

Usability and accessibility  
Introduction

CSCI E 45b: The Cyber World – part B

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Introduction: learning goals



- Understand the importance of the human experience of technology
- Understand the process and factors that affect humans interaction with the cyber world
- Understand humans ability to overcome challenges in human to technology interaction

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The power of human computer interaction



- 60's experience at MIT  
Kids from lower income neighborhood in Boston Brought into a room with terminals  
They were told they could ask questions of the computer, using the terminal  
Terminals connected to MIT research team who then called MIT professors to get the answers
- Humans' desire can overcome experience, knowledge

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### Hole in the wall project - Sugata Mitra

- Internet connected kiosk setup in New Delhi slums

Results (as documented on Wikipedia)

- Become computer literate on their own
- Teach themselves enough English to use email, chat and search engines
- Learn to search the Internet for answers to questions in a few months time
- Improve their English pronunciation on their own
- Improve their mathematics and science scores in school
- Answer examination questions several years ahead of time
- Change their social interaction skills and value systems
- Form independent opinions and detect indoctrination



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### Design - definition



- **1de-sign** — (source: Merriam Webster)  
*verb* \di-'zín\ : to plan and make decisions about (something that is being built or created) : to create the plans, drawings, etc., that show how (something) will be made

- : to plan and make (something) for a specific use or purpose
- : to think of (something, such as a plan) : to plan (something) in your mind

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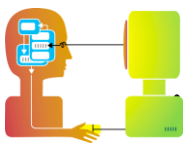
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### Human Computer Interaction (HCI)



- Study of interaction between people and computers

in particular, user interfaces

Many areas of study

- aesthetics, anthropology, artificial intelligence, cognitive science, computer vision, design, ergonomics, library and information science, philosophy, phenomenology, psychology, social psychology, sociology, speech-language pathology (from Wikipedia)

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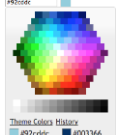
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### User Interface - not just colors, and fonts

- HCI involves many factors
- Only some of which relate to the aesthetics of the interface
- Relates to:
  - User's mental model of the task/activity to be performed
  - Ease of use, and completeness of functionality
  - Feedback to the user
  - Similarity to other systems supporting the same task/activity (Hierarchy of expectations)

Serif (Baskerville)  
 • Old Style (Caslon/Gothic)  
 • Transitional (Garamond)  
 • Modern (Didot)  
**Slab Serif** (Clarendon)  
 Sans serif (Myriad)  
 Script (Coronet)  
**Blackletter** (Frutiger No. 1)  
**DISPLAY** (Lapal/Crestal)  
 Monospaced (Courier)  
 ♦:■:◻:◼:◽:◾:◿:◸:◹:◺:◻:◼:◽:◾:◿ (Dingbat) (ITC Zapf Dingbats)



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 Theme Colors History  
 #92c05e #403366

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### Interface design

- Make something “user friendly”
- Aims are to make it:
  - easy for the user to know what to do to accomplish a goal
  - less tiring to use
  - less likely to make errors
  - less likely to do what should not be done
  - make the process of achieving a goal more efficient
- Applies to newspapers, cars, toasters, MP3 players, computer applications, phones, etc.

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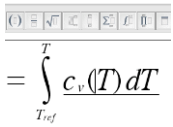
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### User friendly

- Not an absolute concept - relative to user
  - e.g., “user friendly” for an equation editor designed for use by math majors will not be friendly to an English major
- A user friendly interface must “make sense” to the targeted user
  - e.g., intuitive
  - e.g., have dual mag stripe readers in building access system (one for each side)



$$= \int_{T_{ref}}^T c_v(T) dT$$

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# Usability and accessibility

## The design process

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# Process overview

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# Elements of the process

- Discover**  
Many approaches to establish context, wants and needs  
Focus groups  
Statistical sampling  
Tell us what you want  
*"It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them."* – Steve Jobs  
Ethnography  
In-context user research  
Qualitative research  
Produces experience model, interaction models, user profiles, etc.

