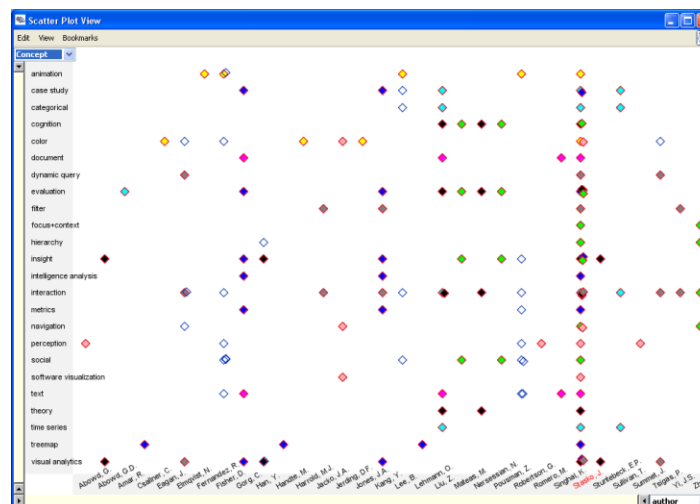
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Scatterplot View



Documents containing pairs of entities



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Demo



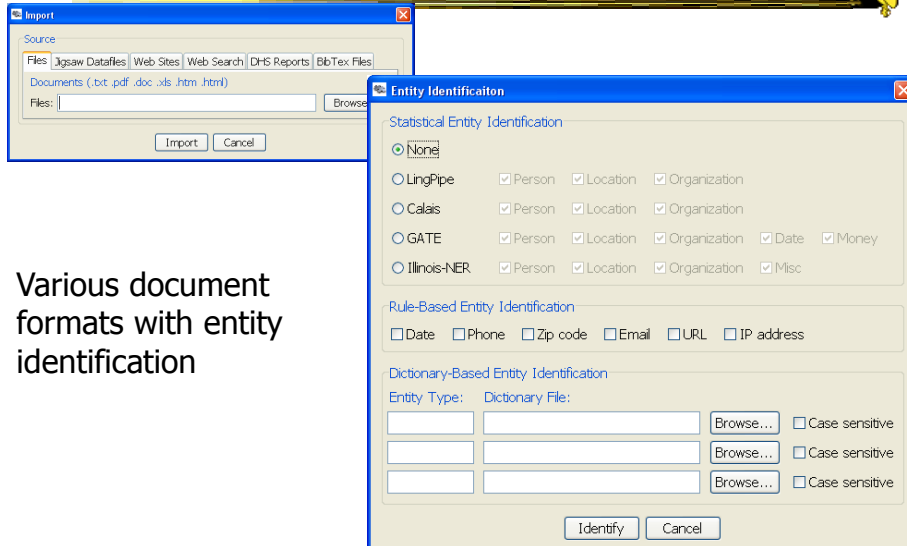
- VAST '10 Challenge
 - Collection of articles, intel reports, etc.
 - Identify a threat in the planning

Computational Analyses



- Document summarization
- Document similarity
- Document clustering by content
 - Text or entities
- Sentiment analysis

Document Import



Various document formats with entity identification

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Input Data Formats



- Text, pdf, Word, html, Excel
- Jigsaw data file format
 - Our own xml
- DB?
 - Go to Excel
 - Go to text, transform to Jigsaw data file

