



Human-Computer Interaction Opportunities for Improving Security/Privacy

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Professor, Department of Computer Science
Member, Institutes for Advanced Computer Studies &
Systems Research





Interdisciplinary research community

- Computer Science & Psychology
- Information Studies & Education

(www.cs.umd.edu/hcil)



User Interface Design Goals

- **Cognitively comprehensible:**
Consistent, predictable & controllable
- **Affectively acceptable:**
Mastery, satisfaction & responsibility

NOT:

~~**Adaptive, autonomous & anthropomorphic**~~

Scientific Approach (~~beyond user friendly~~)

- Specify users and tasks
- Predict and measure
 - time to learn
 - speed of performance
 - rate of human errors
 - human retention over time
- Assess subjective satisfaction
(Questionnaire for User Interface Satisfaction)
- Accommodate individual differences
- Consider social, organizational & cultural context

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 & communities
- Manuals, tutorials, training



www.awl.com/DTUI

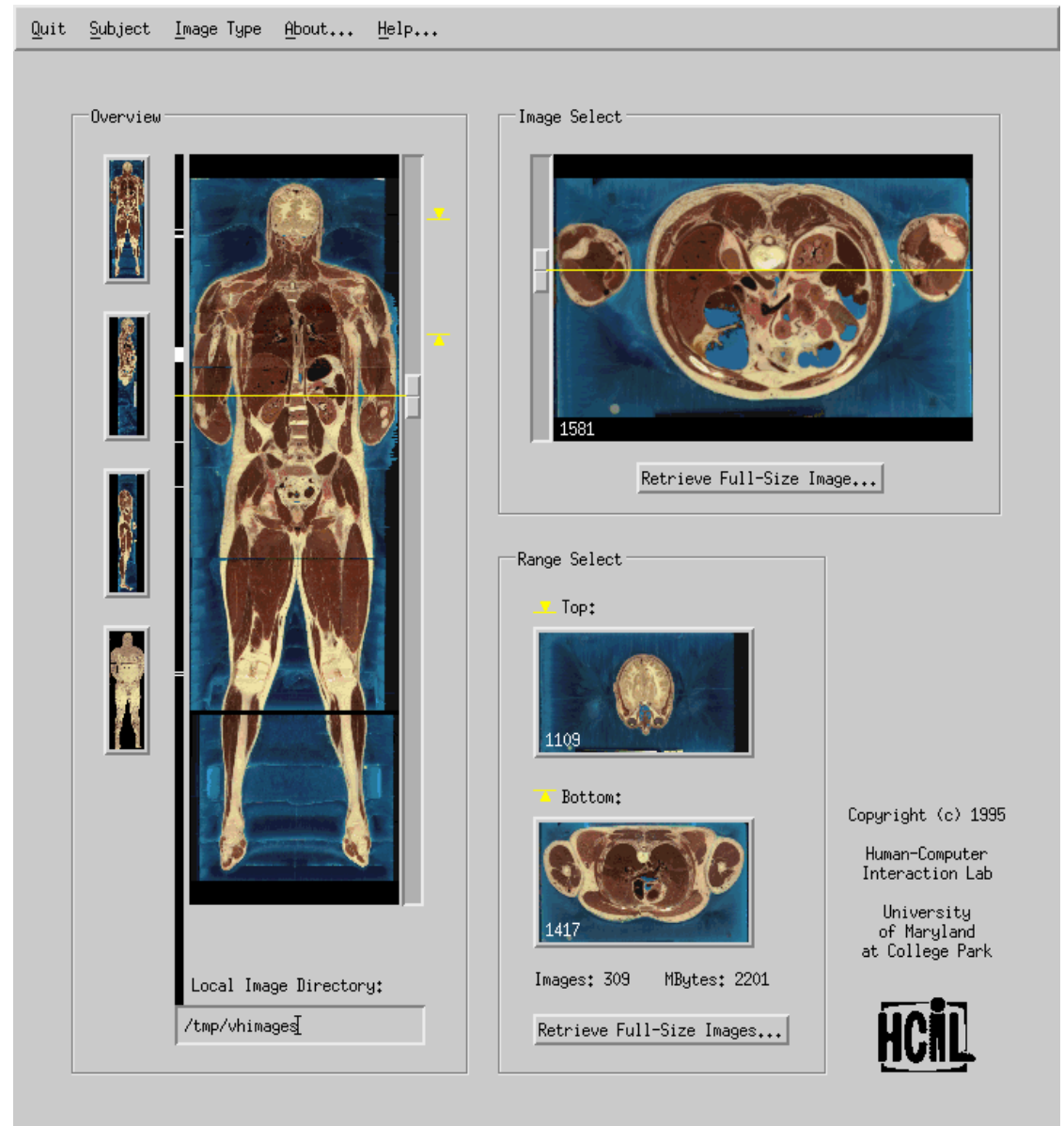
U.S. Library of Congress



- Scholars, Journalists, Citizens
- Teachers, Students


Visible Human Explorer (NLM)

- Doctors
- Surgeons
- Researchers
- Students



NASA Environmental Data

- Scientists
- Farmers
- Land planners
- Students

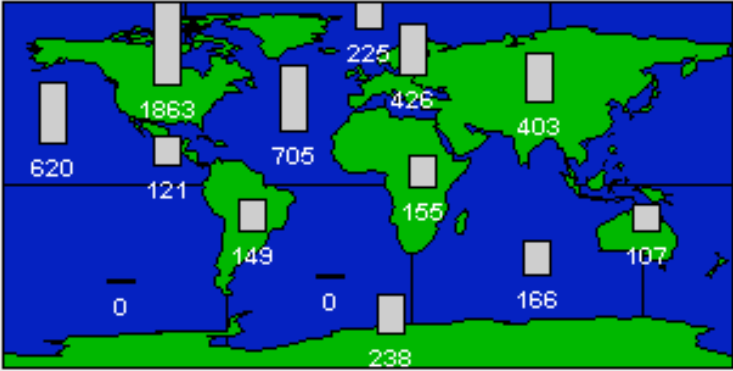


Global Change Master Directory

Global Change Master Directory

Query Preview

Area Selection:



Select attributes of int
by clicking on map ar

Topic Selection:

Atmosphere	2151
Biosphere	1083
Cryosphere	313
Human Dimensions	595
Hydrosphere	643
Land Surface	802
Oceans	1321
Paleoclimate	120
Radiance Or Imagery	738
Solar Physics	113
Solid Earth	429
Not Specified	0

Year Selection:

Prehistoric	0
0001 - 1699	21
1700 - 1799	51
1800 - 1849	91
1850 - 1899	283
1900 - 1929	409
1930 - 1939	415
1940 - 1949	498
1950 - 1959	711
1960 - 1969	978
1970 - 1979	1649
1980 - 1989	2445
1990 - 1999	2391
Not Specified	644

Bureau of the Census



- Economists, Policy makers, Journalists
- Teachers, Students

American FactFinder

NSF Digital Government Initiative



Census,
NCHS,
BLS, EIA,
NASS, SSA

- Find what you need
- Understand what you Find



www.ils.unc.edu/govstat/

FEDSTATS



International Children's Digital Library



International Children's Digital Library

A project of the [University of Maryland](#) and the [Internet Archive](#)

Explore the fun - read **324** books online...



Enter Library



Project



Research



People



Collection



Demos



Press



Frequently Asked Questions



Contact

Choose a version of the library

Enhanced

Basic

Search for books

GO

[Book List](#)

Featured Books



[The Mouse Bride](#)
[Lao shu ch'u hsin niang](#)



[Afsanah'i azhdaha vaab](#)
[\(Farsi book about Dragons\)](#)



[Rosa alada](#)
[\(A Rose with Wings\)](#)

Announcements

DEC 22, 2003:

The ICDL has added 52 more books! These books add to our collection with books in Chinese, Spanish, Vietnamese, Farsi, French, English, and Russian.

DEC 2, 2003:

A new version of ICDL Basic has just been published, the new features include:
- **Unicode compliance:** ICDL web pages can now display languages from all over the world
- **Improved text search:** search in multiple languages; view results in ranked order
- **New books:** 13 new books

DEC 1, 2003:

A recent study of our ICDL users shows:
- ICDL users come from 168 countries world wide.
- Taiwan has the most frequent users of the ICDL after the United States.
- Poland is among the top ten countries of most frequent Basic users.
For more information, go to our "[Fun Facts](#)" page.

Our Mission

The mission of the ICDL is to select, collect, digitize, and organize children's materials in their original languages and to create appropriate technologies for access and use by children 3-13 years old.

www.icdlbooks.org



Piccolo: Toolkit for 2D zoomable objects

Structured canvas of graphical objects in a hierarchical scenegraph

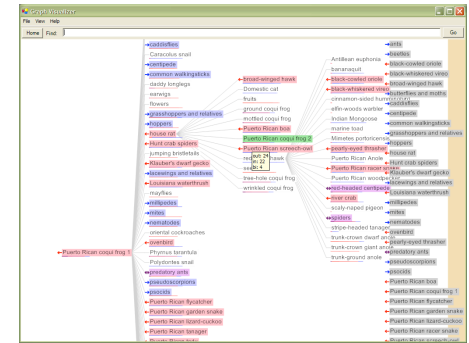
- Zooming animation
- Cameras, layers

Open, Extensible & Efficient
Java, C#, PocketPC versions

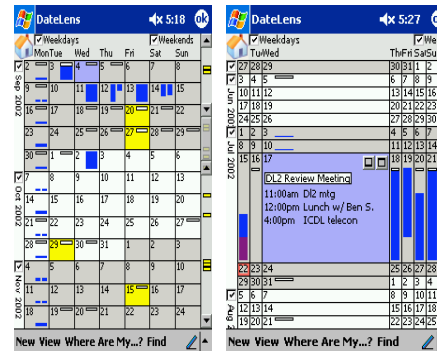
www.cs.umd.edu/hcil/piccolo



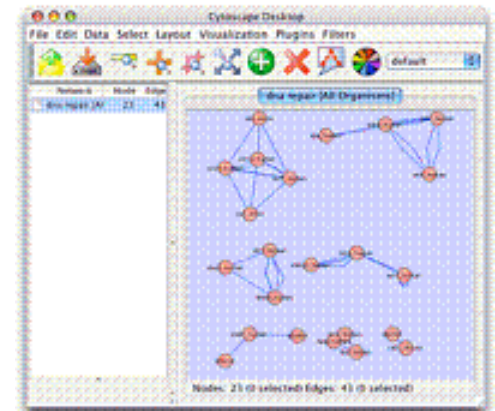
AppLens & Launch Tile
UMD, Microsoft Research



TreePlus
UMD



DateLens
Windsor Interfaces, Inc.

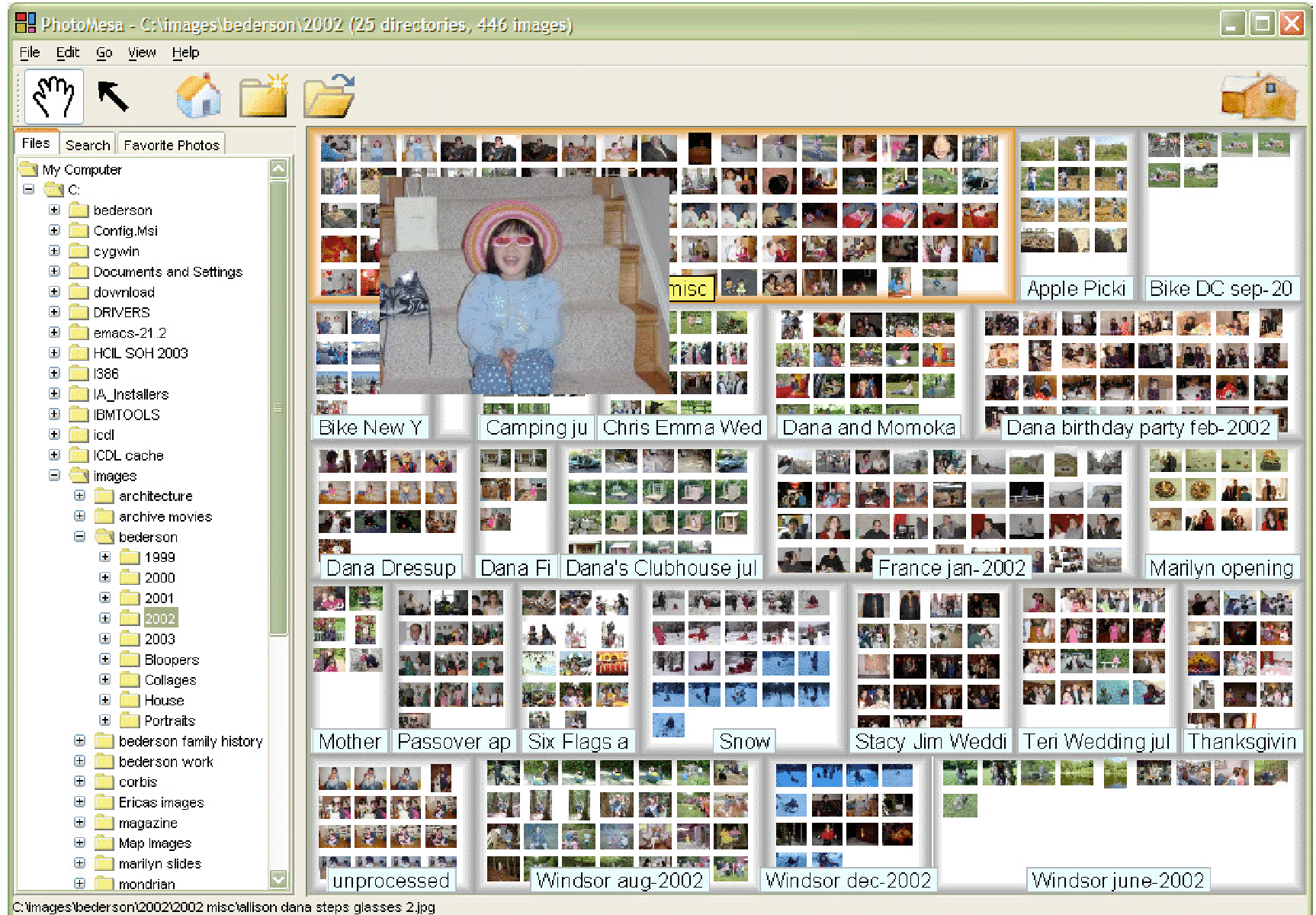


Cytoscape
Institute for Systems Biology
Memorial Sloan-Kettering
Institut Pasteur UCSD

