Utah School of
Computing

Preliminaries

CS5540 HCI
by
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Fall 2005

What is the HCI Issue?

- Is the interface the concern?
- Is the issue a matter of accomplishing work, some set of tasks?
- Are we focusing on wrong thing?
- We don't discuss telephone interfaces often.

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"Doing Work" View - 2

- Need to understand the user and human behavior
- How does an architect approach a custom home design for a new client?

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What good interface principles do we already know? - 1

- Interesting, pleasing, attractive, inviting
- Effective to use
- Intuitive: Alan Kay's children
- Organized, hierarchically structured, clean

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What good interface principles do we already know? - 2

- Help functions, Search, etc
- Consistent form (aka design integrity)
- Automatic assistance
  - Completions
  - Spelling

What good interface principles do we already know? - 3

- Lead the user
  - Prompts
  - Indicate nature of any problem
  - Specific communication
- Navigational aids: systems often huge

What good interface principles do we already know? - 4

- Meaningful error msgs
  - Don't send you elsewhere
  - Give useful number
  - Area of inadequate traditions
- Multiple paths to a function
- Keep it simple

What good interface principles do we already know? - 5

- Gain user's trust
- Bottom up is probably most acceptable
- Simple tasks should be simple
- WYSIWYG – easy to get started
  - Piano v violin

Our history hurts us…- 1

- Developed some poor communications habits
- Natural language is terribly ambiguous
- Resources were scare
- Other priorities, historically

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Our history hurts us… - 2

- Error Messages
  - Early computing: "Compiler error"
  - Even now: Sys Error EM732851
  - Error from wrong module: Latex
- Small road signs
- Confusing directions
  - 400 S HOV Interchange on I15

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Our history hurts us: KE007 - 3

KE007   1 Sep 1983

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Our history hurts us… KE007 - 4

- Korean Airlines Flight 007
- 269 onboard, veered over Soviet airspace in Pacific, and was shot down
- Pilot/Navigator keyed in numerical coordinates by hand for flight plan!

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Our history hurts us… KE007 - 5

How about:
- Automatic download?
- Picking from a menu?
- Symbolic names?
- Confirmation playback?

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Our history hurts us… KE007 - 6

How about:
- Context check (like type-checking…)?
  - Pilot, run, time, plane, schedules, assignments, etc

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Our history hurts us… KE007 - 7

- How about:
- Monitors, Alarms, Inhibitors?
- Confirmation message?
  - Aviation tower communications
  - Telephone technical conversations
- Parity checks?

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Our history hurts us…   - 8

Audi
- Cars took off from a standing position
- Driver error, claimed Audi…
- Whose error was it?

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Our history hurts us…   - 9

NASA's Mars Orbiter
space probe

NASA's Polar Lander
Mars space probe

Our history hurts us…   - 10

- NASA space probe
- Lost major mission over units mistake
- JPL group worked in SI units
- Colorado group worked in English units
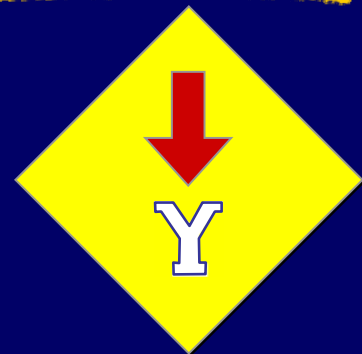- Combining the results let to bad numbers
- Type checking issues?

Culture -1

What does
this sign
mean?
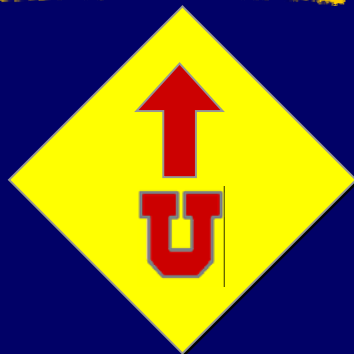
Culture-2

What does
this sign
mean?

Culture-3

- Up is better than down
  - Religion, Dante, …
- When we refer to ourselves
  - We point to our noses?
  - Our chests?
- Point with index finger or hand ?

Critical Interfaces

- Nuclear power plants: 1961 SL1 nuclear disaster
  - Interface had better be clear and foolproof
- Airplane cockpit
  - Computer graphics has simplified controls, infomation
- Power saw, gun: laser predictive indicator

Accessibility of Controls

- Where is the interface?
- Where is the emergency "Off" ?
- Does access causes:
  - Exposure to danger?
  - Confusion?
  - Loss of critical time?
  - Distraction (John Denver's plane crash)?
  - Disorientation?

Parameter Overload

- Too many choices
- What does a parameter (widget) do?
- Which is the most important at this time?
- Examples
- What does *cognitive load* mean?

