

# 01. Course Overview; Introduction to Usable Security & Privacy

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April 2<sup>nd</sup>, 2019

CMSC 23210 / 33210



THE UNIVERSITY OF  
CHICAGO



**Security, Usability, & Privacy**  
**Education & Research**

# Today's class

- Course staff introductions
- Overview of course topics
- Usable security and privacy = ???
- Course policies / syllabus
- Usability / the human in the loop

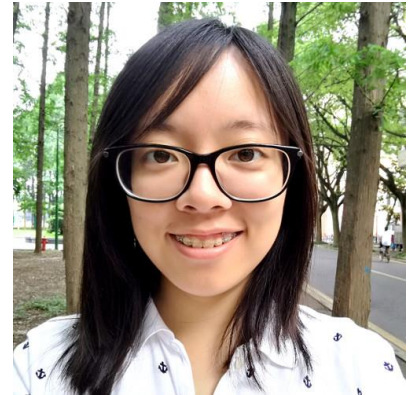
# Introductions



- Blase Ur
- Assistant Professor of CS
  - Joined in January 2017
  - PhD at CMU in Fall 2016, advised by Lorrie Cranor
- SUPERgroup: Security, Usability, & Privacy Education & Research
- ~~“Professor Ur”~~ ~~“Dr. Ur”~~ “Blase” ~~“Dr. Blase”~~
- Office: JCL 363

# Introductions

- Weijia He
- Ph.D. student
  - Joined in Fall 2017
  - Advised by Blase Ur
- Office: JCL 391



# 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.

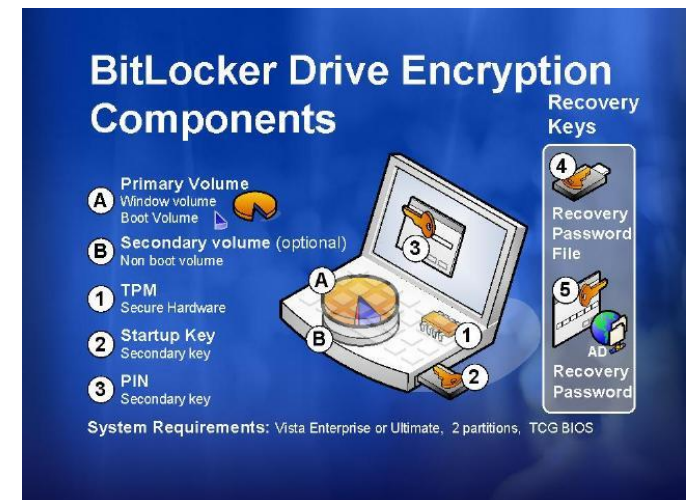
Security & Privacy  
+  
Human-Computer Interaction  
=  
**Usable Security and Privacy**

# Course topics

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

# Usable encryption

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





# Passwords

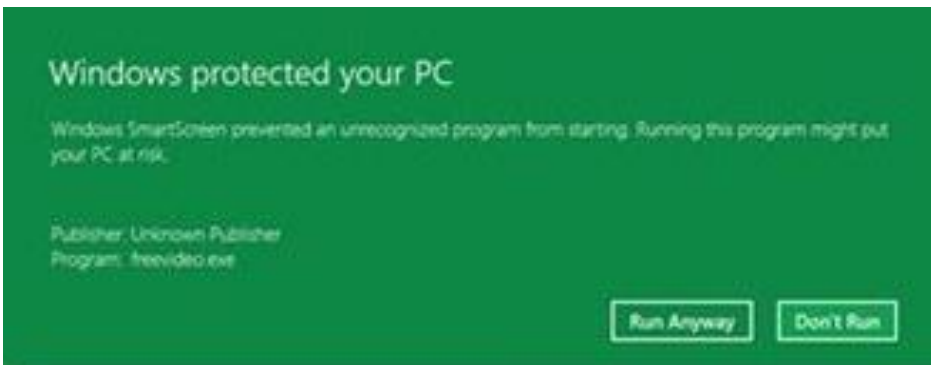
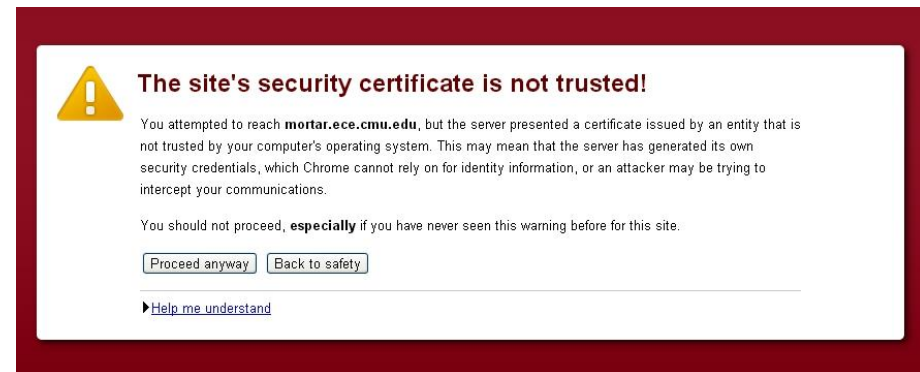
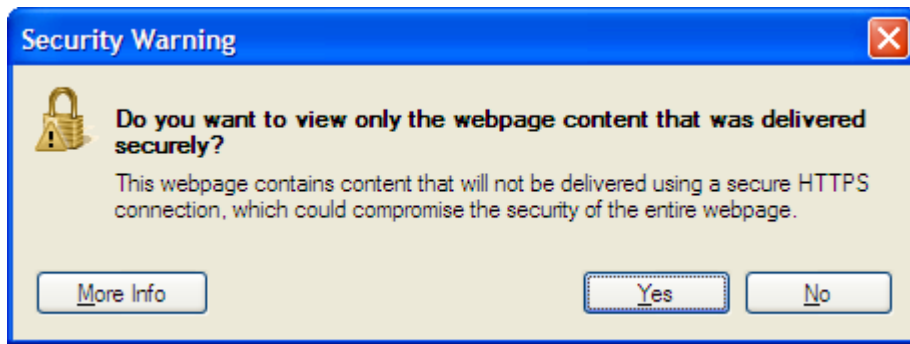
- Can people make passwords that are easy to remember, yet hard to crack?

