



Human-Computer Interaction IS4300



Quiz

Closed book / Closed notes
10 minutes



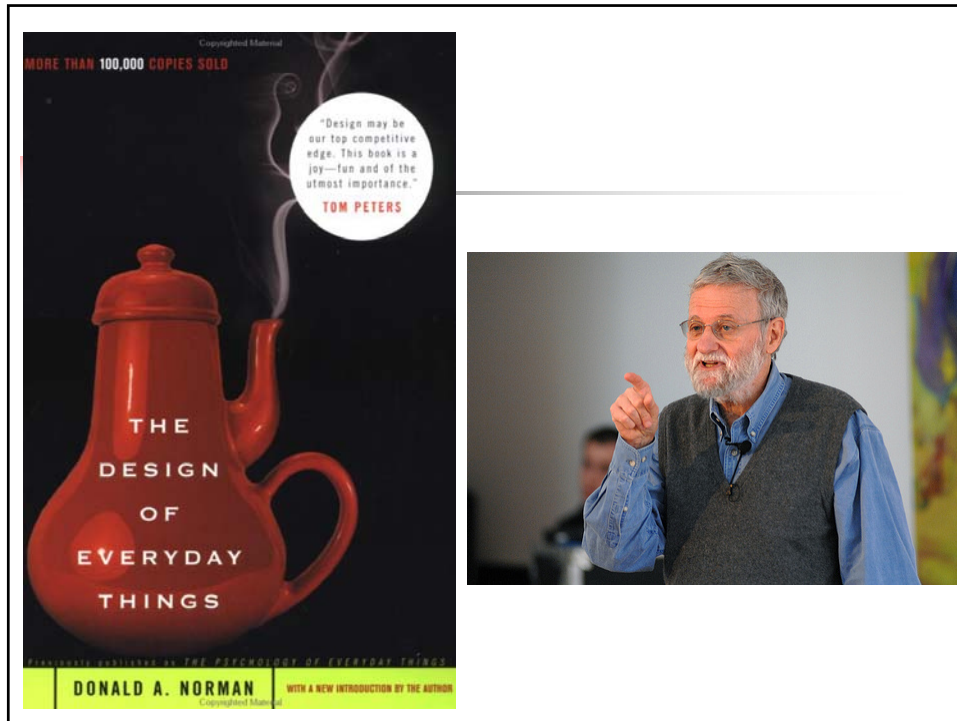
Slip vs. Mistake

- Slip
 - Error in executing action
- Mistake
 - Error in formulating intention & action



Nielsen's Heuristics

1. Simple and Natural Dialogue
2. Speak the User's Language
3. Minimize User Memory Load
4. Consistency
5. Feedback
6. Clearly Marked Exits
7. Shortcuts
8. Good Error Messages
9. Prevent Errors
10. Help and Documentation



Norman Ch 1

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

Affordances

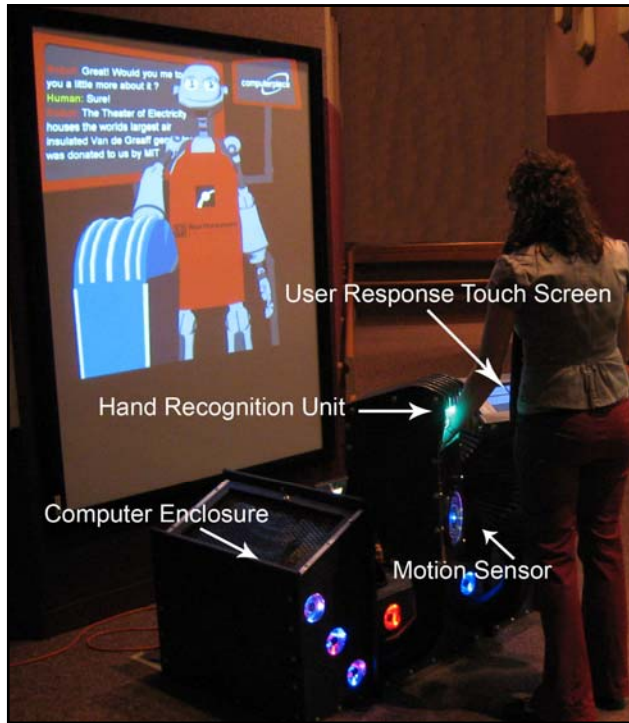
- The fundamental properties of a thing that determine just how it could possibly be used.
 - Examples?
 - A chair affords sitting
 - Knobs are for turning.
 - Slots are for inserting things into.



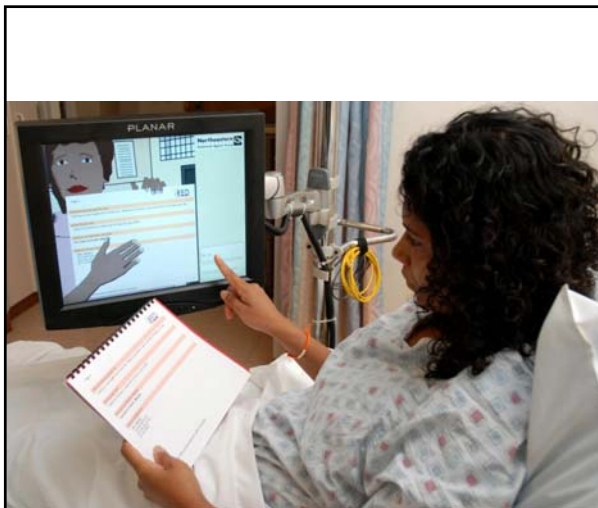
Visibility

- *aka "Obviousness"*
- The correct parts must be visible.
- They must convey the correct message.
- Impacts learnability.
- How different from affordance?
- Examples?