Steve Jobs

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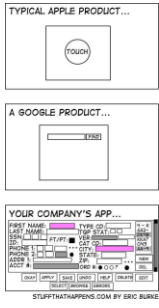
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### Elements of the process

- **Design**
  - Information Architecture**  
Organizing content (and navigation) in a way that optimizes to both function and form
  - Low fidelity interface design**  
Early stage design technique to be used for quick testing with users
  - High fidelity interface design**  
Latter stages technique to document every detail of an interface design
  - Content strategy and management**  
Identifying what type of content is needed, how to classify it, and manage it



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### Elements of the process

- **Evaluate**
  - Usability testing**  
Let real users perform advanced tasks using the design  
**Without any one else to help them**  
To derive both qualitative and quantitative assessments of the design, to improve it  
Useful at every stage of the design (and implementation) process



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### Innovation and design tussle

- **The Steve Jobs model**  
When it comes to major innovations, users don't know what they want, but "Superior" Design (and savvy business) beings do
- **The Eric Von Hippel model**  
Companies do a poor job at assessing the needs for new products or product evolution  
Users are needs driven and know better



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### Interaction: procedures



Don Norman

- Don Norman: interaction framework  
User's view:
  - Establish goal
  - Formulate intention
  - Specify actions through interface
  - Execute action
  - Perceive system state
  - Interpret system state
  - Evaluate system state with respect to goal
- A good design does not inhibit the above
- User's expectations can get in the way if system does not match those expectations

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### Garfinkel's Design Principles



Simon Garfinkel

Original creator of the Security, privacy and usability course

- Focus on users & tasks, not technology  
Who is trying to do what with this application
- Consider function first, presentation later  
Develop conceptual model - keep it simple
- Promote learning inside the interface  
remember: user wants to do a task, not learn a program

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### Garfinkel's Design Principles, contd.



Simon Garfinkel

- Conform to user's view of task  
Understand user's vocabulary & mindset  
Not universal view of tasks - different user, different needs  
Use real world object metaphors - Skeuomorphs
- Don't complicate user's task  
Do just the full job the user needs to get done

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### Garfinkel's Design Principles, contd.



Simon Garfinkel

- Deliver information, not just data  
provide information the user needs
- Design for responsiveness  
speed overcomes some interface issues (for the user)
- Test design on real users & fix whatever problems you find  
i.e., listen to the users and don't be too proud to revise

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### Usability – Don't make me think!

**WHAT WE DESIGN FOR... THE REALITY...**

Read  
Read  
Read  
Read  
[Pause for reflection]  
Finally, click on a carefully chosen link.

Look around feverishly for anything that

a) is interesting, or vaguely resembles what you're looking for, and  
b) is clickable.

As soon as you find a halfway-decent match, click.

If it doesn't pan out, click the Back button and try again.

Steve Krug  
**DON'T MAKE ME THINK**

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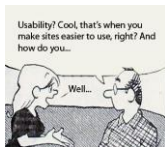
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### Usability principles



Usability? Cool, that's when you make sites easier to use, right? And how do you...

- **Learnability**  
How easy is it for new users?
- **Flexibility**  
Ability to accommodate some level of change within the broader task
- **Robustness**  
How hard it is for the user to get confused

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### Usability principles - **Learnability**



- **Predictability**  
Predicting future results based on past results
- **Synthesizability**  
Properly assessing results
- **Familiarity**  
How consistent with past interactions - guessability
- **Generalizability**  
Consistency between types of interactions

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### Usability principles - **Flexibility**



- **Dialogue initiative**  
Freedom from system-imposed constraints on dialogue
- **Multithreading**  
Ability for user to interact with more than one task
- **Task migration**  
Passing task responsibility from user to system
- **Customizability**  
Allowing user of system to modify user interface

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### Usability principles - **Robustness**



- **Observability**  
Ability of user to observe application state
- **Recoverability**  
Ability of user to take corrective action after an error
- **Responsiveness**  
User perception of system response time
- **Task conformance**  
Can system do all that the user wants?