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



# Security warnings

- Can we make them more effective?



# Social media 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 Friends. If you make your posts visible 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 of 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

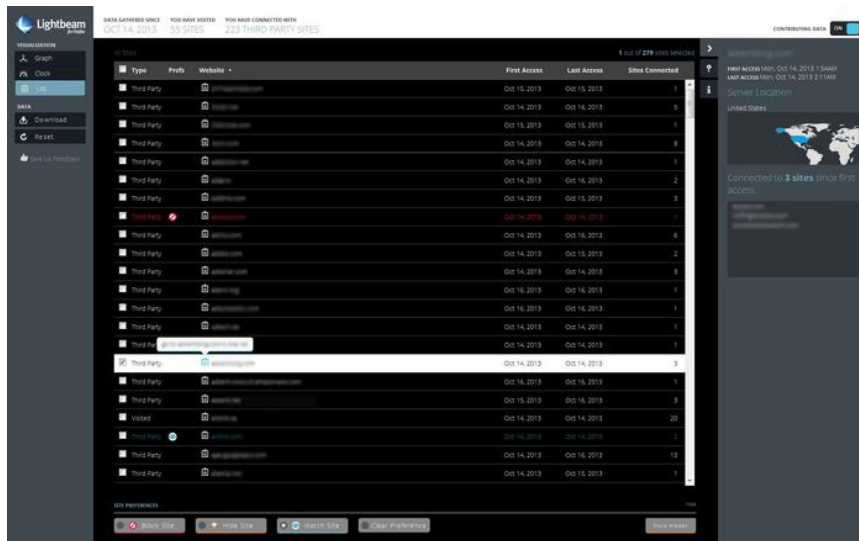


The screenshot shows the Facebook interface with a post from Adobe Photoshop. The post has a privacy dropdown menu open, showing options: Public, Friends, Friends except Acquaintances, Only Me, and Custom. The 'Friends' option is selected. The post has 102 likes and 1,111 customer-created photos. The interface also shows the 'Privacy Shortcuts' panel on the right, which includes sections for 'Who can see my stuff?', 'Where can I review all my posts and things I'm tagged in?', 'What do other people see on my timeline?', and 'Who can contact me?'. The bottom of the screenshot shows the 'Security Settings' page, which includes sections for 'General', 'Security', 'Privacy', 'Timeline and Tagging', 'Blocking', 'Notifications', and 'Login Approvals'.



# Web security & privacy

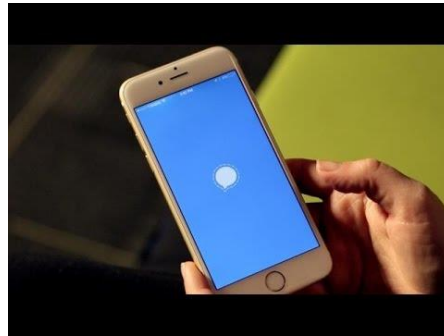
- How do we keep the web secure and private, and how do we keep users aware of what's happening as they browse?





# Anonymity; activists/journalists

- Can anonymity tools help journalists, activists, and others protect their privacy?



# Privacy notice and choice

- 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](#)

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?	<p>The types of personal information we collect and share depend on the product or service you have with us. This information can include:</p> <ul style="list-style-type: none"> <li>Social Security number and <b>Income</b></li> <li>Account balances and <b>Payment History</b></li> <li>Credit history and <b>Credit scores</b></li> </ul> <p>When you are <i>no longer</i> our customer, we continue to share your information as described in this notice.</p>
How?	All financial companies need to share customer's personal information to run their everyday

## 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							

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

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

# Mobile devices and the IoT

- What are the privacy and security implications of new ways of computing?



amazon echo



# Mental models; anti-phishing

- How do non-technical people think about privacy and security, and how can we better support them?





# Developers are users, too

- How can we make security and privacy usable for the experts who are building your tools?



# Inclusive security & privacy

- How can we design security and privacy to work for everyone?
  - Age
  - Abilities
  - Culture



# What makes usable security hard?

- 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

# Security vs. HCI vs. Usable Security

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

# Goals for this course

- Gain an appreciation for the importance of usability within security and privacy
- Learn about current research in usable security and privacy
- Learn how to conduct user studies
- Learn how to critically examine user studies you hear about or read about

# Course communication

- Updated syllabus is always available:  
<https://super.cs.uchicago.edu/usable19>
- We will sign you up for Piazza
  - Opt in to get emails when we send announcements!

# Components of your grade

- Quizzes (daily): 10%
- Midterm: 10%
- Final exam: 15%
- Problem sets (5): 25%
- Group Project: 40%

# Required textbook

- There is no required textbook



# Readings

- Generally 1-3 required readings per class
- Complete the readings before class
- Most readings from recent conferences
- 33210 students: about one additional reading per week

# Quizzes

- Given in the first five minutes of class
- 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 reading(s) as a private post on Piazza
- Drop three lowest grades

# Problem sets

- 5 problem sets
  - Submit them on Canvas
  - No late problem sets accepted!
- 33210 only: “reading summary”
  - 3-7 sentence summary
  - One “highlight”

# What are problem sets like?

- Conduct mini studies + report results
- Evaluate the incidence or state of something in the real world
- Write code that sheds some insight on usable security and privacy
- Conduct usability evaluations of tools
- Propose possible studies

# 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.

# Exams

- Closed-book midterm and final in class
- 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 small 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, ethics application, progress report & presentation, final paper, and final presentation

# Participation in class

- You are expected to participate in class
  - Raise your hand during discussions
  - Share interesting news on Piazza
  - Play an active role in small-group activities
  - Spark discussion on Piazza
- 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



# 23210 vs. 33210

- Same lectures
- Same\* assignments
  - 33210 students have extra problems
- Same project
  - 33210 students must have implementation

## 23210 vs. 33210

- 23210 is an elective within UG CS major
- 33210 may count for UG programming languages and systems sequence if you successfully petition
- Graduate students must take 33210
  - Systems elective

# Academic integrity

- University of Chicago policies about plagiarism and academic integrity
- Don't look at other students' assignments
  - Exception: When we explicitly say you may
  - Talking verbally about problem sets is ok
- Quote text and cite ideas that are not yours
- Consequences of cheating and plagiarism range from a 0 on the assignment to expulsion from the University of Chicago

# Wellness

- Take care of yourself during the class
- Let us know if you are overwhelmed
- Take advantage of the university's wellness and mental health resources

# The Human in the Loop

# The human threat

- Malicious humans
- Clueless humans
- Unmotivated humans
- Humans constrained by human limitations



Are you capable  
of remembering  
a different  
strong  
password for  
every account  
you have?

