

# The User Experience

Week 15

LBSC 671

Creating Information Infrastructures

# Tonight

- Information architecture
- Human-Computer Interaction (HCI)
- Viruses and other nasty things
- Open-source software

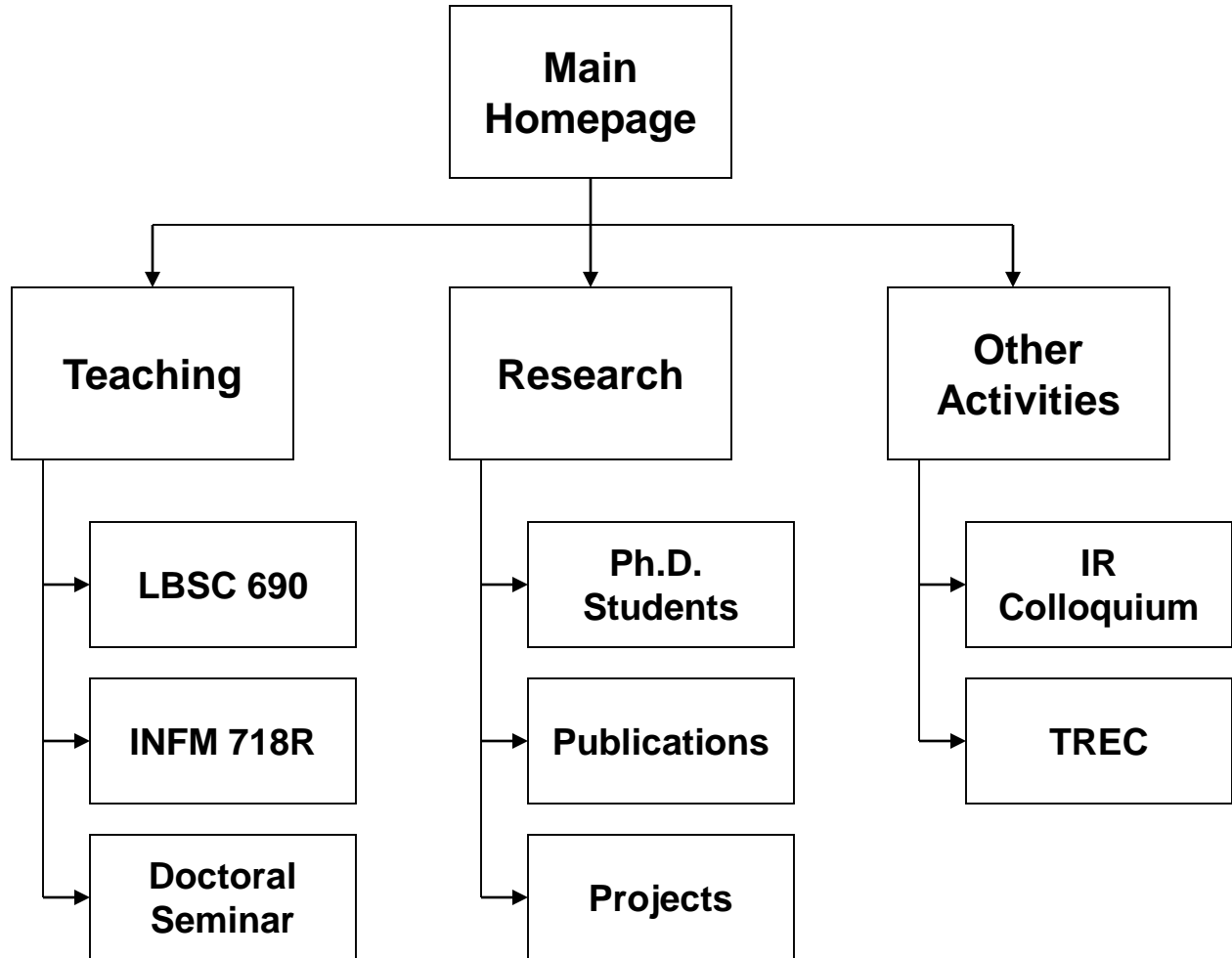
# Information Architecture

- The structural design of an “information space” to facilitate access to content
- Consists of at least two components:
  - Static design
  - Interaction design

# Static Design

- Organizing Principles
  - Logical: inherent structure
  - Functional: by task
  - Demographic: by user
- Take advantage of metaphors
  - Organizational: e.g., e-government
  - Physical: e.g., online grocery store
  - Functional: e.g., cut, paste, etc.
  - Visual: e.g., octagon for stop

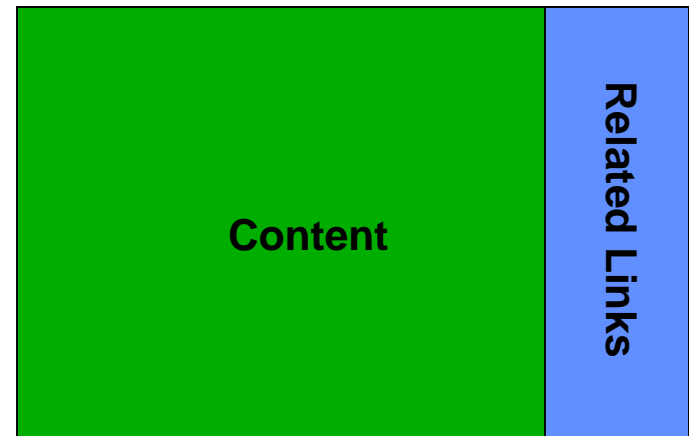
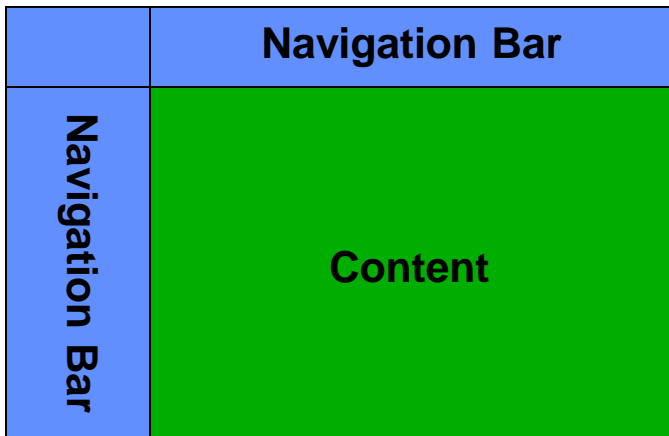
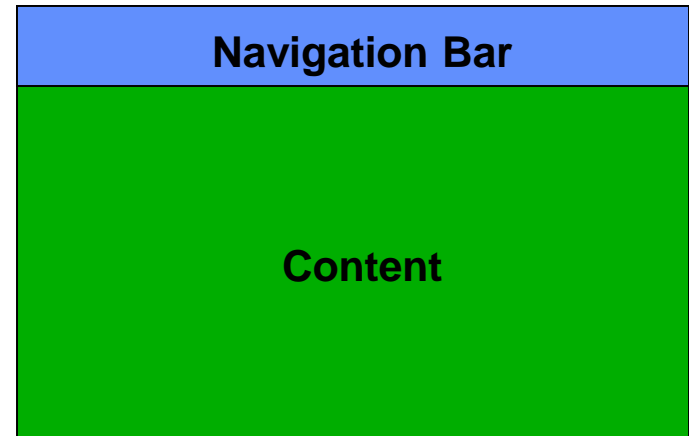
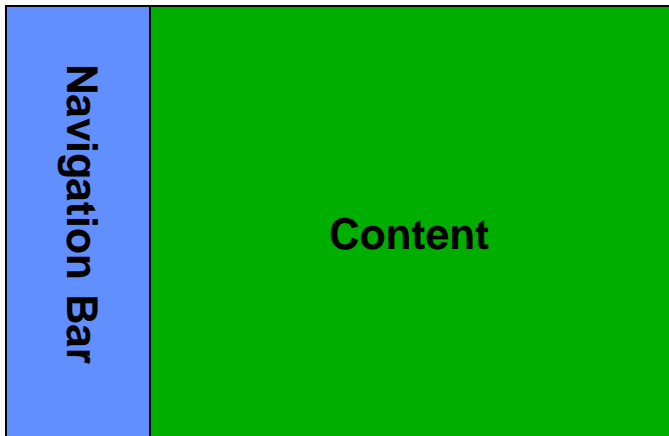
# “Site Blueprint”



# Some Layout Guidelines

- **Contrast**: make different things different
  - to bring out dominant elements
  - to create dynamism
- **Repetition**: reuse design throughout the interface
  - to create consistency
- **Alignment**: visually connect elements
  - to create flow
- **Proximity**: make effective use of spacing
  - to group related and separate unrelated elements

# Screen Design: Use Grids



# Grid Layout: NY Times

The screenshot shows the NY Times Business page in a Mozilla Firefox browser window. The browser title is "Ayn Rand's Literature of Capitalism - New York Times - Mozilla Firefox". The address bar shows the URL "http://www.nytimes.com/business/2007/09/15/07businesscolumn.html". The page features a navigation bar with "HOME PAGE", "MY TIMES", "TODAY'S PAPER", "VIDEO", "MOST POPULAR", and "TIMES TOPICS". The main header includes "The New York Times", "Business", and a search bar. Below the header is a secondary navigation bar with categories like "WORLD", "U.S.", "N.Y. / REGION", "BUSINESS", "TECHNOLOGY", "SCIENCE", "HEALTH", "SPORTS", "OPINION", "ARTS", "STYLE", "TRAVEL", "JOBS", "REAL ESTATE", and "AUTOS". A large advertisement for "SWAP YOUR RIDE" is displayed, featuring various Ford models. The main article is titled "Ayn Rand's Literature of Capitalism" by Harriet Rubin, published on September 15, 2007. The article text discusses the book "Atlas Shrugged" and its impact on business executives. To the right of the article is a sidebar with "More Articles in Business" and an "Afternoon Update" section. Below the article is a "MOST POPULAR - BUSINESS" list. The page also includes a "JUNO" advertisement and a "BASF" advertisement. The browser status bar at the bottom shows "Done".

**Ayn Rand's Literature of Capitalism**  
By HARRIET RUBIN  
Published: September 15, 2007

One of the most influential business books ever written is a 1,200-page novel published 50 years ago, on Oct. 12, 1957. It is still drawing readers; it ranks 388th on [Amazon.com's](#) best-seller list. ("Winning," by [John F. Welch Jr.](#), at a breezy 384 pages, is No. 1,431.)

The book is "Atlas Shrugged," Ayn Rand's glorification of the right of individuals to live entirely for their own interest.

For years, Rand's message was attacked by intellectuals whom her circle labeled "do-gooders," who argued that individuals should also work in the service of others. Her book was dismissed as an homage to greed. [Gore Vidal](#) described its philosophy as "nearly perfect in its immorality."

But the book attracted a coterie of fans, some of them top corporate executives, who dared not speak of its impact except in private. When they read the book, often as college students, they now say, it gave form and substance to their inchoate thoughts, showing there is no conflict between private ambition and public benefit.

"I know from talking to a lot of Fortune 500 C.E.O.'s that 'Atlas Shrugged' has had a significant effect on their business decisions, even if they don't agree with all of Ayn Rand's ideas," said John A. Allison, the chief executive of BB&T, one of the largest banks in the United States.

**More Articles in Business »**

**Afternoon Update**  
Sign up for a recap of the day's top stories and business headlines, sent weekday afternoons. [See Sample](#)  
[abc@defc.com](#) [Sign Up](#)  
[Change E-mail Address](#) | [Privacy Policy](#)

**MOST POPULAR - BUSINESS**  
E-MAILED | BLOGGED

1. Age of Riches: Hedge Funds and Private Equity Alter Career Calculus
2. Ayn Rand's Literature of Capitalism
3. Japanese Housewives Sweat in Secret as Markets Reel
4. A 'Disappointed' Greenspan Lashes Out at Bush's Economic Policies
5. Tell-All PCs and Phones Transforming Divorce
6. Spending: This Glass Is for the Cabernet, That One the Pinot Noir
7. At 25, 'McPaper' is All Grown Up



# Grid Layout: NY Times

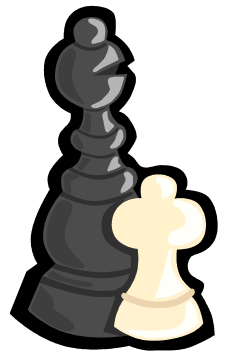
The screenshot shows a browser window displaying the NY Times website. The page is divided into several sections:

- Navigation:** Located at the top, it includes the NY Times logo, a search bar, and a menu with categories like Business, All NYT, Arts, Style, Travel, Jobs, Real Estate, and Autos.
- Banner Ad:** A large advertisement for Ford's "Swap Your Ride" challenge, featuring images of cars and the text "HEAR WHAT PEOPLE LIKE YOU HAD TO SAY AFTER DRIVING A FORD FOR ONE WEEK."
- Content:** The main article is titled "Ayn Rand's Literature of Capitalism" by Harnett Rubin, published on September 15, 2007. The article discusses the book "Atlas Shrugged" and its impact on business and society. A sidebar on the right offers options like E-mail, Print, Single Page, Reprints, Save, and Share.
- Another Ad:** A smaller advertisement for BASF, featuring the text "With BASF innovations in agriculture, get ready to pull up to the future." and "FIND OUT HOW.".
- Popular Articles:** A section titled "MOST POPULAR - BUSINESS" with a list of articles, including "Age of Riches: Hedge Funds and Private Equity Alter Career Calculus" and "Ayn Rand's Literature of Capitalism".