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Human Computer Interface

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The human side

- Card, Moran, Newell model of “human processor”  
Information received & responses given through input/output channels  
Information stored in memory  
Information processed and applied in various ways



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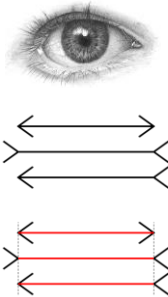
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The human side – Vision

- Vision  
Stereo - provided depth perception, relative size can help  
Limited fine detail discrimination  
Brightness  
Color (hue, intensity, saturation)  
8% men, 1% women are color blind  
Subject to illusion



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### The human side - Reading & Hearing

*The Last Art of Handwriting*  
...nd Art of Handwriting...  
Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...  
The Last Art of Handwriting...



- Processed vision: reading
  - Stages:
    - pattern perception
    - decode using internal language representation
    - interpret using knowledge of syntax, semantics & pragmatics
  - Series of saccades & fixations
    - perception during fixations
  - Word shape used in recognition
- Hearing:
  - Factors: pitch, loudness & timbre
  - Sounds filtered by auditory system

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### The human side - Touch & Reaction time



- Touch
  - Receptors:
    - Heat, pain, pressure, position
  - Fingers more sensitive
- Reaction time
  - Visual: 200 ms
  - Sound: 150 ms
  - Pain: 700 ms

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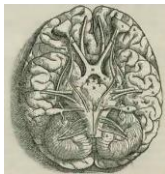
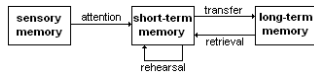
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### The human side - Memory



- Memory system
- Short term memory
  - Rapid access: 70 ms
  - Rapid decay: 200 ms
  - Small: 7 ± 2 units
- Long term memory
  - Slower access: 100 ms
  - Slow (if any) decay (but can "choose to forget")
  - ~unlimited capacity

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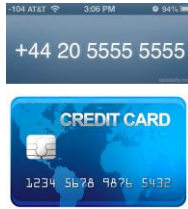
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### The human side – Memory, contd.

- Implications of memory limits
  - Display of numbers (e.g., phone or credit card #s)
  - Do not display > 7 in a row and expect the user to be easily able to make use of them
  - e.g., phone number: 18881234567 harder than 1-888-123-4567
  - e.g., AmEx card #: 347865279364861 harder than 3478 652793 64861 which is what is on the card



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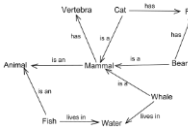
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### The human side – Long term memory

- Explicit memory
  - Episodic - serial memory of events
  - Semantic - structured data
  - Autobiographical – episodic pertaining to self
- Implicit (procedural) memory



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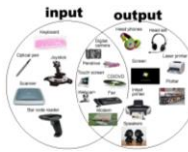
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### The computer side

- Input devices
  - Keyboard, mouse, lightpen, trackball (or other pointer)
  - Sound
  - Other (e.g., accelerometer)
  - Network
- Output devices
  - Screen
  - Sound
  - Network
- Memory
  - RAM
  - Storage (e.g., disk, CD. ...)



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### Multi-sensory systems



- Humans (in general) have 5 senses  
Sight, sound, touch, taste & smell
- Current computer interfaces can not reasonably use taste & smell  
Some smell-based “toys”
- Most common computer interfaces use sight & sound
- Some use touch  
e.g., “butt kicker” home theater speakers & Braille “display”

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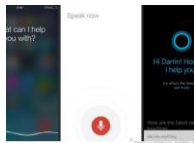
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### Multi-sensory systems, contd.