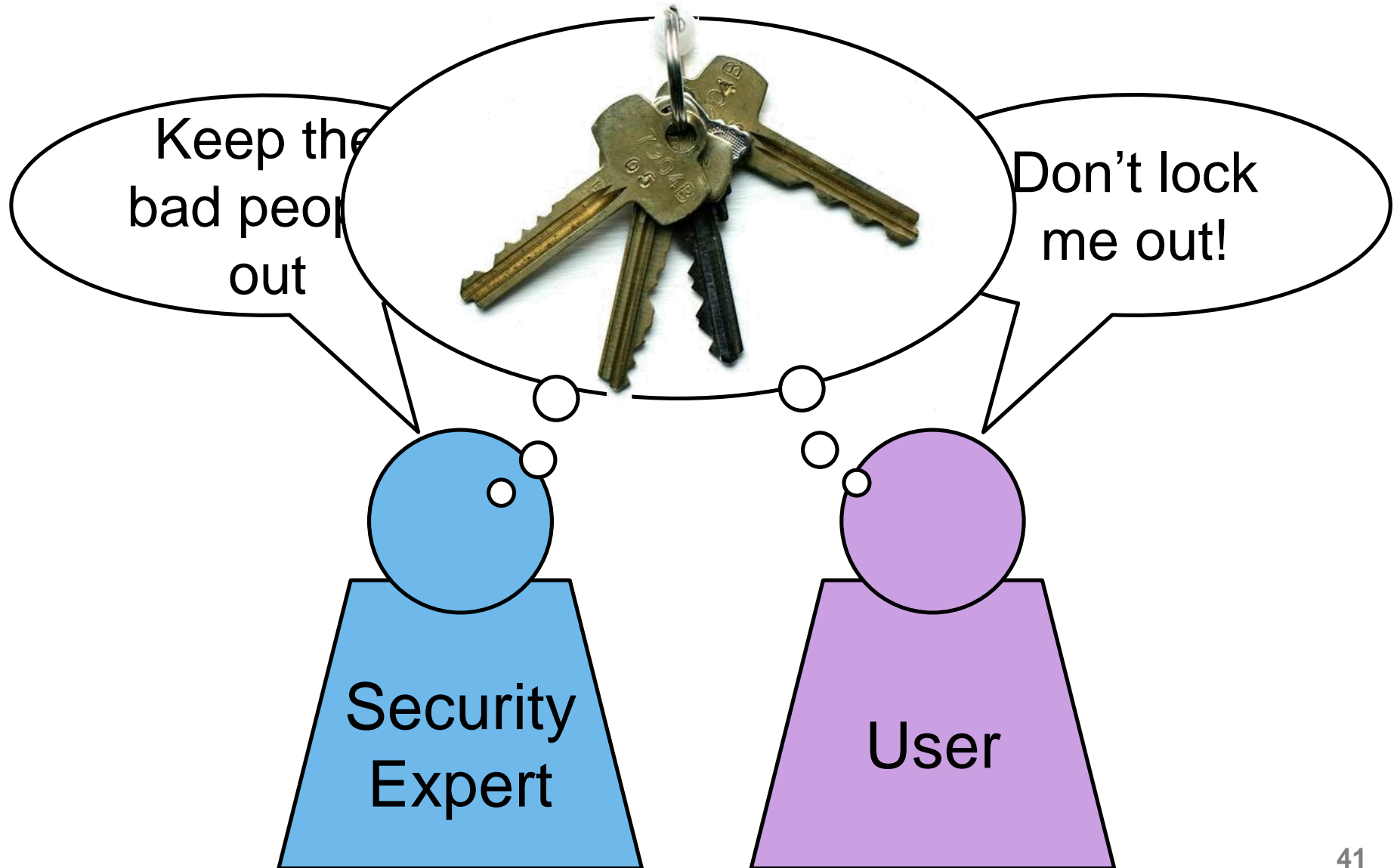


# Security is a secondary task

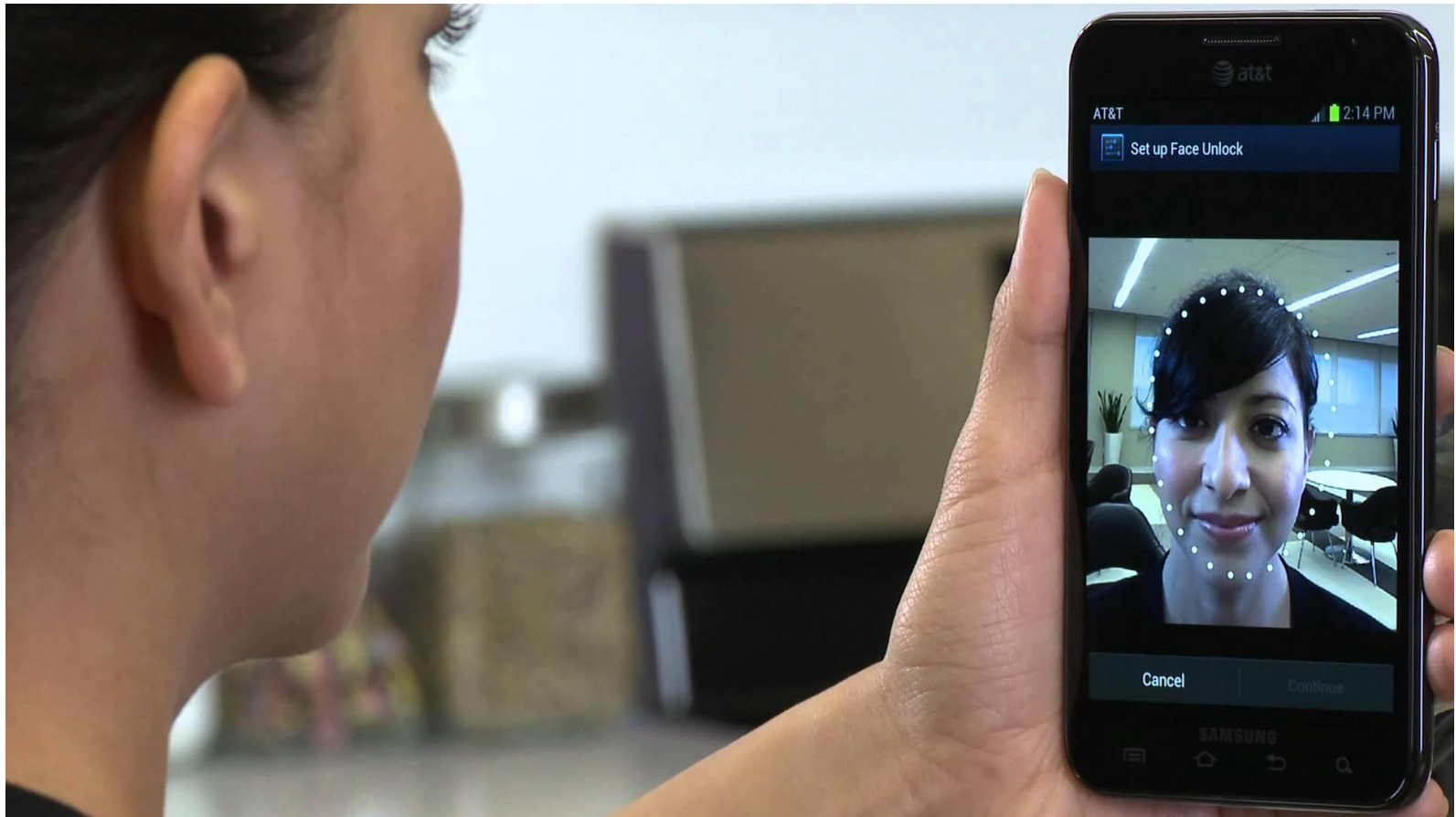




# Concerns may not be aligned



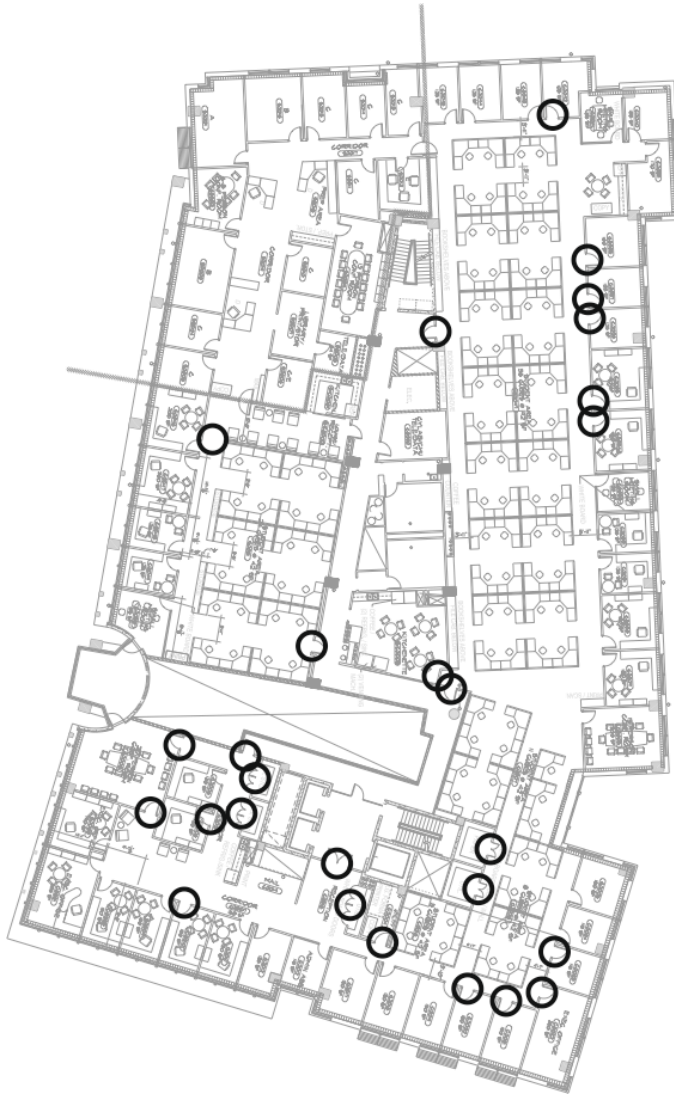
# Perceptions have an important impact



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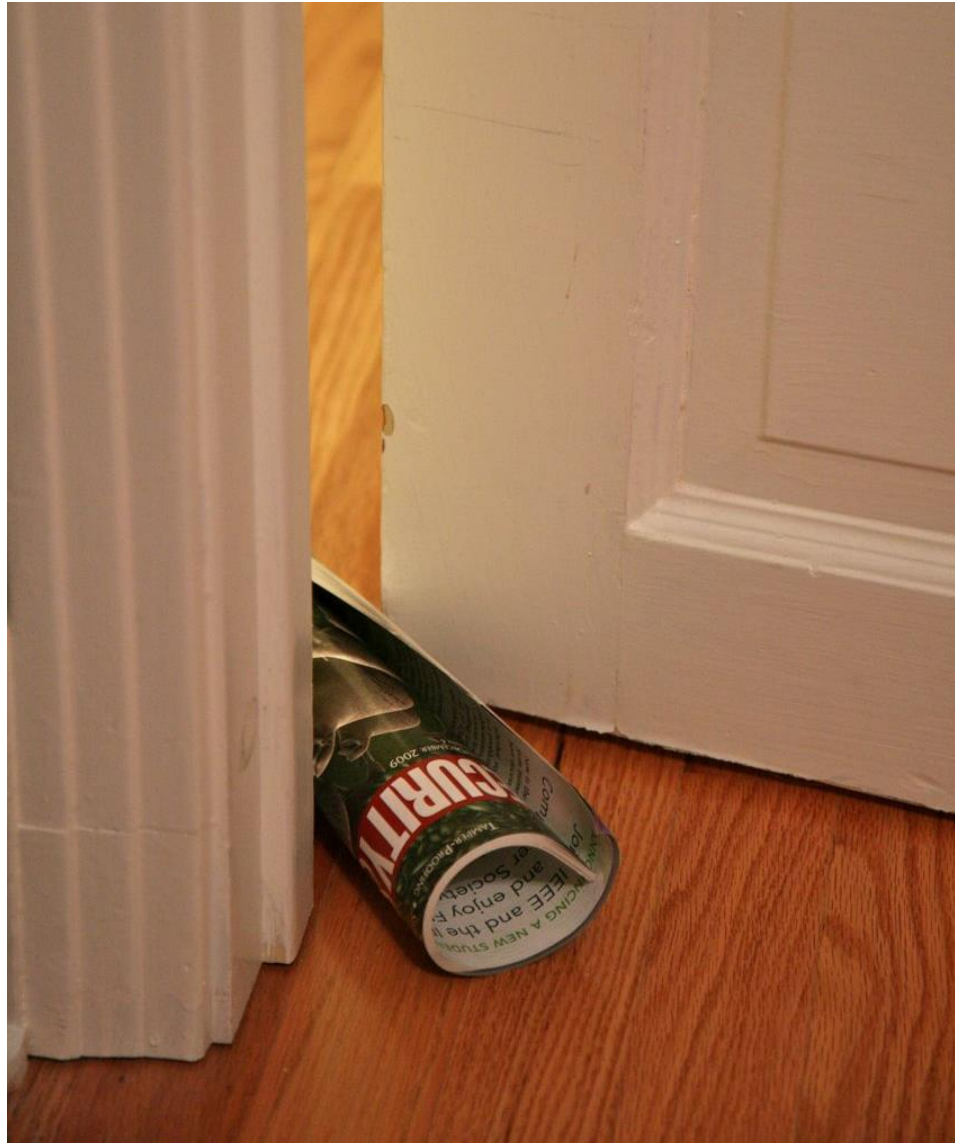