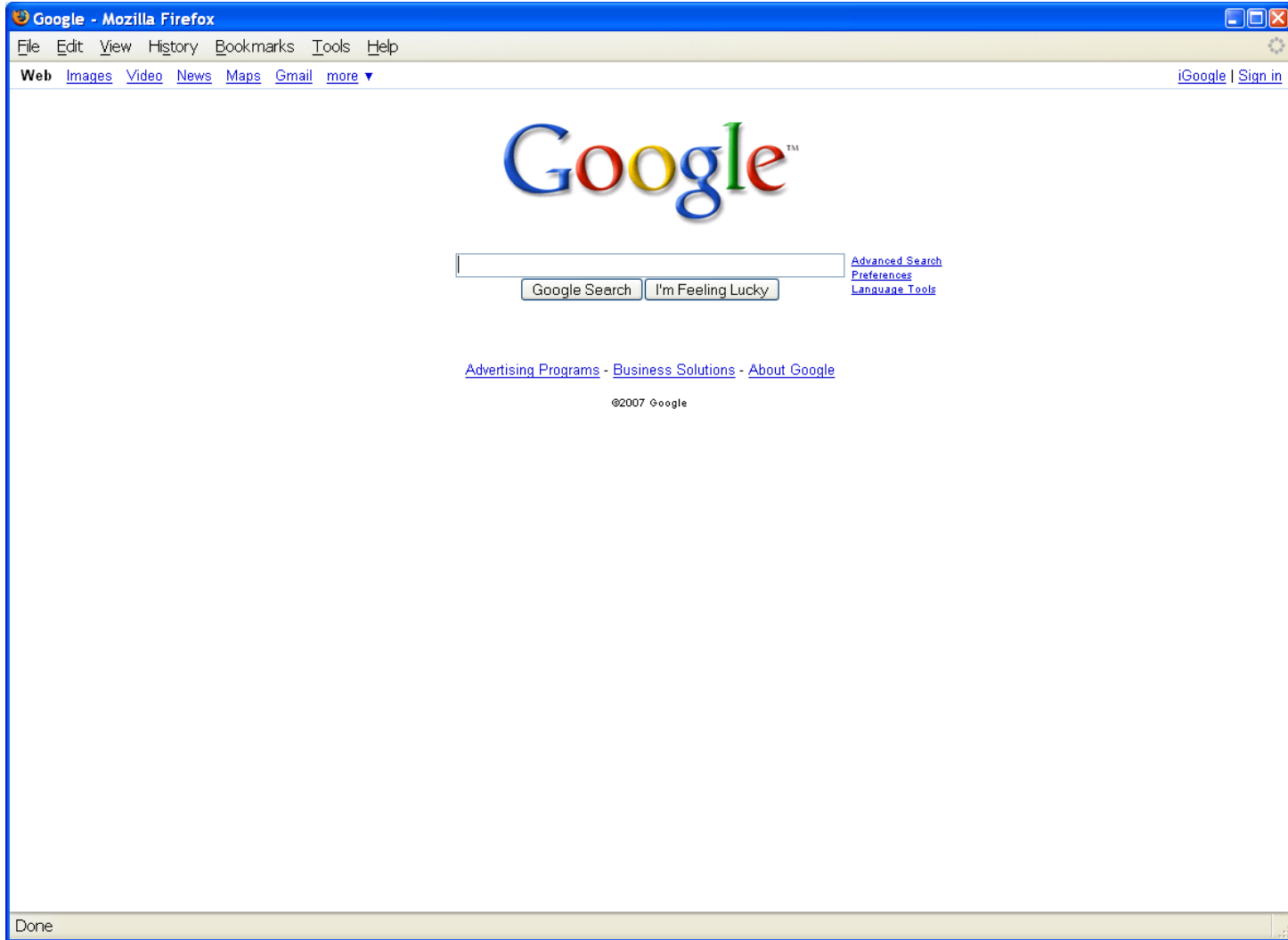
# Interaction Design

- Chess analogy: a few simple rules that disguise an infinitely complex game
- The three-part structure
  - Openings: many strategies, lots of books about this
  - End game: well-defined, well-understood
  - Middle game: nebulous, hard to describe
- Information navigation has a similar structure!
  - Middle game is underserved

From Hearst, Smalley, & Chandler (CHI 2006)



# Opening Moves



# Opening Moves

Yahoo! - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Browse the Web - quickly and safely with Yahoo! Toolbar [Get It Now](#)

**YAHOO!** Web Images Video Local Shopping more

Search:  **Web Search**

My Yahoo! My Mail Page Options

**Answers**

- Autos
- Finance
- Games
- Groups
- HotJobs
- Maps
- Mobile Web
- Movies
- Music
- Personals
- Real Estate
- Shopping
- Sports
- Tech
- Travel
- TV
- Yellow Pages

**Bix** NEW!

**More Yahoo! Services**

**Small Business**

- Get a Web Site
- Domain Names
- Sell Online
- Search Ads

**Featured Services**

- Downloads
- Health

**Featured** Entertainment Sports Video NEW

Sep 17, 2007

**Seven easy dinners**

Get a no-hassle meal on the table with these simple menus for every day of the week. [» See recipes](#)

- Salad recipes
- Quick recipes
- Web sites for quick & easy dinners

Seven quick dinner menus for the week

How to boost your wealth in minutes

Column: Pats' win was a big disappointment

Bill Maher grills Democratic candidates

[» More Featured](#)

**In the News** World Local Finance

As of 5:08 p.m. EDT

- Iraq expels security firm Blackwater USA | Shooting incidents
- New AG nominee played key role in response to 9/11 | Reactions
- D.C. mayor urges Senate to grant city full voting rights in House
- Chavez threatens to take over private schools in Venezuela
- Sales of new hybrid cars rises 49 percent in U.S. | Green cars
- Study suggests percentage of left-handed people increasing
- Fantasy novel writer Robert Jordan dies at 58

[» More: News](#) | [Election '08: Candidate Mashup](#)

Markets: **Dow: -0.3%** **Nasdaq: -0.8%** Sponsored by: **Scottrade**

Stock Quotes:  **Go**

**Marketplace**

**GEICO** Auto Insurance- How much could you save? Get a free auto insurance quote.

Don't let credit-report errors ruin your credit score. Check your report

Check your mail status: [Sign In](#) Free mail: [Sign Up](#)

[Mail](#) [Messenger](#) [Radio](#)

[Weather](#) [Local](#) [Horoscopes](#)

**SO YOU ALWAYS EARN TRIPLE REWARDS.**



**CHASE**

[chase.com/freedom](#) - Ad Feedback

**Be a Better Car Shopper**

Check Out The New 2008 Models

Honda Pontiac Mitsubishi Ford Mazda

**Pulse - What Yahoos Are Into**

**Popular Candid Celeb Photos**



- Dedicated Fashionistas
- J. Lo Struts Her Stuff
- Brangelina's Vacation
- Halle's Baby Bump
- Keeping It Under Wraps

Done

# Middle Game




Search Amazon.com tiger

**Category**  
**Any Category**  
Books (124,039)  
Sports & Outdoors (31,206)  
Home & Garden (15,975)  
Toys & Games (10,716)  
Apparel (7,925)  
Everything Else (7,221)  
Jewelry & Watches (3,608)  
Automotive (1,126)  
Music (917)

**"tiger"**  
**Did you mean tigger?**  
**Related Searches:** [leopard](#), [tiger woods](#).

Showing Top Results

1.  **Apple Mac OS X Tiger 10.4.6 (Mac DVD)**  
Buy new: ~~\$129.00~~ **\$119.99**  
In Stock

# Middle Game

The screenshot shows an eBay search results page for 'autograph Tom Brady'. The browser window title is 'autograph Tom Brady, Autographs-Original, Autographs-Reprints Items on eBay.com - Mozilla Firefox'. The page header includes the eBay logo, navigation links (Home, Buy, Search Results for 'autograph Tom Brady'), and search filters (All Items, Auctions, Buy It Now). The search bar contains 'autograph Tom Brady' and 'All Categories'. Below the search bar, there are options to search title and description, and related searches: 'tom brady auto', 'tom brady', 'reggie bush auto', 'tom brady sp', and 'tom brady contenders'. The main content area shows '31 items found for: autograph Tom Brady' with a 'Save this search' link. The results are displayed in a list view, with a 'Compare' button and 'Item Title' column. The first item is '2007 TOPPS TX TOM BRADY AUTOGRAPH & GAME J...', and the second is 'TOM BRADY 8X10 PHOTO AUTOGRAPH AUTO COA GAI CERTIFIED BY THE BEST IN THE BUSINESS !!!'. A 'Narrow Your Results' sidebar on the left lists categories like 'Sports Mem, Cards & Fan Shop (31)', 'Autographs-Original (13)', and 'Autographs-Reprints (11)'. Related guides include 'Sports Collectibles', 'Graded Sports Cards', and 'Sports Autographs'.

Home > Buy > Search Results for 'autograph Tom Brady'

All Items Auctions Buy It Now

autograph Tom Brady All Categories Search Advanced

Search title and description

Related Searches: **tom brady** auto, **tom brady**, reggie bush auto, **tom brady** sp, **tom brady** contenders

**Narrow Your Results**

Sports Mem, Cards & Fan Shop (31)

- Autographs-Original (13)
- Autographs-Reprints (11)
- Cards (5)
- more ...


**Related Guides**


- Sports Collectibles
- Graded Sports Cards
- Sports Autographs

31 items found for: autograph Tom Brady (Save this search)

