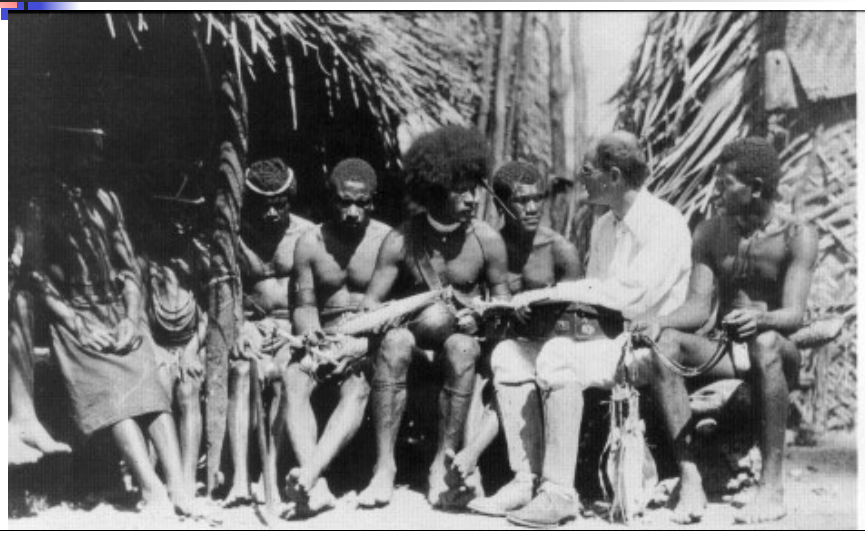
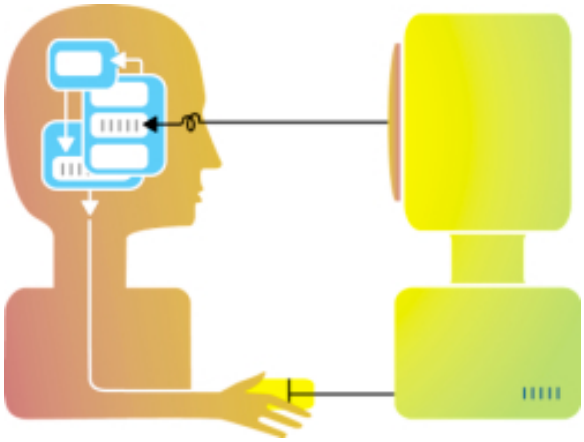
Human-Computer Interaction
IS4300

Ethnography Status?



What is interaction?

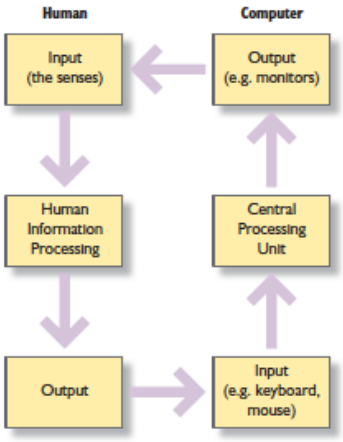


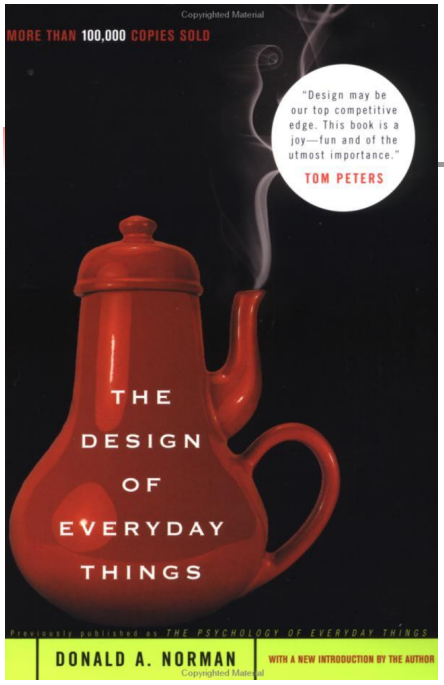
Frameworks for conceptualizing "interaction"

- Cognitive/HIP
  - Norman: psychopathology of everyday things
- Distributed Cognition / Activity Theory
- Affective/Aesthetic/Emotional frameworks
- Interaction styles
- Interaction paradigms

Cognitive/HIP Models

- Early models from cognitive psychology
  - disembodied cognition
  - Human Information Processor





The psychopathology of everyday things

- What objects do we routinely interact with in our environment?
- Norman: We routinely interact with 10,000-30,000 objects in our environment
- Norman: interested in failures

Norman Ch 1

- Affordances
- Visibility
- Conceptual models
- Constraints
- Mappings
- Feedback

Affordances

- The fundamental properties of a thing that determine just how it could possibly be used.
  - Examples?
    - A chair affords sitting
    - Knobs are for turning.
    - Slots are for inserting things into.

Visibility

- *aka "Obviousness"*
- The correct parts must be visible.
- They must convey the correct message.
- Impacts learnability.

- How different from affordance?
- Examples?