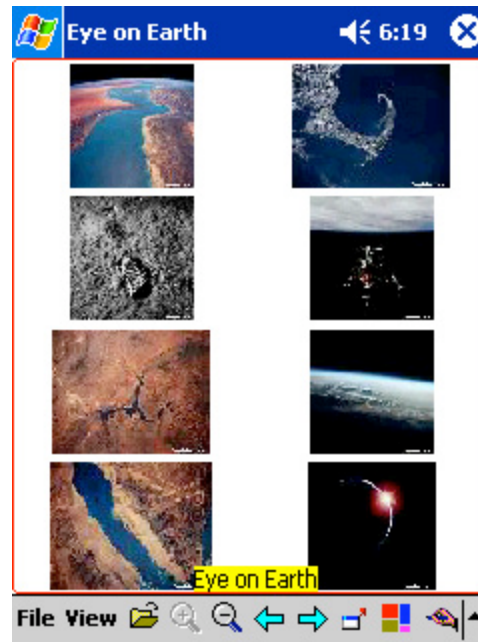


PhotoMesa

www.cs.umd.edu/hcil/photomesa



Pocket PhotoMesa



CRA Grand Challenges, 2003

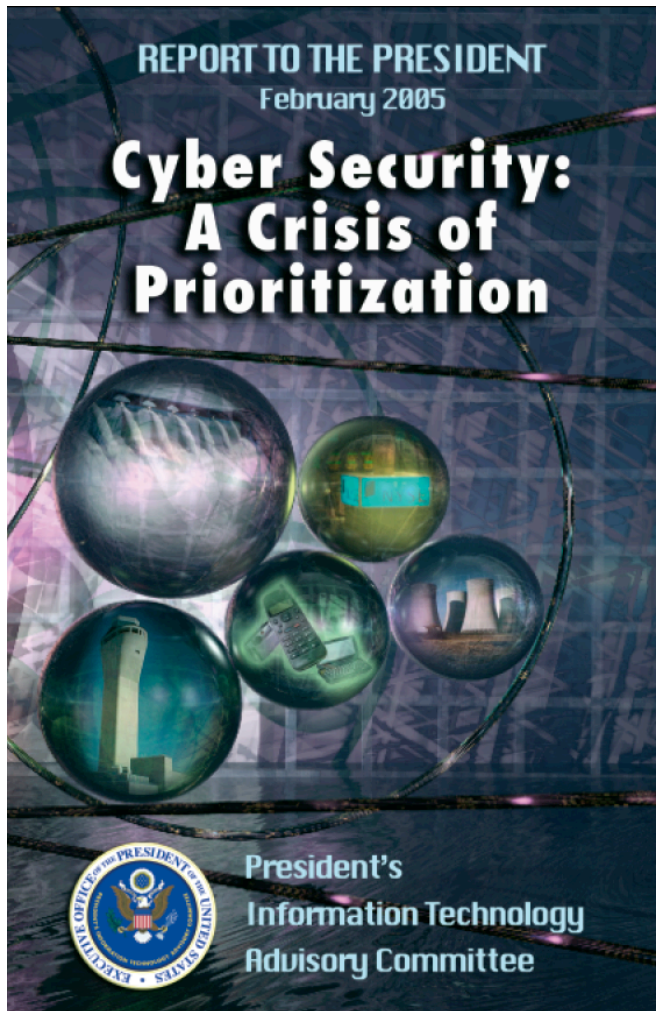


- 4) For the dynamic, pervasive computing environments of the future, give endusers:
- security they can understand
 - privacy they can control.
- patient health record
 - electronic voting
 - law enforcement databases
 - financial management

<http://www.cra.org/Activities/grand.challenges/security/>



PITAC Report, 2005 - Challenges



For end-users:

Incorrectly used software or hostile or confusing user interfaces can lead to user frustration and unauthorized workarounds that can compromise even the most robust security schemes.

For operators:

Usable presentation interfaces that allow operators to better understand incidents in progress.

<http://www.nitrd.gov>



Profusion of Concepts for Security/Privacy

Personal computing was easier

- File protection vs sharing
- Passwords & Access Control

Networking adds complexity

- Firewalls & Virtual Private Networks
- Cookies: good or bad?
- Trusted sources & Digital signatures
- Certificates & Authentication
- Viruses & Worms

Profusion of Concepts for Security/Privacy

Goals

- Availability: Accessible when needed
- Confidentiality: Crypto & limit access
- Data integrity: Prevent modifying your data
- Control: Access rights & physical security
- Audit: Logging, review & damage assessment

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Most current systems present the user with an intricate interface for specifying his protection needs. The result is that the user has trouble figuring out how to make the specification and verifying that he requested the right thing. User interfaces that more closely match the mental models people have of information protection are needed.

Profusion of Concepts for Security/Privacy

Goals

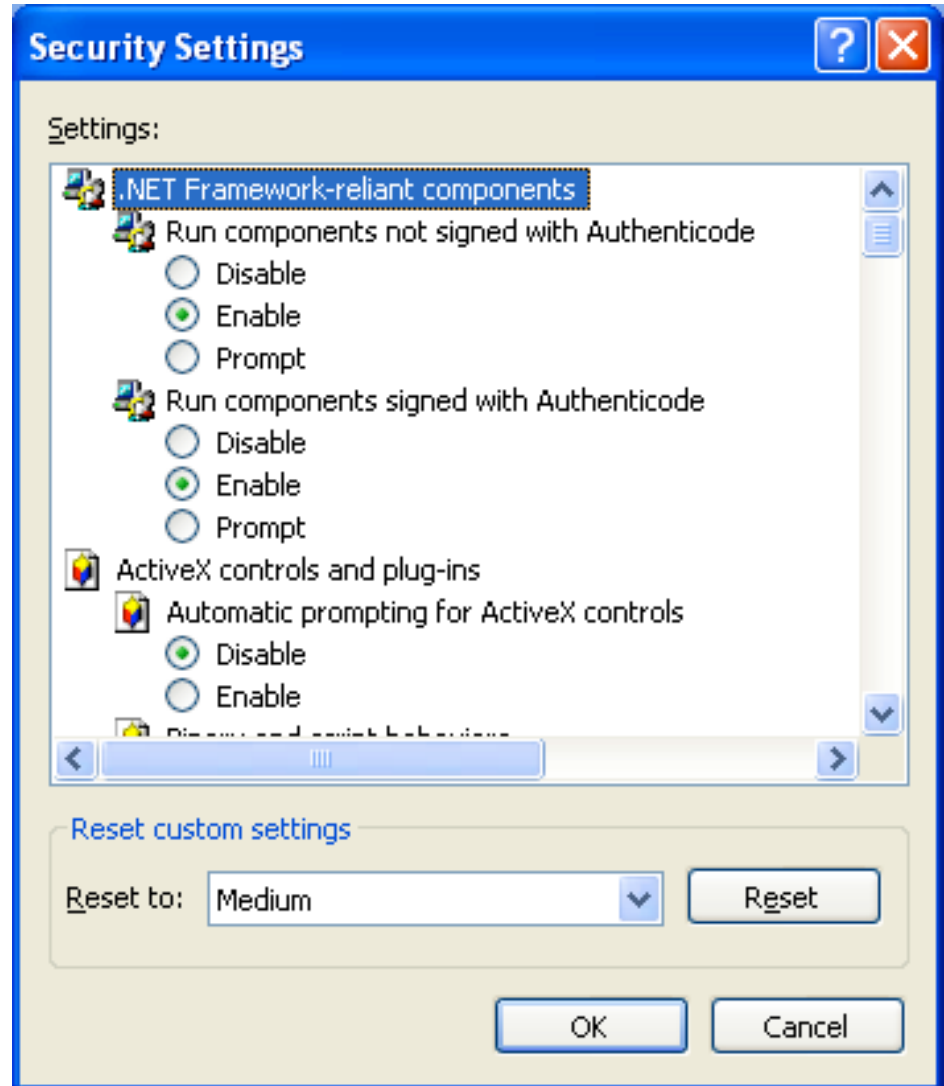
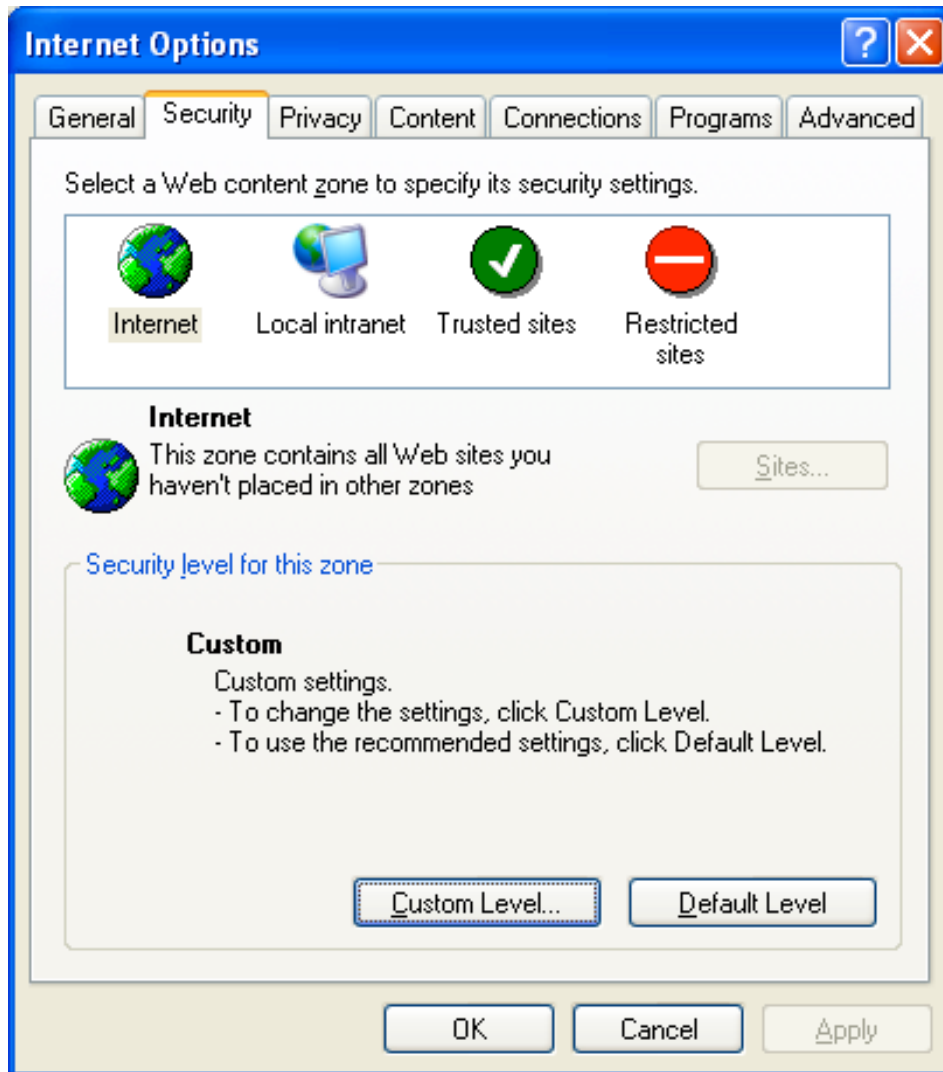
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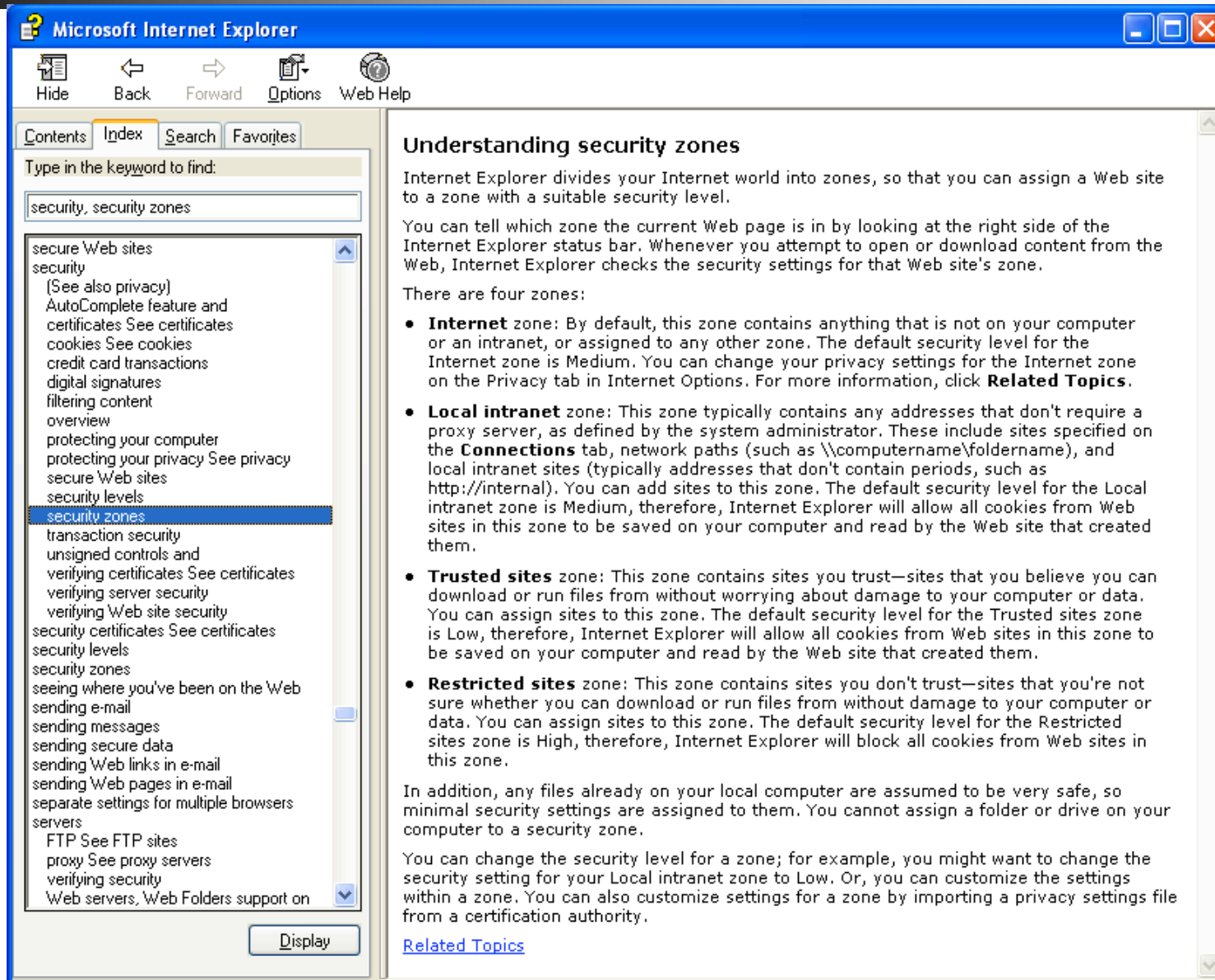
Saltzer & Schroeder, 1975