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```

<award>
<awardnumber>0640291</awardnumber>
<title>SGER: Distributed Spatial Partitioning Algorithms for Scalable Processing of Mobile
<nsforganization>IIS </nsforganization>
<programs>DATA MANAGEMENT SYSTEMS</programs>
<startdate>September 1, 2006</startdate>
<lastamendmentdate>September 12, 2007</lastamendmentdate>
<principalinvestigator>Liu, Ling</principalinvestigator>
<state>GA</state>
<organization>GA Tech Research Corporation - GA Institute of Technology </organizatio
<awardinstrument>Standard Grant </awardinstrument>
<programmanager>Le Gruenwald </programmanager>
<expirationdate>February 29, 2008</expirationdate>
<awardedamounttodate>65502</awardedamounttodate>
<co_pinames></co_pinames>
<piemailaddress>lingliu@cc.gatech.edu
<organizationstreetaddress>Office of Sponsored Programs </organizationstreetaddress>
<organizationcity>Atlanta </organizationcity>
<organizationstate>GA</organizationstate>
<organizationzip>30332</organizationzip>
<organizationphone>4048944819</organizationphone>
<nsfdirectorate>CSE </nsfdirectorate>
<programmelementcodes>7485</programmelementcodes>
<programreferencecodes>HPCC|9218|7484</programreferencecodes>
<fieldofapplications>0104000 Information Systems </fieldofapplicati
<awardnumber>0640291</awardnumber>
<abstract>IIS-0640219 Ling Liu &lt;lingliu@cc.gatech.edu>gt; Georgia Institute of Instit
</award>

```

Scraped XML

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```

<document>
<docID>0808863</docID>
<docDate>July 1, 2008</docDate>
<docSource></docSource>
<docText>FODAVA-Lead: Dimension Reduction and Data Reduction: Foundations for Visualization

FODAVA-Lead: Dimension Reduction and Data Reduction: Foundations for Visualization The FODAVA (Foundations of
Data Analysis and Visualization) Lead research team at the Georgia Institute of Technology provides unified
expertise in the critical areas for providing leadership of the FODAVA effort, including machine learning and
computational statistics, information visualization, massive-dataset algorithms and data structures, and
optimization theory. The team is focused on the fundamental theory and approaches to make breakthroughs in data
representations and transformations. The work is directed along the two main axes of scale reduction, data reduction
<directorate>CSE</directorate>
<award-instr>Continuing grant</award-instr>
<programreferencecode>HPCC</programreferencecode>
<programreferencecode>9218</programreferencecode>
<keyword>visualization</keyword>
<keyword>algorithms</keyword>
<fieldofapplication>0000912 Computer Science</fieldofapplication>
<state>GA</state>
<organization>GA Tech Research Corporation - GA Institute of Technology</organization>
<keyword>data analysis</keyword>
<keyword>information visualization</keyword>
<keyword>machine learning</keyword>
<amount>1200000</amount>
<pi>Park, Haesun</pi>
<copi>John Staasko</copi>
<copi>Alexander Gray</copi>
<copi>Renato D. C. Monteiro</copi>
<copi>Vladimir Koltchinskii</copi>
<progmgr>Lawrence Rosenblum</progmgr>
<division>CCF</division>
<keyword>visual analytics</keyword>
<programmelementcode>I114</programmelementcode>
<programmelementcode>H194</programmelementcode>
</document>

```

Jigsaw Datafile Format

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El Correction



Document View

analysis approach based design exploration **graph** information interaction
 interactive large layout method network paper patterns present results space technique
 techniques users using visual visualization visualizations

Documents

- 2 infovis00-885091
- 1 infovis01-963...
- 1 infovis03-124907
- 2 infovis04-158296
- 2 infovis05-1532136
- 3 infovis07-4376134
- 2 infovis07-4376144
- 2 infovis08-4658127
- 1 infovis08-4658129
- 2 infovis08-4658146
- 1 infovis09-5290708
- 1 infovis09-529685
- 3 vaest07-4389006
- 1 vaest07-4389013
- 3 vaest09-5332596
- 6 infovis09-5333878
- 0 infovis01-963288
- 0 infovis02-1173144
- 0 infovis04-1382888
- 0 infovis05-1532148
- 0 infovis06-4015426
- 0 infovis07-4376129
- 0 infovis08-5306604

Summary: it also provides a flexible user interface for examining different perspectives that show the behavior of the source code on test sets, ranging from individual tests, to important subsets such as the set of failed tests, to the entire test suite.

Source: Information Visualization, 2001. INFOVIS 2001. IEEE Symposium on
 Date: Oct 22, 2001

Technical note: visually encoding program test information to find faults in software

Large test suites are frequently used to evaluate software systems and to locate errors. Unfortunately, this process can generate a huge amount of data that is difficult to interpret manually. We have created a system, [INFOVIS 2001](#), that visually encodes test data to help find program errors. The system uses a grid to represent how source lines act in passed and failed test interface for examining different perspectives that show on test sets, ranging from individual tests, to important tests, to the entire test suite.