- How to get visitors to put their hand in the box?



- touch what you want to say...



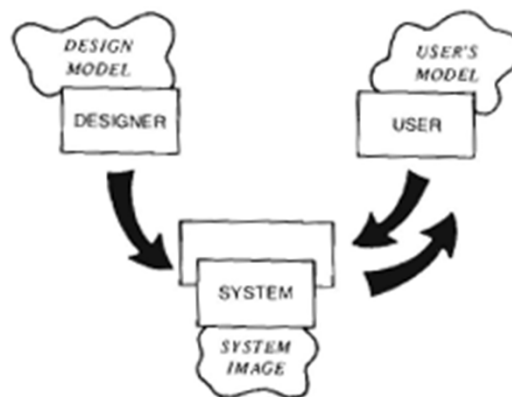
Conceptual models

- 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.



Another important kind of mapping for UI users...

- External Consistency
- A kind of “cultural” knowledge.

Feedback

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

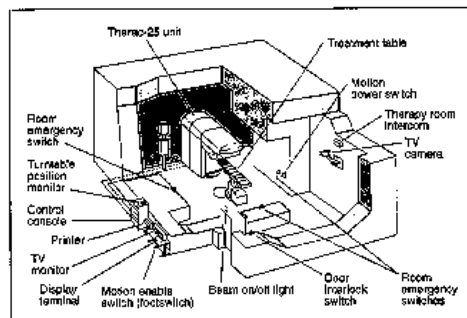


Figure 1. Typical Therac-25 facility.

```

PATIENT NAME : TEST          BEAM TYPE: X ENERGY (keV): 25          A 1
TREATMENT MODE: FIX
UNIT RATE/MINUTE          ACTUAL          PRESCRIBED
ROTATION SPEED           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
SERIES NUMBER            1            1            VERIFIED
ACCESSORY NUMBER         0            0            VERIFIED


DATE : 04-OCT-26 SYSTEM: BEAM READY OP.MODE: TREAT AUTO
TIME : 12:55.8 TREAT : TREAT PAUSE          Z-PAY 173777
OPR ID: T25002-000 REASON: OPERATOR COMMAND:
  
```

Some Kinds of Feedback

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

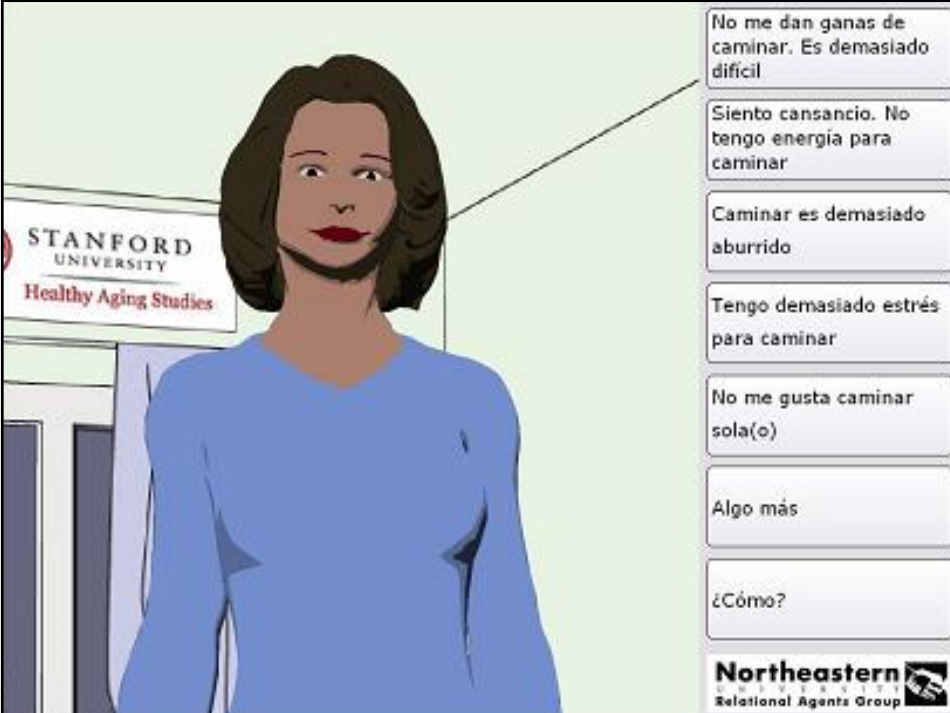
Feedback





Feedback

- Air France Flight 447, 1 June 2009, Airbus A330-200
- Stalled, crashed, killed 216 passengers and 12 aircrew
- Final report:
 - Initial cause: icing of airspeed sensors
 - Many feedback problems:
 - Inconsistency between the airspeed measurements
 - Incomprehension of the situation when the autopilot disconnection occurred,
 - The lack of a clear display in the cockpit of the airspeed inconsistencies identified by the computers
 - A failure to identify the aural stall warning
 - The appearance at the beginning of the event of transient warnings that could be considered as spurious
 - The absence of any visual information to confirm the approach-to-stall after the loss of the limit speeds



STANFORD UNIVERSITY
Healthy Aging Studies

No me dan ganas de caminar. Es demasiado difícil

Siento cansancio. No tengo energía para caminar

Caminar es demasiado aburrido

Tengo demasiado estrés para caminar

No me gusta caminar sola(o)

Algo más

¿Cómo?

