

HCI and Usability: History and Concepts

- What is human-computer interaction (*HCI*)?
 - Where did it come from? How has it developed?
- What is *usability*?
 - Origins and development
- Usability engineering
 - Scenario-based usability engineering

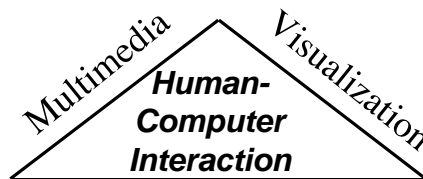
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What is HCI?

- computer science \cap social, cognitive, behavioral science
- integrate tech dev w/ planning/assessing impacts/utility

Technical Support for Users

Documentation, Training, Help, Education



Collaboration

Support for System Development Process

Design methods and models; Usability evaluation methods and tools

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Where did HCI come from?

- Software Engineering
 - software crisis: applications outrunning technology
 - formal methods not even formally adequate
- Software Psychology
 - experiments and surveys to clarify problems and codify principles
- Computer Graphics
 - proto-GUIs: technology outrunning applications

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HCI in the 1970s

- work within an assumed process
 - tweaking at the end of the “waterfall”
 - principal research objective was guidelines
- describe the user
 - extreme dichotomies, unrepresentative content
 - Newell: playing 20-questions with nature
- verify usability experimentally
 - coarse, quantitative, time & errors studies
 - too costly & uninformative

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HCI in the 1980s

- Iterative development (vs. waterfalls)
 - prototyping, mock-ups
 - formative evaluation (thinking aloud)
 - usability engineering, usability specifications
- Models and theory (versus guidelines)
 - the model human processor: Fitts' Law, GOMS
 - mapping models: syntactic-semantic consistency
 - the active user: prior knowledge, problem solving, and error as primary resources
- Gradual better integration with UI technology

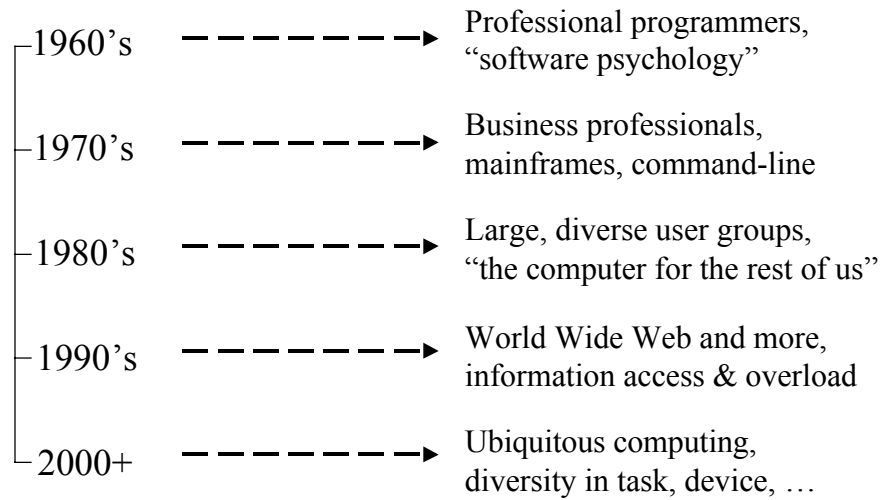
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HCI in the 1990s

- UE is multifaceted, qualitative, field-oriented
 - participatory design, contextual design, ethnographically-informed design
 - drives/integrates system development lifecycle
- Conceptual frameworks beyond user models
 - activity theory, ethnomethodology, distributed cognition, grounded theory, design rationale, ...
 - *But* diminishing role in mainstream discourse
- User interface technology too well integrated!

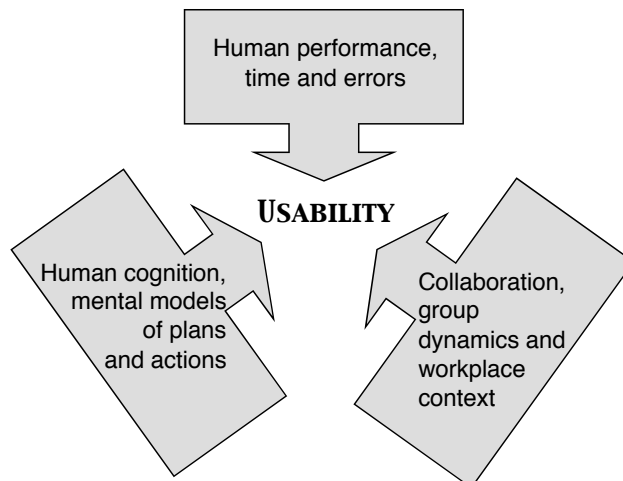
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Context of HCI: Changes in Computer Use



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What is *Usability*?