- Multi-sensory system - use two or more senses  
e.g., United Airlines reservations system (“touch or say your Mileage Plus number”)
- Speech recognition  
Much research over many years  
Getting good but still not as good as a person  
Google Voice transcribing voice mail as an example  
Siri  
*Are you a male or a female?  
They haven't given me a gender, sir*

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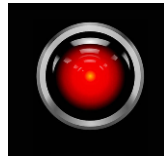
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### Multi-sensory systems, contd.



- Speech synthesis  
Both pure synthesis and pre recorded words  
Good enough for some applications  
e.g., telephone interaction, cockpit warning

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Usability and accessibility  
**Evolution**

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DEC PDP-4 (Late 1960s)



The image shows two parts of the DEC PDP-4 computer system. On the left is a close-up of the front panel, which features a large circular window and a control panel with several buttons and a small display. On the right is a black and white photograph of the computer in a room, showing its large size and the presence of several people sitting at desks, likely operating or maintaining the machine.

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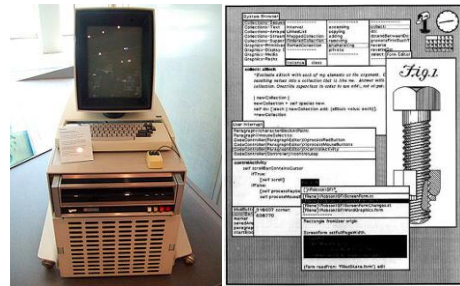
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Xerox Alto (Early 1970s)



The image shows the Xerox Alto computer system. On the left is a photograph of the physical machine, which is a desktop computer with a monitor, keyboard, and mouse. On the right is a screenshot of the graphical user interface (GUI) displayed on the monitor. The GUI includes a window with a list of files, a window with a diagram of a bolt labeled 'Fig. 1', and a window with a text document. The interface is designed to look like a real-world desktop environment.

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### Devices evolve at a rapid pace

- Far faster
- Far more memory
- Far more storage
- Editing easier but not faster than TECO



Text Editor and Corrector -  
"interpreted programming language targeted for text manipulation"

- Programs & complexity tend to expand to compensate for increased speed & memory availability

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### Interface types

- Format:
  - command line
  - menu-based
  - question/answer forms
- Device
  - WIMP ("windows, icon, menu, pointing device")
  - keyboard
  - pointing device (e.g., mouse, tablet, etc.)
  - voice (e.g., speech recognition)
  - position/motion sensors (e.g., where eyes are looking, Wii controller)



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### Interface types, contd.

- Command Line Interface (CLI) - e.g., Unix terminal
  - Easy for complex but frequent commands
  - Better for experts
- Menus - e.g., hotel check in systems
  - Only relevant options presented at each stage
  - Less expertise/training needed but can be slow



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### Interface types, contd.



- Question/answer, Wizards - e.g., tax preparation software
  - Lead user through complex environment
  - Can ensure all required information is obtained
  - Hard to discover special cases
- Forms - e.g., FedEx web site, spreadsheet, tax form
  - Familiar interface - just like paper form
  - Clear design important

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### Interface types, contd.



- WIMP - e.g., Alto, Mac, Windows ("windows, icon, menu, pointing device")
  - Can be intuitive, but only for some
  - Consistent & logical model important
    - common functions in different applications should work the same way (e.g., "print")
  - Very easy to make very bad interfaces
    - illogical control placement, confusing or busy layout

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### Graphical User Interface (GUI)



- General term for any non-command line interface
- Big push for GUIs for networking equipment
  - Management feels that GUIs are required
  - Most network operators use command line
- Shows usability conflict
  - GUI looks easier but takes too many steps
  - Command line requires more knowledge but is much faster
  - Tasks often easier to do in bulk or to automate with CLI than GUI

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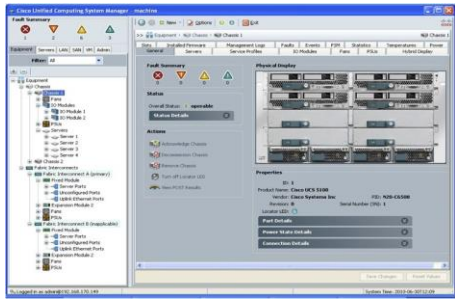
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### GUI, contd.