List View | Picture Gallery

Compare Item Title

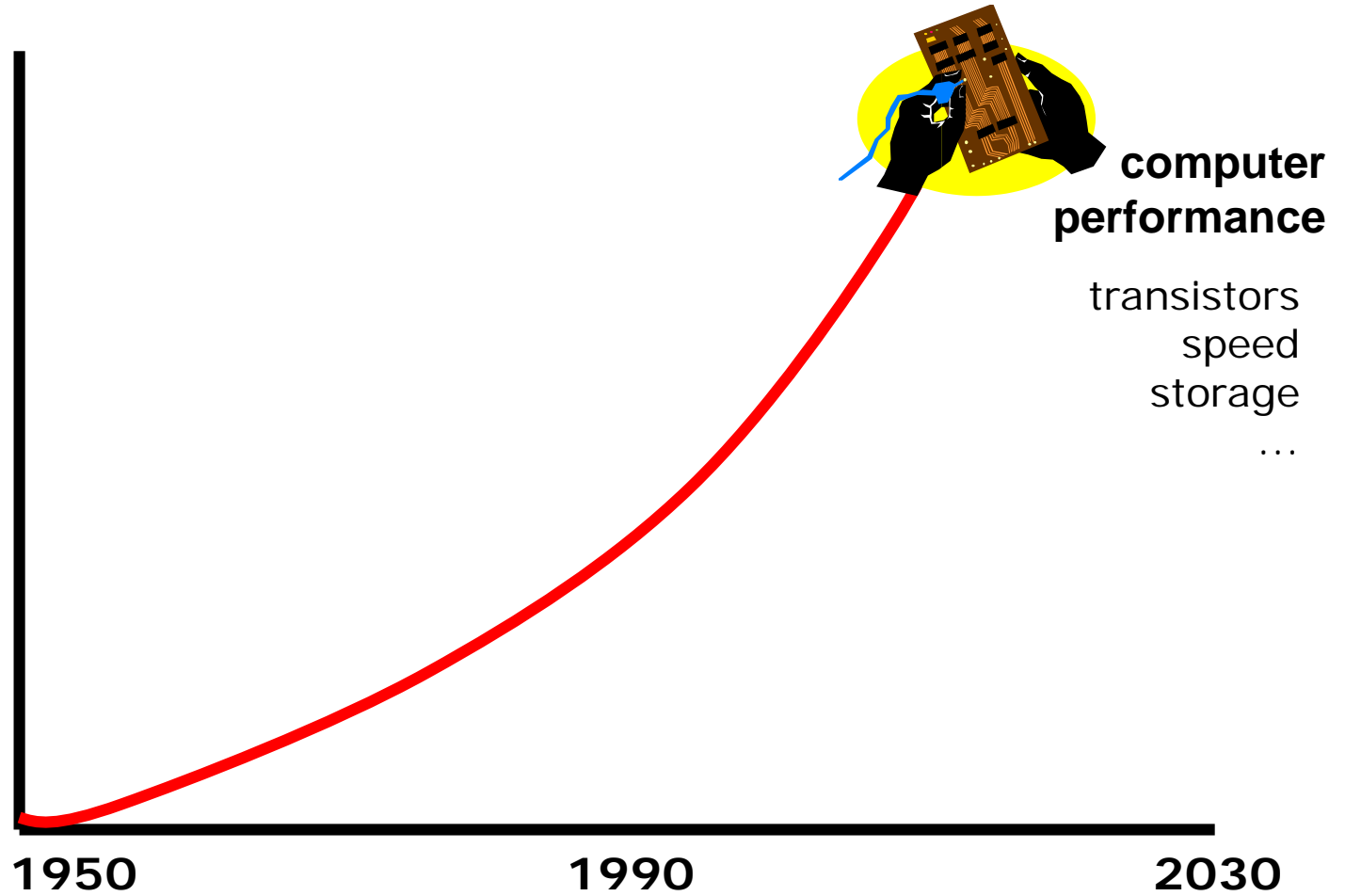
 2007 TOPPS TX TOM BRADY AUTOGRAPH & GAME JERSEY CARD  
Brady's regular card #3 in the set is included

 TOM BRADY 8X10 PHOTO AUTOGRAPH AUTO COA GAI CERTIFIED BY THE BEST IN THE BUSINESS !!!

# Navigation Patterns

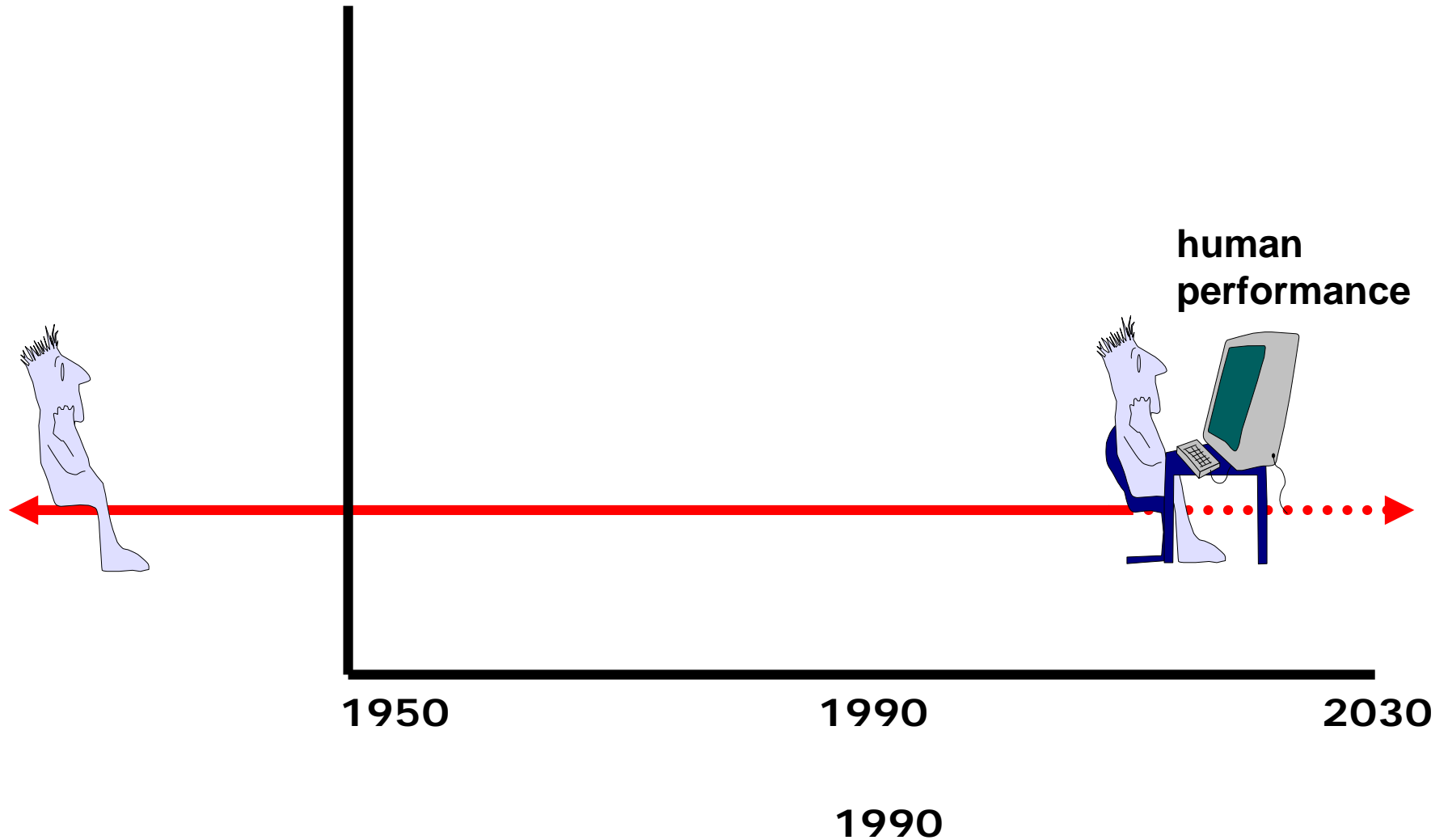
- Drive to content
- Drive to advertisement
- Move up a level
- Move to next in sequence
- Jump to related

# Moore's Law



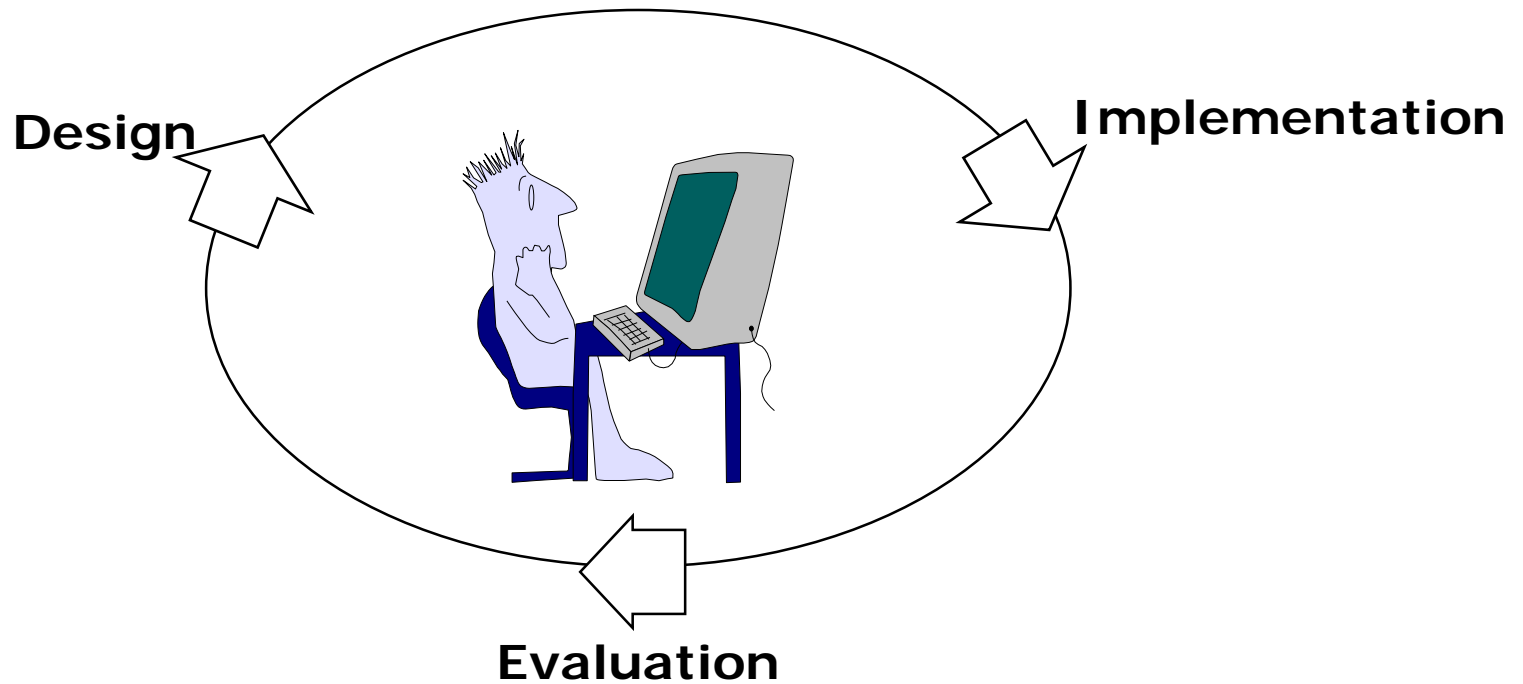


# Human Cognition



# Human Computer Interaction

- A discipline concerned with the



of interactive computing systems for human use

# What are Humans Good At?

- Sense low level stimuli
- Recognize patterns
- Reason inductively
- Communicate with multiple channels
- Apply multiple strategies
- Adapt to changes or unexpected events

# What are Computers Good At?

- Sense stimuli outside human's range
- Calculate quickly and accurately
- Store large quantities and recall accurately
- Respond rapidly and consistently
- Perform repetitive actions reliably
- Work under heavy load for an extended period

# Synergy

- Humans do what they are good at
- Computers do what they are good at
- Strengths of one cover weakness of the other

# Types of Applications

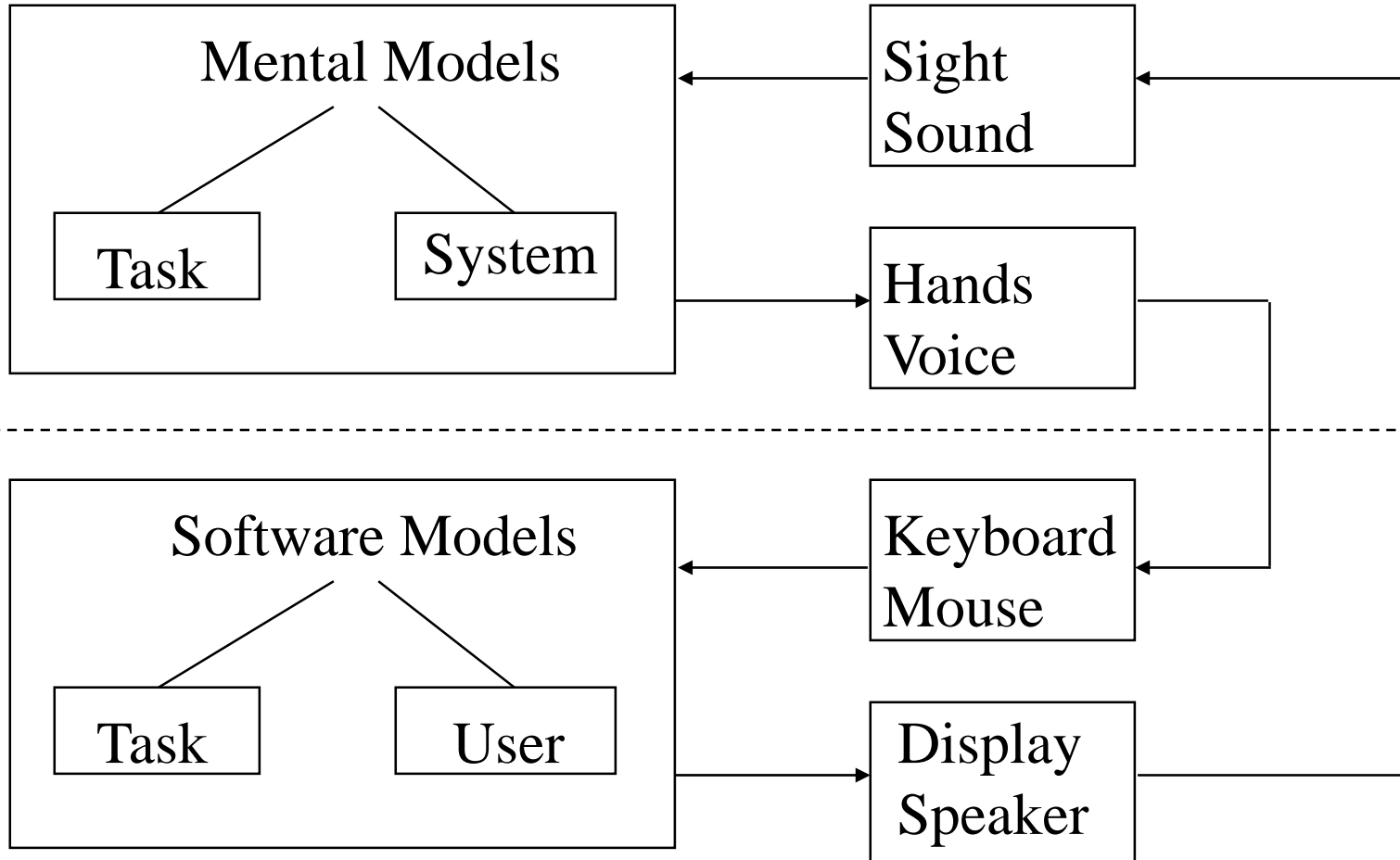
- Life critical
  - Low error rate first and foremost
  - Justifies an enormous design and testing effort
- Custom Commercial
  - Speed and error rate
- Office and Home
  - Easy learning, high user satisfaction, low cost
- Creative
  - User needs assessment is very challenging