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The developing concept of usability

- 1970s -- human factors engineering
 - Taylorism: minimize time and errors
- 1980s -- cognitive science and engineering
 - internal consistency of displays and interactions
 - match interaction to cognitive architecture (sophisticated Taylorism)
 - match domain-specific knowledge-based expectations: metaphoric design
 - support and exploit problem-solving, error recognition, diagnosis and recovery

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The developing concept of usability

- 1990s -- organizational task analysis
 - group interaction, collaborative synergy vs. process losses, power and status, conflict and cooperation
 - business process/work practices, work flow vs. invisible work
 - common ground, knowledge management, peer-driven professional development
 - preference and fun, affective computing
 - accessibility, customization (tailorability), internationalization (localization)

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Why Usability *Engineering*?

- Waterfall models of development do not work
 - too many unknowns (Brooks: No Silver Bullet)
- Need an iterative discovery-oriented process
 - but at the same time need to manage it
- Demands well-defined process with metrics
 - specifying usability goals as objectives
 - assessing and redesigning to meet these objectives
 - manage usability as a quality characteristic, much like modularity or nonfunctional requirements

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Can We /How Should We *Measure Usability*?

- Bottom line is whether the users got what they wanted, i.e., is the client satisfied
- Practically speaking, need to break this down so that we can *operationalize* our objectives
- Our textbook definition:
 - the quality of an interactive computer system with respect to ease of learning, ease of use, and user satisfaction*
 - can the users do what they want to do in a comfortable and pleasant fashion?

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Scenarios in Usability Engineering

- Stories of people and their activities, sometimes includes computer use, always includes goals
- Typical elements of the story are:
 - a *setting*
 - one or more *actors* or *agents*
 - an orienting or motivating *goal* or *objective*
 - mental activity, *plans* or *evaluation* of behavior
 - a “storyline” sequenced by *actions* and *events*
- Emphasis on use, i.e., people’s needs, expectations, actions, and reactions

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Scenarios in UE: A Simple Example

A problem scenario describing current situation:

Marissa was not satisfied with her class today on gravitation and planetary motion. She is not certain whether smaller planets always move faster or how a larger or denser sun would alter the possibilities for solar systems.

She stays after class to speak with Ms. Gould, but she isn’t able to pose these questions clearly, so Ms. Gould suggests that she re-read the text and promises more discussion tomorrow.

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A design scenario describing our initial vision:

Marissa , a 10th-grade physics student, is studying gravity and its role in planetary motion. She goes to the virtual science lab and navigates to the gravity room.

In the gravity room, she discovers two other students, Randy and David, already working with the Alternate Reality Kit, which allows students to alter various physical parameters (such as the universal gravitational constant) and then observe effects in a simulation world.

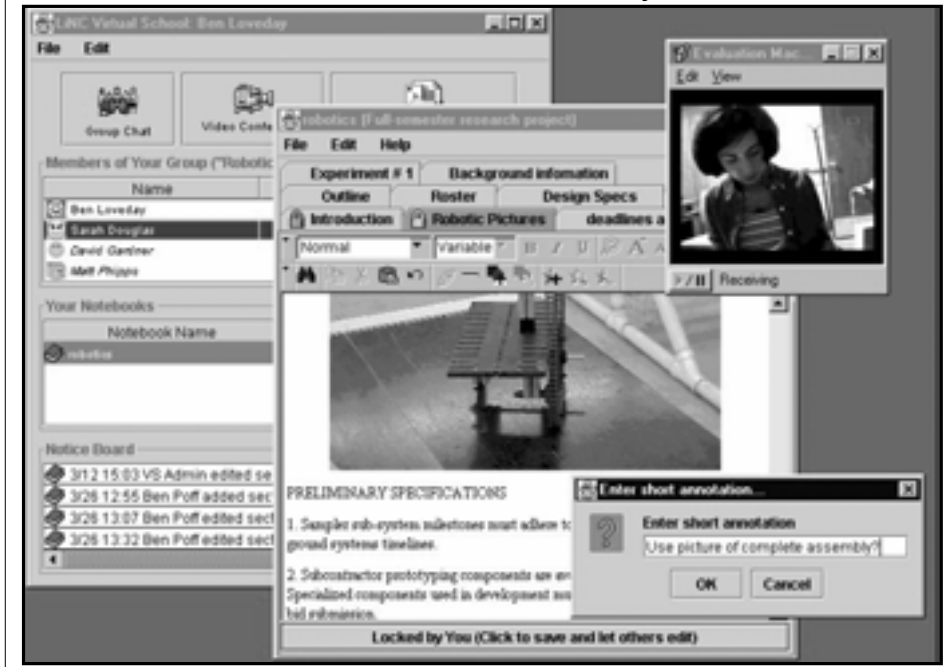
The three students, each of whom is from a different school in the county, discuss possible experiments by typing messages from their respective personal computers. Together they build and analyze several solar systems, eventually focusing on the question of how comets can disrupt otherwise stable systems.

They capture data from their experiments and display it with several visualization tools, then write a brief report of their experiments, sending it for comments to Don, another student in Marissa's class, and Mr. Arkins, Randy's physics teacher.

