

01- Course overview and introductions

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05-436 / 05-836 / 08-534 / 08-734

Usable Privacy and Security

**Carnegie
Mellon
University**

CyLab



**Engineering &
Public Policy**



Today's class

- Course staff introductions
- Usable security and privacy = ???
- Overview of course topics
- Course policies / syllabus
- Student introductions

Who we are

- Blase Ur blase@blaseur.com
- Fourth-year Ph.D. student advised by Lorrie
- Authored 20+ peer-reviewed publications in security, privacy, and usability
- Interests: passwords, OBA, teen-parent privacy, network security, and smart homes
- Office hours: By appointment



Who we are

- Rich Shay rich@richshay.com
- Sixth-year Ph.D. student advised by Lorrie
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Humans

“Humans are incapable of securely storing high-quality cryptographic keys, and they have unacceptable speed and accuracy when performing cryptographic operations... But they are sufficiently pervasive that we must design our protocols around their limitations.”

— C. Kaufman, R. Perlman, and M. Speciner.
Network Security: PRIVATE Communication in a PUBLIC World.
2nd edition. Prentice Hall, page 237, 2002.

Better together

Examining security/privacy and usability together is often critical for achieving either



Interdisciplinary approach useful

Other disciplines have experience studying human behavior. We can borrow their models and methods:

- Psychology
- Sociology
- Ethnography
- Cognitive sciences
- Warnings science
- Risk perception
- Organizational change
- Behavioral economics
- HCI
- Marketing
- Counterterrorism
- Communication
- Persuasive technology
- Learning science
- Network analytics

What makes usable security different?

- Presence of an adversary
- Usability is not enough. We also need systems that remain secure when:
 - Attackers (try to) fool users
 - Users behave in predictable ways
 - Users are acting under stress
 - Users are careless, unmotivated, busy

Usable security research bridges security and usability

Security	Usability/HCI	Usable Security
Humans are a secondary constraint to security constraints	Humans are the primary constraint, security rarely considered	Human factors and security are both primary constraints

Usable security research bridges security and usability

Security	Usability/HCI	Usable Security
Humans are a secondary constraint to security constraints	Humans are the primary constraint, security rarely considered	Human factors and security are both primary constraints
Humans considered primarily in their role as adversaries/attackers	Concerned about human error but not human attackers	Concerned about both normal users and adversaries
Involves threat models	Involves task models, mental models, cognitive models	Involves threat models AND task models, mental models, etc.
Focus on security metrics	Focus on usability metrics	Considers usability and security metrics together
User studies rarely done	User studies common	User studies common, often involve deception + active adversary

User-selected graphical passwords



Security

Usability/HCI

Usable Security

User-selected graphical passwords



Security	Usability/HCI	Usable Security
<p>What is the space of possible passwords?</p> <p>How can we make the password space larger to make the password harder to guess?</p> <p>How are the stored passwords secured?</p> <p>Can an attacker gain knowledge by observing a user entering her password?</p>	<p>How <i>difficult</i> is it for a user to create, remember, and enter a graphical password?</p> <p>How long does it take?</p> <p>How hard is it for users to learn the system?</p> <p>Are users <i>motivated</i> to put in effort to create good passwords?</p> <p>Is the system <i>accessible</i> using a variety of devices, for users with disabilities?</p>	<p>All the security/privacy and usability HCI questions</p> <p>How do users select graphical passwords?</p> <p>How can we help them choose passwords harder for attackers to predict?</p> <p>As the password space increases, what are the impacts on usability factors and predictability of human selection?</p>

Goals for this course

- Gain an appreciation for the importance of usability within security and privacy
 - HCI → Security & Privacy, and vice versa
- Learn about current research in usable privacy and security
- Learn how to conduct usability studies
- Learn how to critically examine UPS studies you hear about or read about

Policies and logistics

- Updated syllabus is always available:
<http://cups.cs.cmu.edu/courses/ups-sp15/>

Which course #?