# User Characteristics

- Physical
  - Anthropomorphic (height, left handed, etc.)
  - Age (mobility, dexterity, etc.)
- Cognitive
- Perceptual
  - Sight, hearing, etc.
- Personality
  - Including cultural factors

# Modeling Interaction

Human



Computer



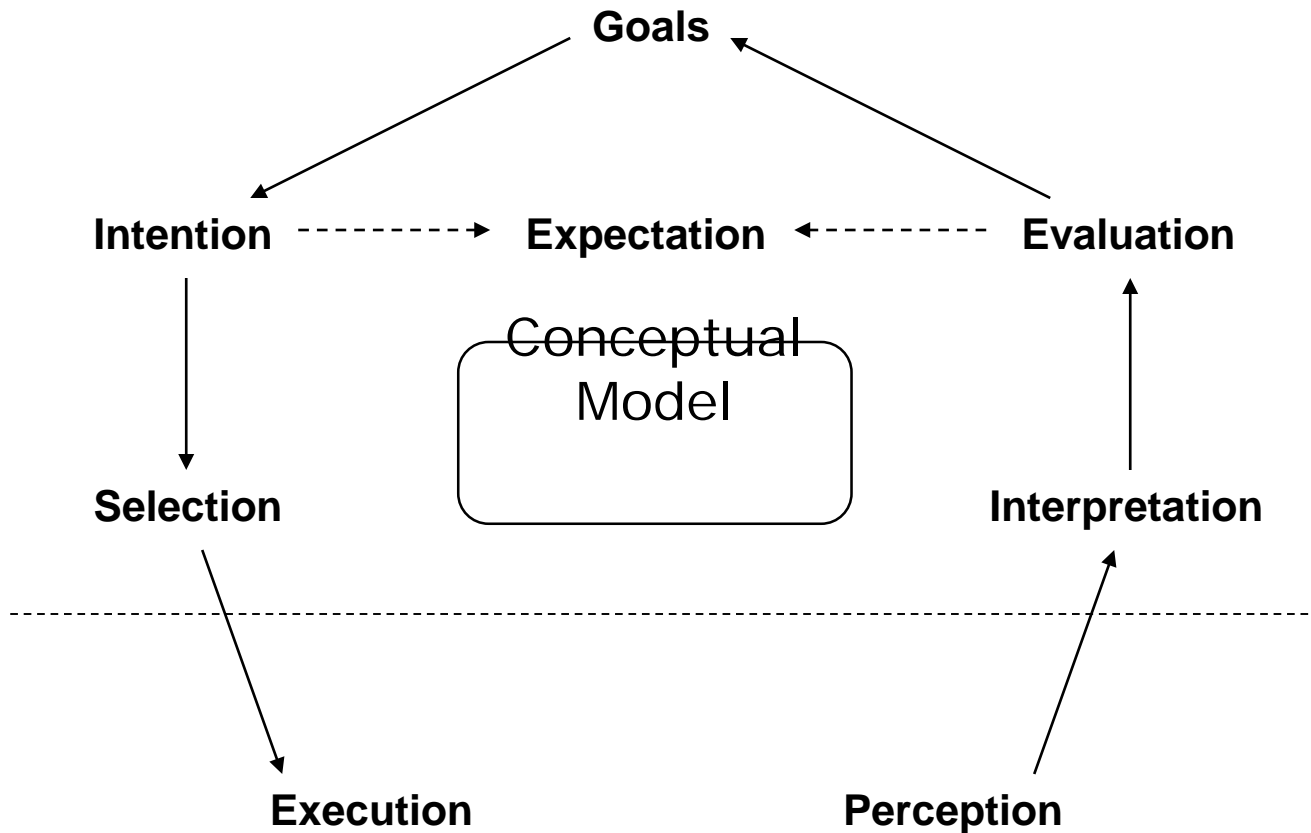
# Discussion Point: Mental Models

- As a user, what do you need to know about a machine in order to interact with it effectively?

# Mental Models

- How the user thinks the machine works
  - What actions can be taken?
  - What results are expected from an action?
  - How should system output be interpreted?
- Mental models exist at many levels
  - Hardware, operating system, and network
  - Application programs
  - Information resources

# Stages of Interaction



# The GOMS Perspective

- Goals
  - What the user is trying to achieve
- Operators
  - What capabilities the system provides
- Methods
  - How those capabilities can be used
- Selection strategies
  - Which method to choose in a specific case

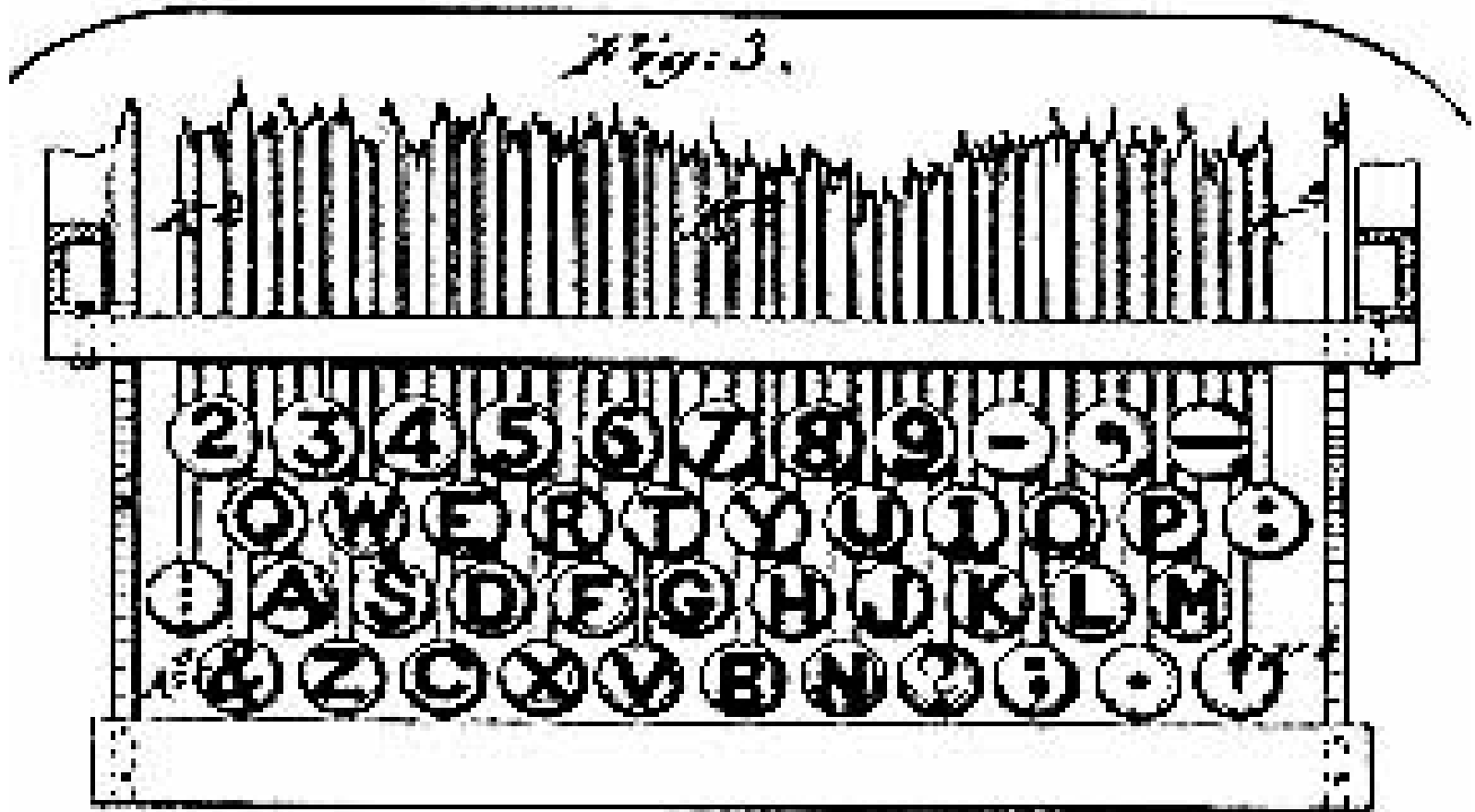
# Input Devices

- Text
  - Keyboard, optical character recognition
  - Speech recognition, handwriting recognition
- Direct manipulation
  - 2-D: mouse, trackball, touch pad, touch panel
  - 3-D: wand, data glove
- Remote sensing
  - Camera, speaker ID, head tracker, eye tracker

# Keyboard

- Produces character codes
  - ASCII: American English
  - Latin-1: European languages
  - UNICODE: (nearly) Any language
    - Pictographic languages need “entry methods”
- Keyboard shortcuts help with data entry
  - Different conventions for standard tasks abound
- “VT-100 standard” functions are common
  - Differing layouts can inhibit usability

# Design Example: QWERTY Keyboard



From <http://home.earthlink.net/~dcrehr/whyqwerty.html>

# Dvorak Keyboard



Dvorak Keyboard Layout

From <http://www.mwbrooks.com/dvorak/>

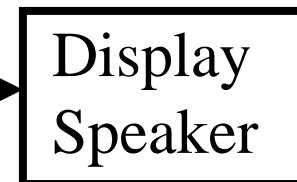
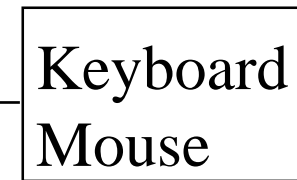
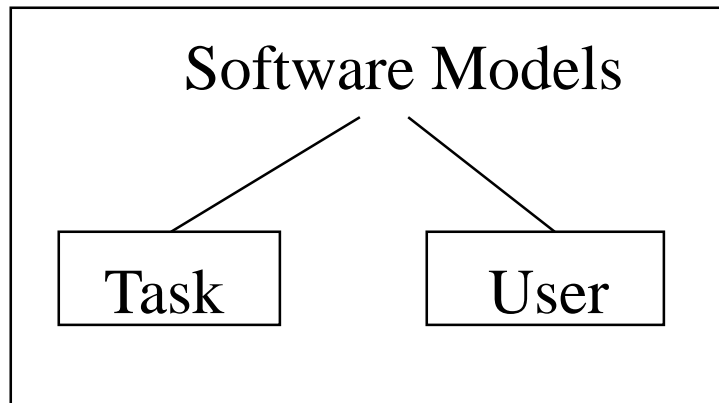
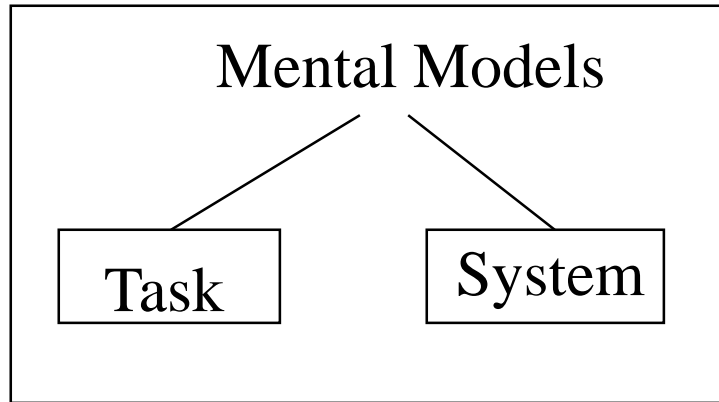