# Perceptions have an important impact



“I find myself standing outside and everybody inside is looking at me standing outside while I am trying to futz with my phone and open the stupid door.”

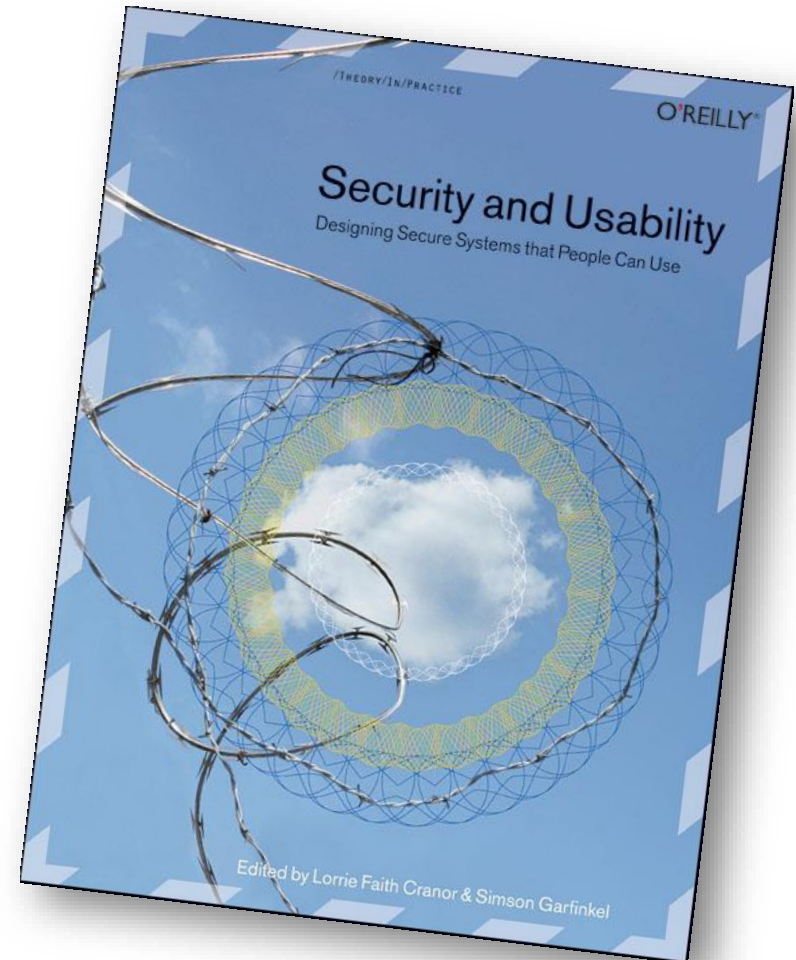