Effect of *Function*: Examples

- Water faucets in a sink
- Manual gear shift: 4 on the floor
- Chords on a guitar: hard!
- Interface is dictated (confused) by functional need

Other Historical Examples

- Books are essentially linear
- Stories or communications needs are not
- Hyper-text
  - Breaks the shackles of linear text stream
  - Digress as needed, desired

HCI is a *Design Problem*

- Design is *old* subject
- Well studied, rich traditions
- Apply design methodologies to build better interfaces
- We will look at this viewpoint

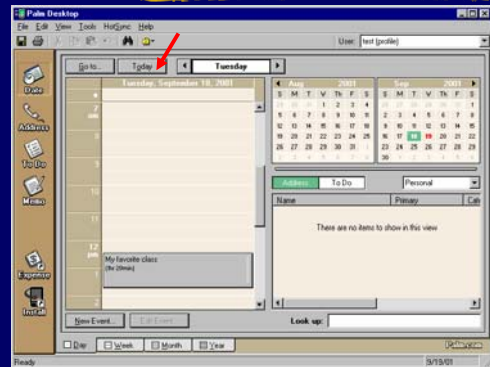## Important Operational Issues

- Reliability
- Availability
- Security
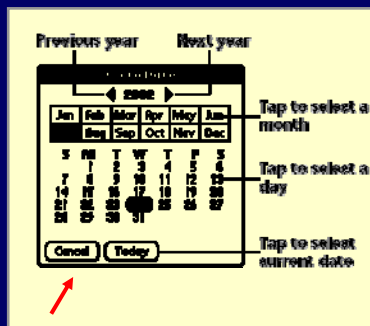- Data integrity

Important Basics

- Standardization across app's
  - Apple did this first
- Integration of packages and tools
  - Unix does this well
- Consistency in actions, design style, terms, menus, color, fonts, etc
- Portability across platforms
  - Less than advertised (Quicken, eg)

Palm Desktop Calendar

Palm Handheld Calendar

Important Stats -1

- Time to learn
- Speed of performance
  - How much coffee can one drink?
- Rate of errors by users
  - *The user is always right!*

Important Stats -2

- Retention over time
  - Do you have to start at square 1?
- Subjective satisfaction
  - Do you like it (no explanation needed!)
  - Can you develop attachment for it?
  - Donald Norman, …

Dramatically Different Needs - 1

- Life-critical systems
  - Air traffic; nuclear reactors; cockpits; power utilities; emergency, military, medical, operations
- Commercial
  - Banks, resv's, inventory, point-of-sales (Hertz, Fedex,..), registration,..

Dramatically Different Needs - 2

- Home, office, entertainment
  - Obvious needs
- Exploratory, creative, cooperative systems
  - Bad interface (computer or otherwise) can destroy the process
- Clarity: icons, simplicity

Human Diversity

- Ergonomics, anthropometry
  - Anyone here "average?"
- Physical consideration
  - Height, stiffness, posture, shapeness, size of working area
  - IPD, headsize, light sensitivity
  - Lefthandedness

Cognitive Processes (from Engineering Abstracts) - 1

- Short-term memory
- Long-term memory
- (Over 40 year old users…)
- Problem solving
- Decision making
  - Armageddon situations

Cognitive Processes (from Engineering Abstracts) - 2

- Attention and set (scope of concern)
  - ADHD, Ritalin population (5%)…
- Search and scanning
- Time perception
  - We are impatient at a red light unless we are trying to accomplish a task

Perceptual and Motor Performance Factors (ibid) - 1

- Arousal and vigilance
- Fatigue
- Perceptual (mental) load
- Knowledge of results
- Monotony and boredom
  - Big issue: retaining engagement, alertness
  - Road hypnosis

Perceptual and Motor Performance Factors (ibid) - 2

- Sensory deprivation
- Sleep deprivation
  - New driving regulations
  - Medical interns/residents
- Anxiety and fear
- Isolation

Perceptual and Motor Performance Factors (ibid) - 3

- Aging
- Drugs and alcohol
  - What is the condition of the other driver on Saturday night?
  - New Year's Eve?
- Circadian rhythms

Gender Differences

- Males and Females are different!
  - Aggressive comparisons
  - Learning environments
    - Positive v. Negative Reinforcement
  - Sensitivities
- Much has been observed
- Firm principles are scarce
  - Some research at Stanford

Carl Jung's Personality Differences - 1

- Extrovert v Introvert
  - Extroverts like action

- Sensing v Intuition
  - Routine v discovering new

Carl Jung's Personality Differences - 2

- Perceptive v judging
  - New situations v planning

- Feeling v thinking
  - Sensitive v logical

Recent Study Result …

- Multi-tasking does not work!
- Ergo, one should not:
  - Drive a car
  - Talk on a mobile phone

- Q: Is driving a car a single task??

Cultural & International Diversity - 1

- Characters, numerals, special characters, diacriticals
- Left-to-right v (right-to-left or vertical reading)
- Date and time formats
  - International standards
- Numeric and currency formats

Cultural & International Diversity - 2

- Weights and measures
- Telephones and addresses
  - Fixed v variable length
- Names and titles
  - Mr., Ms., Mme, M., Dr.
- SSNs, national IDs,
- Capitalization and punctuation

Cultural & International Diversity - 3

- Sorting sequences
  - Different alphabets
- Icons, buttons, colors
- Pluralization, grammar, spelling
- Etiquette, policies, tone, formality, metaphors

Users with Disabilities

- Can truly open doors
  - Man with ALS who uses head to type
- Doing it well requires good client model
- Designer challenges

Evaluating Interfaces - 1

- Understanding of a practical problem
- Lucid statement of a testable hypothesis
- Manipulation of small number of independent variables
- Measurement of specific dependent variables

Evaluating Interfaces - 2

- Careful selection and assignment of subjects
- Control for bias in subjects, procedures, and materials
- Application of statistical tests
- Interpretation of results, refinement of theory, and guidance for experimenters

Possible Research Directions - 1

- Reduced anxiety of computers
- Graceful evolution of systems
- Specification and implementation of interaction
- Direct manipulation

Possible Research Directions - 2

- Input devices
- Online assistance
- Information exploration
- Applications across platforms

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End of Lecture Set 1
Preliminaries