Northeastern
Relational Agents Group



Norman's Interaction Framework

1. user establishes the goal
2. formulates intention
3. specifies actions at interface
4. executes action
5. perceives system state
6. interprets system state
7. 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

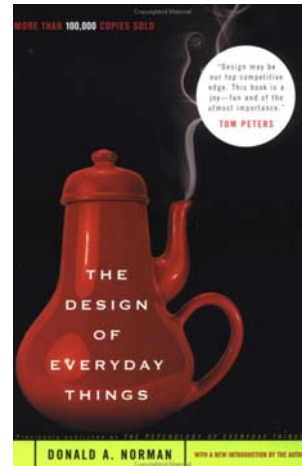


Slip vs. Mistake

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Norman Ch 5 Design for Errors

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



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
 - Many options, but few steps (e.g. ordering)
 - Many steps (driving to work)
- Most everyday tasks are Wide or Deep
- Most computer tasks are BOTH

- Do confirmation dialogs help?

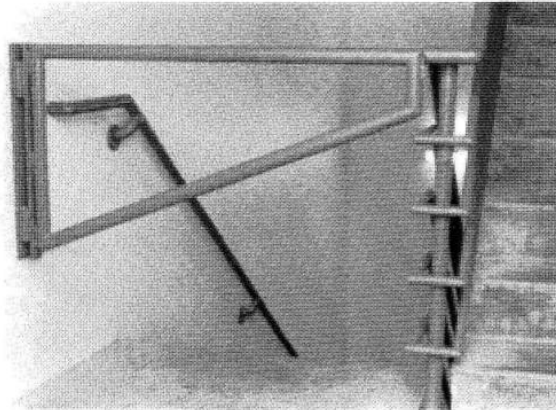


Design for Error

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

Forcing Functions

- Lockouts



Norman Ch 6

User-centered Design

- What works against usability in new product design?
- error of putting aesthetics first
- I am not my user
- complexity of design
- Feature creep vs. simplicity



The Problem with Computers

- Invisible
- Abstract
- Complex
- Software designed by Programmers
- New applications, tasks (no standards)
- Easy to perform irreversible actions



Dix Ch 3: The Interaction

What is interaction?

communication

user ↔ system

Terminology

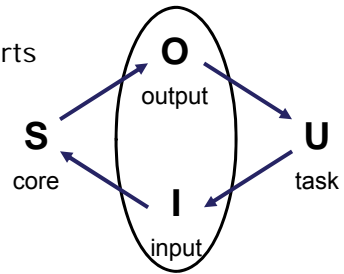
- domain – the area of work under study
e.g. graphic design
- goal – what you want to achieve
e.g. create a solid red triangle
- task – how you go about doing it
– ultimately in terms of operations or actions
e.g. ... select fill tool, click over triangle

Abowd and Beale framework

extension of Norman...

their interaction framework has 4 parts

- user
- input
- system
- output



each has its own unique language

interaction \Rightarrow translation between languages

problems in interaction = problems in translation

interaction styles

Common interaction styles

- command line interface
- menus
- natural language
- question/answer and query dialogue
- form-fills and spreadsheets
- WIMP
- point and click
- three-dimensional interfaces

- Pros & Cons of each?

elements of the wimp interface

windows, icons, menus, pointers

+++

buttons, toolbars,
palettes, dialog boxes

Windows

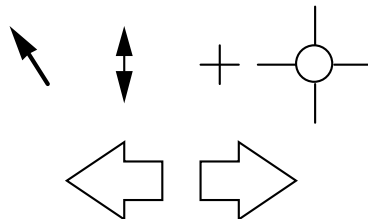
- Areas of the screen that behave as if they were independent
 - can contain text or graphics
 - can be moved or resized
 - can overlap and obscure each other, or can be laid out next to one another (tiled)
- scrollbars
 - allow the user to move the contents of the window up and down or from side to side
- title bars
 - describe the name of the window

Icons

- small picture or image
- represents some object in the interface
 - often a window or action
- windows can be closed down (iconised)
 - small representation for many accessible windows
- icons can be many and various
 - highly stylized
 - realistic representations.