Context menu options:

- Add as Concept entry
- Add as author entry
- Add as conference entry
- Add as journal entry
- Add as keyword entry
- Add as year entry
- Add as new entity type
- Add Text to Tablet
- Use user code
- Use failed

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Entity Aliasing



List View

Concept

- insight
- interaction
- visual analytics
- business
- case study
- database
- evaluation
- graph
- intelligence analysis
- metrics
- aesthetics
- animation
- awareness
- bioinformatics
- brushing
- categorical
- cluster
- cognition
- collaboration
- color
- data mining
- document
- dynamic query
- education
- filter
- fishery
- focus/context
- geographic
- geospatial
- glyph
- hardware
- hierarchy
- high-dimensional data
- machine learning
- matrix
- multiple views
- navigation
- network
- nominal
- overview
- parallel coordinates

author

- Kam, D.A.
- Okazaki, J.
- Munson, T.
- Ward, M.O.
- Witterberg, M.
- Hanrahan, P.
- Rundensteiner, E.A.
- Shneiderman, B.
- van Ham, F.
- van Wijk, J.J.
- Carpenter, S.
- Heer, J.
- Ribickiy, W.
- Yang, J.
- Ebert, D.S.
- North, C.
- Thomas, J.
- Wong, P.C.
- Fekete, J.D.
- Robertson, G.
- Ch, E.H.
- Fisher, D.
- Ma, K.-L.
- MacEachern, A.M.
- Roth, S.F.
- Stoths, G.B.
- Heggie, C.
- Weaver, C.
- Zhou, M.X.
- Sagrawal, M.
- Card, S.K.
- Chen, M.C.
- Davis, V.
- Eddy, S.G.
- Footz, M.
- Hao, M.C.
- Hauser, H.
- Hessler, E.
- Keahney, T.A.
- Kozara, R.
- Lee, B.

year

- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009

keyword

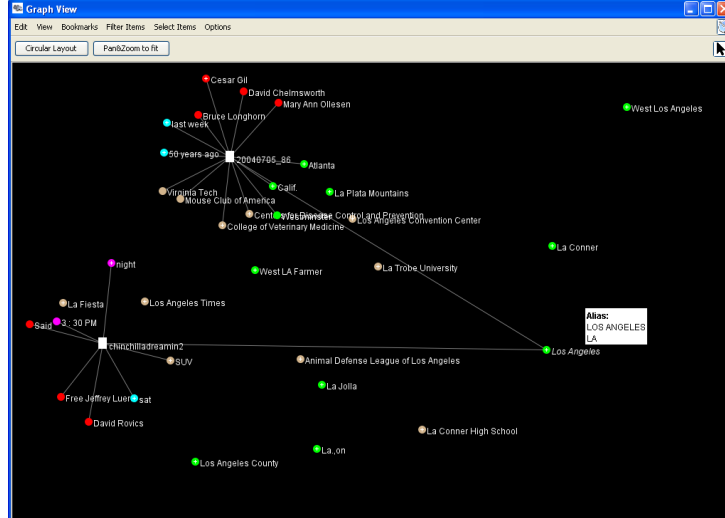
- graph visualization
- graphical user interface
- graphical user interfaces
- grayscale shading
- historical trend analysis
- image processing
- image visualization
- immediate context graph
- indoor radio
- information display
- information mural
- information navigation
- information visualization
- inspection techniques
- inter-attribute visual analysis
- interactive systems
- interactive visualization
- investigative
- investigative
- investigative
- investment
- 3D saw system
- large graph ent
- large graph ent
- large graph ent
- large informat
- large software
- legal citation
- map visualization
- mathematics computing
- matrix visualizations
- medical information systems
- multi-scale temporal event se...
- multilevel call matrices
- multilevel visualizations
- mutual fund portfolios
- navigation
- node link diagrams
- object-oriented programming
- object-oriented programs
- optimal annotations