Security setting - IE



Security zones – Online Help



The screenshot shows the Microsoft Internet Explorer browser window. The title bar reads "Microsoft Internet Explorer". The address bar is empty. The menu bar includes "File", "Edit", "View", "Tools", "Internet Options", "Help", and "Web Help". The toolbar contains "Hide", "Back", "Forward", "Options", and "Web Help". The left sidebar has tabs for "Contents", "Index", "Search", and "Favorites". The "Index" tab is active, showing a search box with the text "security, security zones". Below the search box is a list of search results, with "security zones" highlighted. The main content area displays the article "Understanding security zones".

Understanding security zones

Internet Explorer divides your Internet world into zones, so that you can assign a Web site to a zone with a suitable security level.

You can tell which zone the current Web page is in by looking at the right side of the Internet Explorer status bar. Whenever you attempt to open or download content from the Web, Internet Explorer checks the security settings for that Web site's zone.

There are four zones:

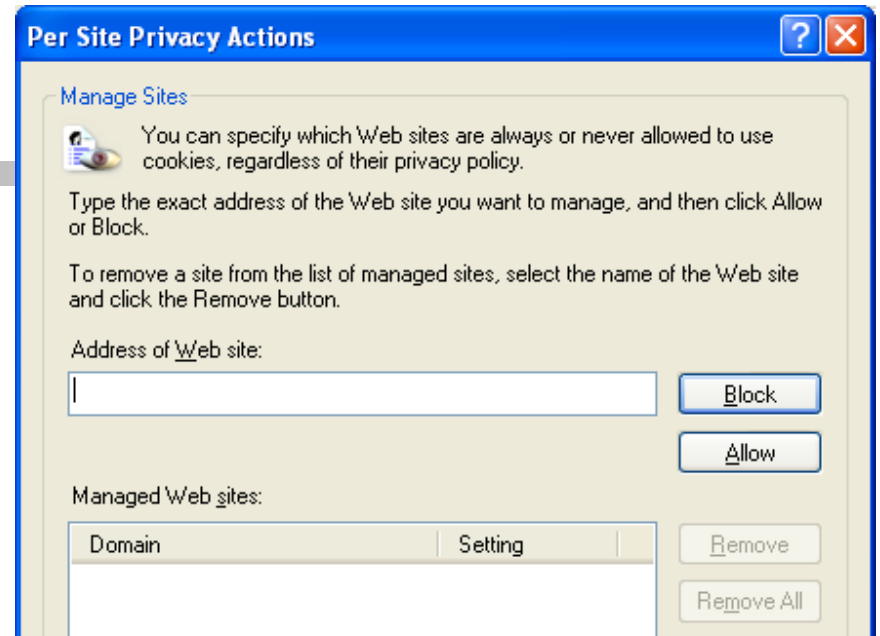
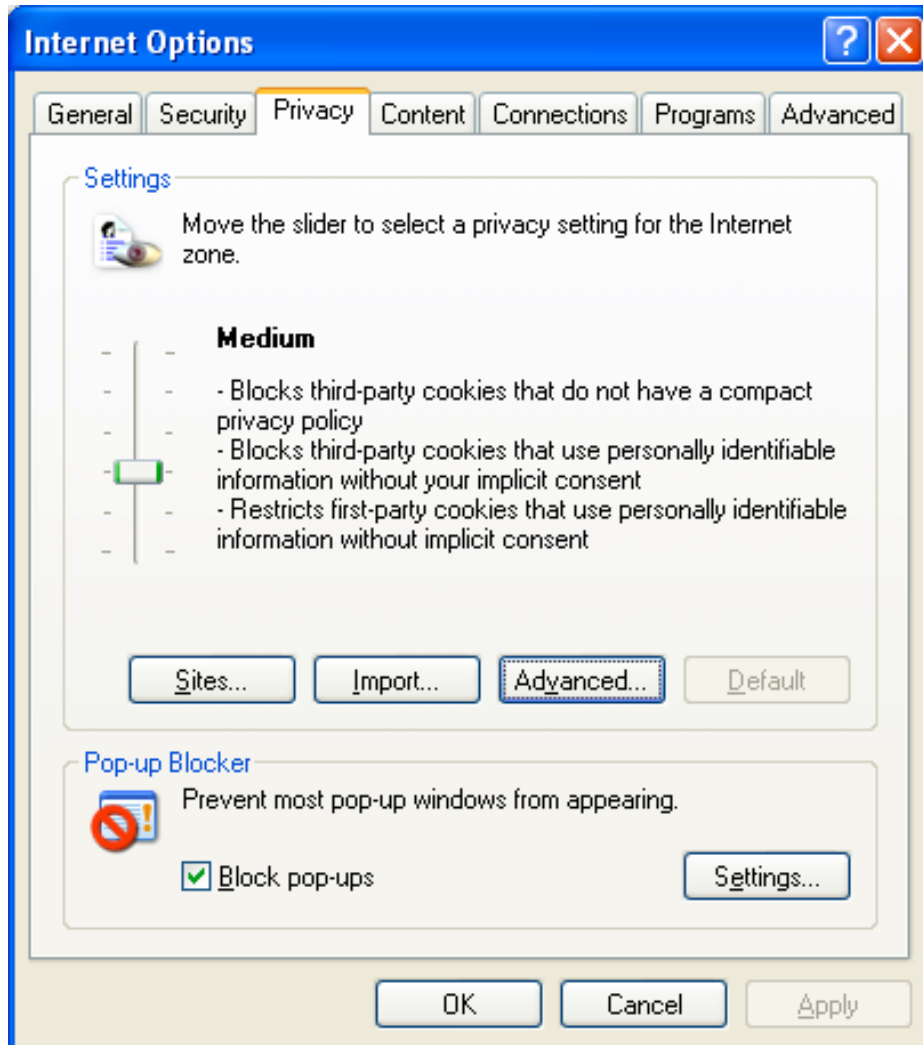
- **Internet zone:** By default, this zone contains anything that is not on your computer or an intranet, or assigned to any other zone. The default security level for the Internet zone is Medium. You can change your privacy settings for the Internet zone on the Privacy tab in Internet Options. For more information, click **Related Topics**.
- **Local intranet zone:** This zone typically contains any addresses that don't require a proxy server, as defined by the system administrator. These include sites specified on the **Connections** tab, network paths (such as \\computername\foldername), and local intranet sites (typically addresses that don't contain periods, such as http://internal). You can add sites to this zone. The default security level for the Local intranet zone is Medium, therefore, Internet Explorer will allow all cookies from Web sites in this zone to be saved on your computer and read by the Web site that created them.
- **Trusted sites zone:** This zone contains sites you trust—sites that you believe you can download or run files from without worrying about damage to your computer or data. You can assign sites to this zone. The default security level for the Trusted sites zone is Low, therefore, Internet Explorer will allow all cookies from Web sites in this zone to be saved on your computer and read by the Web site that created them.
- **Restricted sites zone:** This zone contains sites you don't trust—sites that you're not sure whether you can download or run files from without damage to your computer or data. You can assign sites to this zone. The default security level for the Restricted sites zone is High, therefore, Internet Explorer will block all cookies from Web sites in this zone.

In addition, any files already on your local computer are assumed to be very safe, so minimal security settings are assigned to them. You cannot assign a folder or drive on your computer to a security zone.

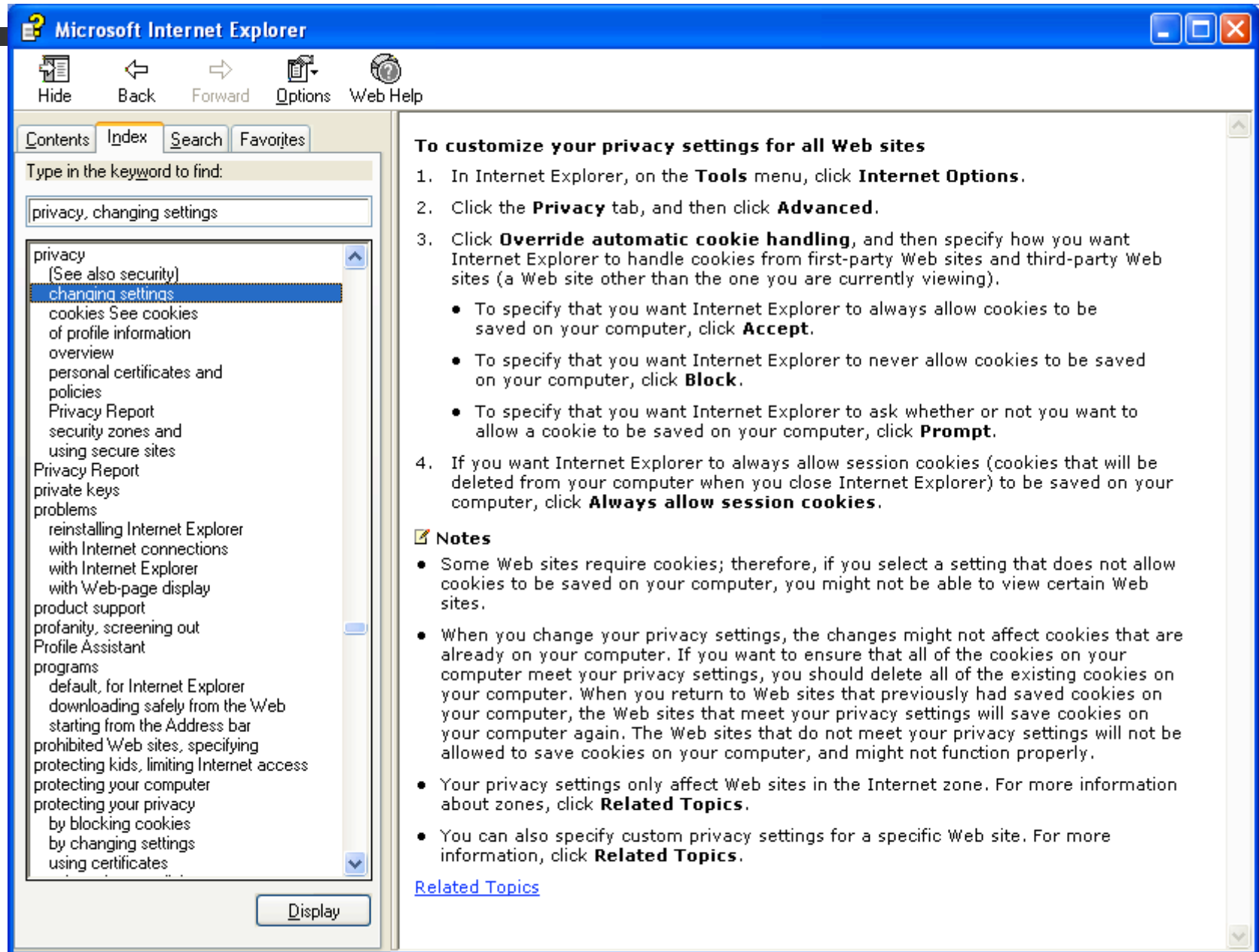
You can change the security level for a zone; for example, you might want to change the security setting for your Local intranet zone to Low. Or, you can customize the settings within a zone. You can also customize settings for a zone by importing a privacy settings file from a certification authority.