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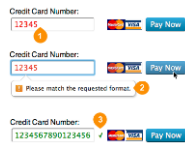
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### Common example of a poor interface



- E-commerce web sites
  - Ask for credit card # and phone # but do not permit spaces or other punctuation
    - e.g.: AmEx # 347865279364861 on card
    - as 3478 652793 64861
    - note: no string > 7 digits - meets short term memory limits
    - e.g.: card expiration date - on card as 11/09
    - Systems want you to pick a month (w/o number) by name from a pull down list

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### Poor interfaces



- All make it harder to verify you entered the right information
- Very easy programming to make it easier for the user & thus more reliable

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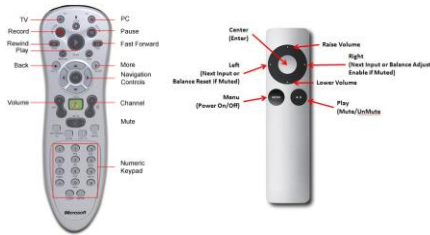
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### Interface complexity

- e.g., remotes for PC-based media centers



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### Interface flexibility

- e.g., Apple iPhone



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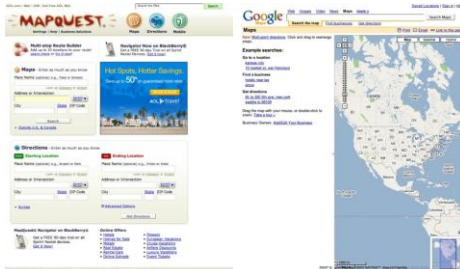
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### Interfaces, what it says about you?



From 1/1/2008 examples

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## Aesthetics

**SOBCO**  
web pages accessible on this server

- SOBCO Home page
- SOBCO Logo
- SOBCO Services
- SOBCO Contact
- SOBCO About Us
- SOBCO Privacy Policy
- SOBCO Terms of Service
- SOBCO Disclaimer
- SOBCO Copyright
- SOBCO Sitemap



**sobco.com**  
Focused on functional, with no "bells and whistle"

**apple.com (2013)**  
Balancing functional and high brand

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Usability and accessibility  
Usability and security

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Usability and security



Bruce "Tog" Tognazzini

- *“The goal of security is not to build systems that are theoretically securable, but to build systems that are actually secure.”* - Bruce Tognazzini
- Security, in general, makes things harder to use
- If a user does not follow the processes required to keep a system secure, the system will not be secure

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Usability and security, contd.



- Thus, security systems should be designed not to discourage use of the security system
- They should also be designed to fit into the operational models users have – **psychological acceptability**

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### Proper process must be clear to users



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### Example - Logging reminder

1	First Name	Last Name	SSN
2	Ben	Jones	XXX-XXX-3014
3	Mary	Smith	XXX-XXX-0149
4	Mary	Smith	XXX-XXX-4712
5	Tom	Rogers	XXX-XXX-8591
6	Bill	Allen	XXX-XXX-8776
7	Paul	Reynolds	XXX-XXX-1914
8	MaryEllen	Carter	XXX-XXX-5719
9	Sue	Pottin	XXX-XXX-0401

- Default screen about an individual contains public & non high-risk info e.g., name, photo, address, phone #, email address, organizational role, ...
- High-risk info not shown but some people may need the info
- Buttons shown for SSN, bank account #, etc.
- When clicked the info is shown along with a message  
Reminder: this access has been logged

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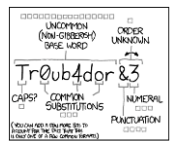
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### Example - Passwords