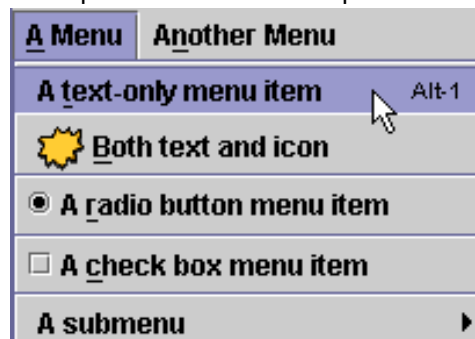
Pointers

- important component
 - WIMP style relies on pointing and selecting things
- uses mouse, trackpad, joystick, trackball, cursor keys or keyboard shortcuts
- wide variety of graphical images



Menus

- Choice of operations or services offered on the screen
- Required option selected with pointer



problem – take a lot of screen space

solution – pop-up: menu appears when needed

Kinds of Menu

- Menu Bar at top of screen (normally), menu drags down
 - pull-down menu - mouse hold and drag down menu
 - drop-down menu - mouse click reveals menu
 - fall-down menus - mouse just moves over bar!
- Contextual menu appears where you are
 - pop-up menus - actions for selected object
 - pie menu - arranged in a circle
 - easier to select item (larger target area)
 - quicker (same distance to any option)
 - ... but not widely used!



Menus extras

- Cascading menus
 - hierarchical menu structure
 - menu selection opens new menu
 - and so in ad infinitum
- Keyboard accelerators
 - key combinations - same effect as menu item
 - two kinds
 - active when menu open – usually first letter
 - active when menu closed – usually Ctrl + letter

Menus design issues

- which kind to use
- what to include in menus at all
- words to use (action or description)
- how to group items
- choice of keyboard accelerators

- Card Sort!

Buttons

- individual and isolated regions within a display that can be selected to invoke an action



- Special kinds
 - radio buttons
 - set of mutually exclusive choices
 - check boxes
 - set of non-exclusive choices

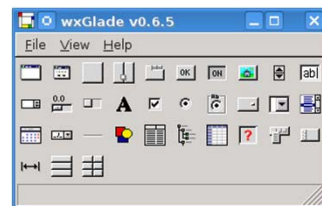
Toolbars



- long lines of icons ...
... but what do they do?
- fast access to common actions
- often customizable:
 - choose *which* toolbars to see
 - choose *what* options are on it

Palettes and tear-off menus

- Problem
menu not there when you want it
- Solution
palettes – little windows of actions
 - shown/hidden via menu option
e.g. available shapes in drawing package
 tear-off and pin-up menus
 - menu ‘tears off’ to become palette



Dialogue boxes

- information windows that pop up to inform of an important event or request information.

e.g: when saving a file, a dialogue box is displayed to allow the user to specify the filename and location. Once the file is saved, the box disappears.

interactivity

easy to focus on look
what about feel / behavior?

Speech-driven interfaces

- rapidly improving ...
... but still inaccurate
- how to have robust dialogue?
... interaction of course!

e.g. airline reservation:
reliable "yes" and "no"
+ system reflects back its understanding
"you want a ticket from New York to Boston?"

Look and ... feel

- WIMP systems have the same elements:
windows, icons., menus, pointers, buttons, etc.
- but different window systems
... *behave* differently
e.g. MacOS vs Windows menus

appearance + behaviour = look and feel

Initiative

- In interfaces you are familiar with, who has the initiative, system or user?
- who has the initiative?
 - old question–answer – computer
 - WIMP interface – user
- WIMP exceptions ...
 - pre-emptive* parts of the interface
- modal dialog boxes
 - come and won't go away!
 - good for errors, essential steps
 - but use with care

Experience, engagement and fun

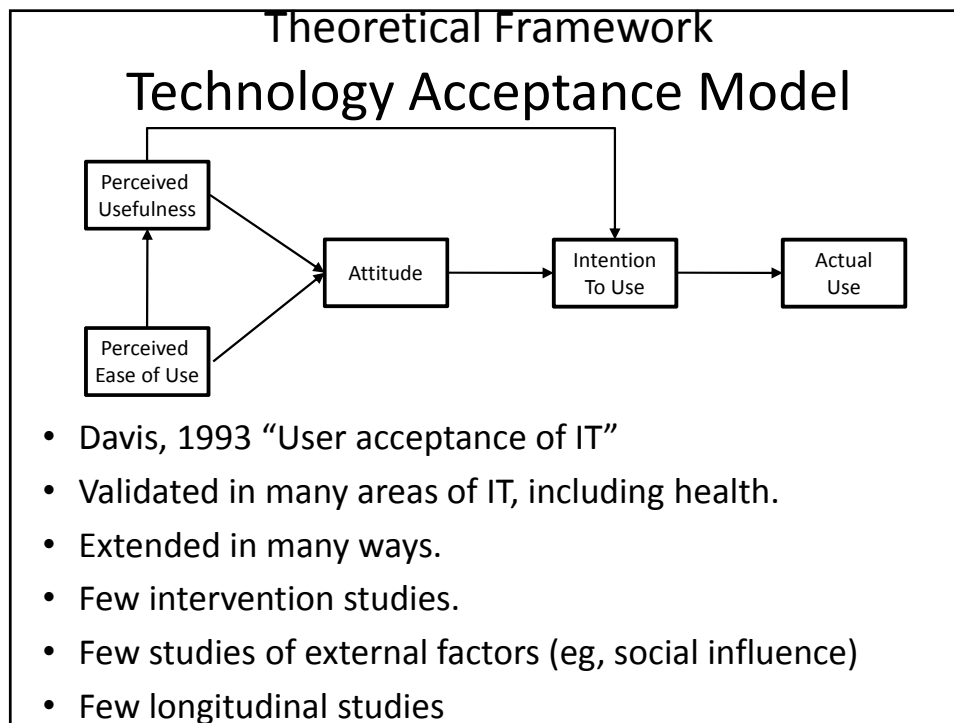
HCI is not only about efficiency

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



Frameworks for Subjective "User Experience"?