8:17
89.5
FM

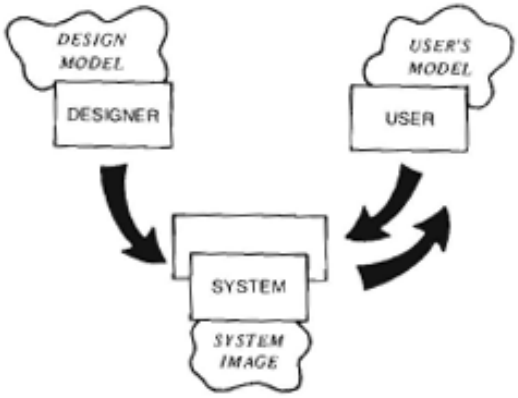

8:17
89.5
FM

Conceptual models

- Mental representation of how a thing works – allows you to mentally simulate and predict its behavior.

- Daily
- Weekday
- Custom

"I am not my user…"



Constraints

- Limit the ways you can interact with an object.

Mappings

- Relationship between controls and functions.
- Natural mapping – taking advantage of physical analogies and cultural standards – leads to immediate understanding.

Feedback

- Providing user with information about the results of an action.

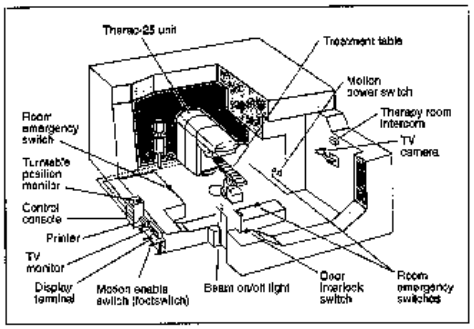


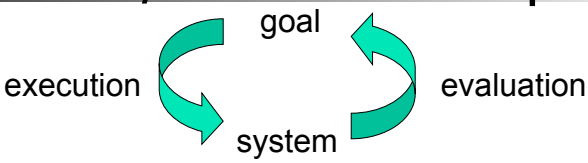
Figure 1. Typical Therac-25 facility.

```
PATIENT NAME  : TEST                                          A     1
TREATMENT MODE: FIX    BEAM TYPE: X ENERGY (KeV):  25

                                        ACTUAL              PRESCRIBED
        UNIT RATE/MINUTE                   0                200
        MONITOR UNITS                 50   50                200
        TIME (MIN)                          0.27              1.00

GANTRY ROTATION (DEG)                 0.0                   0   VERIFIED
COLLIMATOR ROTATION (DEG)     359.2                       359   VERIFIED
COLLIMATOR X (CM)                    14.2                  14.3  VERIFIED
COLLIMATOR Y (CM)                    27.2                  27.3  VERIFIED
WEDGE NUMBER                            1                     1  VERIFIED
ACCESSORY NUMBER                        0                     0  VERIFIED

DATE  : 84-OCT-26  SYSTEM: BEAM READY    OP.MODE: TREAT    AUTO
TIME  : 12:55. 8   TREAT : TREAT PAUSE                X-RAY     173777
OPR ID: T25VO2-ROO REASON: OPERATOR      COMMAND:
```

Some Kinds of Feedback

- Immediate control manipulation feedback
- "Action in progress" feedback
- Updated system state feedback

execution/evaluation loop



- user establishes the goal
- formulates intention
- specifies actions at interface
- executes action
- perceives system state
- interprets system state
- evaluates system state with respect to goal

execution/evaluation loop

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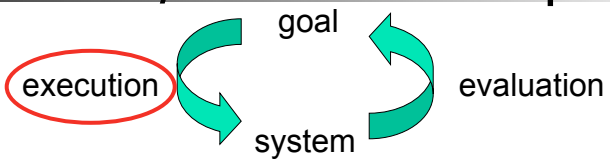

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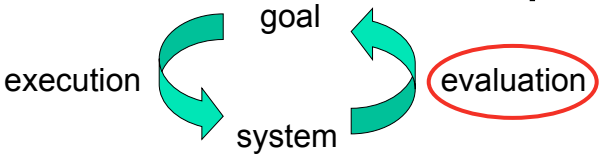

- user establishes the goal
- formulates intention
- specifies actions at interface
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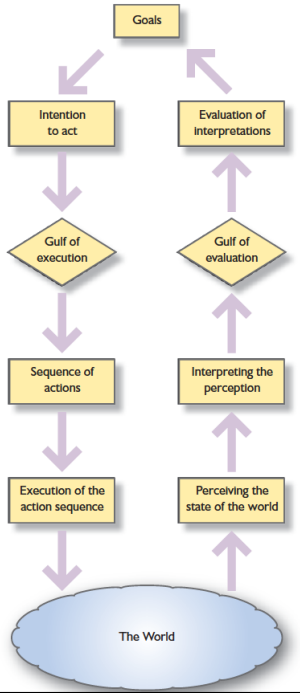
- evaluates system state with respect to goal