- Goals
  - Have users choose and use hard to guess passwords
  - Not make things easy for dishonest fellow employee
- Random passwords are hard to guess
  - Usability problem - must be written down
- Long passwords are harder to guess
  - Usability problem - type slowly to avoid errors

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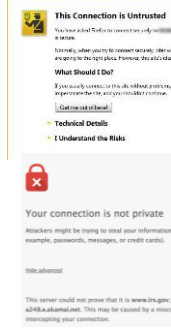
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## Security error messages



- **Most difficult user interface issue**

- **What do you tell a user about a security problem so that the user can make an intelligent decision on how to proceed?**

e.g., CA for a digital signature on a document is unknown:

1. Refuse to open document?
2. Say "CA is unknown, do you want to open anyway?"

What would your dad understand?

- **Much research, few solutions**

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Usability and accessibility  
Accessibility

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Accessibility



- Enable people with sensory limitations to use systems
  - e.g., sight limitations
  - e.g., hearing limitations
  - e.g., movement or movement control limitations
  - e.g., speaking limitations
- Americans with Disabilities Act of 1990
  - law lists 12 specific “places of public accommodation” that must accommodate handicapped
  - all are physical locations (e.g., restaurants, private schools, etc.)

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Target case



- National Federation of the Blind sued Target complaining that Target’s web site violates ADA
  - i.e., the web site is a “place of public accommodation” that must accommodate handicapped (i.e., blind users)
- Target asked that case be dismissed because the ADA only applied to the physical stores

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Target case, contd.



- California judge ruled that case could proceed  
*"the 'ordinary meaning' of the ADA's prohibition against discrimination in the enjoyment of goods, services, facilities or privileges, is that whatever goods or services the place provides, it cannot discriminate on the basis of disability in providing enjoyment of those goods and services."*
- Target settled & agreed to fix web site

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Netflix case



- National Association of the Deaf sued Netflix because not all movies have closed captions – June 2011  
Sued under ADA
- US District Court Judge refused to dismiss suit – June 2012
- Netflix and National Association of the Deaf reached consent decree – October 2012  
All content will be captioned by 2015

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eBay case



- Melissa Earll sued eBay because she, as a deaf person, could not complete the seller registration process  
Requires answering phone and recording a password  
Sued under ADA
- Case dismissed by U.S. District Judge December 2012
- Case being appealed

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### Amending the ADA



- U.S. Department of Justice (DoJ) updated ADA regulations – required as of March 15, 2012

*"The Department has consistently interpreted the ADA to cover Web sites that are operated by public accommodations and stated that such sites must provide their services in an accessible manner or provide an accessible alternative to the Web site that is available 24 hours a day, seven days a week."*

But did not include web-related regulations

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### Amending the ADA, contd.



- Proposed new regulations relating to private sector web site accessibility published July 2010

Was not yet published as of 2023

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### Assistive devices



- **Blind & visually impaired**  
Screen reader, screen magnification, text-to-speech, Braille displays
- **Deaf and hard of hearing**  
Speech recognition, captioning decoder
- **Mouse alternatives**  
Touch screen, eye movement tracker, head tracking, joystick, mouse keys, track ball, touch pad
- **Keyboard alternatives**  
Eye movement tracker, one hand keyboards, large keys, sticky keys, on-screen keyboards

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### Braille displays and keyboards



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### Eye movement tracking



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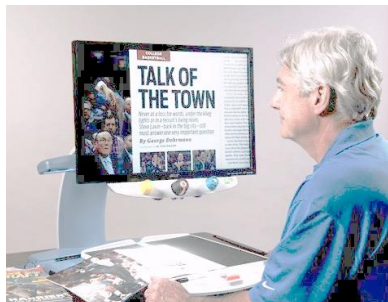
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### Screen magnification



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### W3C WCAG



- Web Content Accessibility Guidelines developed by W3C  
Version 1.0 published May 1999  
Version 2.0 published December 2008  
Adopted by ISO as ISO/IEC 40500:2012 October 2012
- Covers all types of content accessible through a browser (text, images, videos, etc.)