- satisfaction
- engagement / stickiness
- Technology Acceptance Model
- psychology of experience
 - flow (Csikszentimihalyi)
 - balance between anxiety and boredom
- education
 - zone of proximal development
 - things you can just do with help
- wider ...
 - literary analysis, film studies, drama



Flow

- The “holistic sensation that people feel when they act with total involvement.”
- When a person 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

- Enjoyment
- Time distortion

"Engagement"

- What is it?
- Who cares?

Notions of Engagement

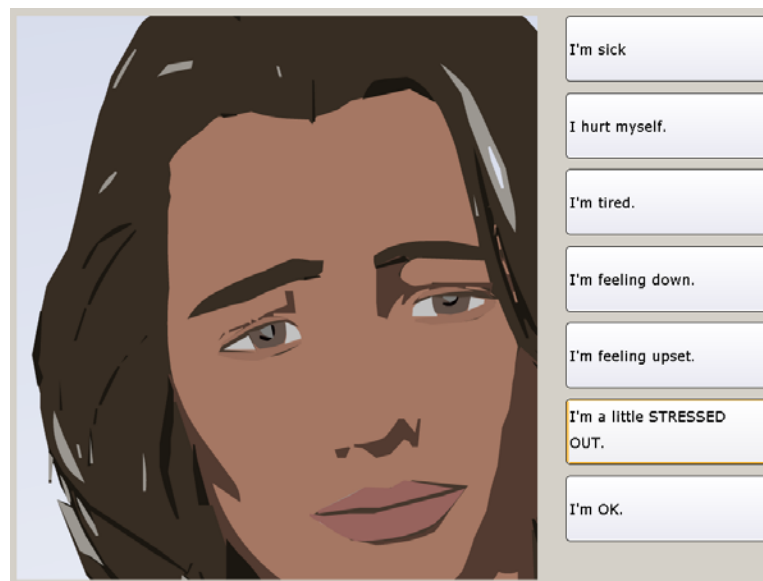
- First contact
 - Attraction
 - Seduction
 - Persuasion
- Cognitive engagement
 - Flow
 - Entrainment
 - Rapport
 - Immersion
- Short time scale
 - Stickiness (per session)
- Long time scale
 - Stickiness (aggregate over sessions)
 - Relationship Marketing
 - Adherence
 - Bonding
- Dark side
 - Addiction

Why is this important?

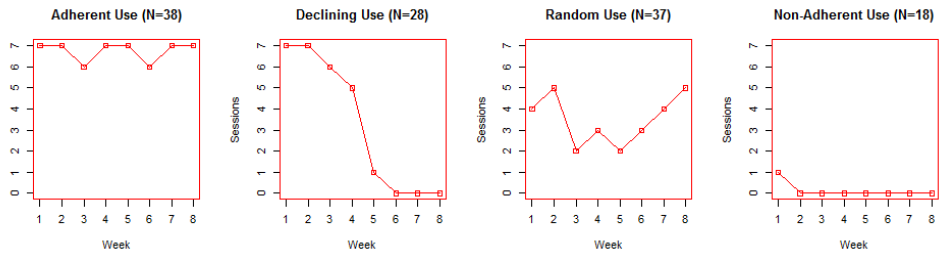
- Dot coms care about retaining users.
- Businesses care about repeat customers.
- Game designers care about repeat users and word of mouth advertising.
- Educators care about keeping attention.
- HCI researchers care about loss of productivity due to interruptions while users are deeply engaged.
- Health providers care about changing and maintaining health behavior
 - Usually takes weeks, months, years or a lifetime!
 - Assumed 'dose-response' relationship.
 - Retention is a pre-requisite to change.

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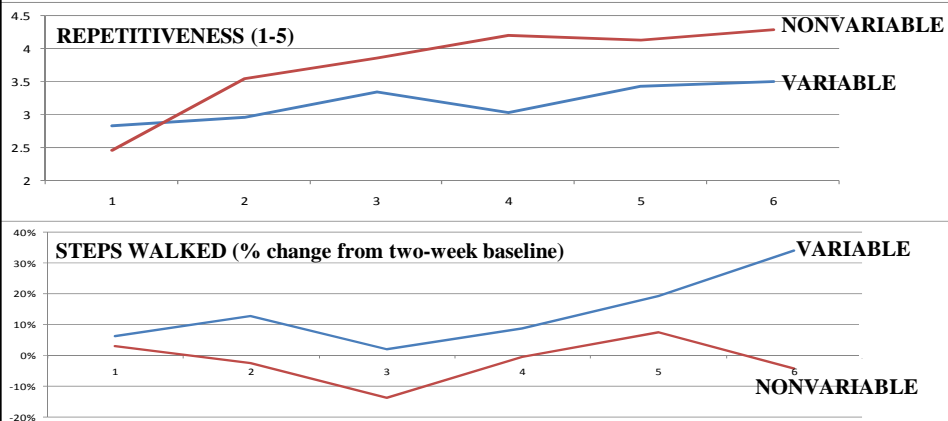
Virtual Coach Engagement Studies



Patterns of Engagement



Variability Study



Backstory Experiment

1ST-PERSON

I'd like to tell you some stories about myself.