[Related Topics](#)

Privacy setting



Privacy setting – Online Help



The screenshot shows the Microsoft Internet Explorer browser window. The title bar reads "Microsoft Internet Explorer". The address bar is empty. The menu bar includes "File", "Edit", "View", "Tools", "Settings", "Help", and "Window". The toolbar contains icons for Hide, Back, Forward, Options, and Web Help. The left sidebar has tabs for "Contents", "Index", "Search", and "Favorites". The "Index" tab is active, and a search box contains the text "privacy, changing settings". Below the search box is a list of search results, with "changing settings" selected. The main content area displays the following text:

To customize your privacy settings for all Web sites

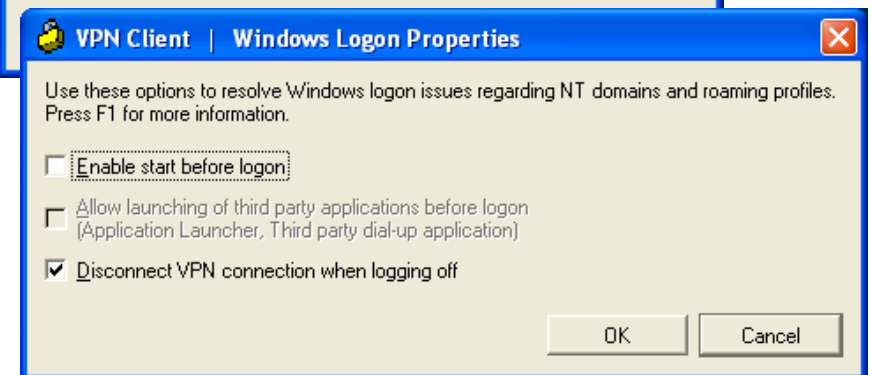
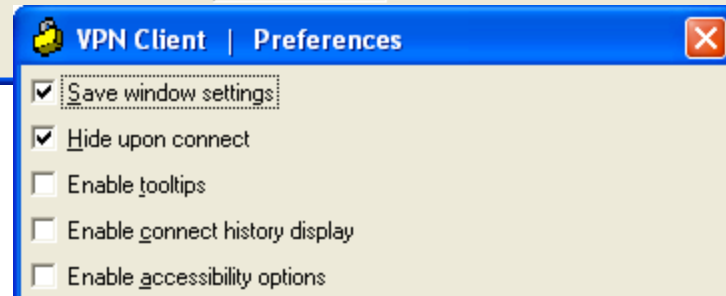
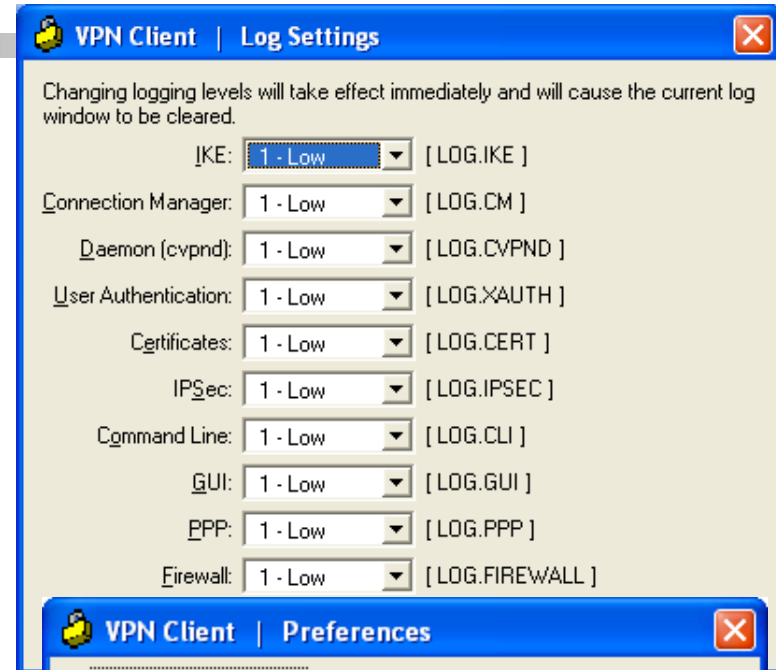
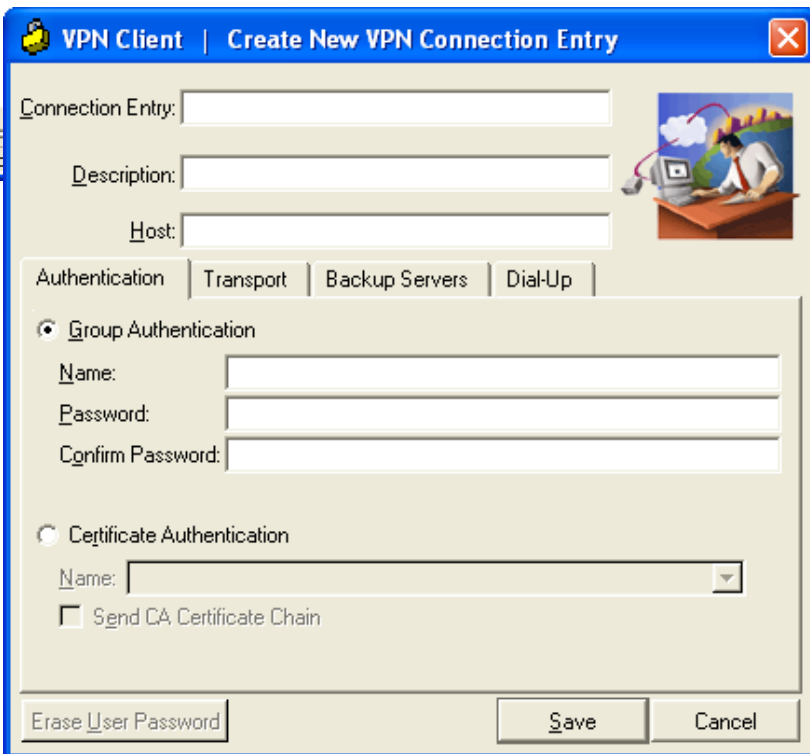
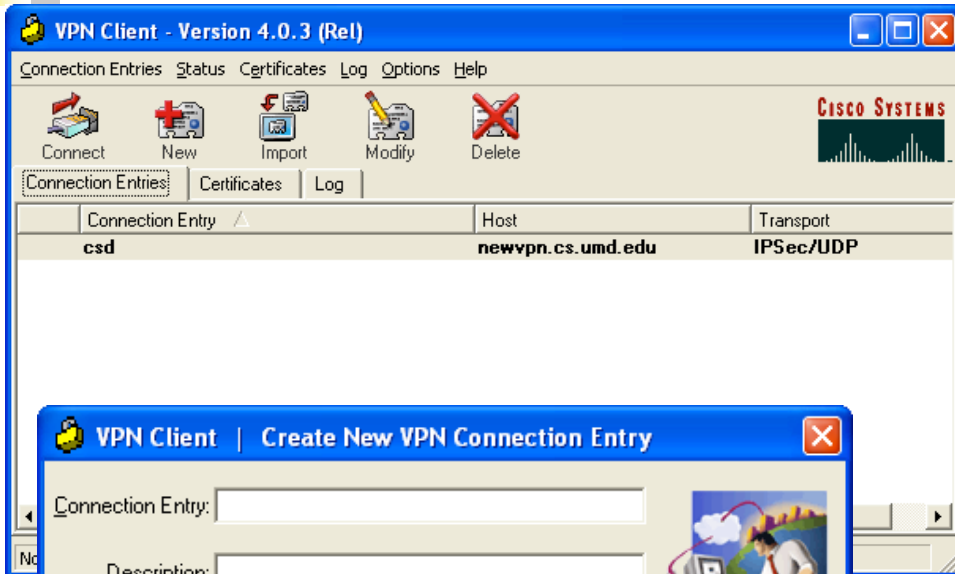
1. In Internet Explorer, on the **Tools** menu, click **Internet Options**.
2. Click the **Privacy** tab, and then click **Advanced**.
3. Click **Override automatic cookie handling**, and then specify how you want Internet Explorer to handle cookies from first-party Web sites and third-party Web sites (a Web site other than the one you are currently viewing).
 - To specify that you want Internet Explorer to always allow cookies to be saved on your computer, click **Accept**.
 - To specify that you want Internet Explorer to never allow cookies to be saved on your computer, click **Block**.
 - To specify that you want Internet Explorer to ask whether or not you want to allow a cookie to be saved on your computer, click **Prompt**.
4. If you want Internet Explorer to always allow session cookies (cookies that will be deleted from your computer when you close Internet Explorer) to be saved on your computer, click **Always allow session cookies**.

Notes

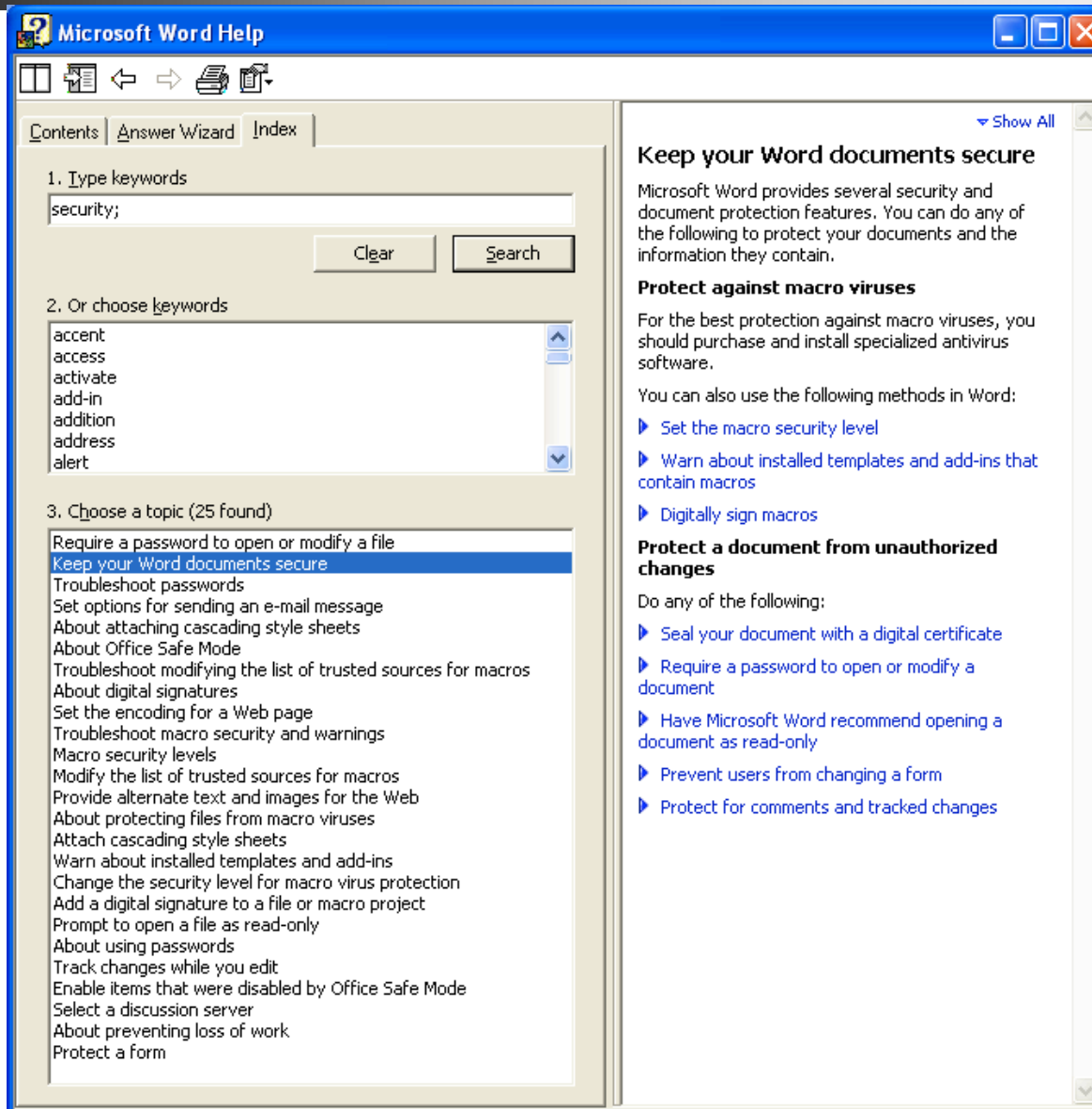
- Some Web sites require cookies; therefore, if you select a setting that does not allow cookies to be saved on your computer, you might not be able to view certain Web sites.
- When you change your privacy settings, the changes might not affect cookies that are already on your computer. If you want to ensure that all of the cookies on your computer meet your privacy settings, you should delete all of the existing cookies on your computer. When you return to Web sites that previously had saved cookies on your computer, the Web sites that meet your privacy settings will save cookies on your computer again. The Web sites that do not meet your privacy settings will not be allowed to save cookies on your computer, and might not function properly.
- Your privacy settings only affect Web sites in the Internet zone. For more information about zones, click **Related Topics**.
- You can also specify custom privacy settings for a specific Web site. For more information, click **Related Topics**.

[Related Topics](#)

VPN Virtual Private Network



MS Word Security



The screenshot shows the Microsoft Word Help window. The title bar reads "Microsoft Word Help". The window contains a search interface on the left and a help article on the right. The search interface has three sections: "1. Type keywords" with a text box containing "security;" and "Clear" and "Search" buttons; "2. Or choose keywords" with a list box containing "accent", "access", "activate", "add-in", "addition", "address", and "alert"; and "3. Choose a topic (25 found)" with a list of topics, where "Keep your Word documents secure" is highlighted. The right pane displays the article "Keep your Word documents secure", which includes a paragraph about security features, a section "Protect against macro viruses" with a list of methods, and a section "Protect a document from unauthorized changes" with a list of actions.