- Ph.D. students must take 05-836 (HCII) or 08-734 (ISR) for 12 units
- Undergrads: 05-436 or 08-534 for 9 units
- Master's students: check with your program
- If you switch sections, you will be waitlisted (but we will let you in)

Components of your grade

- Homework: 20%
- Quizzes: 20%
- Midterms: 20%
- Class Project: 40%

Readings

- Generally one required reading per class
 - There will be quizzes – see next slide
- Complete the readings before class
- Textbook: Lazar et al.'s *Research Methods in Human-Computer Interaction*
- Most readings from recent conferences
- 12-unit students: one additional reading for most classes (see homeworks)

Quizzes

- Given in the first five minutes of class
 - End at 3:05pm
- Will be a quick quiz based on that day's required reading
- If you will be unable to arrive on time for a class, submit a reading summary and highlight of the required readings before class

Homework

- 11 homework assignments
 - Drop single lowest grade
 - No late homework accepted!
- For 12-unit Students
 - These will include a “reading summary” of one optional reading per class
 - 3 to 7 sentence summary
 - One “highlight”

What is the homework like?

- Conduct mini studies + report results
- Evaluate the incidence or state of something in the real world
- Conduct usability evaluations of tools
- Propose possible studies
- Other activities

Homework 1 is already posted (and due Jan 22)!

Example reading summary

Ur et al. investigated whether crowdsourced recommendations impact the Firefox privacy settings humans and sloths choose. They conducted a 183-participant lab study in which participants were prompted to set up a clean installation of Firefox as they normally would when given a new computer. Participants were randomly selected either to see crowdsourced recommendations for the settings, or no recommendations. They found that both humans and sloths were statistically significantly more likely to choose privacy-protective settings when given recommendations, though sloths took 83 times as long to do so.

Highlight: I wonder if the results would have differed if they had used Chrome, rather than Firefox. Chrome's privacy settings are hidden behind multiple browser clicks. I would be surprised if Chrome recommendations change non-use of privacy settings.

Midterms (two of them)

- Given about one-third and two-thirds of the way through the class
- 20% of your grade
- These will ask you to use the skills developed in class, rather than remembering trivia
- Prepare by doing the readings and participating in discussions

Project

- Design, conduct, and analyze a user study in usable privacy or security
 - Groups assigned based on your preferences
 - We will provide a list of project topics but your suggestions are welcome
- Deliverables: Project proposal, IRB application, progress report & presentation, final paper, and a final presentation
- Submit a poster to SOUPS 2015 and a paper to another conference

Projects from prior UPS courses

- The Post that Wasn't: Exploring Self-Censorship on Facebook (CSCW '13)
- How Does Your Password Measure Up? The Effect of Strength Meters on Password Creation (USENIX Security '12)
- QRishing: The Susceptibility of Smartphone Users to QR Code Phishing Attacks (USEC '13)
- Biometric Authentication on iPhone and Android: Usability, Perceptions, and Influences on Adoption" (USEC '15)
- To Update or Not to Update: Review-Based Notifications for Android App Updates
- Passwords Gone Mobile: An Analysis of the Usability and Security of Text Passwords on Mobile Devices

Participation in class

- You are expected to participate in class
 - Raise your hand during discussions
 - Share interesting privacy/security news
 - Play an active role in small-group activities
 - Spark discussion on the class email list
- You are expected to be in class (on time!)
- Please note exam and group presentation dates and DO NOT schedule job interviews on those dates

Academic integrity

- Make yourself familiar with CMU's policies about plagiarism and academic integrity
- Don't even look at other students' homework assignments
 - Exception: When we explicitly say that you may work in groups for a particular task
- Quote text and cite ideas that are not yours
- Consequences of cheating and plagiarism range from a 0 on the assignment to expulsion from CMU

Logistics

- There is final no exam
 - Project presentations during final exam period
- We have no Blackboard site
- We will sign you up for a course e-mail list
- You may wish to join the CUPS mailing list
 - Weekly CUPS lunch (Wednesdays @ Noon)
 - News and opportunities of interest
 - To sign up, follow link on course webpage

Course topics

- Introduction to HCI methods and the design of experiments
 - How (and why) to conduct different types of quantitative and qualitative studies
 - Ecological validity and ethics
 - Overview of statistics
- Quick overviews of security and privacy
- Specific usable privacy and security topics

Topic: Passwords

- At least 8-characters.