# 2-D Direct Manipulation

- Match control actions with on-screen behavior
  - Use a cursor for visual feedback if needed
- Rotary devices
  - Mouse, trackball
- Linear devices
  - Touch pad, touch screen, iPod shuttle, joystick
- Rate devices
  - Laptop eraserhead

# Modeling Interaction

Human



Computer

# Human Senses

- Visual
  - Position/motion, color/contrast, symbols
- Auditory
  - Position/motion, tones/volume, speech
- Haptic
  - Mechanical, thermal, electrical, kinesthetic
- Olfactory
  - Smell, taste
- Vestibular

# Computer Output

- Image display
  - Fixed view, movable view, projection
- Acoustic display
  - Headphones, speakers, within-ear monitors
- Tactile display
  - vibrotactile, pneumatic, piezoelectric
- Force feedback
  - dexterous handmaster, joystick, pen

# Computer Output

- Inertial Display
  - Motion-based simulators
- Olfactory Display
  - Chemical (requires resupply)
- Locomotive display
  - Stationary bicycle, treadmill, ... (trip hazards)
- Temperature Display

# Four Stages of Interaction

- Forming an **intention**
  - “What we want to happen”
  - Internal mental characterization of a goal
  - May comprise sub-goals (but rarely well planned)
  - For example, “write e-mail to grandma”
- **Selection** of an action
  - Review possible actions and select most appropriate
  - For example, “use Outlook to compose e-mail”

# Four Stages of Interaction

- **Execution** of the action
  - Carry out the action using the computer
  - For example, “double-click Outlook icon”
- **Evaluation** of the outcome
  - Compare results with expectations
  - Requires perception, interpretation, and incremental evaluation
  - For example, “did Outlook open?”

# Interaction Styles

- Graphical User Interfaces (GUI)
  - Direct manipulation (2D, 3D)
  - Menus
- Language-based interfaces
  - Command line interfaces
  - Interactive voice response systems
- Virtual Reality (VR)
  - Direct manipulation
- Ubiquitous computing



# WIMP Interfaces

- Windows
  - Spatial context
- Icons
  - Direct manipulation
- Menus
  - Hierarchy
- Pointing devices
  - Spatial interaction

# GUI Components

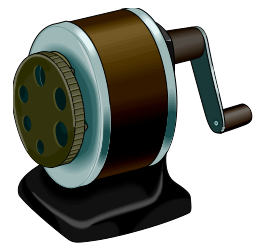
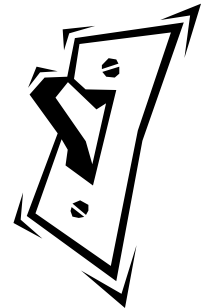
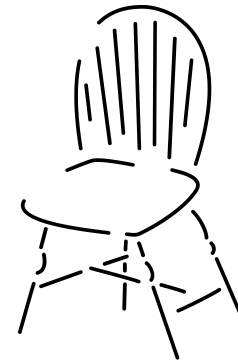
- Windows (and panels)
  - Resize, drag, iconify, scroll, destroy
- Selectors
  - Menu bars, pulldown lists
- Buttons
  - Labeled buttons, radio buttons, checkboxes
- Icons (images)
  - Select, open, drag, group

# Direct Manipulation

- Select a metaphor
  - Desktop, CD player, map, ...
- Use icons to represent conceptual objects
  - Watch out for cultural differences
- Manipulate those objects with feedback
  - Select (left/right/double click), move (drag/drop)

# Visual Affordance

- The perceived and actual fundamental properties of the object that determine how it could be used
  - Appearance indicates how the object should be used
    - Chair for sitting
    - Table for placing things on
    - Knobs for turning
    - Slots for inserting things into
    - Buttons for pushing
- Complex things may need explaining but simple things should not
  - When simple things need instructions, design has failed



# Visible Constraints: Date Entry

The image shows a software interface with two windows. The 'Form1' window has a 'Date:' label and a text input field. Below it are two smaller input fields labeled 'Month' and 'Day'. The 'Appointment' dialog box is open, showing tabs for 'General', 'Attendees', 'Notes', and 'Planner'. The 'When' section has 'Start' and 'End' fields with time and date pickers. A calendar for May 1997 is overlaid on the date field, showing dates from 27 to 31. The 14th and 22nd are highlighted. The 'Description' field contains 'Smart Technology Sen'. The 'Where' field is empty.

**Form1**

Date:

Month Day

Month Day

Month Day

**Appointment**

General Attendees Notes Planner

When

Start: 8 : 30 AM Wed 5 /14 /97  All day

End: 4 : 30 PM Wed 5 /14 /97

Description:  
Smart Technology Sen

Where:

May 1997

S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

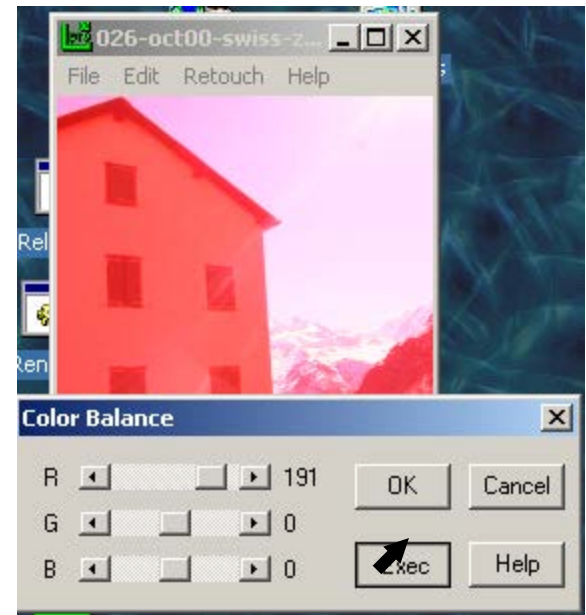
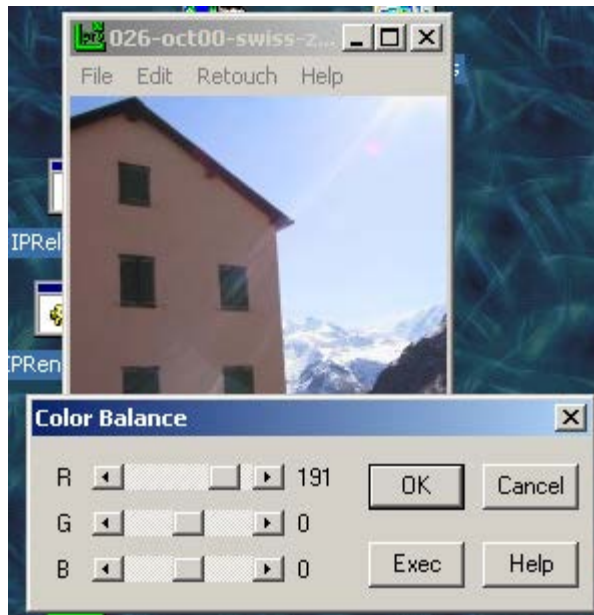
# Causality

- The thing that happens right after an action is assumed by people to be caused by that action
  - “Feedback”
- False causality
  - Incorrect effect
    - Invoking unfamiliar function just as computer hangs
    - Causes “superstitious” behaviors
  - Invisible effect
    - Command with no apparent result often re-entered repeatedly
      - For example, mouse click to raise menu on unresponsive system

# Causality: An Example

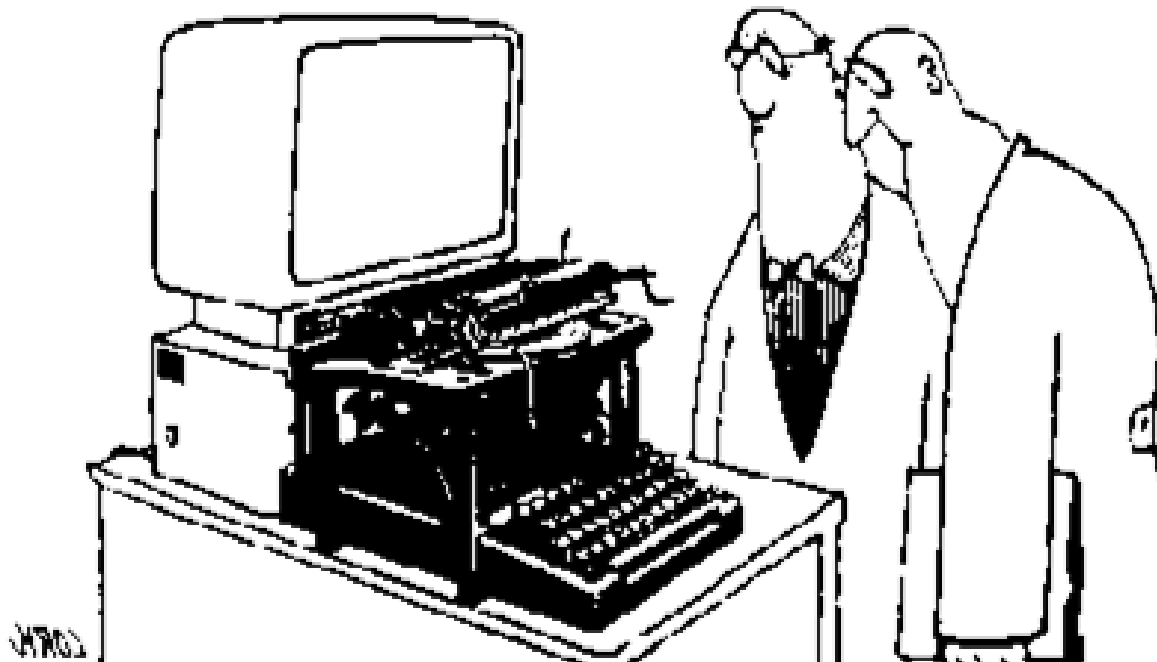
Effects visible only after Exec button is pressed

- Ok does nothing!
- Awkward to find appropriate color level



# Transfer Effects

- People transfer expectations from similar objects
  - Positive: prior learning applies to new situation
  - Negative: prior learning conflicts with new situation





# Positive and Negative Transfer

“First we thought the PC was a calculator. Then we found out how to turn numbers into letters with ASCII — and we thought it was a typewriter. Then we discovered graphics, and we thought it was a television. With the World Wide Web, we've realized it's a brochure.” — Douglas Adams

Caller: Hello, is this Tech Support?"

**Tech:** Yes, it is. How may I help you?

Caller: The cup holder on my PC is broken and I am within my warranty period. How do I go about getting that fixed?

**Tech:** I'm sorry, but did you say a cup holder?

Caller: Yes, it's attached to the front of my computer.

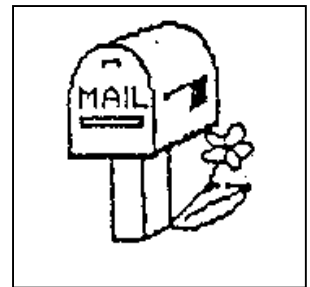
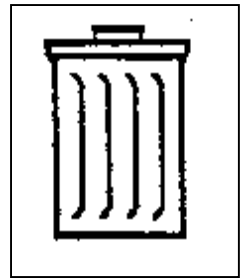
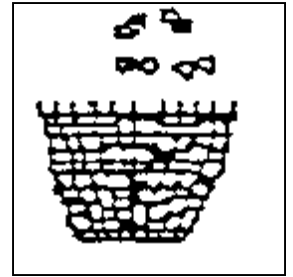
**Tech:** Please excuse me if I seem a bit stumped, it's because I am. Did you receive this as part of a promotional, at a trade show? How did you get this cup holder? Does it have any trademark on it?