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.

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.

3RD-PERSON

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.

When her family was living in Falmouth, her parents always had them doing outdoor stuff.

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.

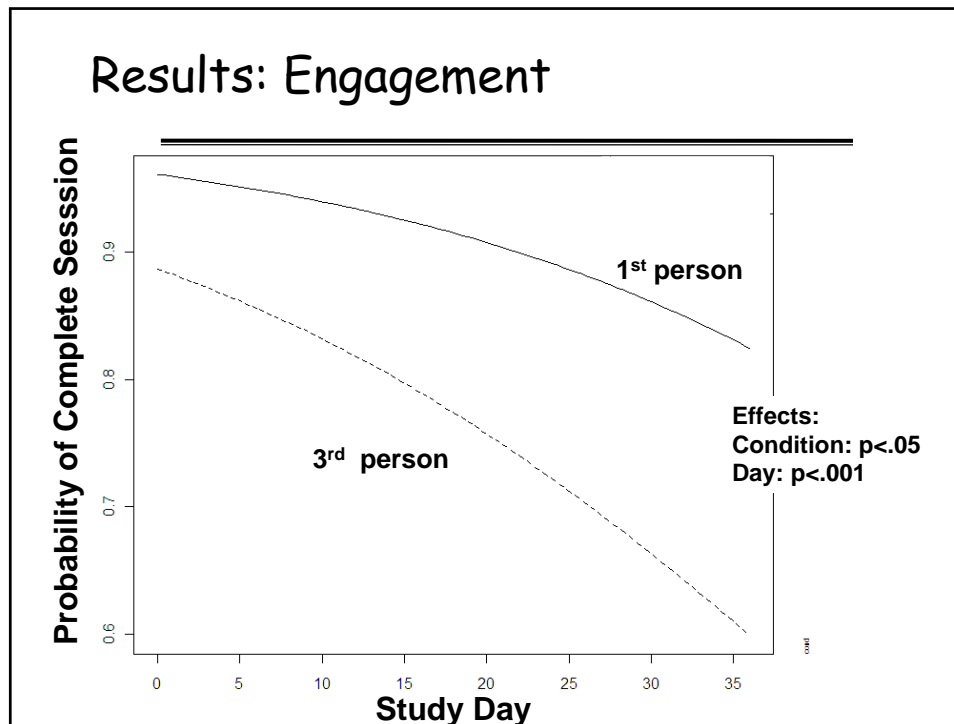
Results: Engagement N=26, avg 29 days

• **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

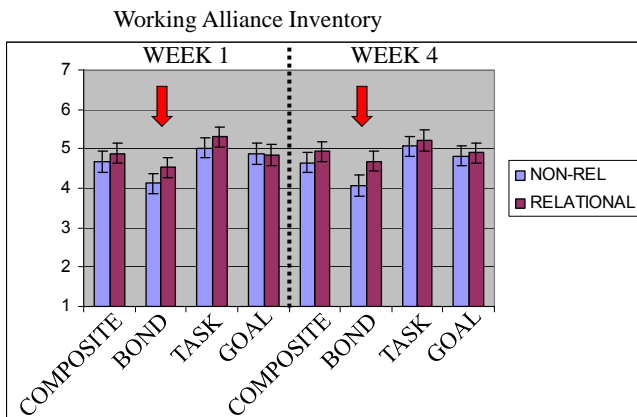


Simulating Human Relationship-building Behavior

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

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

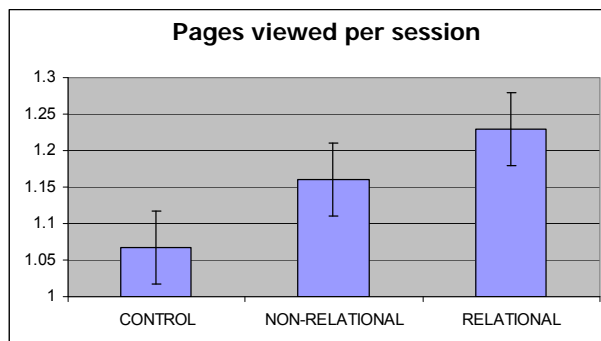
Bickmore, et al, *ToCHI*, 12:2 (2005), 293-327