- Can people make passwords that are easy to remember, yet hard to crack?

Password strength: Poor. Consider adding a digit or making your password longer.



hashcat
advanced
password
recovery

Worst. Password.
Ever.

Topic: Secondary authentication

- Mother's maiden name?
- Favorite athlete?
- A code sent to your phone?

2-step verification

Help keep the bad guys out of your account by using both your password *and* your phone.

Get Started



Image from <http://www.wikipedia.org>

Topic: Privacy Tools

- How can tools help users protect their privacy?
- How usable are those tools?



Image from
<http://www.wikipedia.org>



Topic: UPS in the home

- The home is becoming a tangled mess of devices, files, and sensors... what do we do about it?



Image from <http://www.ftc.gov>

Home Sharing

Home Sharing makes it easy to play or copy music, movies, and more among computers in your home. Just use the same Apple ID on up to five computers.

Enter the Apple ID used to create your Home Share.

No Thanks

Turn On Home Sharing

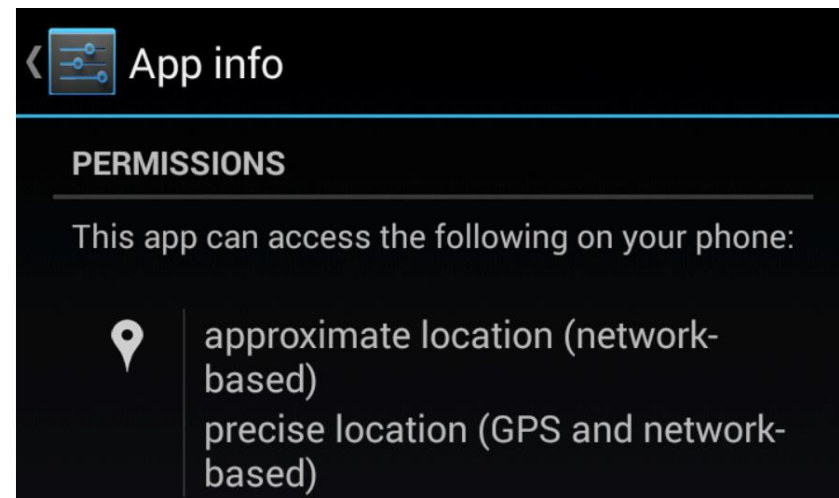
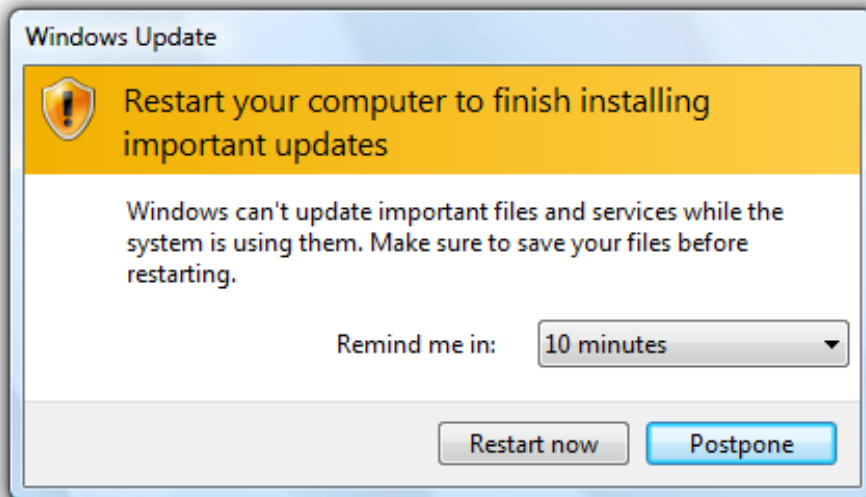
[Don't have an Apple ID?](#)