Microsoft Word Help

Contents | Answer Wizard | Index

1. Type keywords
security;
Clear Search

2. Or choose keywords
accent
access
activate
add-in
addition
address
alert

3. Choose a topic (25 found)
Require a password to open or modify a file
Keep your Word documents secure
Troubleshoot passwords
Set options for sending an e-mail message
About attaching cascading style sheets
About Office Safe Mode
Troubleshoot modifying the list of trusted sources for macros
About digital signatures
Set the encoding for a Web page
Troubleshoot macro security and warnings
Macro security levels
Modify the list of trusted sources for macros
Provide alternate text and images for the Web
About protecting files from macro viruses
Attach cascading style sheets
Warn about installed templates and add-ins
Change the security level for macro virus protection
Add a digital signature to a file or macro project
Prompt to open a file as read-only
About using passwords
Track changes while you edit
Enable items that were disabled by Office Safe Mode
Select a discussion server
About preventing loss of work
Protect a form

Keep your Word documents secure

Microsoft Word provides several security and document protection features. You can do any of the following to protect your documents and the information they contain.

Protect against macro viruses

For the best protection against macro viruses, you should purchase and install specialized antivirus software.

You can also use the following methods in Word:

- ▶ Set the macro security level
- ▶ Warn about installed templates and add-ins that contain macros
- ▶ Digitally sign macros

Protect a document from unauthorized changes

Do any of the following:

- ▶ Seal your document with a digital certificate
- ▶ Require a password to open or modify a document
- ▶ Have Microsoft Word recommend opening a document as read-only
- ▶ Prevent users from changing a form
- ▶ Protect for comments and tracked changes

Emerging Research

- Saltzer & Schroeder, IEEE, 1975
- Adams & Sasse, CACM, 1999
- Whitten & Tygar, USENIX, 1999
“Why Johnny Can’t Encrypt”
- Gene Spafford, Purdue Univ
Center for Education and Research Information
and Assurance and Security
- Ka-Ping Yee, UC-Berkeley, 2002

Guidelines



Match the most comfortable way to do tasks with the least granting of authority

Grant authority to others in accordance with user actions indicating consent

Offer the user ways to reduce others' authority to access the user's resources

Maintain accurate awareness

- of others' authority as relevant to user decisions
- the user's own authority to access resources

Guidelines

Protect the user's channels to agents that manipulate authority on the user's behalf

Enable the user to express safe security policies in terms that fit the user's task

Draw distinctions among objects and actions along boundaries relevant to the task

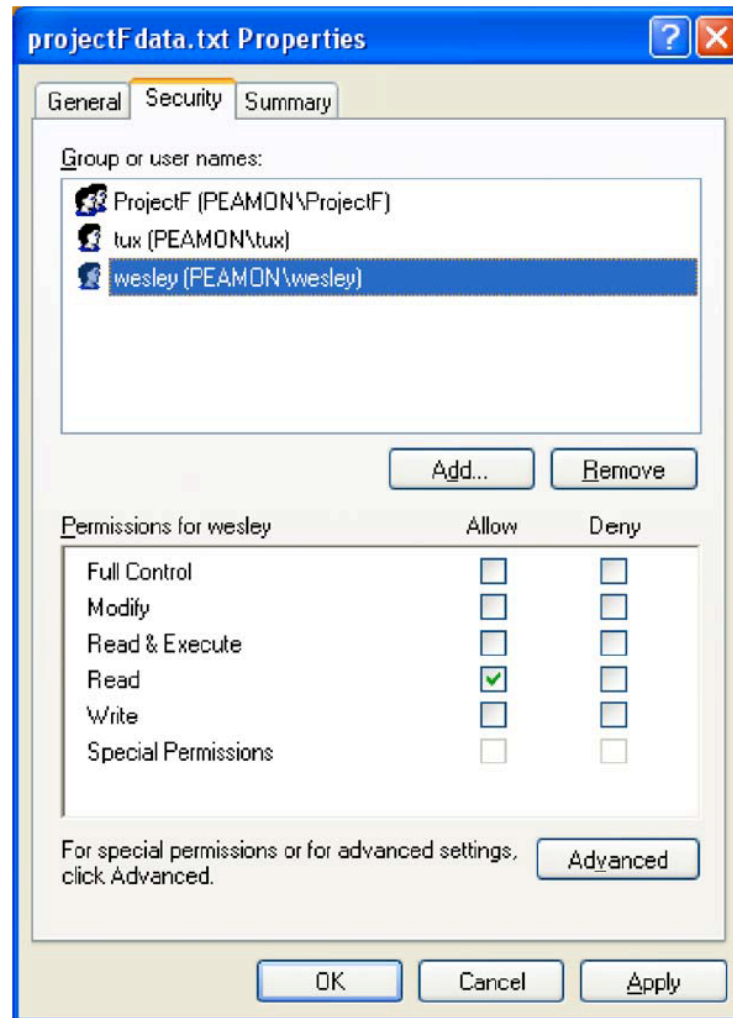
Present objects and actions using distinguishable, truthful appearances

Indicate clearly the consequences of decisions that the user is expected to make

Emerging Research

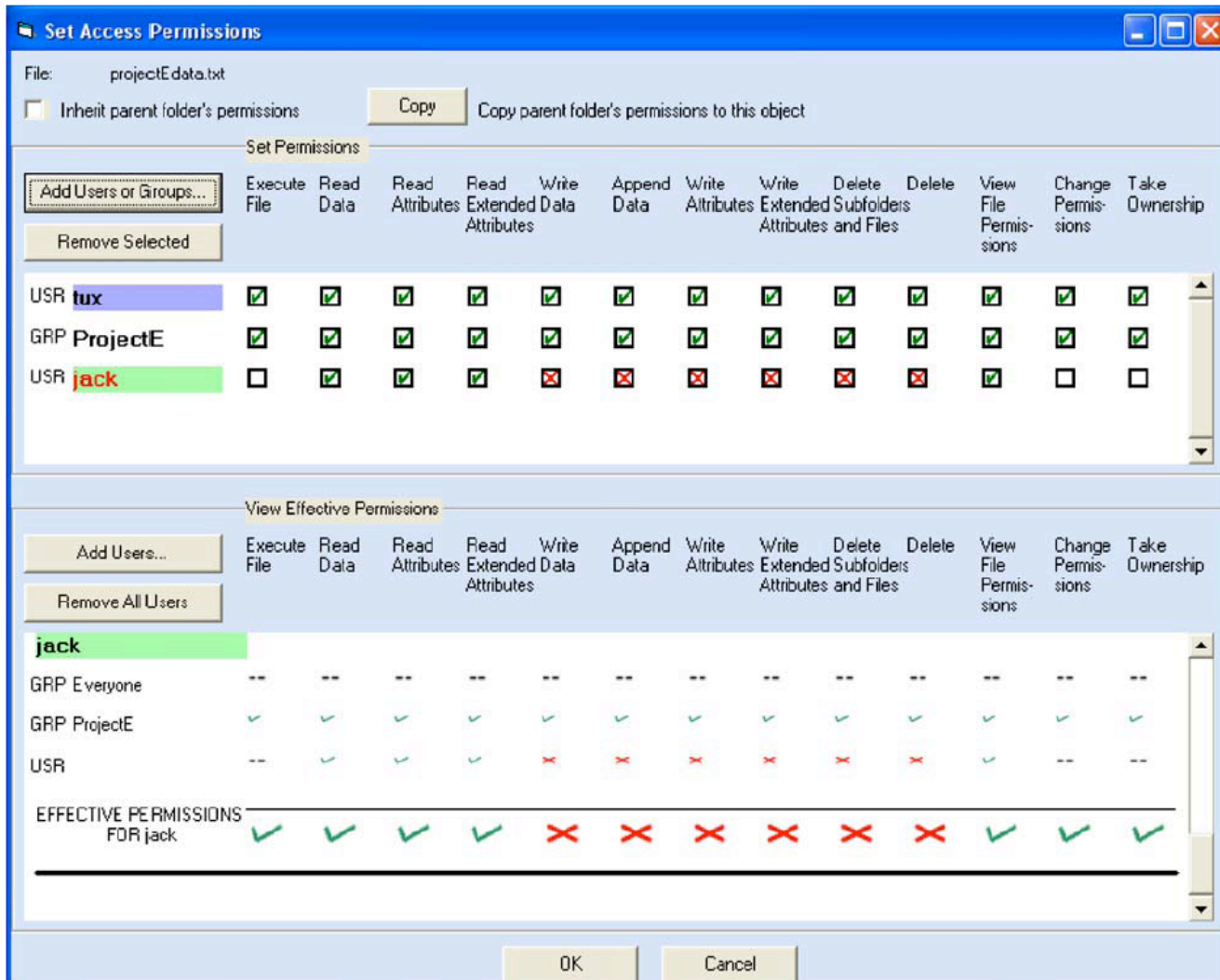
- Good & Krekelberg, CHI 2003, Kazaa
- Simson Garfinkel, MIT, 2004 (David Clark, Rob Miller)
- Lorrie Cranor, CMU
 - Center for Usable Privacy and Security (CUPS)
 - Symposium on Usable Privacy and Security (SOUPS 2005)
- Karat, Karat & Brodie, IJHCS 2005 Special Issue:
HCI Privacy & Security

Controlled Experiment: XPFP



(Maxion & Reeder, IJHCS Special Issue, 2005)

Controlled Experiment: Salmon



(Maxion & Reeder, IJHCS Special Issue, 2005)



Controlled Experiments

- 12 subjects for each interface

Tasks	% done	
	XPFP	Salmon
W	58	83
J	25	100
T	75	100

Errors	
XPFP	Salmon
9	4
16	6
3	0

- Successful users: XPFP=178s Salmon=61s

(Maxion & Reeder, IJHCS Special Issue, 2005)



Possible Strategies



- Multi-layer interface that:
 - Ties increasing complexity to increasing control
 - Permits evolutionary learning as needed
- Cleaner cognitive model
 - Fewer objects & actions
 - Clearer feedback about decisions
- Show consequences of decisions
- Show dynamics of activity with viewable log

Commercial Practice - Usability Engineering

- User-centered design processes
 - Contextual Design - Beyer and Holtzblatt
 - Participatory Design
- Guidelines documents and processes
- User interface building tools
- Expert reviews and usability testing

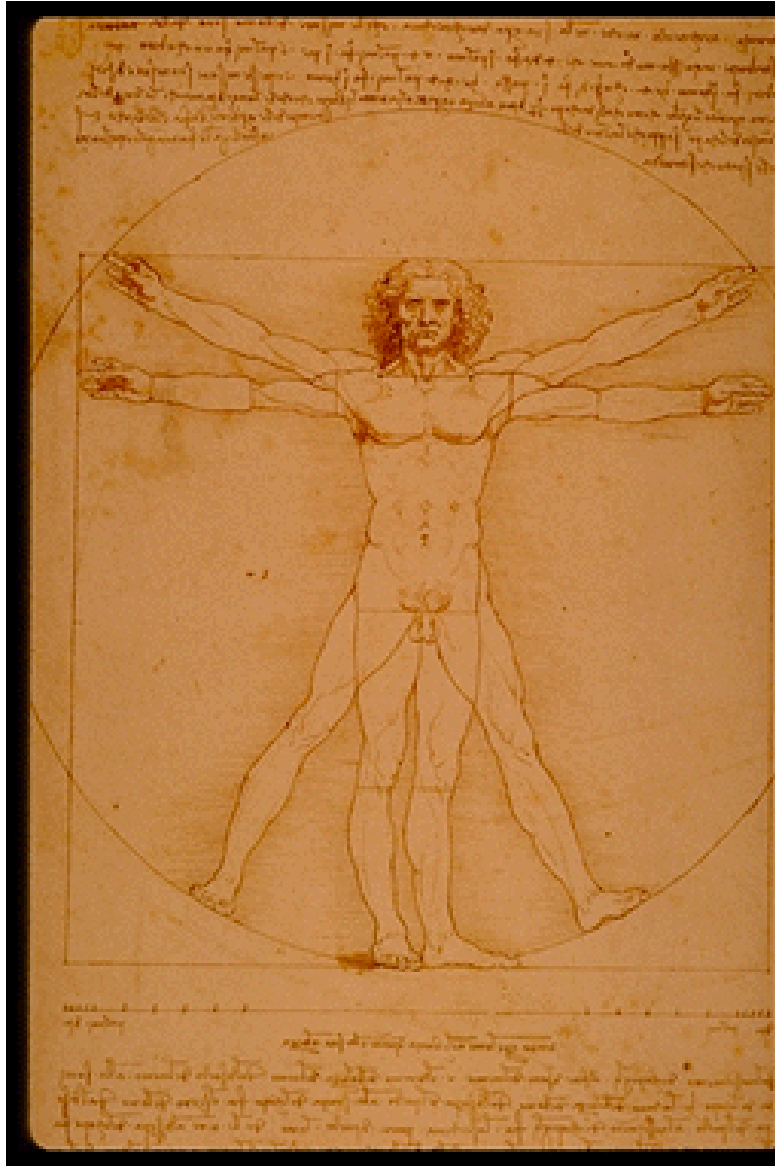
Usability Testing

- Physical place and permanent staff vs. discount usability testing
- Focuses attention on user interface design
- Encourages iterative testing
 - Pilot test of paper design
 - Online prototype evaluation
 - Refinement of versions
 - Testing of manuals, online help, etc.
 - Rigorous acceptance test
- Must participate from early stages
- Must be partners, not "the enemy"