Gulf of execution

user's formulation of actions
≠ actions allowed by the system

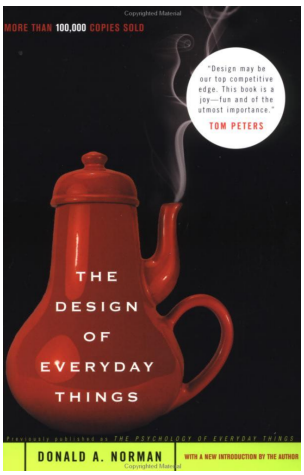
Gulf of evaluation

user's expectations about system state
≠ presentation of state by system



Norman Ch 5
Design for Errors

- Slips
- Mistakes
- Modes
- Preventing Errors
- Error Recovery



Slip vs. Mistake

- Slip
  - Error in executing action
  - Intend to do one thing, but find yourself doing something else
- Mistake
  - Error in formulating intention & action

Slips

- Capture errors
  - start of task sequence same, e.g., drive to store, but end up going to work
- Description errors
  - two tasks are very similar, e.g., throwing laundry in toilet
- Data-driven errors
  - need a number, but confronted with another and get confused
- Associative activation errors
  - internal associations between tasks, e.g., freudian slips
- Loss-of-activation errors
  - forgetting why you started a task
- Mode errors

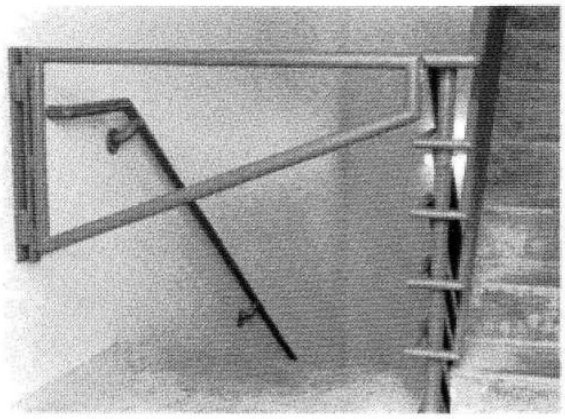
- *All caused by inattention*
- *Do confirmation dialogs help?*

Mistakes

- "Wide" vs. "Deep" tasks
  - Wide: Many options, but few steps (e.g. restaurant menu)
  - Deep: Many steps, but few choices (e.g., driving to work, following a recipe)
- Most everyday tasks are Wide or Deep
- Most computer tasks are BOTH
- Do confirmation dialogs help?

Forcing Functions

- Lockouts – anticipate and prevent error



Design for Error

- Your users will make mistakes!

- Design to minimize error
- Undo
- Error Feedback
- Attitude: assume errors will be made as part of problem solving

Quiz
Slip or Mistake?

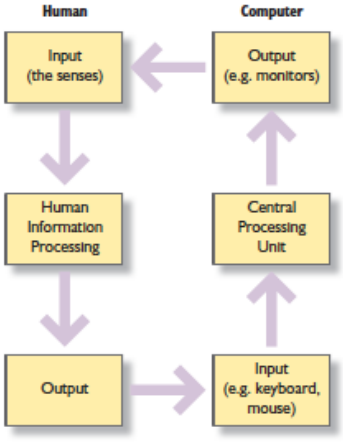
1. A user playing your new Virtual Autopsy game selects the electric saw, but while making a cut (using mouse click-and-drag) her pet cat startles awake and yelps, causing the distracted user to make the cut in the wrong place.
2. The user wants to amputate a limb. Not knowing what tool to use, she randomly selects the scalpel.
3. The user wants to make an incision but clicks on the MagicMarker tool, thinking it is a scalpel.

Cognitive, HIP Models of Interaction

- Still dominates HCI
  - E.g., Fitt's law studies
- "Usability" is primarily concerned with cognitive interaction
  - Efficiency
  - Learnability
  - Memorability
  - Error rate

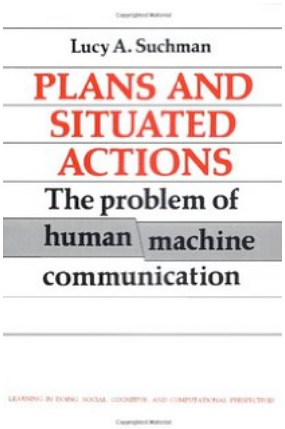
Benyon

- Early models from cognitive psychology
  - disembodied cognition
  - HIP
- Shortcomings?
  - Oversimplified
  - No context
  - Ignores social aspects
  - No affect



Situated Action

- The cognitive viewpoint models people as rational actors, solving problems by formulating and executing plans
- Shortcomings?
- Suchman:
  - human action is constantly constructed and reconstructed from dynamic interactions with the world
  - Plans are just one source of info



Question

- How can User Interfaces support "situated action"?

Distributed cognition

- Cognitive processes and knowledge are often distributed across multiple people, tools and representations.
- Examples?