Image from <http://www.makezine.com>

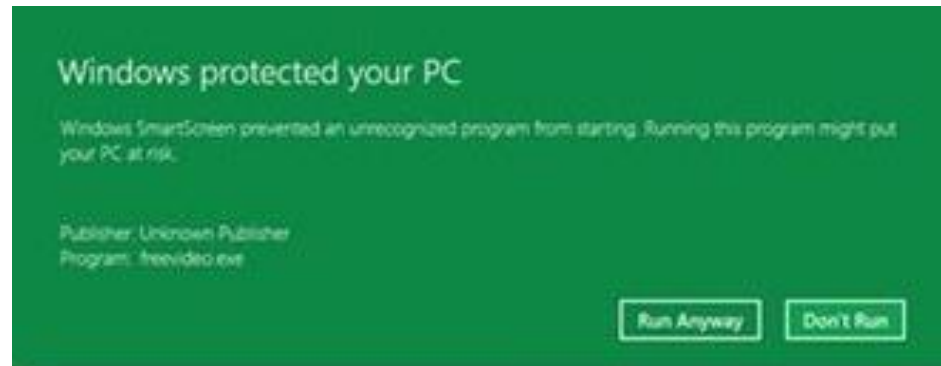
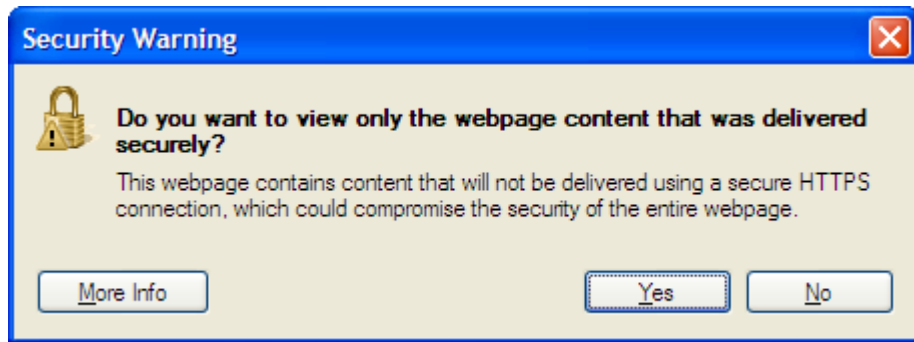
Topic: Software Updates and Mobile App Updates

- Software is constantly changing.
- Are users able to make correct decisions about whether to accept new updates?
- Should they need to?



Topic: Security warnings

- Can we make them more effective?



Topic: Smartphones and UPS

- Do people understand where the information on their phone goes?
- ...And can someone please make app permissions usable?



Image from <http://www.nokia.com>

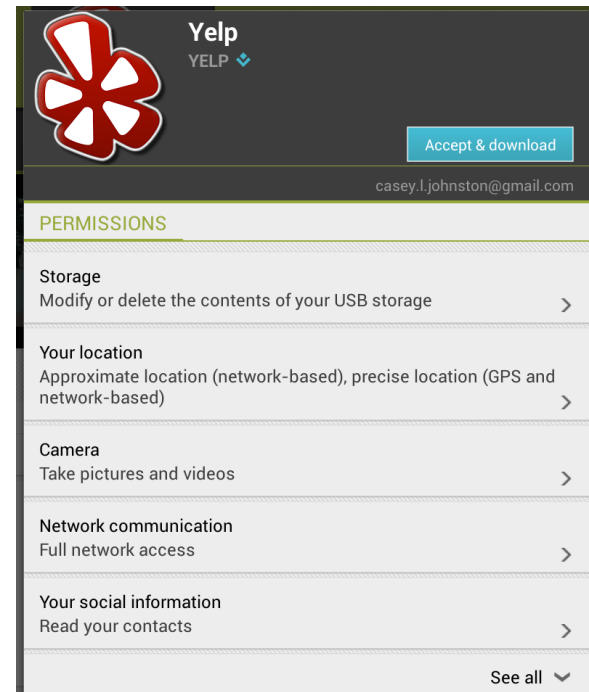


Image from <http://www.arstechnica.com>

Topic: Mobile and UbiComp

- What are the privacy and security implications of devices that go wherever you go?
- How can that be addressed?



Topic: Privacy policies and notices

- How do we communicate privacy-critical information in a sea of information?