(Dumas & Redish, 1999; Nielsen, 1993)



Information Visualization- SysAdmin

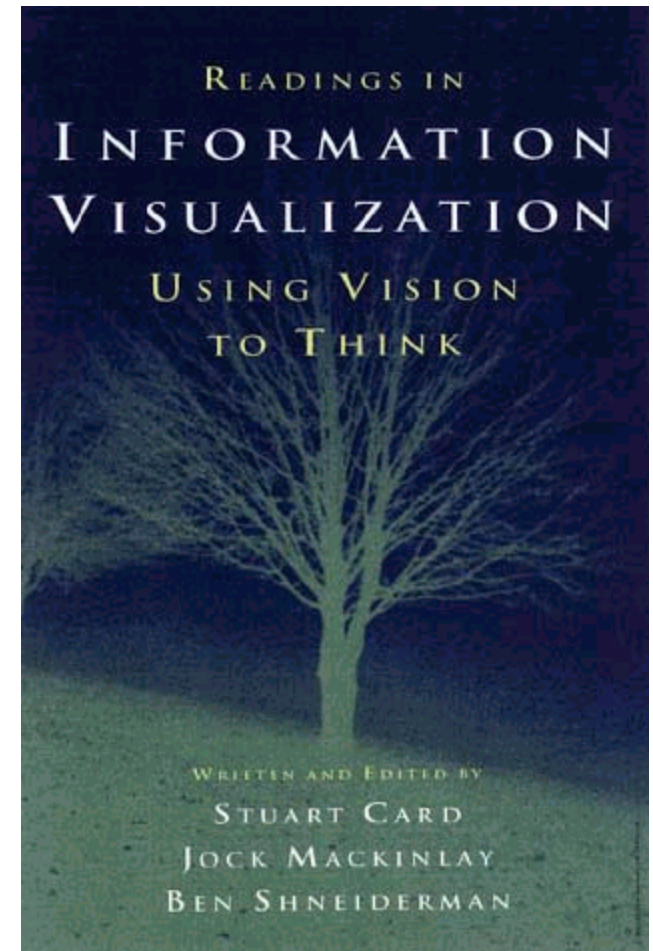


**The eye...
the window of the soul,
is the principal means
by which the central sense
can most completely and
abundantly appreciate
the infinite works of nature.**

***Leonardo da Vinci*
(1452 - 1519)**

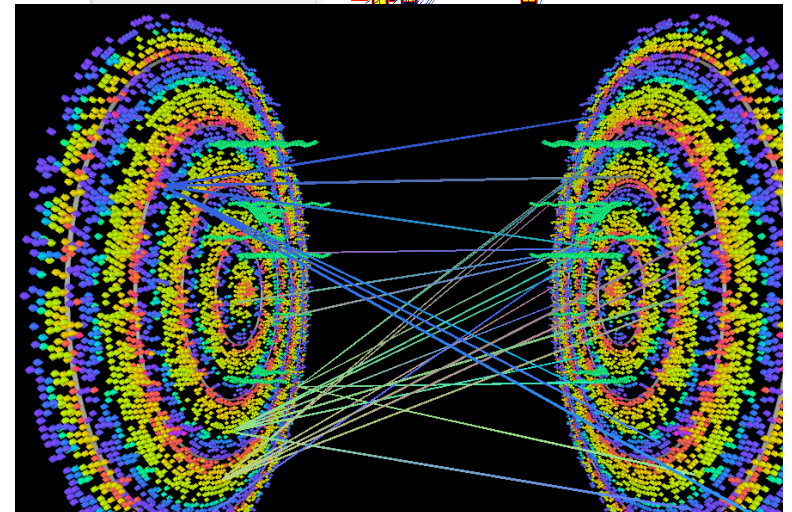
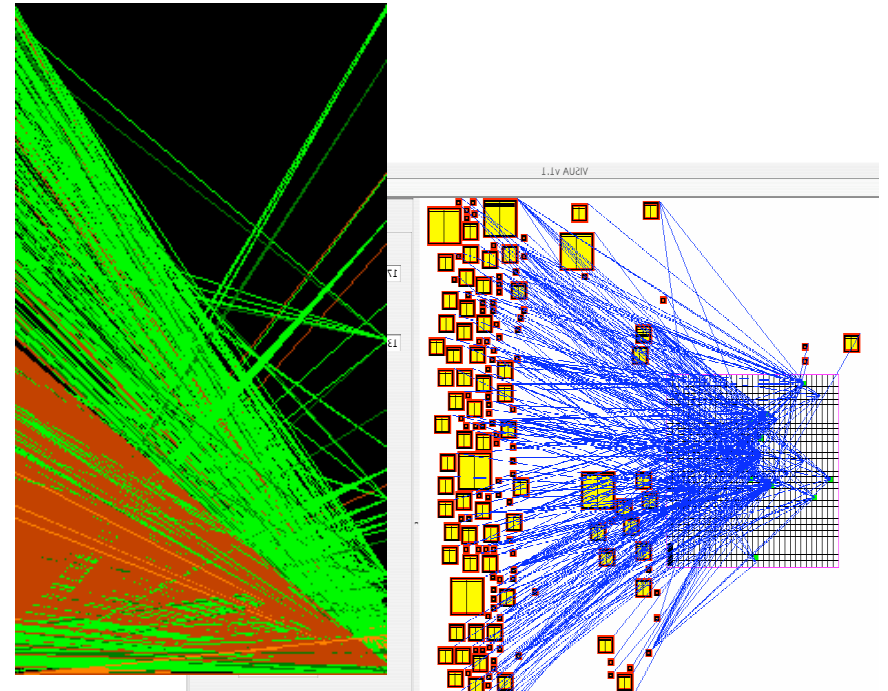
Using Vision to Think

- **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

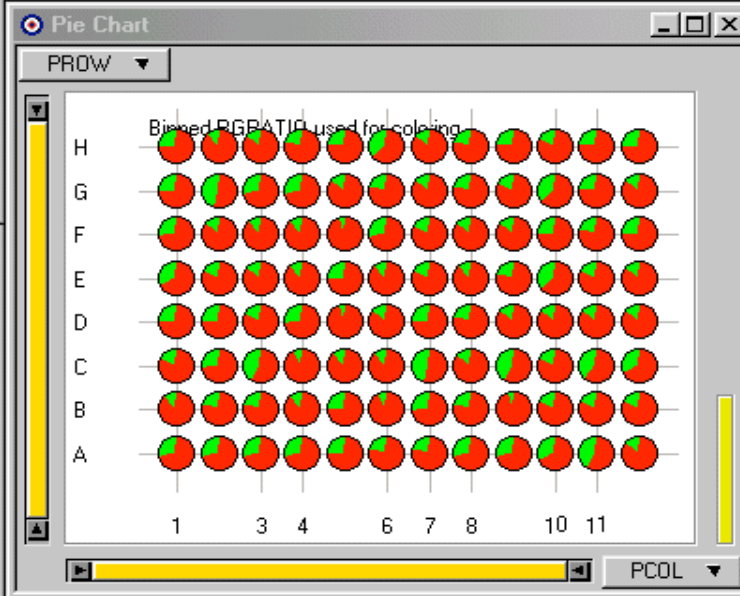
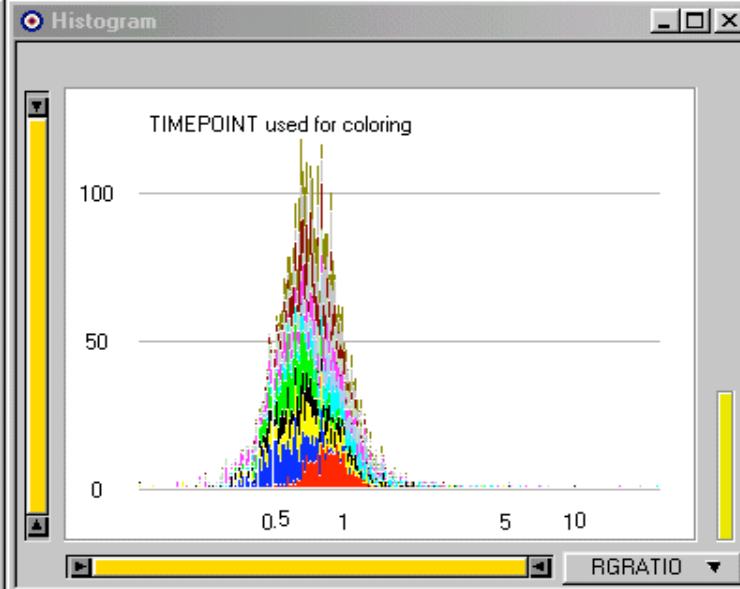
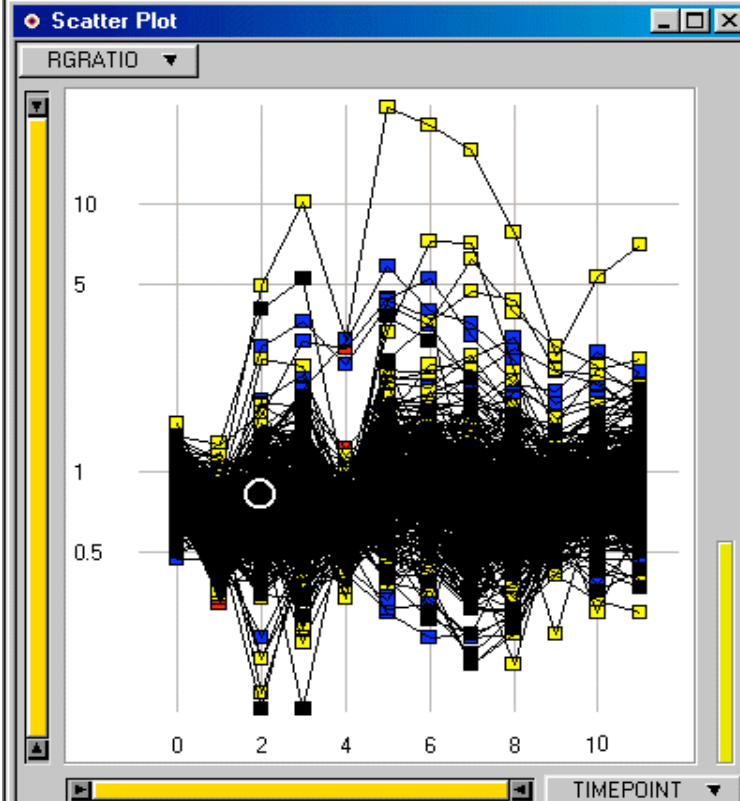
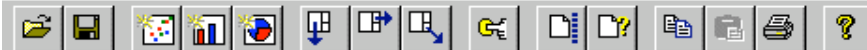


Information Visualization for Security

Detecting intrusions
Anomaly detection
Network Traffic classification
Hostile event
Link Relationships
Security Situation Awareness
Fingerprint network attacks
Attack Graph complexity
Profiling users & traffic
Malicious insider detection



VIZSEC 2004



RED	42	38938
RGRAT	0.13	23
REGR	-1.48	10.17
CORR	-0.64	1
AROW	<input checked="" type="checkbox"/> 7	<input checked="" type="checkbox"/> 8
	<input checked="" type="checkbox"/> 9	<input checked="" type="checkbox"/> 10
ACOL	1	51
	<input checked="" type="checkbox"/> 14	<input checked="" type="checkbox"/> 15
PLAT	<input checked="" type="checkbox"/> 16	