# Convenience always wins



# How can we make secure systems more usable?

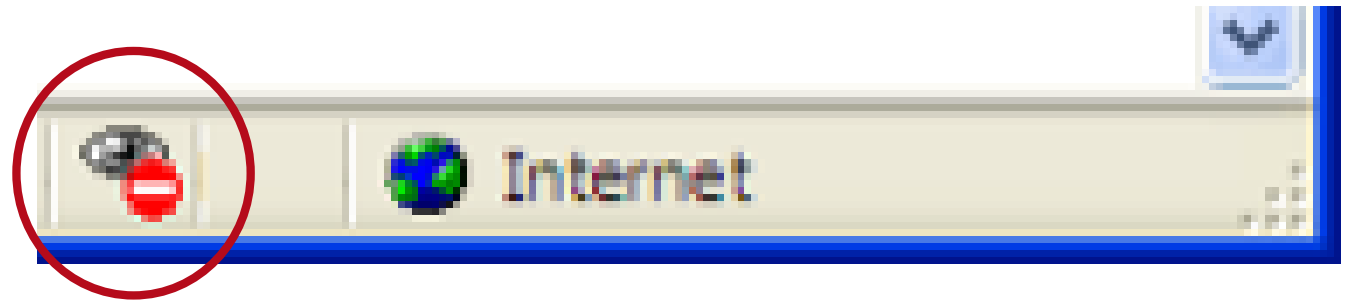
- Make it “just work”
  - Invisible security
- Make security/privacy understandable
  - Make it visible
  - Make it intuitive
  - Use metaphors that users can relate to
- Train the user