- 👍 You stay in control of your copyright
- 👍 Collected personal data used for limited purposes
- 👍 6 weeks to review changes
- 👍 Indemnification from claims related to your content or your account
- 👍 Personal information can be disclosed in case of business transfer or insolvency

More details

Screenshot from <http://www.tosdr.org>

Rev. 12/2010

FACTS	WHAT DOES FARMERS-MERCHANTS BANK (FM Bank) DO WITH YOUR PERSONAL INFORMATION?
Why?	Financial companies choose how they share your personal information. Federal law gives consumers the right to limit some but not all sharing. Federal law also requires us to tell you how we collect, share, and protect your personal information. Please read this notice carefully to understand what we do.
What?	The types of personal information we collect and share depend on the product or service you have with us. This information can include: <ul style="list-style-type: none"> ■ Social Security number and Income ■ Account balances and Payment History ■ Credit history and Credit scores When you are <i>no longer</i> our customer, we continue to share your information as described in this notice.
How?	All financial companies need to share customer's personal information to run their everyday business. In the section below, we list the reasons financial companies can share their

Amazon Privacy Policy

types of Information	how we use your information					who we share your information with	
	provide service & maintain site	research & development	marketing	telemarketing	profiling	other companies	public forums
contact information			opt out	opt out		opt in	
cookies			opt out	opt out		opt in	
demographic information							
financial information							
health information							
preferences			opt out	opt out		opt in	
purchasing information			opt out	opt out		opt in	
social security number & govt ID							
your activity on this site			opt out	opt out		opt in	
your exact location							

opt out we will collect and use your information in this way by default, we will collect and use your information in this way unless you tell us not to by opting out

opt in we will not collect and use your information in this way by default, we will not collect and use your information in this way unless you allow us to by opting in

Topic: Biometrics

- Characteristics of the human body can be used to identify or authenticate
 - How can this be done in a user-friendly way?



Image from <http://www.economist.com>

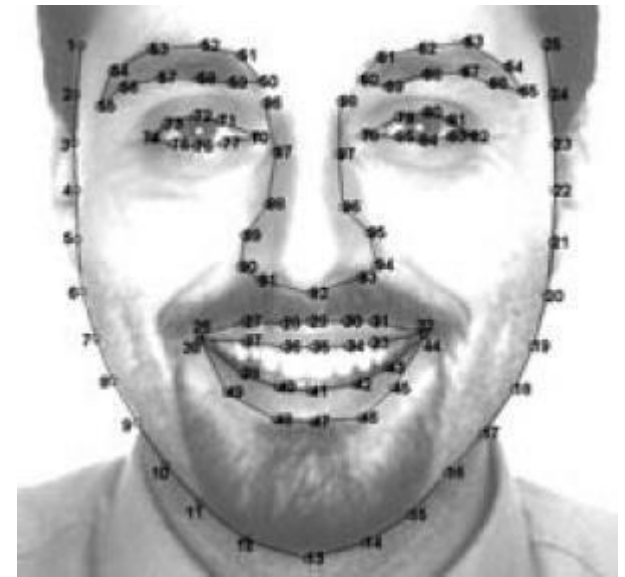
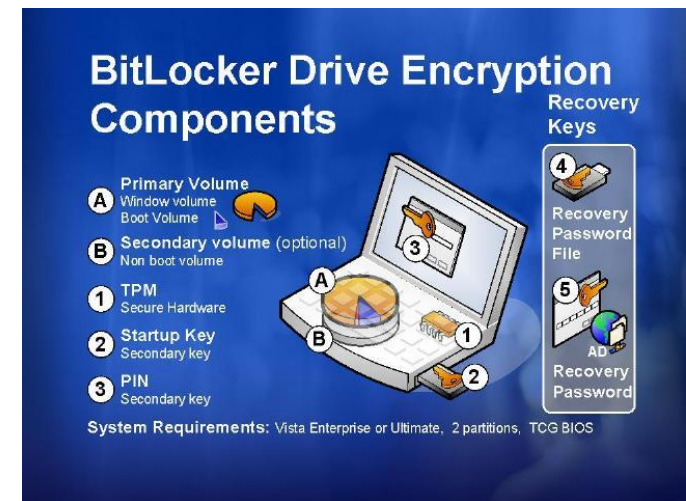
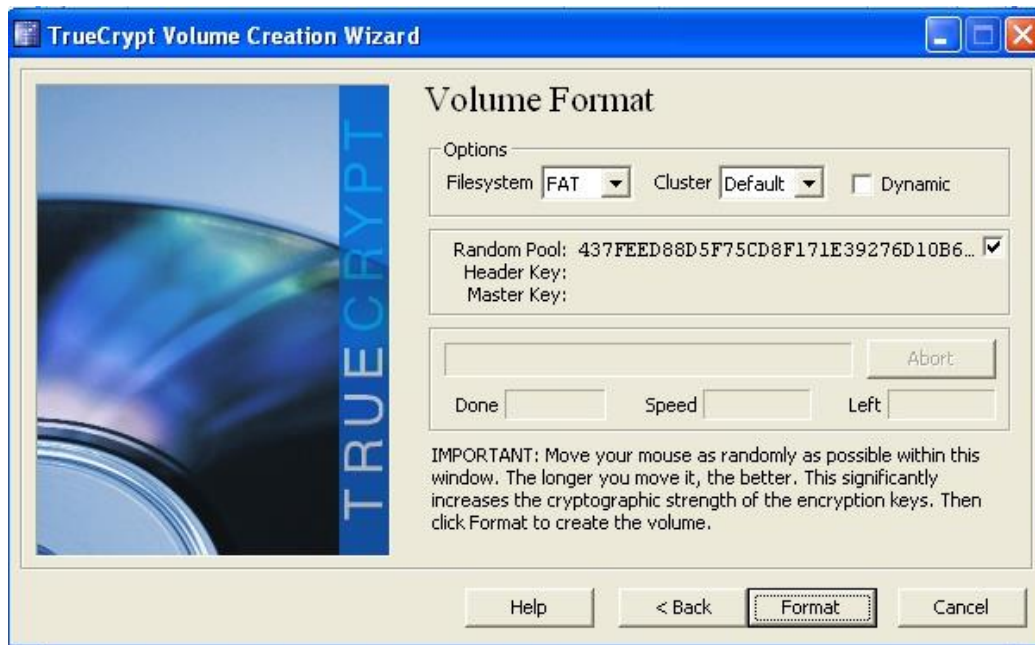