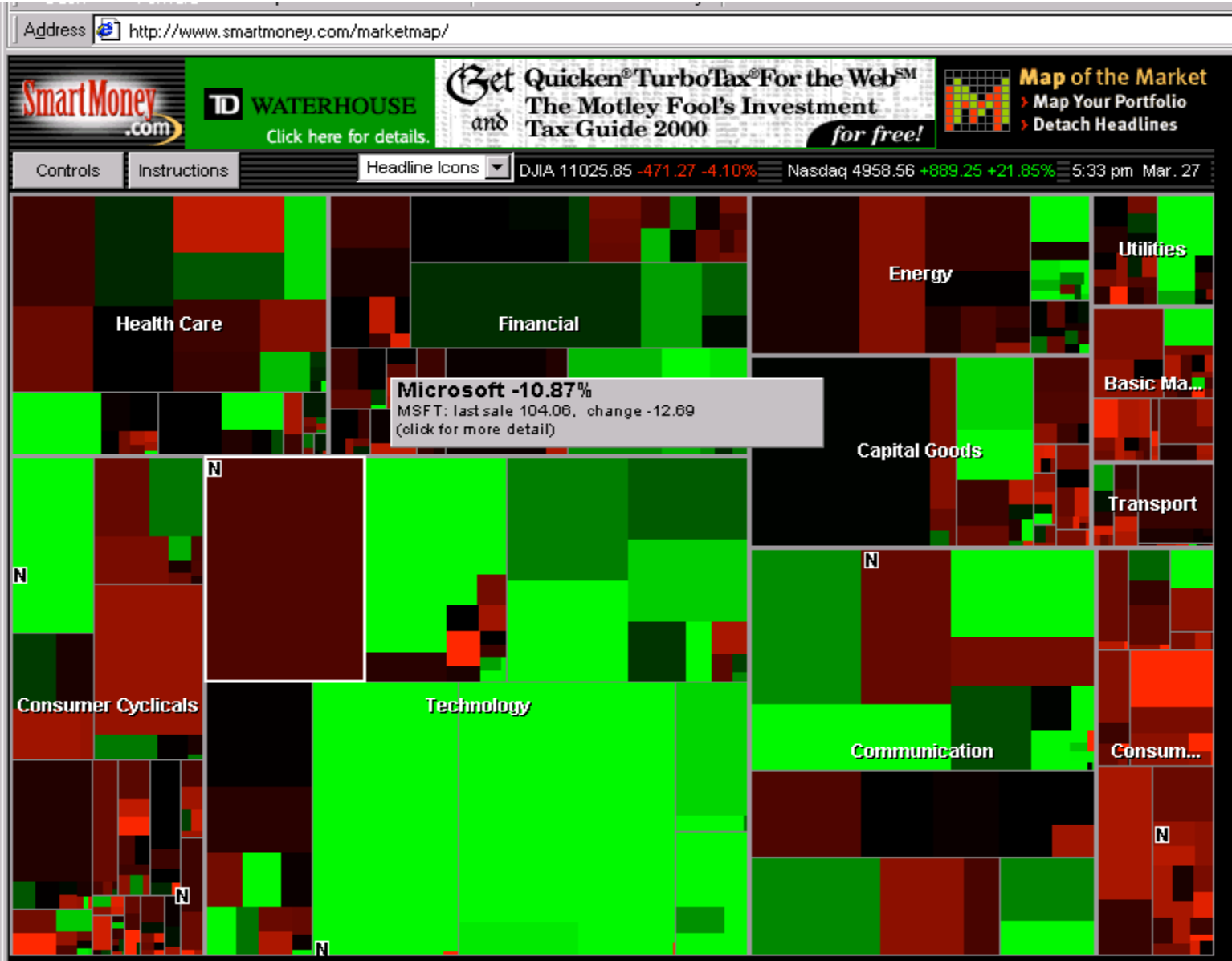
TIMEPOINT	2
DESCRIPTION	ESTs
TYPE	cDNA
GENENAME	R71468
GREEN	2089
RED	1706
RGRATIO	0.82
REGR	1.28
CORR	0.95
AROW	8
ACOL	41
PLAT	15
PROW	E
PCOL	4



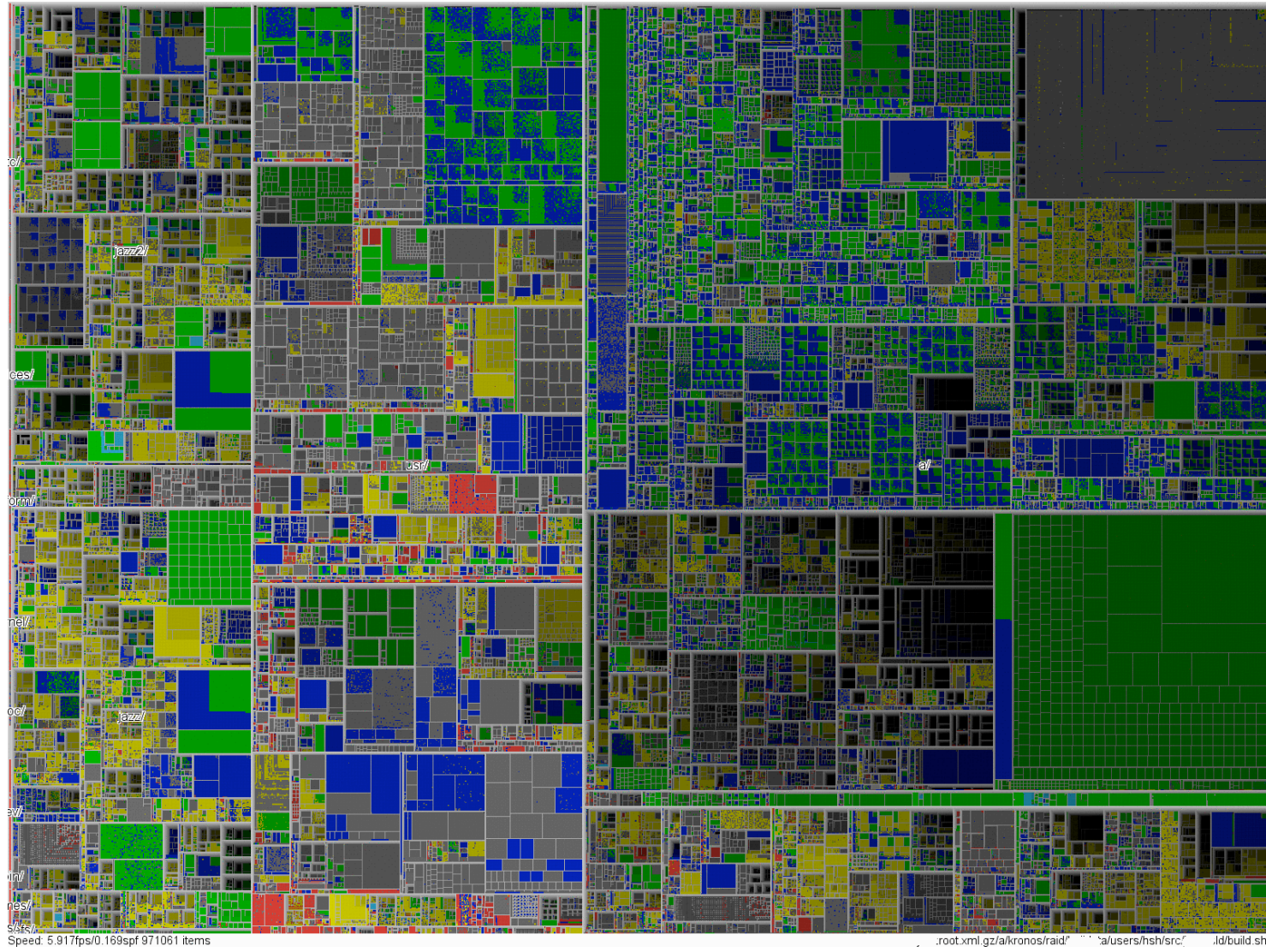
Information Visualization: Mantra

- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
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- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand

Treemap: Stock market, clustered by industry



Treemap: Million files



www.cs.umd.edu/hcil/millionvis/





MERIT

MARINE CORPS EQUIPMENT READINESS INFORMATION TOOL

USMC BY TAMCN | USMC By MEF | 1 MEF | 2 MEF | 3 MEF | MARFORRES | NAVAS | PREPOSITIONED | EPFLS

Home | [Readiness by Commodity](#) | [Readiness by Functional Area](#) | [Feedback](#) | [Logout](#)

GROUP
Functional Area

SIZE
Rating - Current

COLOR
Rating - Current

FILTER BY PROBLEMS
TAMCNs with problems in every checked area will be displayed.

	Current	This Month	This Quarter	This Year
MR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
R	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FILTER BY ITEMS
Selected items will be shown.

- 00 - Unknown
- 10 - Radios
- 11 - Communications Support Equipment
- 13 - Air Command/Control Equipment
- 14 - Air Support Radar/IFF Equipment
- 15 - Electronic Equipment
- 17 - Ground Support Radar
- 18 - Tactical Remote Sensor Equipment
- 19 - Intelligence/Surveillance Equipment
- 20 - Generators
- 21 - Environmental Control Equipment
- 23 - Earthmoving Equipment
- 26 - Materials Handling Equipment
- 29 - Engineer Support
- 30 - Trucks
- 25 - Towed Motor Transport Equipment
- 40 - Tanks
- 41 - Assault Amphibious Vehicles
- 42 - Light Armored Vehicles
- 43 - Antileak
- 45 - Infantry Weapons
- 48 - Anti-Air Weapon Systems and I
- 43 - Missile Systems
- 50 - High Density/Low Deadline
- 97 - Communications Security Equipment
- 98 - Assault Crafts
- 99 - Nuclear Biological Chemical Equip

View Deadlined Items for this TAMCN
 Generate Control Chart for this TAMCN
 Generate Historical View for this TAMCN
 Show Tabular data for this TAMCN

Track this TAMCN
 Zoom In on this group
 Zoom Out to view all
 Close Menu

B2469
 Tractor, Full-Track, W/AngleBlade, T-5

	Last	This	This	This
	Week	Month	Quarter	Year
MR	101%	101%	100%	94%
S	111%	113%	112%	110%
R	91%	89%	89%	86%

Click mouse for reports and options.

Currently displaying: 186 of 186 items

Search by TAMCN #

Search by TAMCN Title

Filter by Current Excess

Label by Current Excess

Show Only Pacing Items

FILTER BY SEARCH CRITERIA
TAMCNs meeting search criteria will be shown.

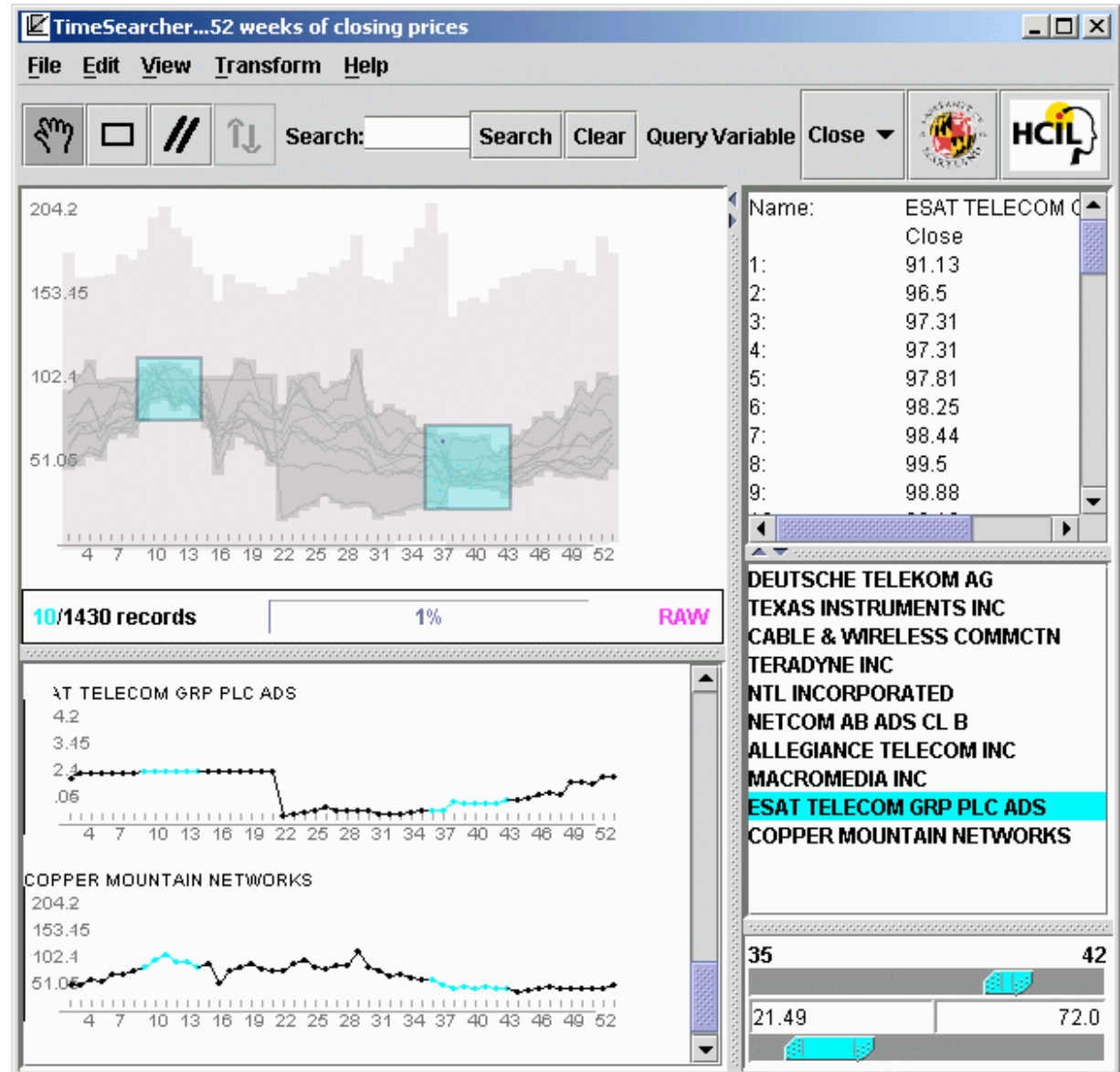
EXCESS FILTER & LABEL
Isolate items w/excess equipment

FILTER BY PACING ITEM
Pacing Items will be shown.



