Utah School of Computing

Lecture Set 1

Preliminaries I

CS5540 HCI
Rich Riesenfeld
Fall 2010

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?
- Do we often discuss telephone interfaces?

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What is the HCI Issue?

- Is the interface the concern?
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Is Discussion about Interface? - 2

- Do we often discuss telephone interfaces?
- Does dancer look at his/her feet?
- Does guitar player look at string?
- Does driver look at pedals?
- Does …?

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"Doing Work" View

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

Ex: Architecture's *Bubble Diagram* ‡ - 1

- Tool architects use during early design
- Assists in capturing living dynamics & flow
- Helps to drive suitable layout

‡ Succeeding *Bubble Diagram* section based on *Flickr* post (Aug 2009) by *Harrison Architects*

Ex: Architecture's *Bubble Diagram* ‡ - 2

- Quick way of diagramming basic relationships among rooms
- Exposes *functions* in building
- Heavier lines imply stronger connections
- Need not translate directly to a floor plan
  - Helps clarify where rooms ought to be

Ex: Architecture's *Bubble Diagram* ‡ - 3

- Legend:
  - *Dining Room (DR)*
  - *Kitchen (K)*
  - *Mud Room/Laundry (MR)*
  - *Living (LR)*
  - *Great Room (GR)*
  - *Study Nook (S)*
  - *Away Room (AR)*
  - *Toilet (WC)*
  - *Bathing Rooms (BR)*

Ex: Architecture's *Bubble Diagram*⁺ - 4

Next is 1st bubble diag of main floor (More) Affordable Green Home:

- S connected to LR
- AR connected to LR
  - not connected as directly
  - AR intended to be "away"

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Ex: Architecture's *Bubble Diagram*⁺ - 5

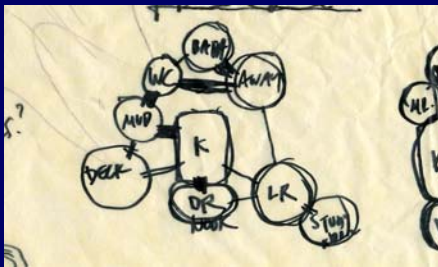Next is 1st *bubble diagram* of main floor (More) Affordable Green Home:

- WC & BR need to be near MR & AR
  - not connected as directly –
  - intended to be "away"
  - AR will function as an occasional BR

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Ex: Architecture's *Bubble Diagram*⁺ - 6

1st Diagram capturing flows

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Ex: Architecture's *Bubble Diagram*⁺ - 7
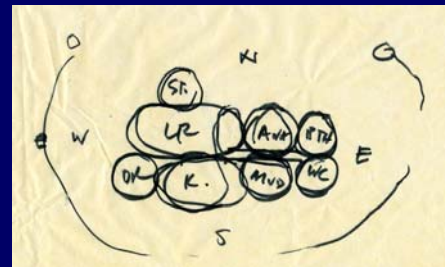
2nd Diagram rearranges blobs into a vague shape

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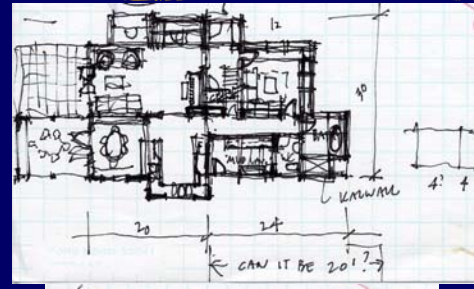
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Ex: Architecture's *Bubble Diagram* - 8
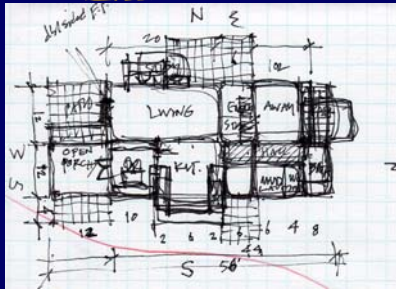
3rd Diagram attempts metric space allocation;
looks at effects of arrangement on quality

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Ex: Architecture's *Bubble Diagram* - 9

4rd Diagram further tries to resolve conflicts bet
building and owner lot. Some dimensions do not
work

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Ex: Architecture's *Bubble Diagram* - 10
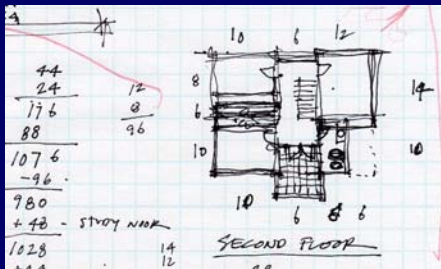
5th Diagram involves a whack at second floor

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Ex: Architecture's *Bubble Diagram* - 11

6th Diagram becomes
increasing realistic;
Many calculations to
establich feasibility,
satisfaction of
constraints, determine
what specs to relax

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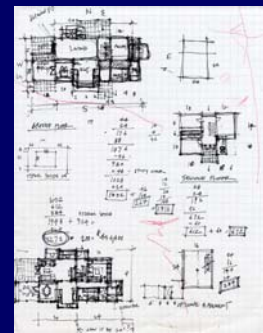
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Assignment

General Task:
In teams of two, create a sequence of progressively refined bubble diagrams with text description explaining what is being illustrated. Final diagram should reveal the final floorplan as it actually exists. Although accurate scaling is not necessary, a representative scale should be applied to the final floor plan.