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Alias Representation

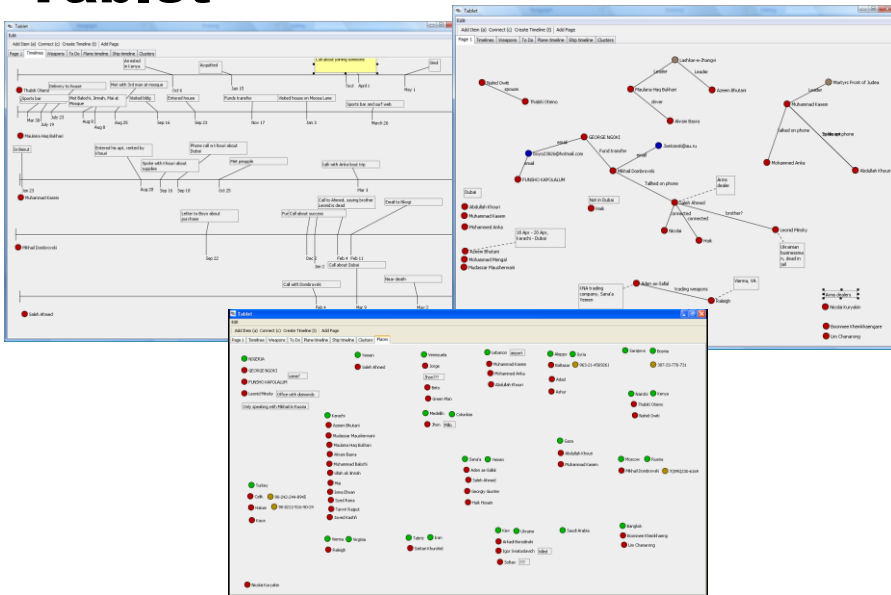


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Tablet

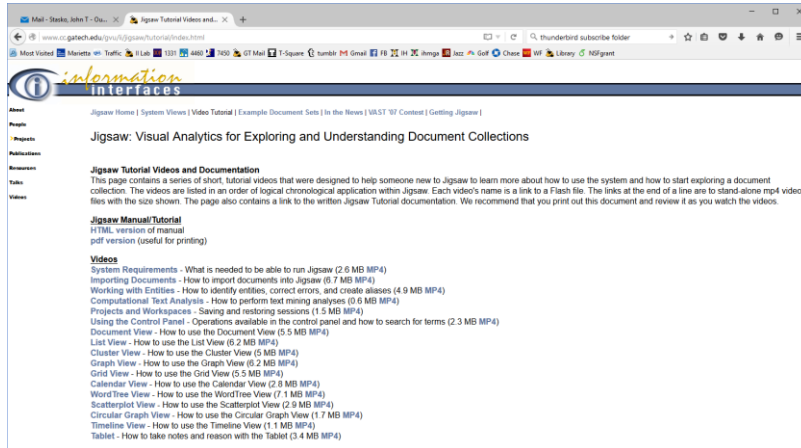


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Getting Help



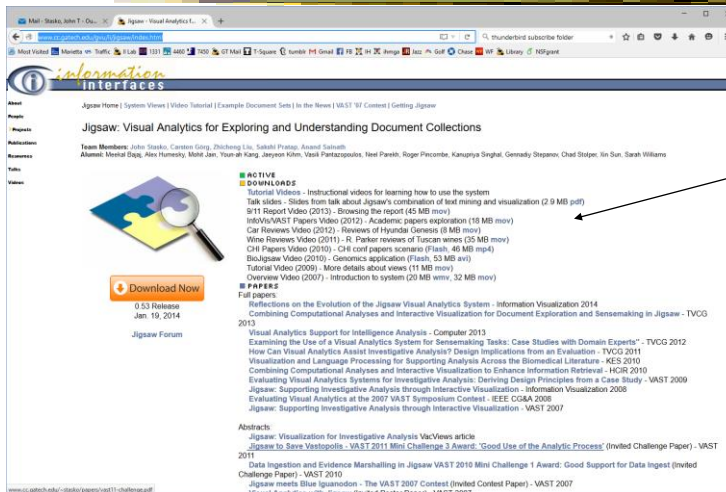
Manual, how-to videos

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See Examples



Usage scenario videos

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Application Domains



- Intelligence & law enforcement
 - Police cases
 - Won 2007 VAST Contest
 - Stasko et al, *Information Visualization* '08
- Academic papers, PubMed
 - All InfoVis & VAST papers
 - CHI papers
 - Görg et al, KES '10
- Investigative reporting
- Fraud
 - Finance, accounting, banking
- Grants
 - NSF CISE awards from 2000
- Topics on the web (medical condition)
 - Autism
- Consumer reviews
 - Amazon product reviews, edmunds.com, tripadvisor.com
 - Görg et al, HCIR '10
- Business Intelligence
 - Patents, press releases, corporate agreements, ...
- Emails
 - White House logs
- Software
 - Source code repositories
 - Ruan et al, SoftVis '10