Distributed cognition

Distributed Cognition

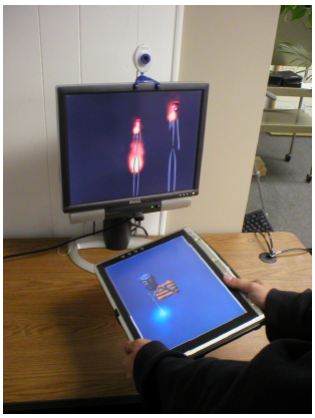
Distributed cognition

- Task Dialogue

Activity Theory

- Human activity is the unit of analysis
- Defines aspects (facets)
  - Subject
  - Mediating artifacts
  - Object (purpose & product)
  - Community (stakeholders)
  - Social rules
  - Division of labor

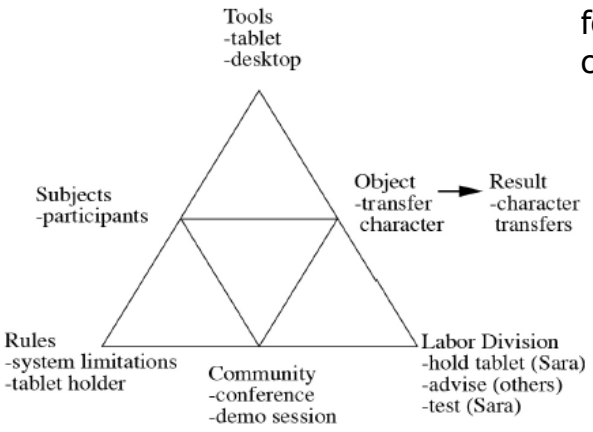
Activity Theory & Distributed Cognition shootout



Baumer & Tomlinson, CHI' 11

Activity Theory

"Activity Triangle" for transferring a character.



Distributed Cognition

	Event (time)	Sara	Blake	Tony	Tablet	LCD	Desktop	Character
rep state	First event: tilting demonstration (3:03)	hold/tilt tablet	speech, tilt tablet	speech, gesture	orientation	raft moving	fire crackling	on raft
medium		body, tablet	voice, body	voice, body	tablet	LCD	speakers	program
processing / type		propagate / motor, aural	create / verbal, motor	create / verbal, motor	propagate / physical	propagate/ physical to graphical	propagate / physical to audio	create / virtual
rep state	Second event: how to transfer (3:19)	speech		speech	orientation	character on raft	fire crackling	on raft
medium		voice		voice	tablet	LCD	speakers	program
processing / type		create / aural		create / aural	propagate / physical	propagate / virtual to graphical	propagate/ physical to audio	create / virtual
rep state	Third event: character leaves tablet (3:23)	speech			position	character jumps	creaking sound	in transit
medium		voice			tablet	LCD	speakers	program
processing / type		propagate / visual to verbal			propagate / physical	propagate / virtual to graphical	propagate / physical to audio	create / virtual

How do we address context in design?

- Practical impact of insights from distributed cognition, activity theory, etc?
- Need to understand users and their contexts
- Design Methodologies
  - Ethnography
  - Personas
  - Scenarios
- Real-world, longitudinal evaluation

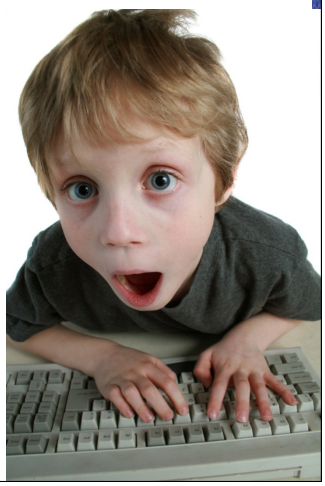
Exercise

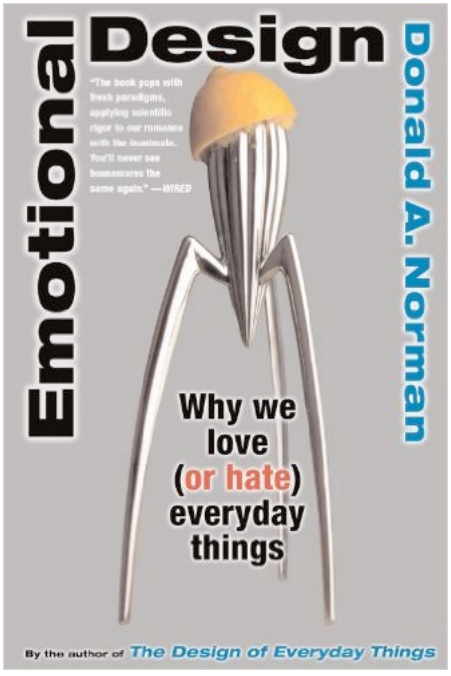
- Project teams
- What kinds of context should you be concerned with in your application?
- How can your interface support this?

Affective / Aesthetic Dimension
Experience, engagement and fun

HCI is not only about efficiency

How do we optimize the user's experience (satisfaction, enjoyment, fun, engagement)?