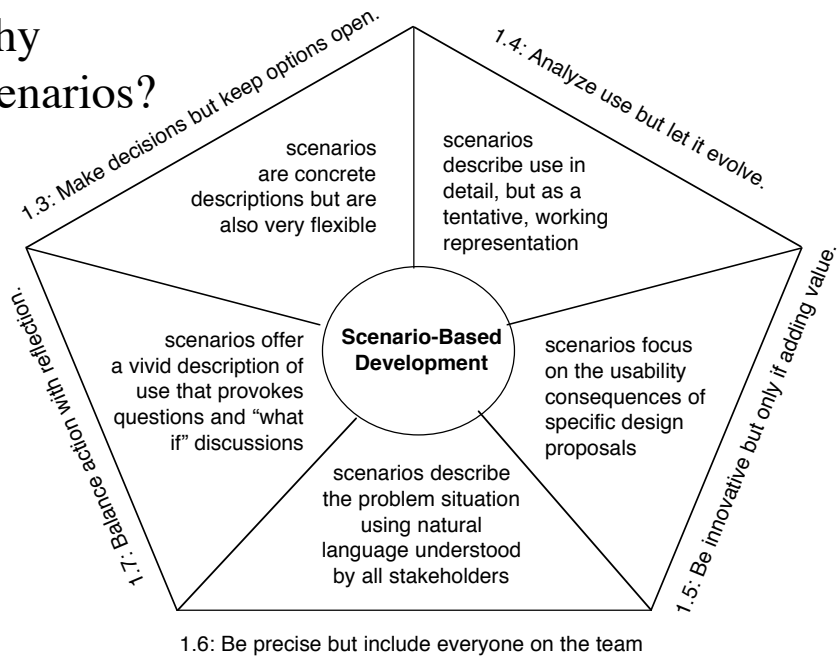


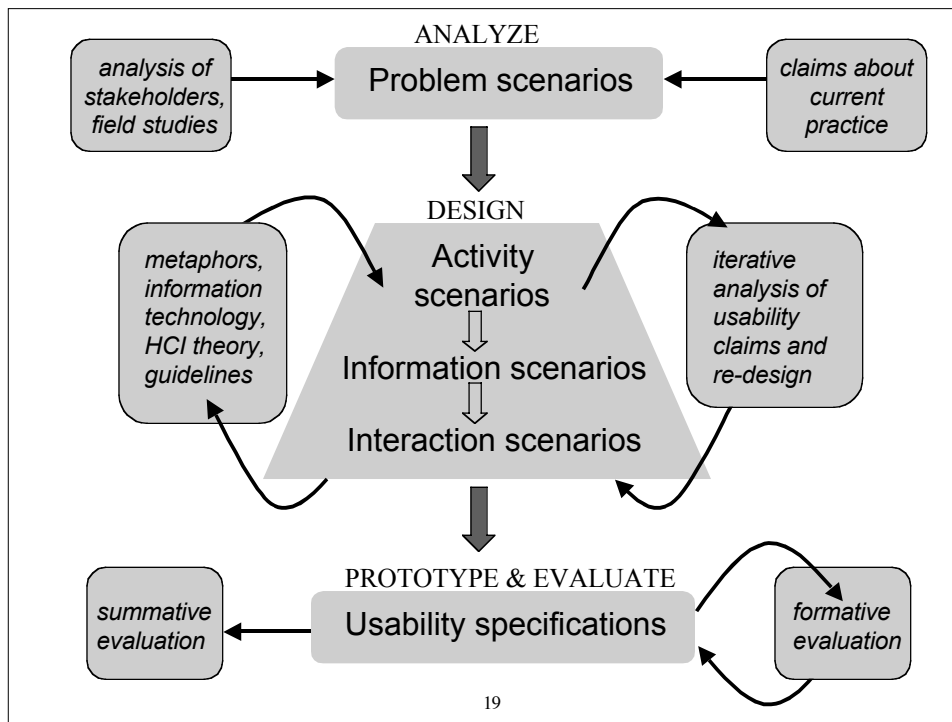
an artist's
rendition of the
initial design
scenario

The Final 'Virtual School' System



Why Scenarios?





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Tradeoffs and SBD

- Design by definition is invention, creativity
 - never just one approach, never one correct answer
 - BUT some answers are demonstrably better
- Interactive system design tremendously complex
 - many interdependencies, eg schedule, cost, competitive advantage, local expertise, ...
 - users and their needs are one large set of dependencies
- Tradeoffs are useful in analyzing these relations
 - here, we focus on tradeoffs affecting *users' experiences*
 - guides design thinking, also serves as design rationale

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Learning SBD — *By Example*

- Virtual science fair as a case study
 - complement to real world physical science fairs
 - goal is to extend fair interactions, across time & space
- Cumulative, illustrates activities at each phase
 - detailed examples of the methods used in projects
 - use as a model for your group's materials & analyses
- Many details specific to this example
 - e.g., collaboration, community network, education
 - other case studies under construction on the Web at <http://ucs.cs.vt.edu>