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Assignment

Requirements:
Interview someone intimately familiar with and a representative for a space that hosts significant activity and traffic for several individuals who use the space.

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Assignment

Treat this exercise as an inquiry about lifestyle and flow requirements. Then create a sequence of bubble diagrams, perhaps with an interveening interview to enhance your grasp of how the space is used.

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Assignment

Finally, compare your sense of optimal layout specification with what is actually in existence and use. Compare your analysis versus the existing instance. Which comes closer to serving the true needs, your analysis or the existing space. Incorporate any constraints that inhibited the original design.

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What good interface principles do we already know? - 1

- Effective to use
- Interesting, pleasing, attractive, inviting
- Intuitive *à la* 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

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What good interface principles do we already know? - 3

- Lead the user
  - Prompts
  - Indicate **nature** of any problem
    - No indication
    - Vague, misleading indication
    - Wrong indication (Latex)
  - **Specific** communication
- Navigational aids: navi sys's often huge

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What good interface principles do we already know? - 4

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

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What good interface principles do we already know? - 5

- Gain user's *trust*
- Bottom up is probably most *comfortable*
- Simple tasks should be *simple*
- WYSIWYG – *easy* to get *start*ed
  - piano v violin

Our history hurts us… - 1

- Developed poor communications habits
- Natural language terribly *ambiguous*
  - Meaning: "Mary had a little lamb"
- Resources used 2B scarce
- Other priorities, historically

Our history hurts us… - 2

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

Our history hurts us… - 2

- Small road signs <example>

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Our history hurts us: KE007 - 3

KE007   1 Sep 1983

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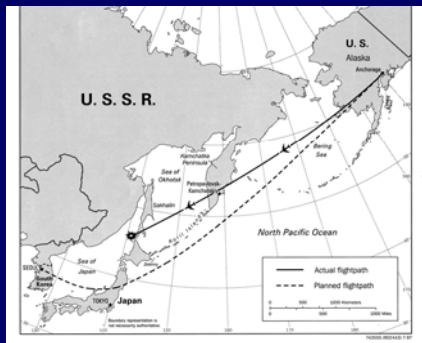
Our history hurts us… KE007 - 4

- 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 - 3a

from Wikipedia article:
"Korean Airlines Flight 007"

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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

Our history hurts us… KE007 - 7

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

Our history hurts us…   - 8

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

Our history hurts us…   - 9

NASA's Mars Orbiter space probe

NASA's Polar Lander Mars space probe
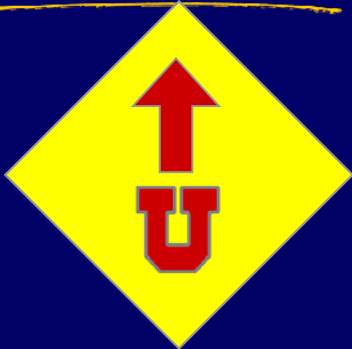
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Our history hurts us…   - 10

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

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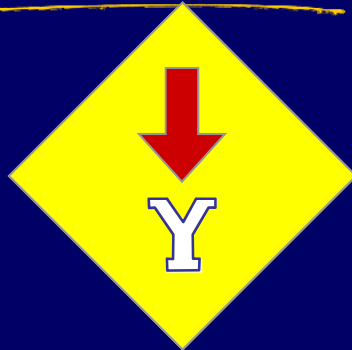
Culture -1

What does this sign mean?

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Culture-2

What does this sign mean?

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Culture - 3

Culture - 4

- 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 ?

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Critical Interfaces

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

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Accessibility of Controls

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

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Parameter Overload

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

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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 needed function

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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

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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)

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Inconsistent Placement — Full Cup Button (Saeco)

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!"

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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?

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

Human Diversity

- Ergonomics, anthropometry
  - Are you "average?"
- Physical consideration
  - Height, stiffness, posture, shape, size of working area
  - IPD, head size, light sensitivity
  - Left-handedness

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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 (fr Eng Abs) - 2

- Attention and set (scope of concern)
  - ADHD, Ritalin population (5%)…
- Search and scanning
- Time perception

Perceptual & Motor Performance Factors (ibid) - 1

- Arousal and vigilance
- Fatigue
- Perceptual (mental) load
- Knowledge of results
- Monotony and boredom

Perceptual and Motor Performance Factors (ibid) - 2

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

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Perceptual and Motor Performance Factors (ibid) - 3

- Aging

- Drugs and alcohol

- Circadian rhythms

Gender Differences

- Males and Females are different!
  - Aggressiveness 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

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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??
- Q: Is playing piano a single task??
- Q: Is speaking a foreign language??

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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

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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

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Cultural & International Diversity - 3

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

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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

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End Lec Set 1