Don Norman, 2007

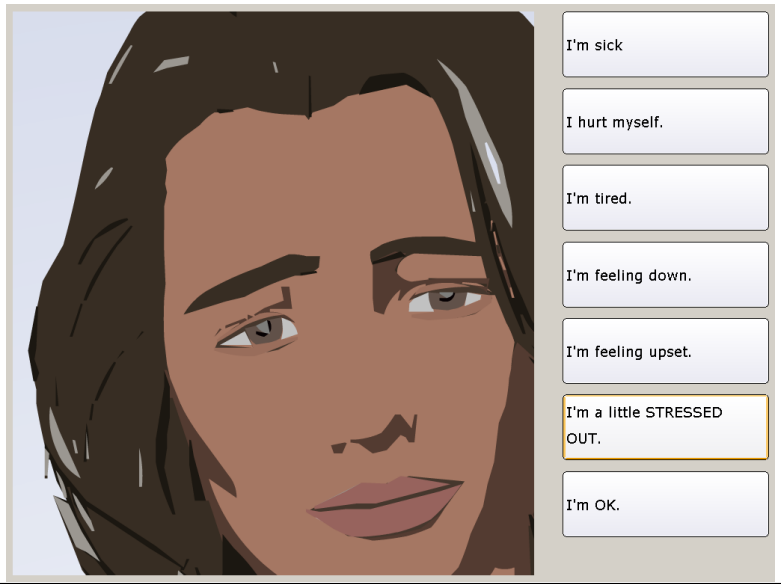
Frameworks for User Experience?

- Satisfaction
- Engagement / Stickiness
- Technology Acceptance Model
- Psychology of experience
  - Flow (Csikszentimihalyi)
  - Sense of presence
  - Immersion

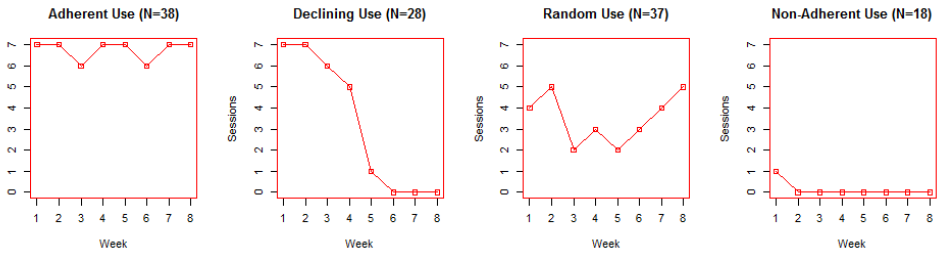
Engagement

- What is it? How do we measure it?
- Stickiness
- Time on site
- Time of use
- Return users
- Conversion rate