Caller: It came with my computer, I don't know anything about a promotional. It just has '4X' on it.

At this point the Tech Rep had to mute the call, because he couldn't stand it. The caller had been using the load drawer of the CD-ROM drive as a cup holder, and snapped it off the drive.

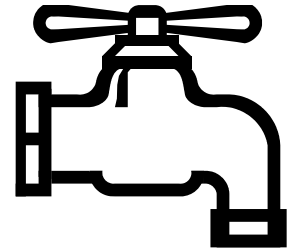
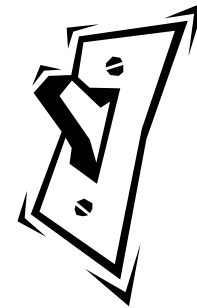
# Cultural Associations

- Because a trashcan in Thailand may look like this:
- A Thai user is likely to be confused by this image popular in Apple interfaces:
- Sun found their email icon problematic for some American urban dwellers who are unfamiliar with rural mail boxes.



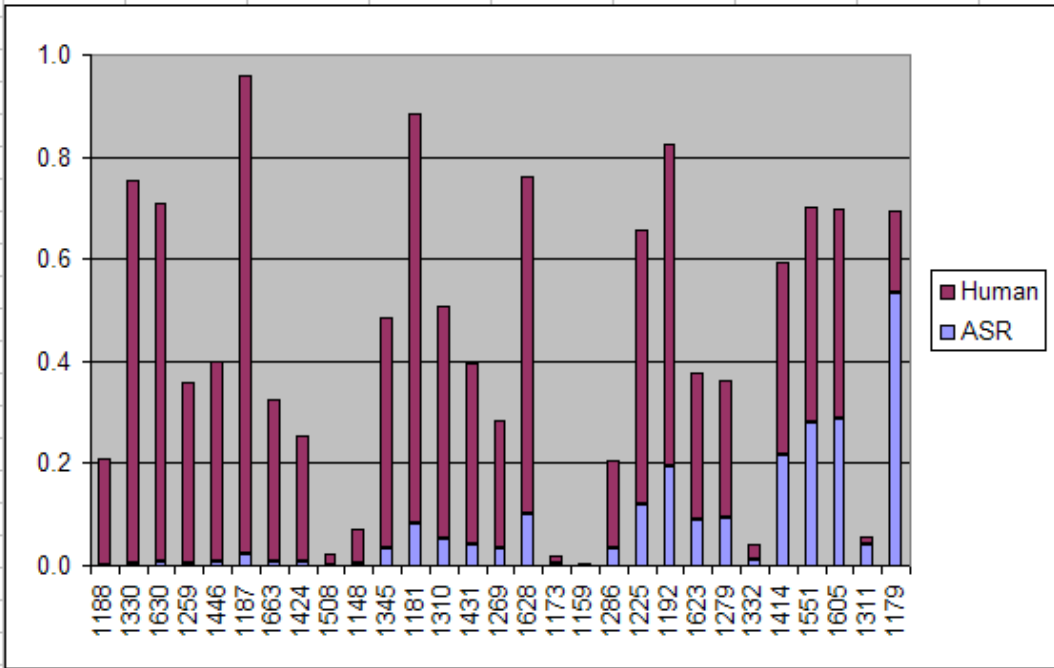
# Population Stereotypes/Idioms

- People learn “idioms” that work in a certain way
  - Red means danger
  - Green means safe
- Idioms vary in different cultures
  - Light switches
    - America: down is off
    - Britain: down is on
  - Faucets
    - America: counter-clockwise on
    - Britain: counter-clockwise off



# Spreadsheets: Direct Manipulation

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Relevant	Topic	ASR	Human	Human total	% Human									
2	12	1188	0.0001	0.2104	0.2105	0%									
3	17	1330	0.0029	0.7492	0.7521	0%									
4	12	1630	0.0056	0.7041	0.7097	1%									
5	46	1259	0.0048	0.354	0.3588	1%									
6	22	1446	0.0062	0.3928	0.399	2%									
7	15	1187	0.0221	0.9375	0.9596	2%									
8	79	1663	0.0077	0.318	0.3257	2%									
9	25	1424	0.0073	0.248	0.2553	3%									
10	49	1508	0.0008	0.0202	0.021	4%									
11	5	1148	0.0032	0.0694	0.0726	4%									
12	10	1345	0.0337	0.4506	0.4843	7%									
13	68	1181	0.0816	0.8026	0.8842	9%									
14	43	1310	0.0533	0.456	0.5093	10%									
15	23	14312	0.0428	0.3534	0.3962	11%									
16	185	1269	0.0347	0.2478	0.2825	12%									
17	10	1628	0.1003	0.6609	0.7612	13%									
18	7	1173	0.0023	0.0148	0.0171	13%									
19	46	1159	0.0006	0.0037	0.0043	14%									
20	33	1286	0.0325	0.1737	0.2062	16%									
21	61	1225	0.1189	0.538	0.6569	18%									
22	40	1192	0.1932	0.6325	0.8257	23%									
23	139	1623	0.0911	0.2852	0.3763	24%									
24	14	1279	0.0944	0.2665	0.3609	26%									
25	13	1332	0.0114	0.031	0.0424	27%									
26	28	1414	0.2159	0.3767	0.5926	36%									
27	610	1551	0.281	0.4189	0.6999	40%									
28	43	1605	0.2884	0.4108	0.6992	41%									
29	41	1311	0.0399	0.0164	0.0563	71%									
30	28	1179	0.535	0.1593	0.6943	77%									
31	<b>Average</b>		<b>0.079714</b>	<b>0.355255172</b>	<b>0.434968966</b>	<b>0.176015</b>									



# Menus

- Conserve screen space by hiding functions
  - Menu bar, pop-up
- Can hierarchically structured
  - By application's logic
  - By convention (e.g., where is the print function?)
- Tradeoff between breadth and depth
  - Too deep  $\Rightarrow$  can become hard to find things
  - Too broad  $\Rightarrow$  becomes direct manipulation

# Dynamic Queries

- What to do when menus become too deep
  - Merges keyboard and direct manipulation
- Select menu items by typing part of a word
  - After each letter, update the menu
  - Once the word is displayed, user can click on it
- Example: Windows help index

# Language-Based Interfaces

- Command Entry
  - Compact and flexible
  - Powerful in the hands of expert users
  - Difficult for novices to learn
- Natural Language
  - Intuitive and expressive
  - Ambiguity makes reliable interpretation difficult

# “Seamless Interfaces”

- Informative feedback
- Easy reversal
- User in control
  - Anticipatable outcomes
  - Explainable results
  - Browsible content
- Limited working memory load
  - Query context
  - Path suspension
- Alternatives for novices and experts
  - Scaffolding



# Evaluation Measures

- Time to learn
- Speed of performance
- Error rate
- Retention over time
- Subjective satisfaction

# Evaluation Approaches

- Extrinsic vs. intrinsic
- Formative vs. summative
- Human subjects vs. simulated users
- Deductive vs. abductive

# Evaluation Examples

- Direct observation
  - Evaluator observes users interacting with system
    - in lab: user asked to complete pre-determined tasks
    - in field: user goes through normal duties
  - Validity depends on how contrived the situation is
- Think-aloud
  - Users speak their thoughts while doing the task
  - May alter the way users do the task
- Controlled user studies
  - Users interact with system variants
  - Correlate performance with system characteristics
  - Control for confounding variables

# Summary

- HCI design starts with user needs + abilities
  - Users have a wide range of both
- Users must understand their tools
  - And these tools can learn about their user!
- Many techniques are available
  - Direct manipulation, languages, menus, etc.
  - Choosing the right technique is important

# Denial of Service Attacks

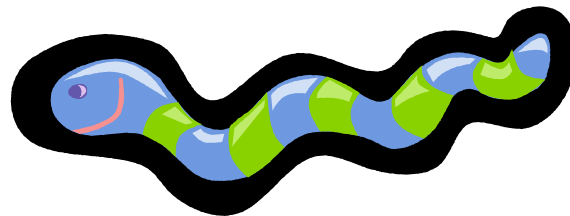
- Viruses
  - Platform dependent
  - Typically binary
- Flooding
  - Worms
  - Zombies
  - Chain letters

# Viruses

- 1988: Less than 10 known viruses
- 1990: New virus found every day
- 1993: 10-30 new viruses per week
- 1999: 45,000 viruses and variants

# Worms

- Self-reproducing program that sends itself across a network
  - Virus is dependent upon the transfer of files
  - Worm spreads itself
- SQL slammer worm (January 25, 2003) claimed 75,000 victims within 10 minutes



# Viruses

- Computer programs able to attach to files
- Replicates repeatedly
  - Typically without user knowledge or permission
- Sometimes performs malicious acts







*"On the Internet, nobody knows you're a dog."*

# Authentication

- Used to establish identity
- Two types
  - Physical (Keys, badges, cardkeys, thumbprints)
  - Electronic (Passwords, digital signatures)
- Protected with social structures
  - Report lost keys
  - Don't tell anyone your password
- Use SSH to defeat password sniffers

# Good Passwords

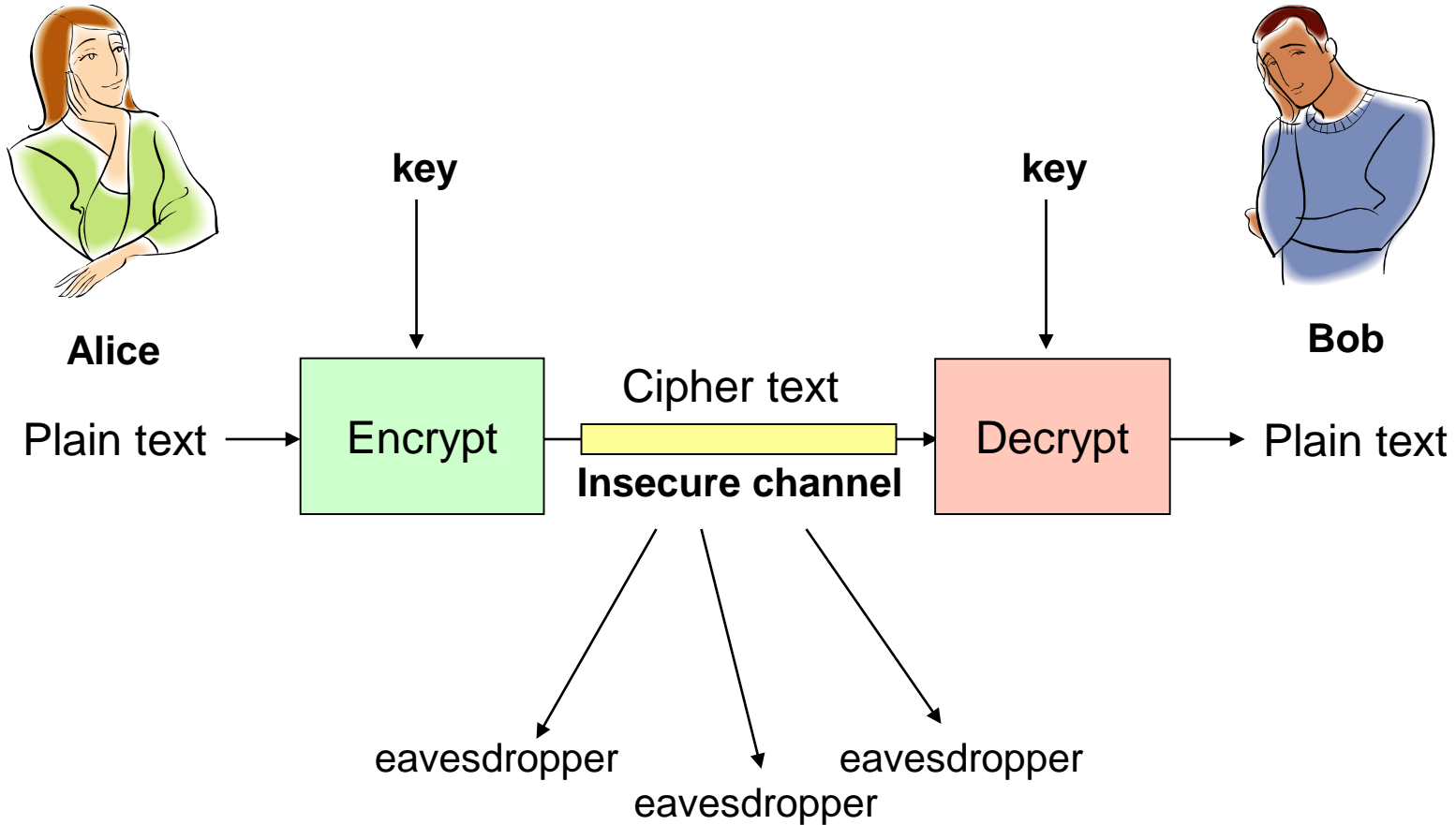
- Long enough not to be guessed
  - Programs can try every combination of 5 letters
- Not in the dictionary
  - Programs can try every word in a dictionary
  - every proper name, pair of words, date, every ...
- Mix upper case, lower case, numbers
- Change it often
- Reuse creates risks
  - Abuse, multiple compromise