# Visual communication







# What can make a system unusable?

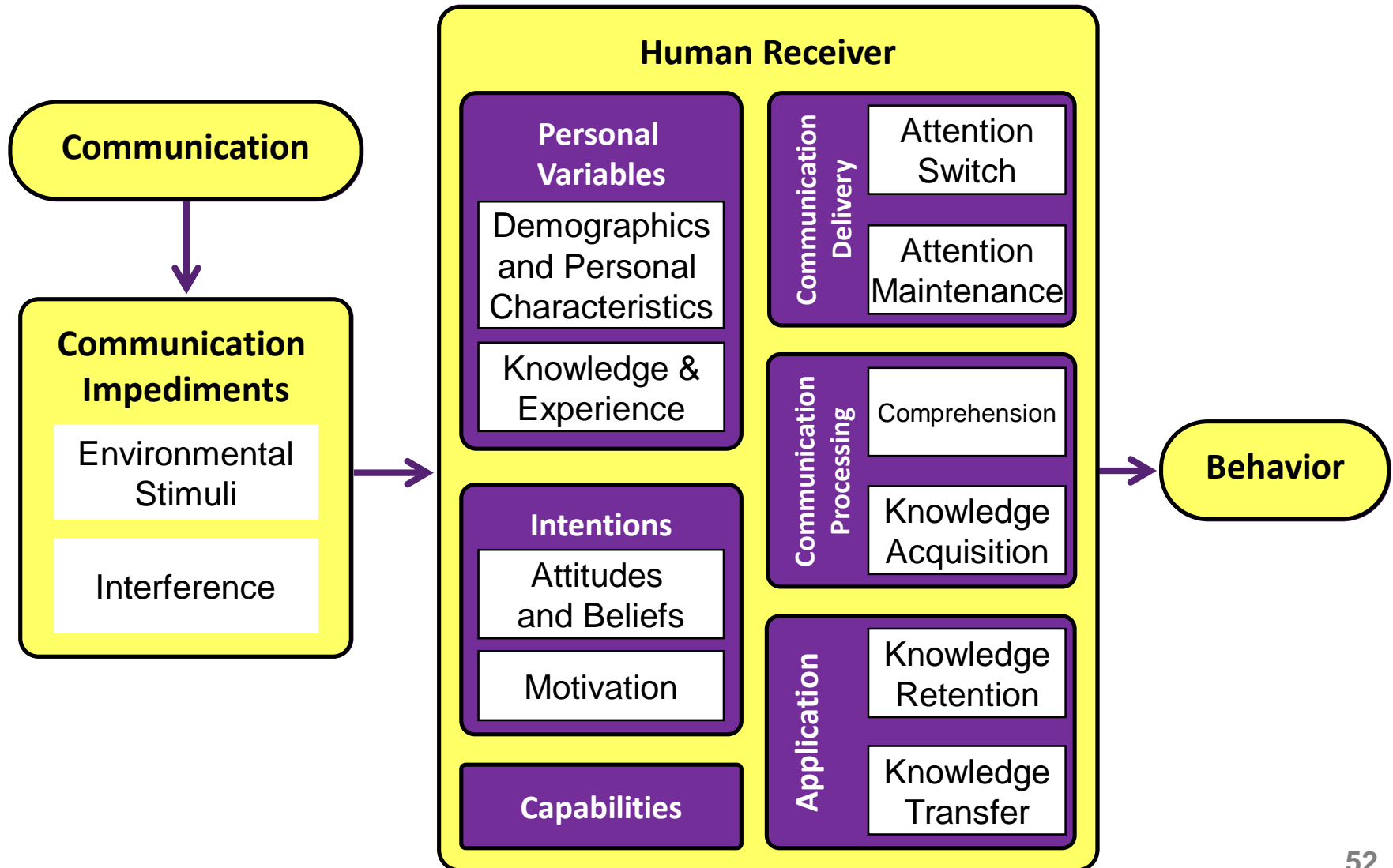
- Confusing / misleading / unhelpful user interface
- Requiring a user to make decisions for which the user is not qualified
- Assuming knowledge or abilities that the user doesn't have
- Assuming unreasonable amount of attention / effort