Image from <http://www.sciencedaily.com>

Topic: Usable encryption

- Why don't people encrypt their email and their files?



Topic: Browser privacy & security

- What kinds of tracking currently occurs, and what do average people think of it?
- ... And why has phishing been so effective?

AdChoices

The screenshot shows the Lightbeam browser extension interface. At the top, it displays statistics: 'DATA GATHERED SINCE: OCT 14, 2013', 'YOU HAVE VISITED: 15 WEBSITES', and 'YOU HAVE CONNECTED WITH: 122 THIRD PARTY SITES'. Below this is a table with columns for 'Type', 'Profile', 'Website', 'First Access', 'Last Access', and 'Sites Connected'. The table lists various third-party websites and their access dates. On the right side of the interface, there is a 'Server Location' section showing a world map and indicating 'Connected to 3 sites since first access'.

Type	Profile	Website	First Access	Last Access	Sites Connected
Third Party	adchoices	adchoices.com	Oct 15, 2013	Oct 15, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 16, 2013	5
Third Party	adchoices	adchoices.com	Oct 15, 2013	Oct 15, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	6
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 15, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 15, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	6
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 15, 2013	2
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	3
Third Party	adchoices	adchoices.com	Oct 15, 2013	Oct 15, 2013	1
Third Party	adchoices	adchoices.com	Oct 15, 2013	Oct 16, 2013	1
Visited	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	20
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 14, 2013	1
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 16, 2013	11
Third Party	adchoices	adchoices.com	Oct 14, 2013	Oct 15, 2013	1

You've gone incognito. Pages you view in this window won't appear in your browser history or search history, and they won't leave other traces, like cookies, on your computer after you close all open incognito windows. Any files you download or bookmarks you create will be preserved, however.