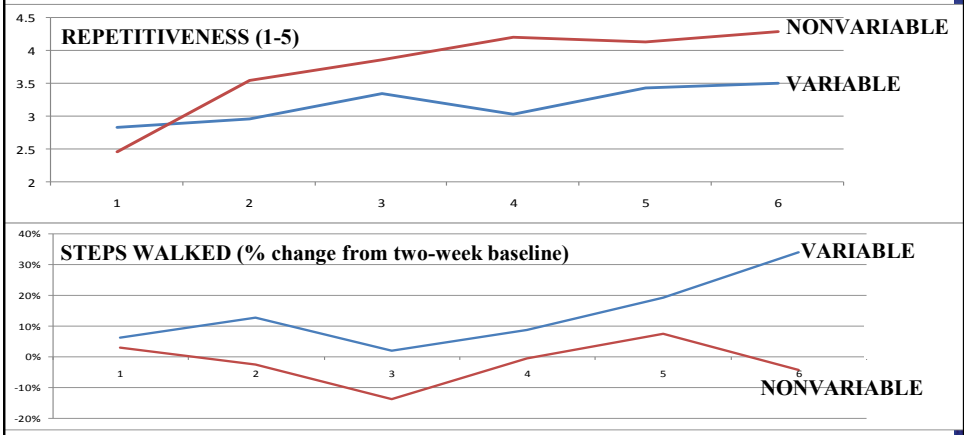
Virtual Coach Engagement Studies



Patterns of Engagement



Variability Study



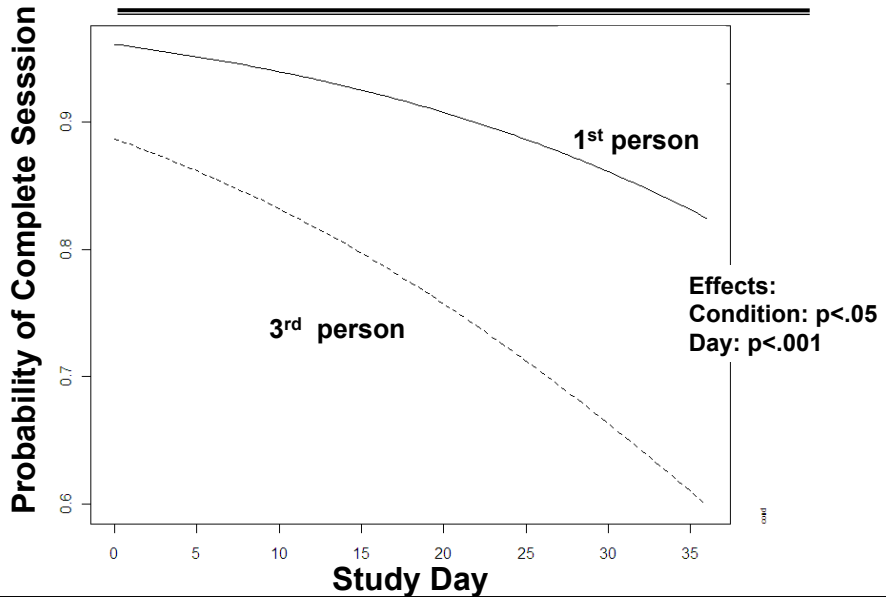
Backstory Experiment

1ST-PERSON	3RD-PERSON
I'd like to tell you some stories about myself.	I'd like to tell you some stories about a friend of mine. She's an exercise counselor too.
I'm not quite sure if I told you about this before.	I'm not quite sure if I told you about this before.
When my family was living in Falmouth, my parents always had us doing outdoor stuff.	When her family was living in Falmouth, her parents always had them doing outdoor stuff.
So especially when it was nice out I would go biking or hiking or we would just go for a walk and have a picnic, things like that.	So especially when it was nice out she would go biking or hiking or they would just go for a walk and have a picnic, things like that.

Results: Engagement N=26, avg 29 days

- **Enjoyment**
  - "I enjoy the stories that the counselor tells."
  - 1ST-PERSON reported significantly greater enjoyment of the stories compared to those in the 3RD-PERSON group (p<.001).
  - Significant decrease in enjoyment over time for all participants (p<.001)
- **Dishonesty**
  - "I feel that the counselor is dishonest".
  - No significant differences by condition or study day.
    - 1ST-PERSON: mean 1.8
    - 3RD-PERSON: mean 2.1

Results: Engagement



Simulating Human Relationship-building Behavior

- use of
  - Social dialogue
  - Self disclosure
  - Meta-relational dialogue
  - Increasing common ground
  - Empathy
  - Nonverbal immediacy behavior
  - Humor
  - etc. etc.

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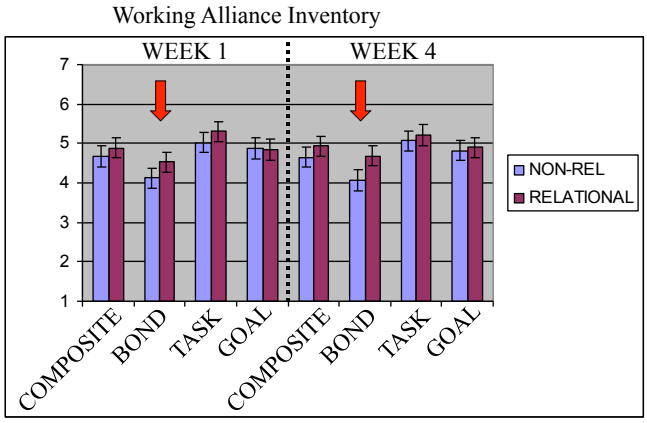
MIT Study
30d/daily, 3-arm, N=101

Bickmore, et al, *ToCHI*, 12:2 (2005), 293-327



Differences in BOND subscales significant:
WK1 $p<.05$
WK4 $p=.007$

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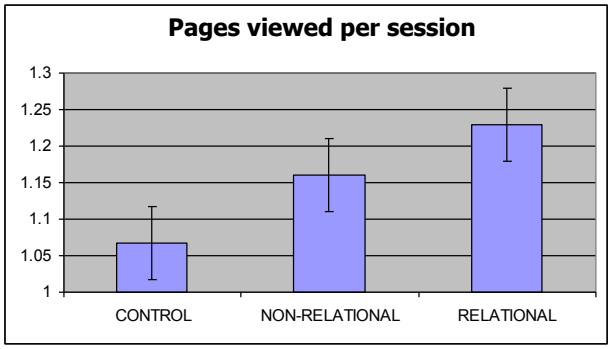
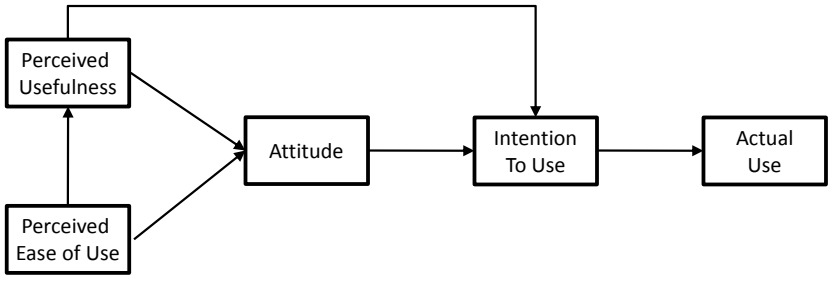
Participation Results
All Subjects