# Human-in-the-loop framework

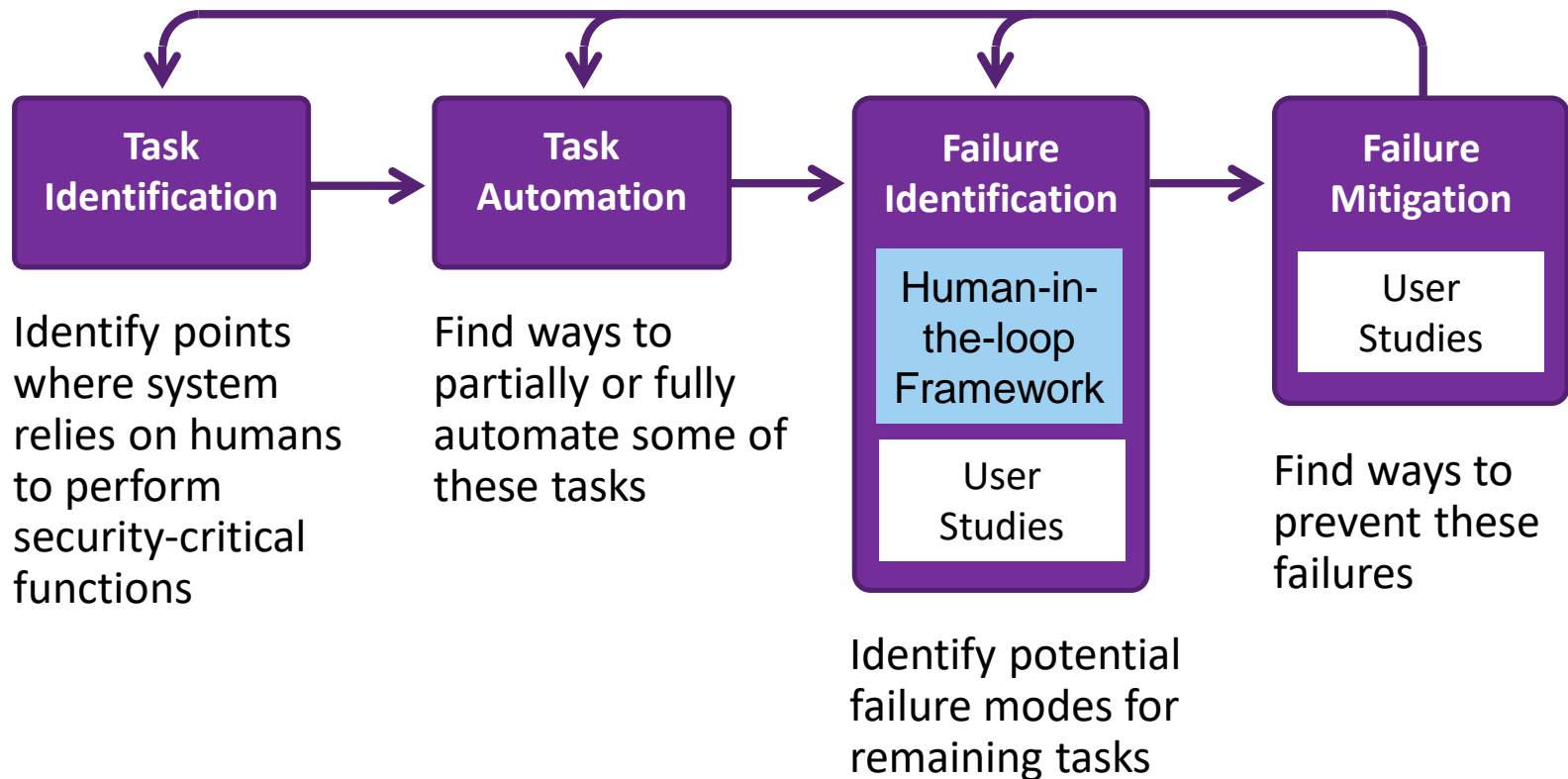
- Based on Communication-Human Information Processing Model (C-HIP) from Warnings Science
- Models human interaction with secure systems
- Can help identify human threats



# Human-in-the-loop framework



# Threat identification & mitigation



# Understand human in the loop

- Do they know they are supposed to be doing something?
- Do they understand what they are supposed to do?
- Do they know how to do it?
- Are they motivated to do it?
- Are they capable of doing it?
- Will they actually do it?

# Designing for Usability





What to do about hazards?





Best solution: remove hazard





If all else fails: warn

Door slams



Please hold  
the door when  
closing.  
Thanks!

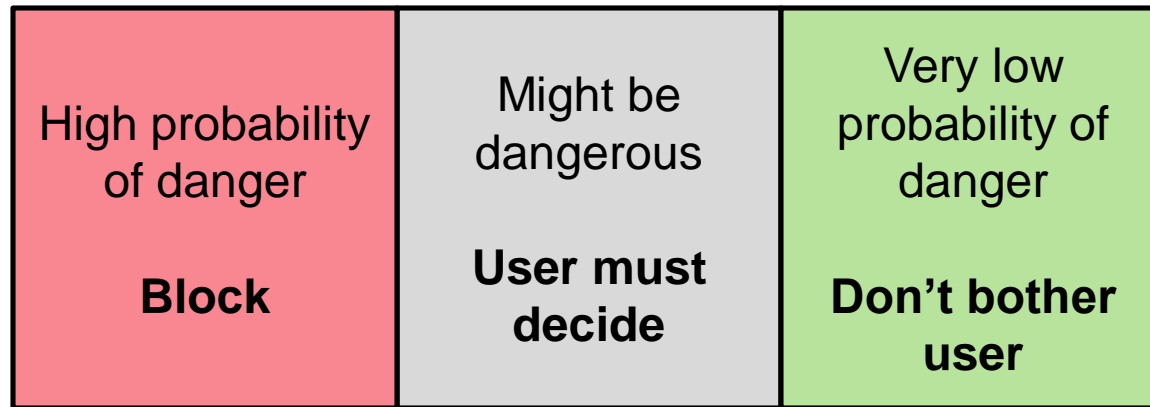
A better  
solution  
would be to  
add a spring  
so the door  
won't slam