Going incognito doesn't affect the behavior of other people, servers, or software. Be wary of:

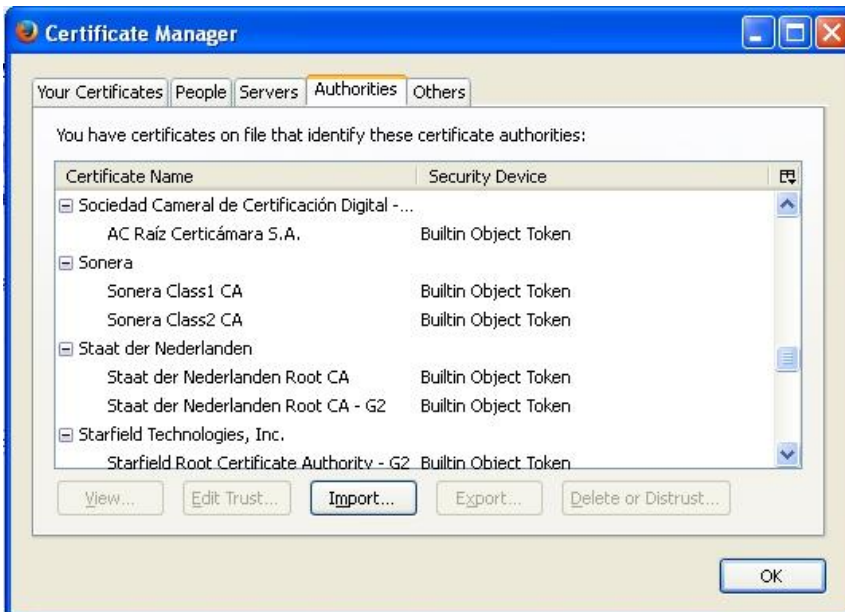
- Websites that collect or share information about you
- Internet service providers or employers that track the pages you visit
- Malicious software that tracks your keystrokes in exchange for free smileys
- Surveillance by secret agents
- People standing behind you

[Learn more](#) about incognito browsing.

Because Google Chrome does not control how extensions handle your personal data, all extensions have been disabled for incognito windows. You can reenable them individually in the [extensions manager](#).

Topic: SSL and PKIs

- Is there any hope for making certificates and SSL warnings usable?



The site's security certificate is not trusted!

You attempted to reach **mortar.ece.cmu.edu**, but the server presented a certificate issued by an entity that is not trusted by your computer's operating system. This may mean that the server has generated its own security credentials, which Chrome cannot rely on for identity information, or an attacker may be trying to intercept your communications.

You should not proceed, **especially** if you have never seen this warning before for this site.

[▶ Help me understand](#)

Topic: Social networks and privacy

- Can people want to share some things widely yet want other things to be private?

A GUIDE TO FACEBOOK'S PRIVACY OPTIONS

◆ Turn on Secure Browsing to help prevent eavesdroppers from reading your Facebook posts or stealing your password.

◆ Adjust your Security Settings to protect your Facebook account.

◆ For extra protection, turn on Login Approvals to have Facebook send a special security code to your mobile phone whenever you try to login to Facebook from a new device. If someone steals your Facebook password they will not be able to login without this code.

◆ Visit the Apps settings to limit the amount of information each app can access and also make sure apps don't post on your timeline if you don't want them to. If you don't want your friends to see what your apps are posting, change the Posts on your behalf setting to Only Me. Also pay attention to the Apps others use settings, which control the information about you that Facebook will provide to apps that your friends use, even if you don't use those apps. Disable Instant Personalization if you don't want Facebook to share your information with partner websites.

◆ These icons are used throughout Facebook to control who can see your information. For example, they control who can see the information on your profile and timeline.

◆ Check to find out who can see your posts before you click the Post button, and click on the icon to change your settings. Consider limiting your posts to Public or Friends of Friends, thousands of people might see them.

◆ Only accept friend requests from people you know. If you are friends with some people you don't know very well, consider adding them to your Acquaintances list and setting your sharing settings to Friends except Acquaintances.

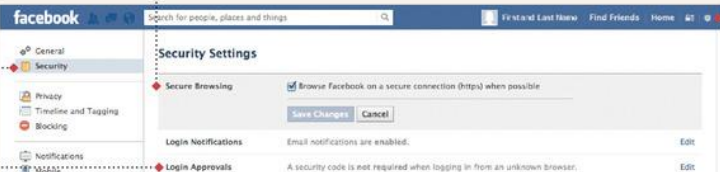
◆ Click the lock icon in the top right corner to access Facebook's Privacy Shortcuts.