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

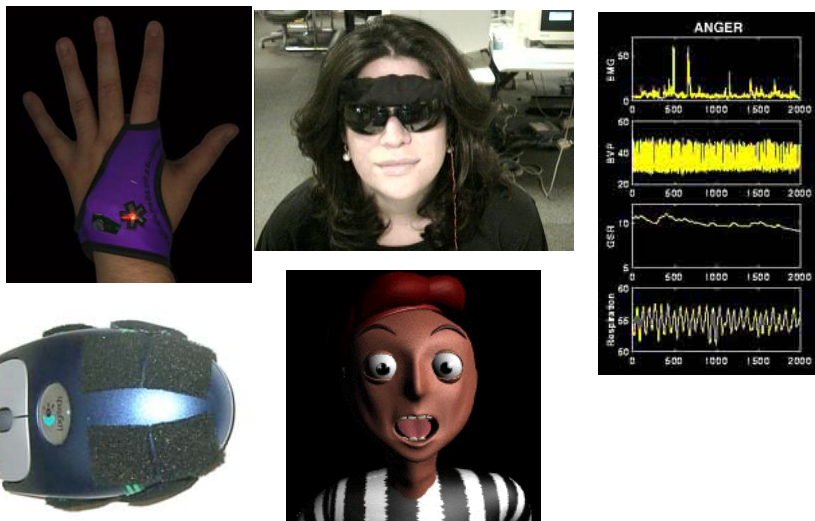
73

Participation Results All Subjects



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

Positive / Negative Affect Affective Computing



chapter 4 paradigms

why study paradigms

Concerns

- how can an interactive system be developed to ensure its usability?
- how can the usability of an interactive system be demonstrated or measured?

History of interactive system design provides paradigms for usable designs

What are Paradigms

- Predominant theoretical frameworks or scientific world views
 - e.g., Aristotelian, Newtonian, Einsteinian (relativistic) paradigms in physics
- Understanding HCI history is largely about understanding a series of paradigm shifts
 - Not all listed here are necessarily “paradigm” shifts, but are at least candidates
 - History will judge which are true shifts

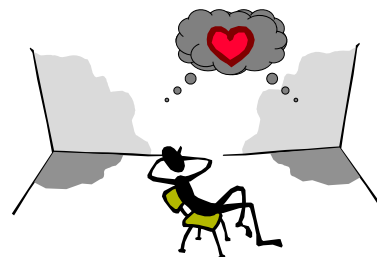
Paradigms of interaction

New computing technologies arrive, creating a new perception of the human—computer relationship.

We can trace some of these shifts in the history of interactive technologies.

Example Paradigm Shifts

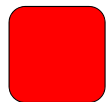
- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor
- WWW
- Ubiquitous Computing
- A symbiosis of physical and electronic worlds in service of everyday activities.



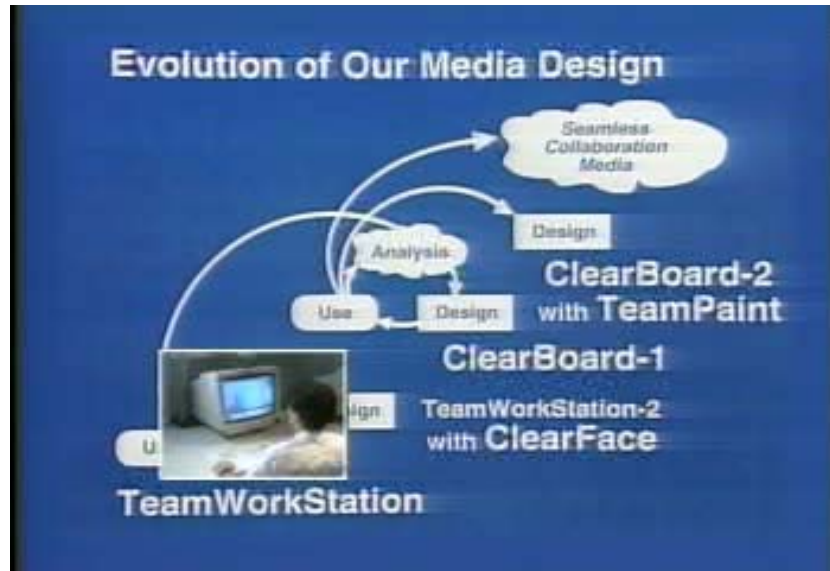
Some HCI Paradigms

- For each...
 - What's the new idea?
 - Pros?
 - Cons?
 - What would you use this for?

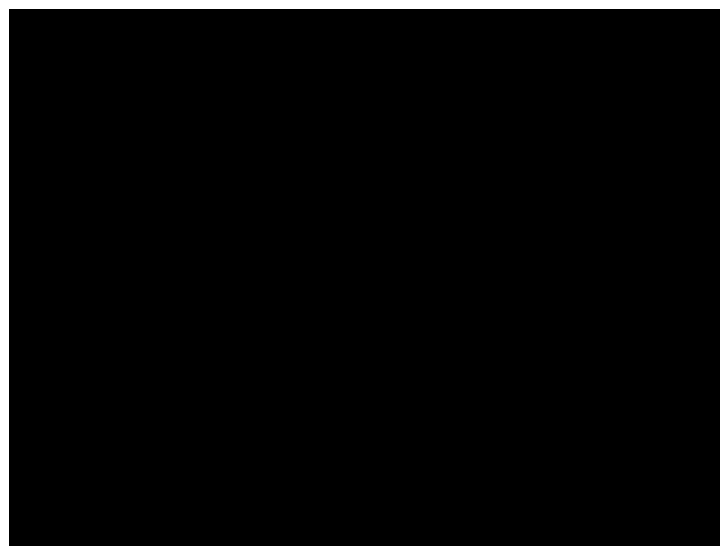
ubicomp



CSCW (one vision)