ARTS

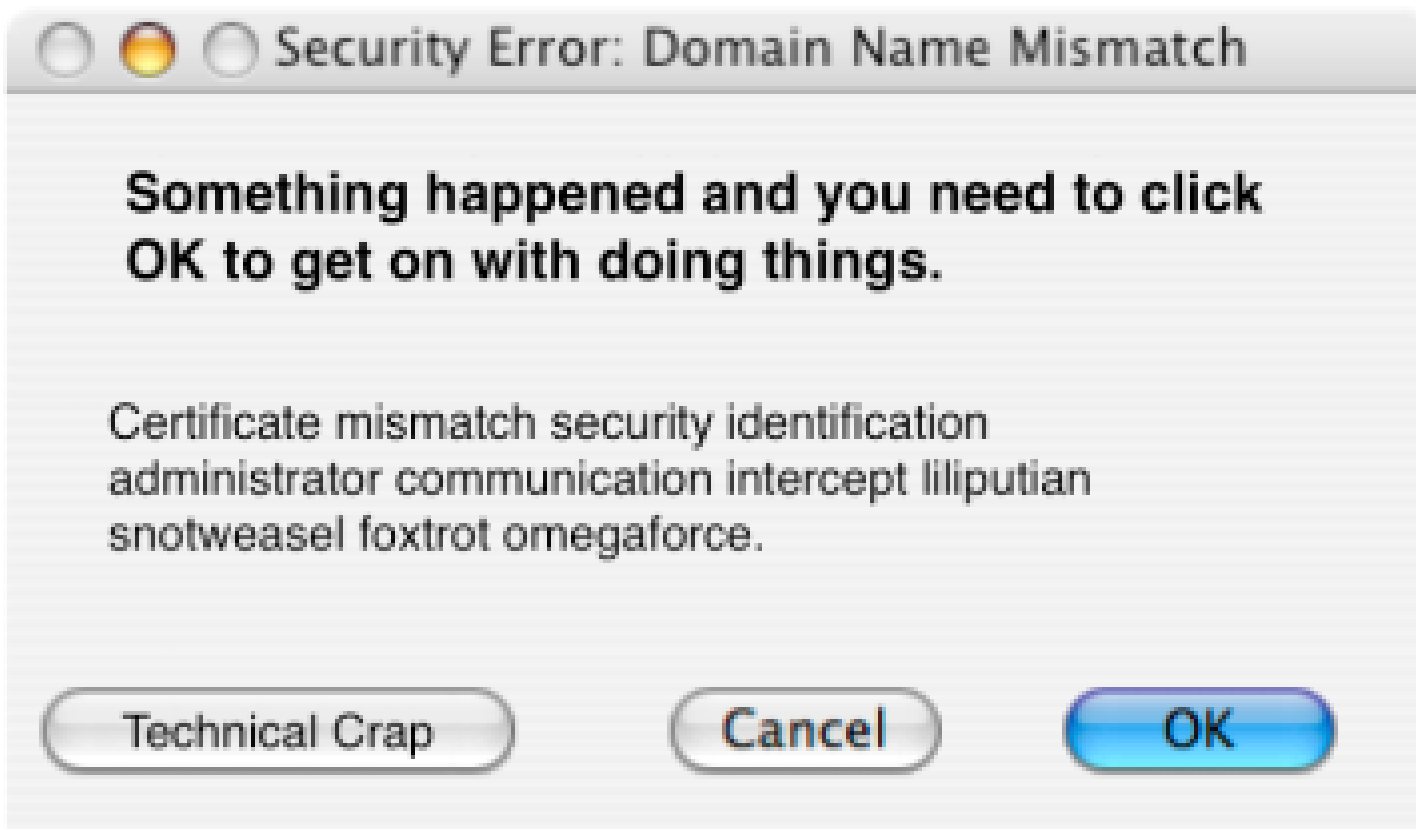


# Support users' decisions



Improve warnings

Help user decide by asking question  
user is qualified to answer



# Bad question

Your web browser thinks this is a phishing web site. Do you want to go there anyway?

Don't go there

Go there anyway





People were  
confused until  
they posted  
instructions



Design communicates function



How do you unplug the sink?



How do you turn on  
this shower?



# Stove layout

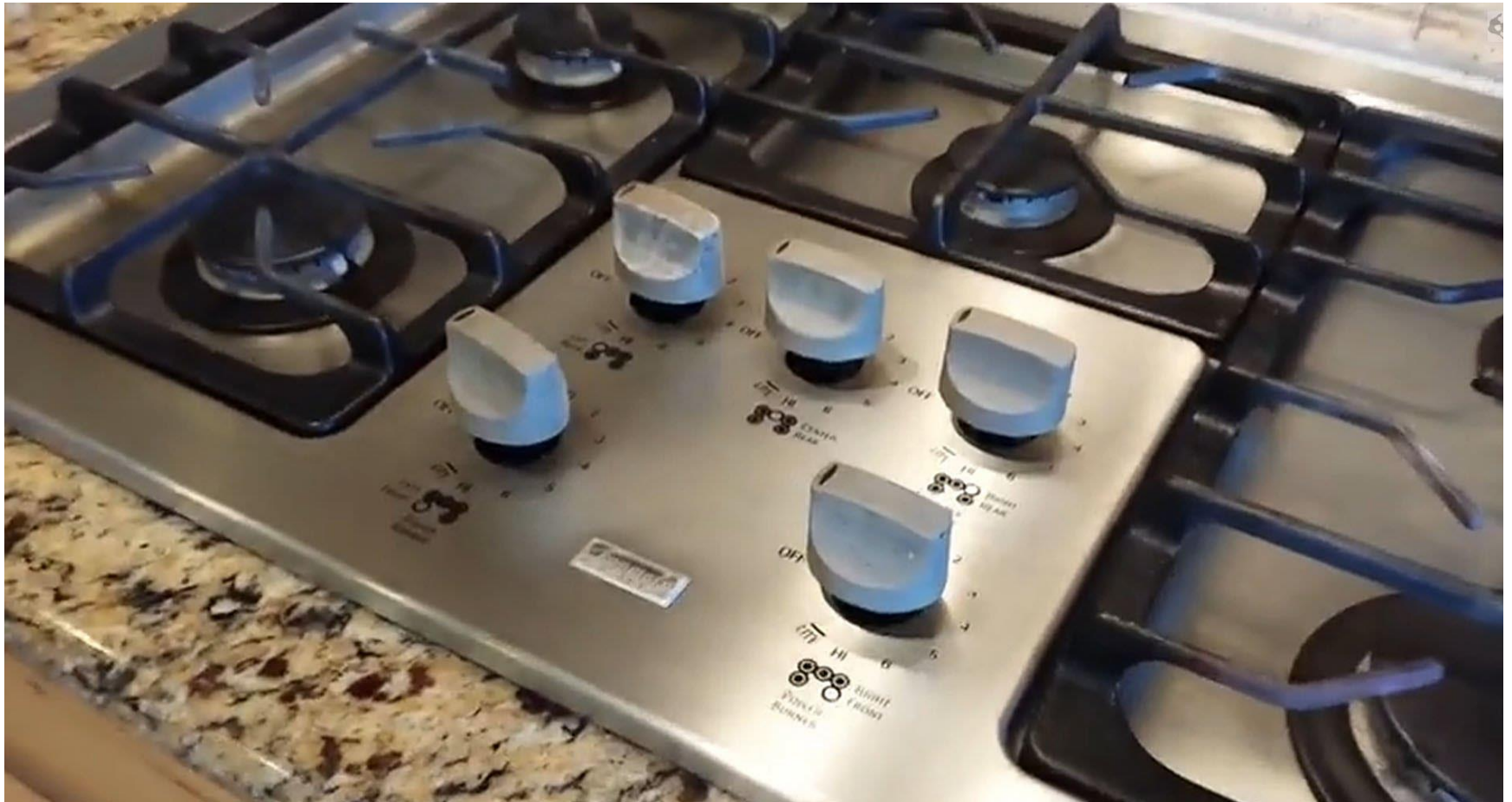


# Stove layout





# Stove layout



# Doors





# Doors



# Doors