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Potential Jigsaw Future Work



- Collaborative capabilities
- Improved evidence marshalling
- Present/browse investigation history
- Scalability upward
- Web document ingest
- Implement network algorithms
- DB import
- Wikipedia & Intellipedia
- Geospatial view
- Better timeline capabilities
- Reliability/uncertainty
- Other types of data
- Active crawling/RSS ingest
- Try it on display wall
- Deployment to real clients

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Room to Improve



- What Jigsaw doesn't do so well now
 - The end-part of the Pirolli-Card model
 - Helping the analyst take notes, organize evidence, generate hypotheses, etc.
(The Tablet is a first step)
 - Sometimes called "evidence marshalling"
 - Others have focused more on that aspect...

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i2's Analyst Notebook



The screenshot shows the i2 Analyst Notebook website. At the top, there is a navigation bar with links for 'Contact Us', 'Download Center', 'Info Request', and a search box. Below this is a secondary navigation bar with 'Home', 'Company', 'Products', 'Solutions', 'Services', 'Partners', and 'Support'. The main content area is titled 'Products' and features a sub-header 'i2 Analyst's Notebook Powering Analysis'. The text describes the software's ability to handle large volumes of data and generate insights. Below the text are four small images illustrating data visualization capabilities. A sidebar on the right lists various products including 'Analytical Capabilities', 'Online Data Analysis', 'Information Sharing', 'Analytical Notebook SDK Solutions', 'iBase', 'iBridge', 'ChartReader', 'PatternTracer', 'TextChart', 'ChartExplorer', 'Analyst's Workstation', 'iW', and 'iXa'.

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Analyst's Notebook



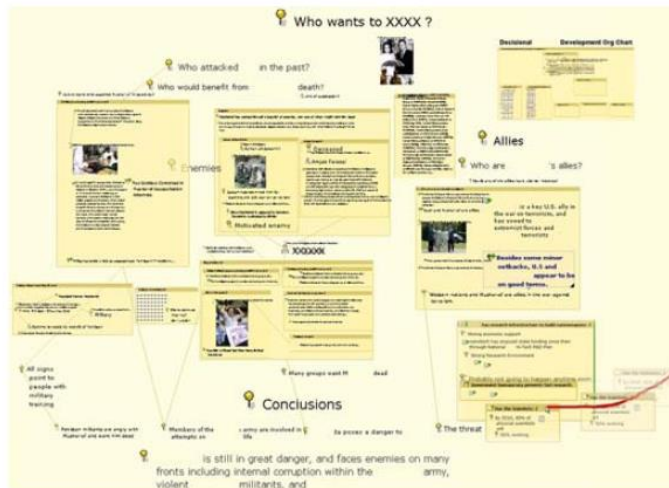
- Leading commercial tool in this space (law enforcement and intelligence agencies)
- Large zooming workspace where analyst creates networks of entities and notes
- Often used to produce presentation or story of analysis done

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Oculus' Sandbox



Video

Wright et al
CHI '06

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Sandbox



- Flexible space for inserting text and graphics
- Objects can be dragged-and-dropped from their other analysis tools
- Flexible level of detail
- Flexible gestures for making space, inserting, etc.
- Assertions with evidence gates
- Reasoning templates