# Authentication Attacks

- Guessing
- Brute force
- Impersonation
- “Phishing”
- Theft

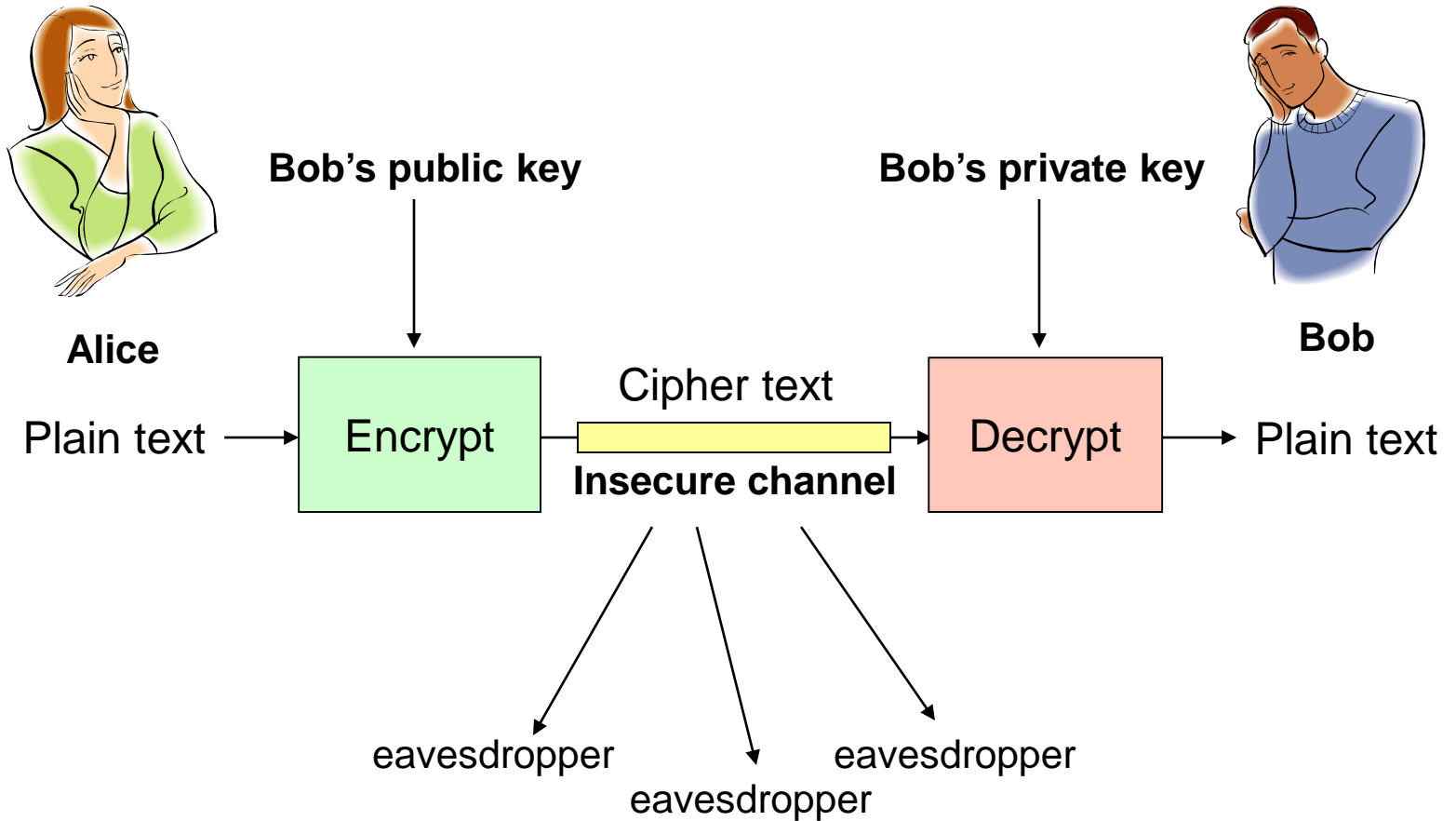
# Symmetric Key Encryption

Same key used both for encryption and decryption



# Asymmetric Key Encryption

Different keys used for encryption and decryption

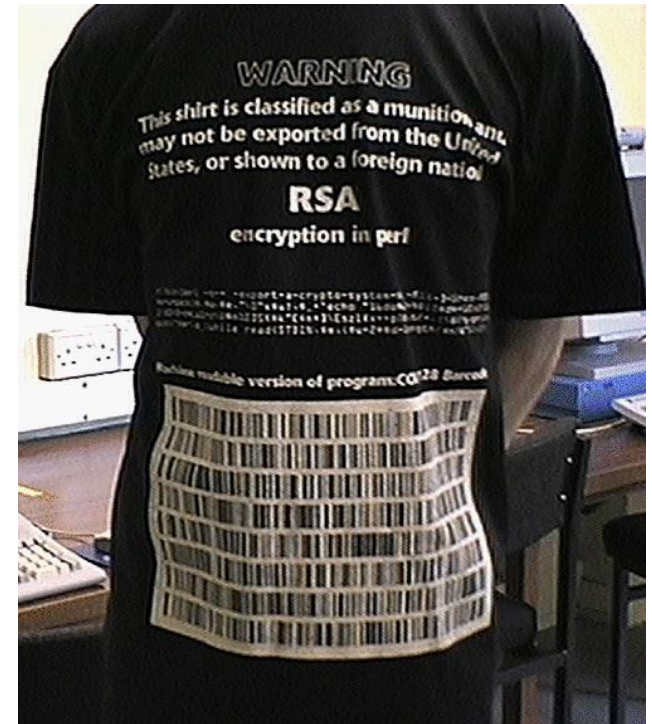


# Asymmetric Key Encryption

- Key = a large number ( $> 1024$  bits)
  - Public key: known by all authorized encoders
  - Private key: known only by decoder
- One-way mathematical functions
  - “Trapdoor functions”
    - Like mixing paint (easy to do, hard to undo)
  - Large numbers are easy to multiply, hard to factor
- Importance of longer keys
  - Keys  $< 256$  bits can be cracked in a few hours
  - Keys  $> 1024$  bits presently effectively unbreakable

# RSA “Public Key” Encryption

Until 1997 –  
Illegal to show  
this slide to  
non-US  
citizens!



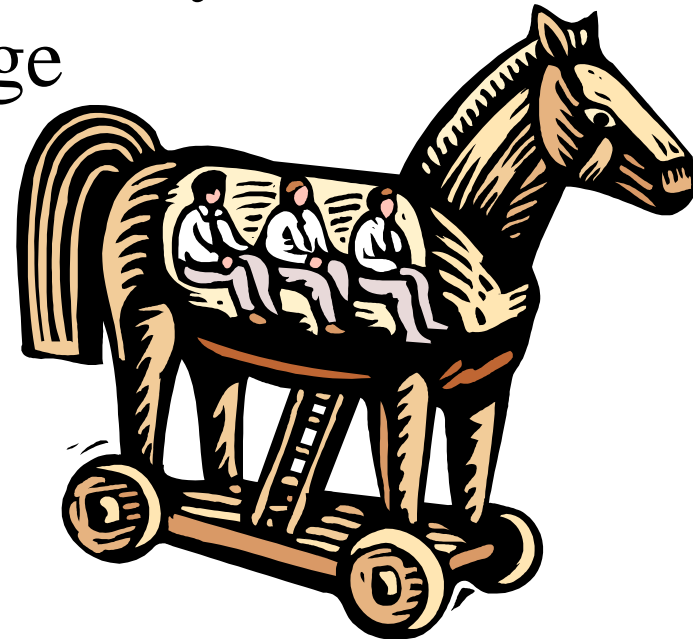
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sp  
'ec  
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> ) ] }  
2 / d 0  
1 M 1 N



# Trojan Horse

- Malicious program with undesired capabilities
  - Log key strokes and sends them somewhere
  - Create a “back door” administrator logon
- Spyware: reports information about your activity without your knowledge
- Doesn't (necessarily) replicate



# Real-Time Local Surveillance

- Built-in features of standard software
  - Browser history, outgoing email folders, etc.
- “Parental control” logging software
  - ChatNANNY, Cyber Snoop, FamilyCAM, ...
- Personal firewall software
  - ZoneAlarm, BlackIce, ...

# Real-Time Centralized Surveillance

- Proxy server
  - Set up a Web server and enable proxy function
  - Configure all browsers to use the proxy server
  - Store and analyze Web server log files
- Firewall
  - Can monitor all applications, not just the Web

# Forensic Examination

- Scan for files in obscure locations
  - Find-by-content for text, ACDSee for pictures, ...
- Examine “deleted” disk files
  - Norton DiskDoctor, ...
- Decode encrypted files
  - Possible for many older schemes

# Integrity

- How do you know what's there is correct?
  - Attribution is invalid if the contents can change
- Access control would be one solution
- Encryption offers an alternative

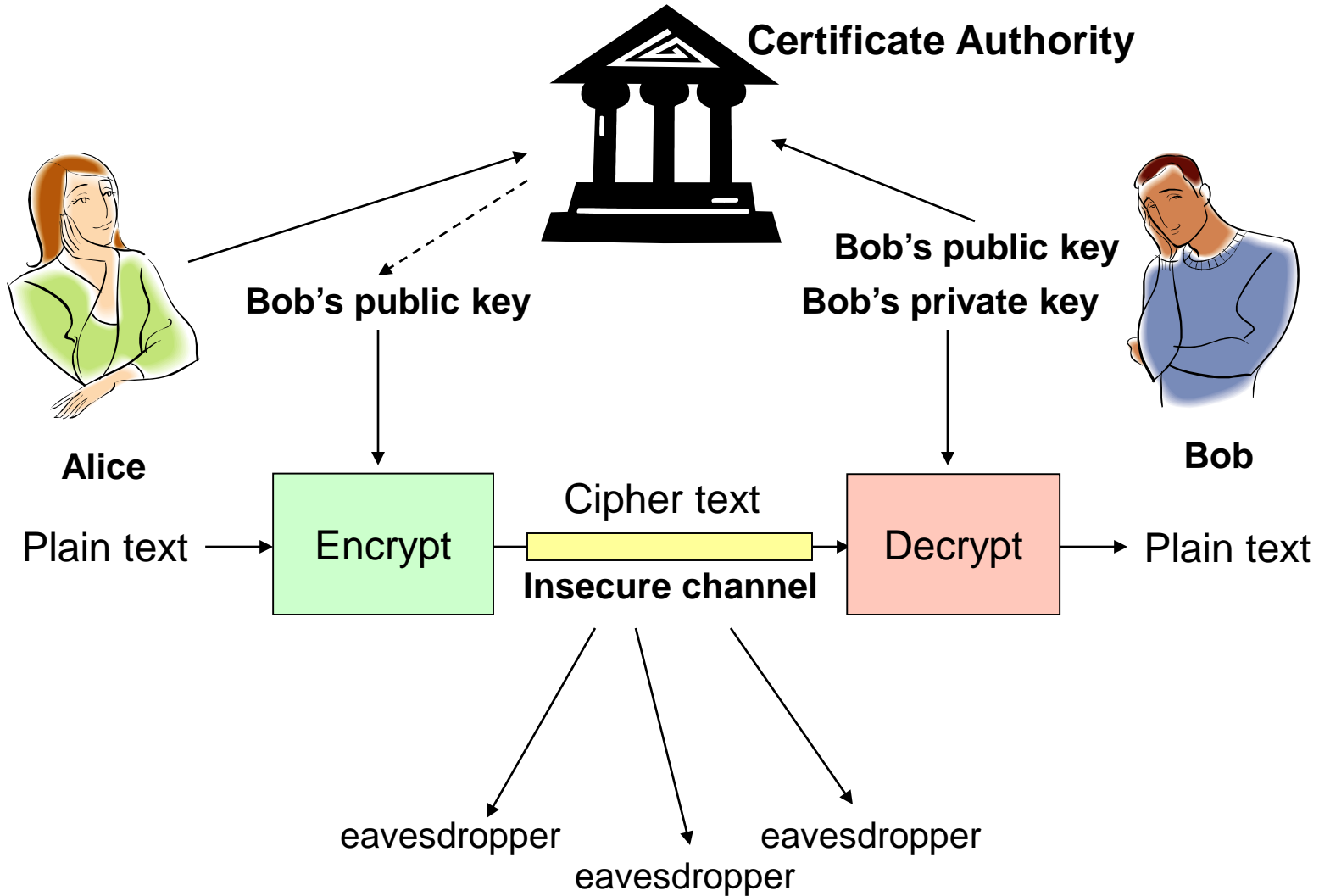
# Digital Signatures

- Alice “signs” (encrypts) with her private key
  - Bob checks (decrypts) with her public key
- Bob knows it was from Alice
  - Since only Alice knows Alice’s private key
- Non-repudiation: Alice can’t deny signing message
  - Except by claiming her private key was stolen!
- Integrity: Bob can’t change message
  - Doesn’t know Alice’s Private Key