Significant difference in educational pages viewed:
CONTROL < AGENT
$p<.05$

Technology Acceptance Model



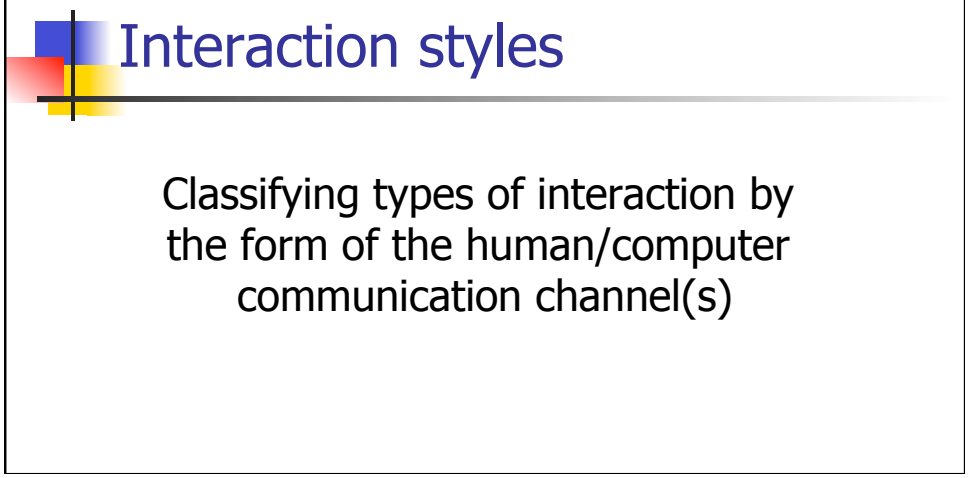
- Davis, 1993 "User acceptance of IT"
- Validated in many areas of IT, including health.
- Extended in many ways.

Flow (Csikszentmihalyi)

- The "holistic sensation that people feel when they act with total involvement."
- When a person is in the flow state "they become absorbed in their activity"
- Characterized by a narrowing of the focus of awareness, loss of self-consciousness; a responsiveness to clear goals and unambiguous feedback; and a sense of control over the environment. Also a heightened sense of playfulness

Measuring Flow

- Questionnaire
  - Retrospective
  - Experience Sampling
- Time distortion
- Physiological measures (e.g., GSR)

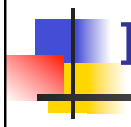


Common interaction styles

- command line interface
- menus
- natural language (including speech)
- question/answer and query dialogue
- form-fills and spreadsheets
- WIMP

Initiative: An important aspect of interaction style

- who has the initiative?
  - Wizard – computer
  - WIMP interface – user
- WIMP exceptions …
  pre-emptive parts of the interface
  - E.g., modal dialog boxes
    - come and won't go away!
    - good for errors, essential steps

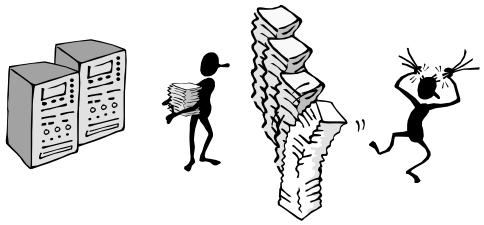


Interaction paradigms

Classifying types of interaction by the overall interaction "metaphor", or user-computer "relationship"

The initial paradigm

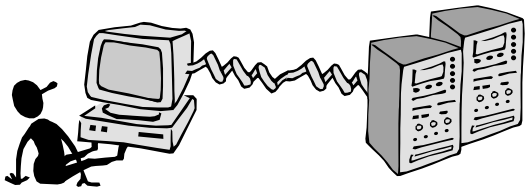
- Batch processing



Impersonal computing

Example Paradigm Shifts

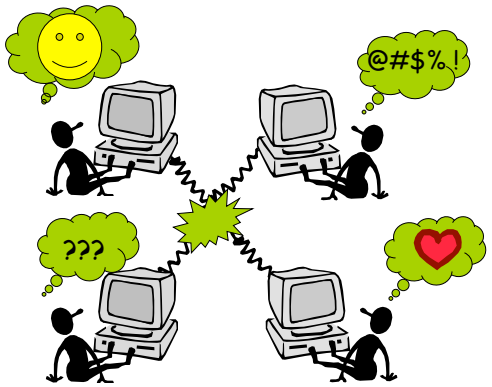
- Batch processing
- Time-sharing



Interactive computing

Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking



Community computing

monday afternoon

december 9 1968

3:45 p.m. / arena

Chairman:
DR. D. C. ENGELBART
Stanford Research Institute
Menlo Park, California

a research center for augmenting human intellect

This session is entirely devoted to a presentation by Dr.

Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical displays

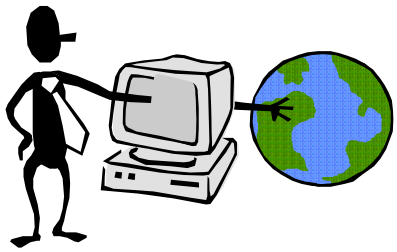
Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor

Personal computing

Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor
- WWW



Global information

Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor
- WWW
- Ubiquitous/Wearable/ Mobile Computing

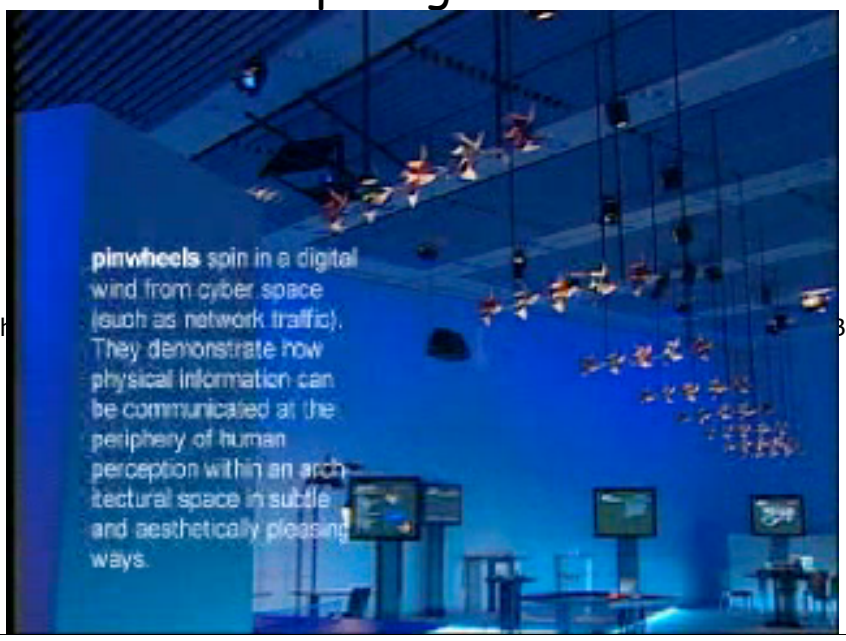
What are other possible paradigms?

Intelligent Assistant

Apple – 1987 – "Knowledge Navigator"

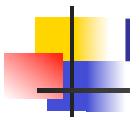
Tangible Computing

Ambient Computing



Embodied Conversational Agents

Companions



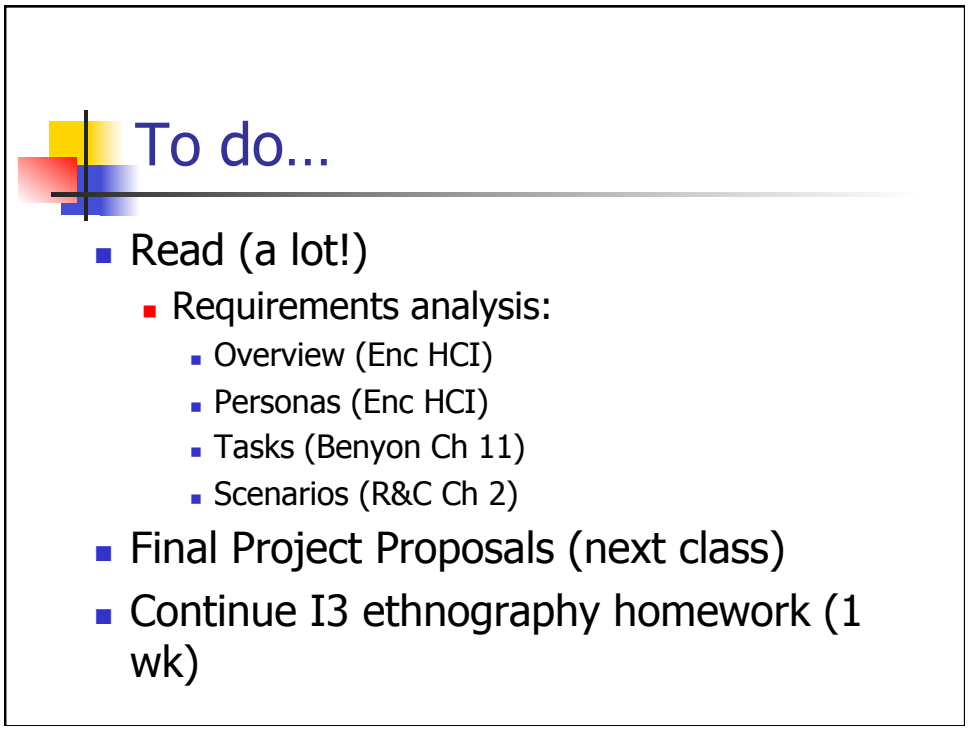
Exercise

- Project teams
- What paradigms or interaction styles might be useful in your project? Why?

Frameworks for conceptualizing "interaction"

- Cognitive/HIP
  - Norman: psychopathology of everyday things
- Distributed Cognition / Activity Theory
- Affective/Aesthetic/Emotional frameworks
- Interaction styles
- Interaction paradigms


Project Teams?
Looking for a team (or team members)?


To do…
Read (a lot!)
Requirements analysis:
Overview (Enc HCI)
Personas (Enc HCI)
Tasks (Benyon Ch 11)
Scenarios (R&C Ch 2)
Final Project Proposals (next class)
Continue I3 ethnography homework (1 wk)