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PARC's Entity Workspace



Video

Bier, Card & Bodnar
VAST '08

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Entity Workspace



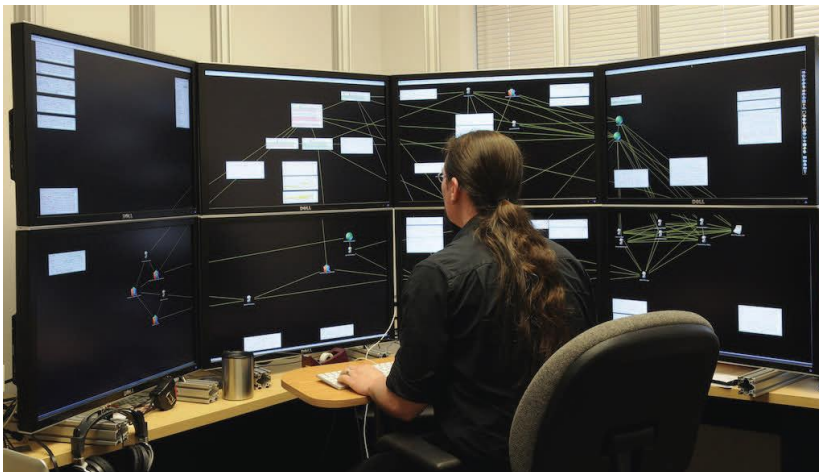
- Tools for rapid ingest of entities from documents
- Can snap together entities into groups
- Can indicate level of interest in objects
- Four main view panels, with zooming UI

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VT's Analyst's Workspace



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Video

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Analyst's Workspace



- Uses spatial affordances from a large display area for benefit in sensemaking
- Analysts move around and arrange items (documents, entities, search results) to externalize the thinking process
 - Like working with pieces of paper on a conference table, but with computational capabilities

Andrews & North
VAST '12

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Related Area of Interest



- Sensemaking
- A general term that has been used in a number of different contexts
 - E.g., How large corporations make decisions
- To me, ultimately about people working with data and information to understand it better

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Sensemaking



Nice definition:

“A motivated , continuous effort to understand connections (which can be among people, places, and events) in order to anticipate their trajectories and act effectively.”

– Klein, Moon and Hoffman
IEEE Intelligent Systems '06

Alternate Definition



“The process of creating situation awareness in situations of uncertainty”

– D. Leedom, '01 SM Symp. Report

Situation awareness:

“It’s knowing what’s going on so you know what to do”

– B. McGuinness, quoting an Air Force pilot

Other VA Projects



- Just a few other nice examples of visual analytics...

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IN-SPIRE™ Visual Document Analysis

A "Thinking Aid" for advanced investigation of unstructured text



The screenshot displays the IN-SPIRE interface with several key components:

- Network Graph:** A hierarchical tree structure on the left showing relationships between categories like 'government', 'war', 'health', and 'economy'.
- 3D Heatmap:** A large central visualization showing a 3D surface plot of data points, likely representing document density or topic frequency over time and space.
- Word Contribution Table:** A table listing words and their contribution to a document.

Word	Contribution	Docs
government	12	12
war	12	12
health	12	12
economy	12	12
million	11	11
president	8	8
force	8	8
conf	12	12
with	12	12
- Time Series Slicer:** A chart at the bottom left showing data over time, with a legend for 'W. viet nam (41)', 'W. ussia (79)', 'W. egypt (49)', 'W. france (84)', 'W. israel (72)', and 'W. china (84)'.
- Document Viewer:** A window showing a document snippet with a highlighted section:

TITLE : 121 MIDDLE EAST WHIS
 DATE : 1963/03/03
 SOURCE : TIME
 PAGE : 1/208

MIDDLE EAST WHIS
 WOODING WHO ? IN CARO, PRESIDENT GAMAL ABDEL NASSER ACTED LIKE AN
 EX-CHAMPION SEEKING A SUCCESSFUL COMBAND. WE LEFT WHICH OF HIS
 CLAIM FOR THE TITLE OF LEADERSHIP IN 1961, WHEN AN ARMY COUP
 HARBORING SPIKE FROM ITS HOPES TO BRING HIM IN BY THE UNITED
 REPUBLIC. THAT LEFT NASSER WITHOUT A SINGLE ALLY, AND
 CONFRONTED BY BACKLASHING ENEMIES AS BRAD'S DELECTOR NASSER AND
 THE KINGS OF JORDAN AND SAUDI ARABIA. THEN CAME LAST MONTH'S BRAD
 RESOLUTION AND THE OVERSHROW OF NASSER. NO ONE COULD BLAME
 NASSER'S LEADER FOR HOPING BACK TO OLD DREAMS OF GRANGEUR. FOR
 THIS NEW MAN IN PRESIDENT ABDEL SALAM AND HIS FORMER
 NASSER PROTEGE DEDICATED TO FARAWAN LIFTY. TRIBUTE TO MOTHER. WITH
- Summary Panel:** An orange box at the bottom right containing text:

Uncovers Common Topics in Large Document Collections
 Engaging Displays for Exploration
 Multiple Query and Search Tools
 Supports Real-Time Streaming Data
 Compatible with Foreign Languages
 Shows Trends over Time

<http://in-spire.pnl.gov>

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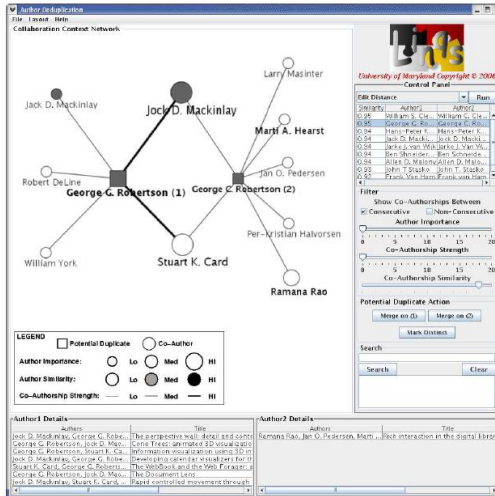
Video

90

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D-DUPE

Video



System for entity resolution in large networks such as bibliographic collections

System does computational analysis and provides suggestions and user can augment and correct

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Bilgic et al
VAST '06

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WireVis

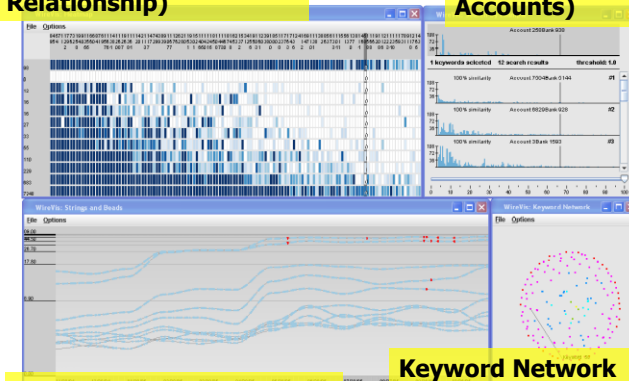
Video



Heatmap View
(Accounts to Keywords Relationship)

Search by
Example (Find Similar Accounts)

Helping Bank of America examine wire transfers of money to detect money laundering and fraud



Strings and Beads
(Relationships over Time)

Keyword Network
(Keyword Relationships)

Look for certain temporal patterns and keywords in descriptions

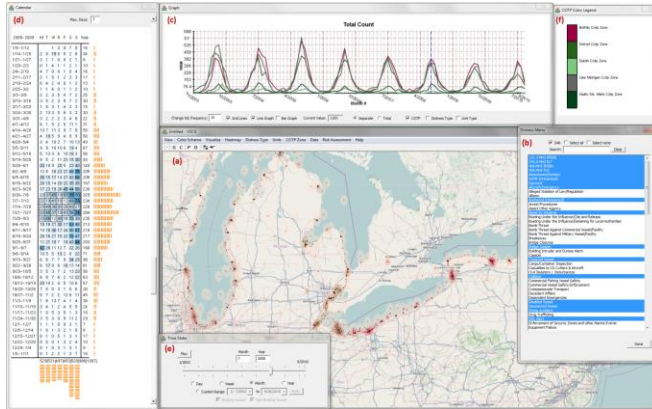
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Chang et al
Information Visualization '08

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Coast Guard Search & Rescue



Shows stations, incidents, response times

Visualize historical data and support "what if" explorations

Calculate risk assessments and then communicate visually

Malik et al
VAST '11

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Many Others



- A number of nice examples shown earlier on Graph & Network visualization day
 - Perer: Social Action
 - etc.

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HW 7



- Be an intelligence analyst
 - Use Jigsaw (emailed you a link)
 - Documents on t-square
- Turn in: Your paragraph description of “threat” + process description (and any materials you want to submit)
- Due Monday 23rd
 - 1 hardcopy
 - Only one late day allowed (30th)

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Upcoming



- Visual Perception
 - Reading
Stone
- Evaluation
 - Reading
Carpendale '08

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