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### Basic goals of the guidelines



- Ensure that web pages are as clear as possible
- Ensure that assistive devices are not needed where possible
- Ensure that assistive devices can operate where needed
- Result should be a "comparable experience"
- By product - better accessibility from cell phones, etc.

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### W3C WCAG, contd.



- **WCAG 1.0** was organized around guidelines that have checkpoints, which are priority 1, 2, or 3. The basis for determining conformance to the WCAG 1.0 are the checkpoints.

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### W3C WCAG, contd.



- **WCAG 2.0** is organized around four design principles of Web accessibility. Each principle has guidelines, and each guideline has testable success criteria at level A, AA, or AAA . The basis for determining conformance to the WCAG 2.0 are the success criteria.

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### WCAG 2.0 guidelines



- **Perceivable**
  - 1.1 - Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, Braille, speech, symbols or simpler language.
  - 1.2 - Provide alternatives for time-based media.
  - 1.3 - Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
  - 1.4 - Make it easier for users to see and hear content including separating foreground from background.

Follow the **red line**,  
not the **green line**

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### WCAG 2.0 guidelines, contd.



- **Operable**
  - 2.1 - Make all functionality available from a keyboard.
  - 2.2 - Provide users enough time to read and use content.
  - 2.3 - Do not design content in a way that is known to cause seizures.
  - 2.4 - Provide ways to help users navigate, find content, and determine where they are.



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### WCAG 2.0 guidelines, contd.



- **Understandable**
  - 3.1 - Make text content readable and understandable.
  - 3.2 - Make Web pages appear and operate in predictable ways.
  - 3.3 - Help users avoid and correct mistakes.
- **Robust**
  - 4.1 - Maximize compatibility with current and future user agents, including assistive technologies.

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### Section 508



- Applies to government agencies that use electronic information - applies to Internet resources
  - Seen to apply to government contractors
- Uses WCAG 2.1 A and AA success criteria
  - See checklist: <https://webaim.org/standards/wcag/checklist>

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3, 4	Target logo
5	Netflix logo
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9	<a href="http://bpsintro2at-fall12.wikispaces.com/?responseToKen=b11f525f38d7c82eaaa0c1b4c048c26f">http://bpsintro2at-fall12.wikispaces.com/?responseToKen=b11f525f38d7c82eaaa0c1b4c048c26f</a>
10	<a href="http://vesaire.org/getem-gonullu-okuyuculari-bekliyor/">http://vesaire.org/getem-gonullu-okuyuculari-bekliyor/</a>
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13-16 <http://www.keepcalm-o-matic.co.uk/p/keep-calm-and-read-wcag/>

17-19 <https://lexum.com/en/blog/supporting-accessibility-wcag-20-level-aa-compatibility>

18 <http://contentinjection.com/club-lighting-guide/>

19 <http://nextlevelat.com/collections/jaws-screen-reader>

20

[http://www.dars.state.tx.us/accessibility/cbt/EIR\\_BasicTraining/6.html](http://www.dars.state.tx.us/accessibility/cbt/EIR_BasicTraining/6.html)

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Usability and accessibility  
Conclusion

CSCI E 45b: The Cyber World – part B

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Final thoughts



- User experience capabilities have enjoyed tremendous recognition and incredible growth in the past couple of decades
- Yet, usability and design seem to still need more attention to continue to make the experience of technology as natural and easy as it could be

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Final thoughts, contd.



- As technology continues to invade our physical environment, new models of experience and interfaces will emerge
- And hopefully, accessibility becomes part of the base standards for developing great technology experiences

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2 <http://glantz.net/blog/the-anatomy-of-a-graphic-designer>

3 <https://usable-iot.com/blog/?p=257>

3 <http://www.slideshare.net/MobileWish/rediscovering-accessibility-for-future-tech-everyone-is-affected>

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