# Key Management

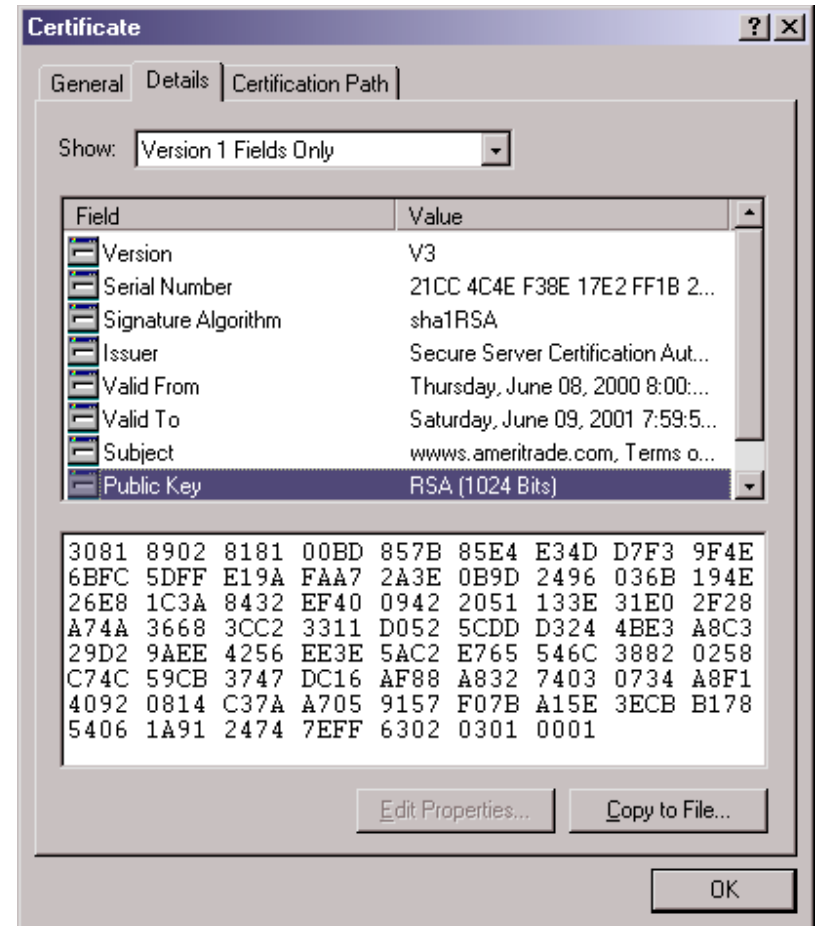
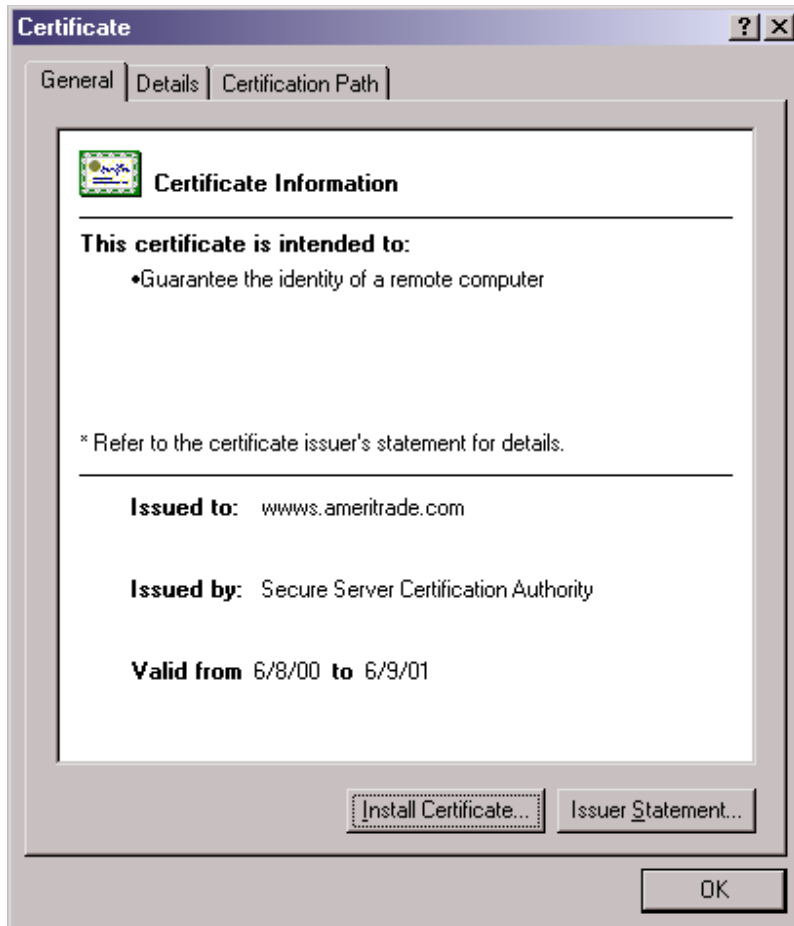
- Public announcement of public key
  - e.g., append public key to the end of each email
  - But I can forge the announcement
- Establish a trusted “certificate authority”
  - Leverage “web of trust” to authenticate authority
  - Register public key with certificate authority

# Certificate Authority





# Certificates: Example



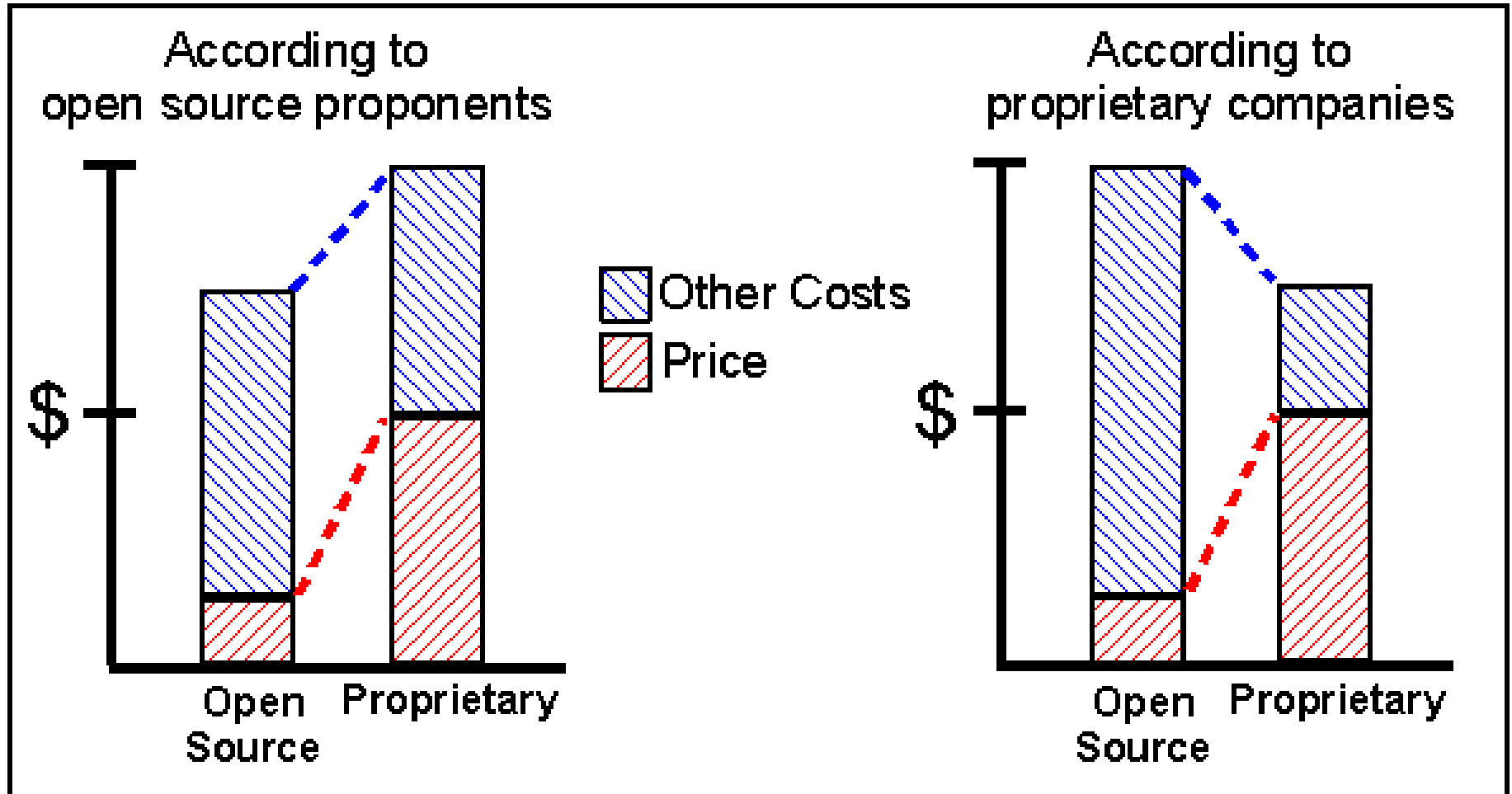
# Practical Tips

- Keep anti-virus software current
- Keep software “patches” current
- Change default settings
- Be wary of anything free

# Total Cost of Ownership

- Planning
- Installation
  - Facilities, hardware, software, integration, migration, disruption
- Training
  - System staff, operations staff, end users
- Operations
  - System staff, support contracts, outages, recovery, ...

# Total Cost of Ownership



# Some Examples

	<b>Proprietary</b>	<b>Open Source</b>
Operating system	Windows XP	Linux
Office suite	Microsoft Office	OpenOffice
Image editor	Photoshop	GIMP
Web browser	Internet Explorer	Mozilla
Web server	IIS	Apache
Database	Oracle	MySQL

# Open Source “Pros”

- More eyes  $\Rightarrow$  fewer bugs
- Iterative releases  $\Rightarrow$  rapid bug fixes
- Rich community  $\Rightarrow$  more ideas
  - Coders, testers, debuggers, users
- Distributed by developers  $\Rightarrow$  truth in advertising
- Open data formats  $\Rightarrow$  Easier integration
- Standardized licenses

# Open Source “Cons”

- Communities require incentives
  - Much open source development is underwritten
- Developers are calling the shots
  - Can result in feature explosion
- Proliferation of “orphans”
- Diffused accountability
  - Who would you sue?
- Fragmentation
  - “Forking” may lead to competing versions
- Little control over schedule

# Open Source Business Models

- **Support Sellers**

**Sell distribution, branding, and after-sale services.**

- **Loss Leader**

**Give away the software to make a market for proprietary software.**

- **Widget Frosting**

**If you're in the hardware business, giving away software doesn't hurt.**

- **Accessorizing**

**Sell accessories:**

**books, compatible hardware, complete systems with pre-installed software**



# Iron Rule of Project Management

- You can control any two of:
  - Capability
  - Cost
  - Schedule
- Open source software takes this to an extreme

# Estimating Completion Time

- Rules of thumb
  - 1/3 specification
  - 1/6 coding
  - 1/2 test planning, testing, and fixing!
- Add time for coding to learn as you go, but don't take time away from the other parts!
  - Reread the section on “gutless estimating” if you are tempted