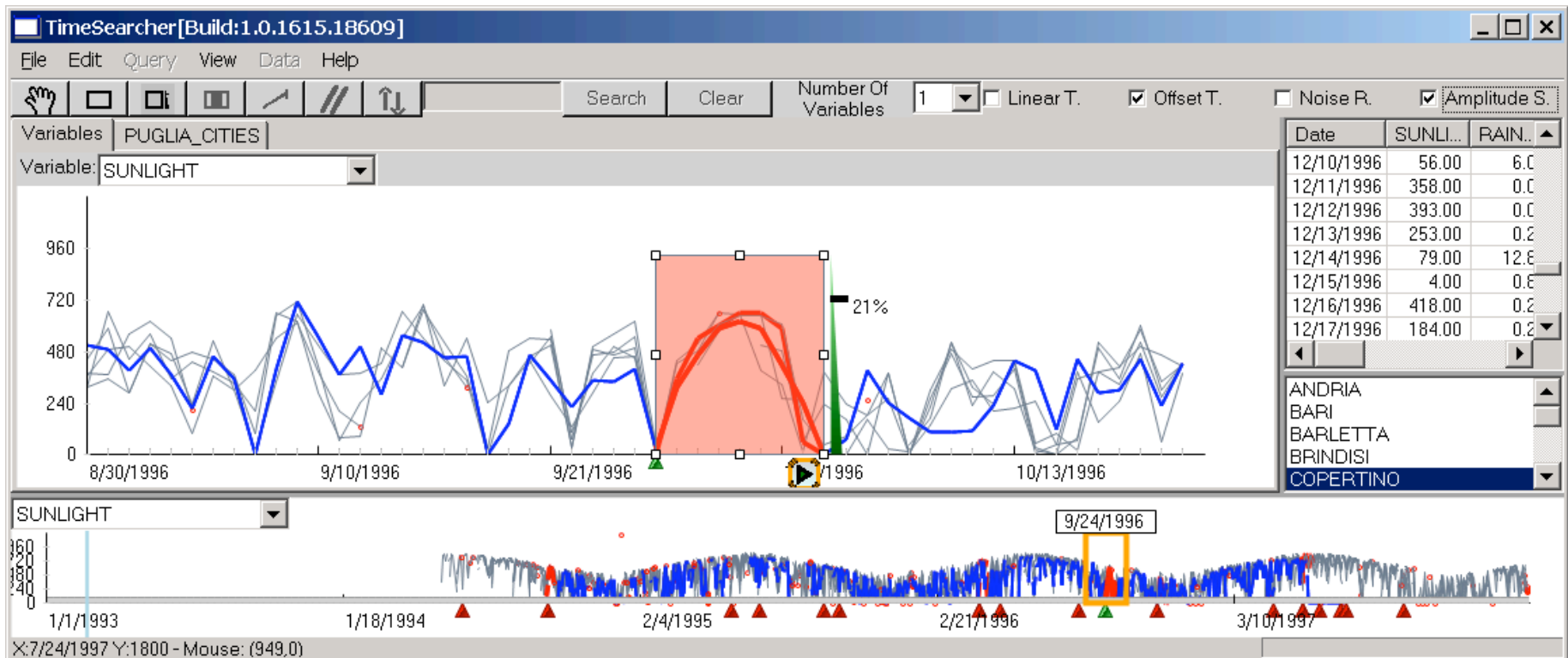
Temporal Data: TimeSearcher 1.3

- Time series
 - Stocks
 - Weather
 - Genes
- User-specified patterns
- Rapid search



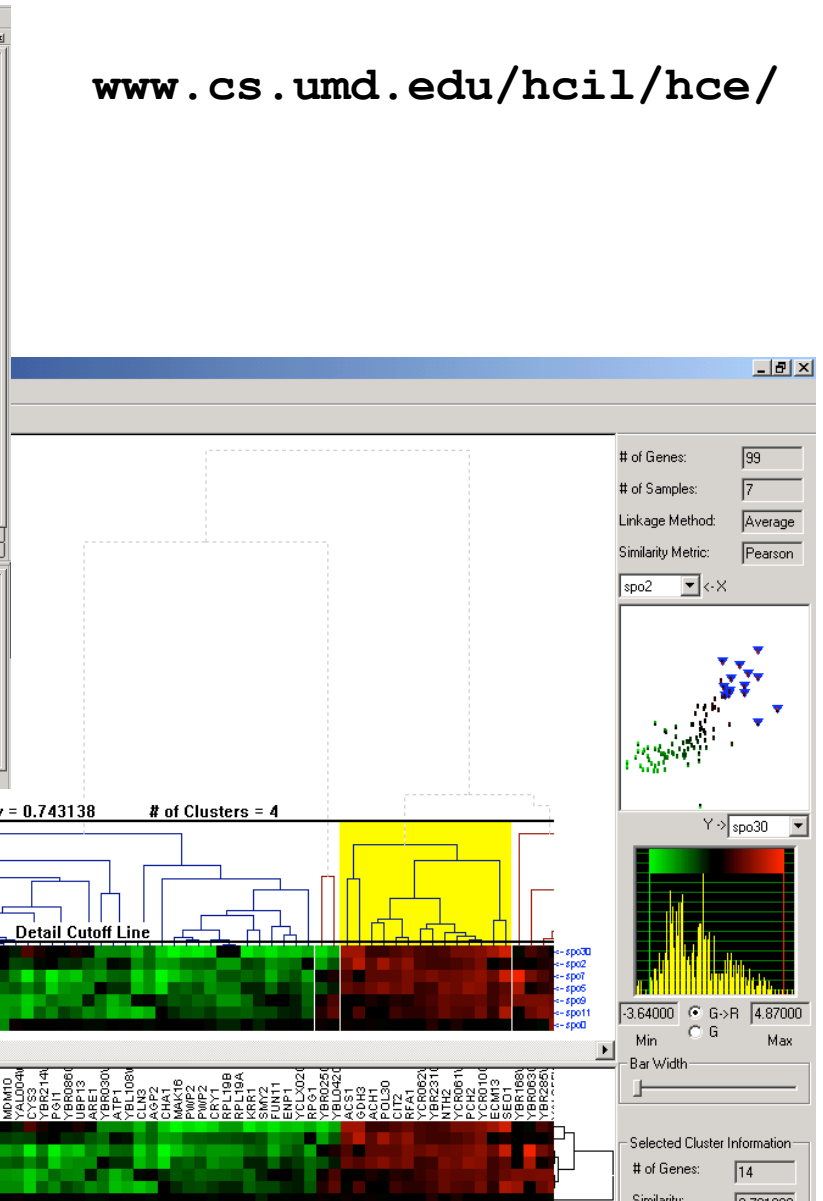
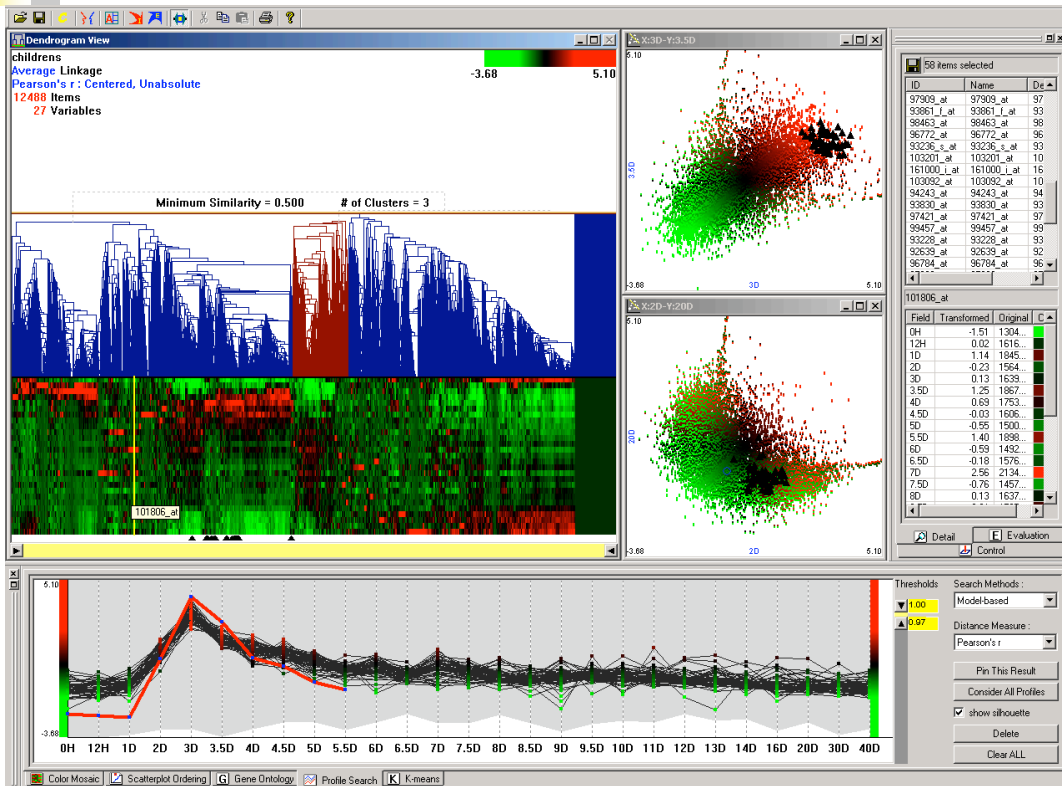
Temporal Data: TimeSearcher 2.0

- Long Time series (>10,000 time points)
- Multiple variables
- Controlled precision in match
(Linear, offset, noise, amplitude)



Multi-V: Hierarchical Clustering Explorer

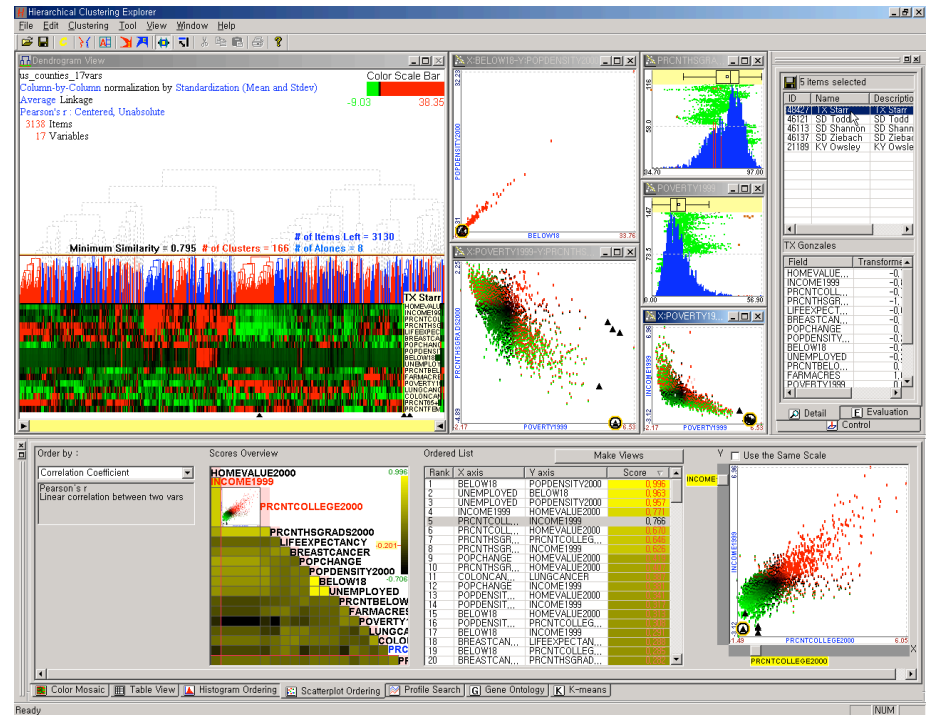
www.cs.umd.edu/hcil/hce/



“HCE enabled us to find important clusters that we didn’t know about.”
 - a user

HCE Status

- In collaboration and sponsored by Eric Hoffman: Children's National Medical Center
- Categorical Variables: 4.0 beta, May 2005
- 60K lines of C++ codes, 58 Classes
- 2,000+ downloads since April 2002
- www.cs.umd.edu/hcil/hce





www.cs.umd.edu/hcil



For More Information

- Visit the HCIL website for 350 papers & info on videos
www.cs.umd.edu/hcil
- Conferences & resources: www.infovis.org
- See Chapter 14 on Info Visualization
Shneiderman, B. and Plaisant, C., *Designing the User Interface: Strategies for Effective Human-Computer Interaction: Fourth Edition* (April 2004) www.awl.com/DTUI
- Edited Collections:
Card, S., Mackinlay, J., and Shneiderman, B. (1999)
Readings in Information Visualization: Using Vision to Think
Bederson, B. and Shneiderman, B. (2003)
The Craft of Information Visualization: Readings and Reflections



For More Information

- **Treemaps**
 - **HiveGroup:** www.hivegroup.com
 - **Smartmoney:** www.smartmoney.com/marketmap
 - **HCIL Treemap 4.0:** www.cs.umd.edu/hcil/treemap
- **Spotfire:** www.spotfire.com
- **TimeSearcher:** www.cs.umd.edu/hcil/treemap
- **Hierarchical Clustering Explorer:**
www.cs.umd.edu/hcil/hce



Logical User Centered Interaction Design

- **Design Methodology**
 - Management strategy to highlight usability engineering
 - Processes, Deliverables, and Reviews
- **Stages for LUCID**
 - 1: Envision
 - 2: Discovery
 - 3: Design Foundation
 - 4: Design Detail
 - 5: Build
 - 6: Release

(Cognetics Corp, www.cognetics.com)



Guidelines Document and Processes

- Social process for developers
- Records decisions for all parties to see
- Promotes consistency and completeness
- Facilitates automation of design
- Should contain philosophy and examples of:
title screens, menus, forms, buttons, graphics,
icons, fonts, colors, instructions, help, tutorials,
error messages, ...
- Multiple levels are desirable:
standards, practices, guidelines
- **E**ducation, **E**nforcement, **E**xemption & **E**nhancement

Expert Reviews and Usability Testing

- Improved product quality
- Shorter development time
- More predictable development lifecycle
- Reduced costs
 - Speed development
 - Simplify documentation
 - Facilitate training
 - Lower support
 - Fewer updates
- Improved organizational reputation
- Higher morale: staff and management

Expert Reviews

- **Experienced reviewers**
 - Review every screen, menu, dialog box
 - Spot inconsistencies and anomalies
 - Suggest additions
- **Disciplined approaches**
 - Heuristic evaluation: check if goals are being met
 - Guidelines review: verify adherence
 - Consistency inspection: terms, layout, color, sequencing
 - Cognitive walkthrough: pretend to be a user following scenario
 - Formal inspection: public presentation and discussion