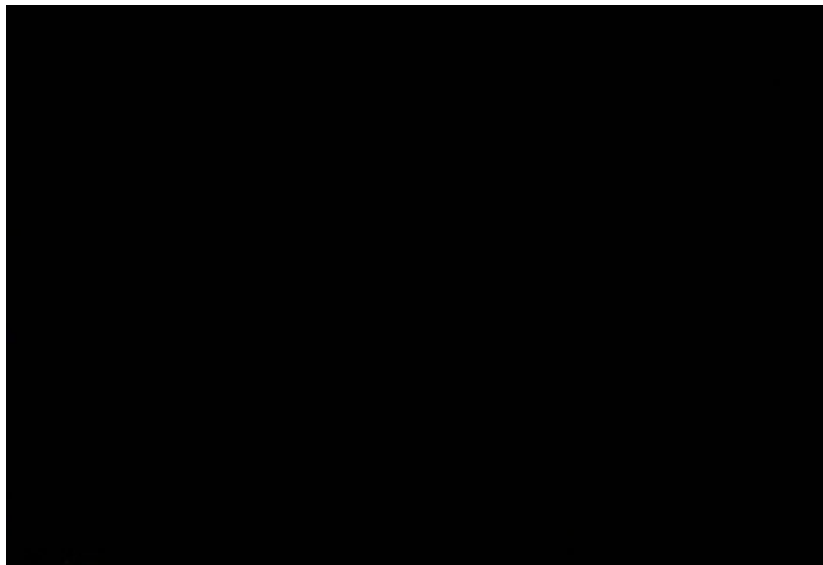
CSCW 2



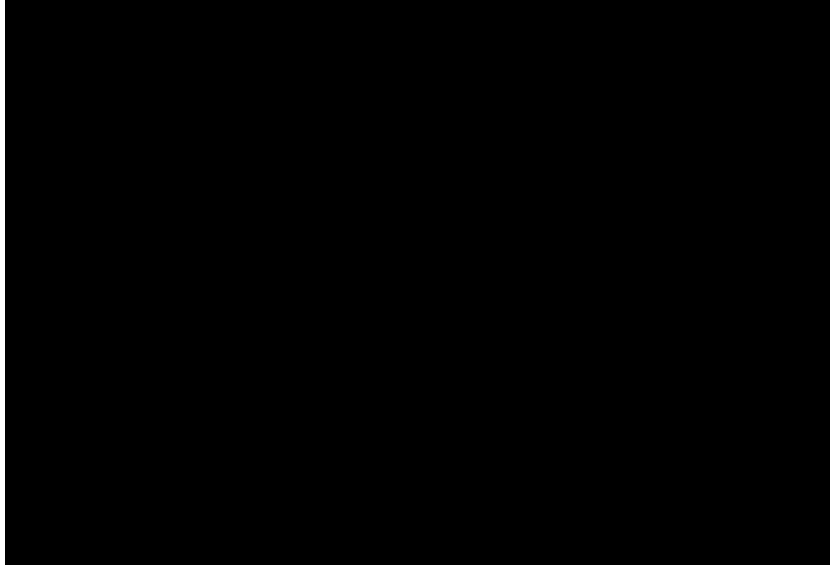
Tangible Computing



Tangible Computing



Tangible Computing



mped

l-goo

Ambient Computing

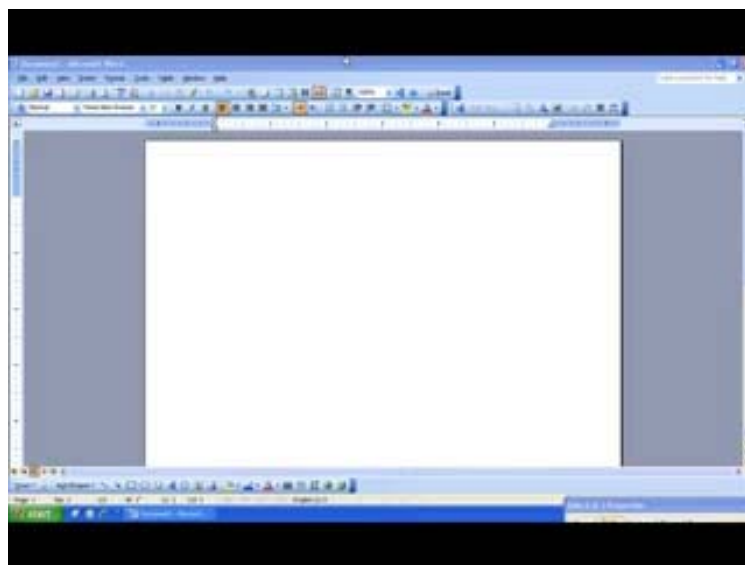


3200

Smart Room (one of many)



Social Interfaces



Intelligent Assistant

Apple - 1987 - "Knowledge Navigator"



Embodied Conversational Agents





To do...

- Read
 - Users & Tasks (Dix Ch 13 & 15)
 - Rosson except
- Final Project Proposals (next class)
- Continue I3 ethnography homework (1 wk)