◆ Click here to configure who can see your future posts, see where you've been tagged, and find out what other people can see on your timeline.

◆ You can change the settings for who sees your future posts here, but be careful. If you change your settings for an individual post, your settings will change for all future posts unless you change the settings again.

◆ Click here to access timeline and tagging settings, app privacy settings and more. For example, if you've previously shared some posts too widely, use the Limit the audience for posts you've shared with friends or public option to change the sharing setting to Friends for all your past posts.

◆ If you like or comment on a post, your comment will be seen by the friends of the person who posted it or a wider audience, depending on that person's



Topic: Trust and mental models

- How do average people think about privacy and security, and how can we help them and educate them?



Topic: UPS in safety-critical devices

- Some cars, medical devices, and household appliances contain computers
 - How do we help users protect their privacy and maintain security while still reaping the benefits of these new technologies?



Image from <http://www.motortrend.com>



Image from
<http://www.hcwreview.com>



Image from **45**
<http://www.allaboutsymbian.com>

Topic: Usable access control

- Controlling who has access to your files, physical spaces, and online posts is hard

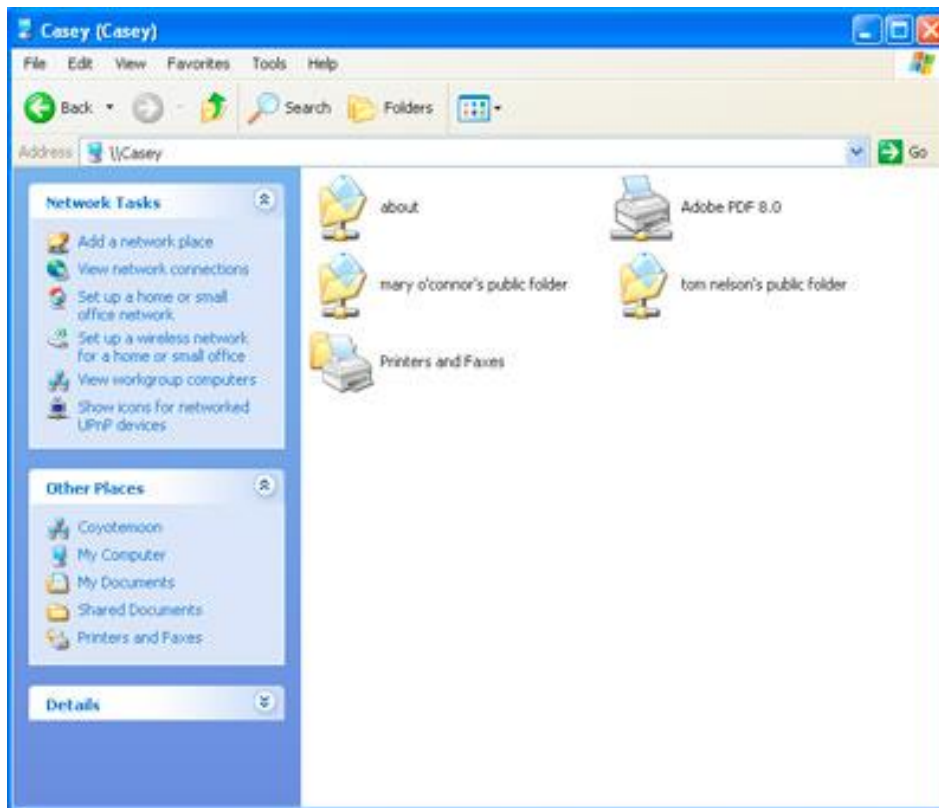


Image from <http://www.about.com>



Topic: User Education and Behavioral Economics

- How can we encourage (*nudge*) people to think about privacy and security?



Topic: Non-US Perspectives on Privacy and Research

- How do the topics of this class change as we look at non-US perspectives?
- Is one's perspective on privacy a function of one's culture?



Who you are?

- Your preferred name
- Program at CMU (e.g., Privacy Engineering, COS, ECE, Master's in HCI)
- Why did you sign up for this course?
- Your first (ungraded) quiz