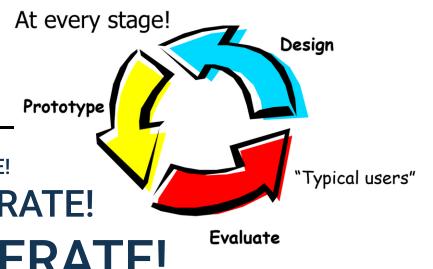


HUMAN-COMPUTER INTERACTION (HCI) is concerned with the design, evaluation & implementation of interactive computing systems for human use

PROCESS OF HCI



RESEARCH & OBSERVE

- goal: validate or generate what the system needs to do, who the user is, what the user needs to do, and examples of system use
- observation leads to **requirements analysis** of potential users
- use multiple techniques for understanding activities in context: background research, interviews, observation, collecting artifacts
- **ethnography**: art & science of describing a group/culture by telling a vivid story of the why, not just the how

IDENTIFY STAKEHOLDERS

- identify the characteristics of your users for each class:
 - **primary**: end users
 - **secondary**: receive output or provide input
 - **tertiary**: directly affected by success or failure
 - **facilitating**: involved with design, development, maintenance
- for each class, create a brief **persona**: representation of a person the system is designed for

ANALYZE TASKS

- **task**: a goal together with some ordered sets of actions
 - decomposes into tech-independent hierarchy of tasks/subtasks
- **knowledge-based analysis** aims to understand knowledge needed to perform a task including objects, actions, events, relationships

CREATE SCENARIOS

- **scenario**: concrete narrative about specific people, in specific contexts, performing very specific tasks
- **problem**: describe current situation features, what users can do
- **activity**: propose transformation from current practice into new design features
- **information**: how users perceive, interpret, make sense of info
- **interaction**: physical actions and system responses that enact and respond to the users' task goals and needs
- **elements**: setting, actors, task goals, plans, eval., actions, events
- have at least one scenario for each type of primary stakeholder

- ENVISION** *making design ideas concrete to ourselves and others*
- all aspects can be envisioned: concepts, functions, structure, interactions, people
 - envisioning occurs throughout development
 - techniques to generate ideas: design sketches, storyboards, mood boards, wireframes, navigation maps, lo-fi and hi-fi prototypes
 - strategies to improve UI (e.g. think about a TV remote):
 - remove, displace, organize, hide
 - sources of design guidance:
 - standards: internationally agreed upon design principles
 - style guide: collection of design rules for company/product line



- Useful = Utility (whether it provides needed features)
 - + Usability (how easy/pleasant the features are to use)
- The best way to have a good idea is to have lots of ideas.
- Ideas are cheap; programming is expensive.
- It's never your users' fault – it's always yours!

EVALUATE

- goal: measure usability metrics and identify specific design problems to fix
- human-centered design principles
 - **learnability**: visibility, consistency, familiarity, affordance
 - **effectiveness**: navigation, control, feedback, recovery, constraints
 - **accommodation**: flexibility, style, conviviality
- expert analysis (easier):
 - inspection methods
 - **heuristic evaluation**: time-efficient, especially in early stage, with severity ratings (see *heuristics on next page*)
 - **cognitive walkthrough**: methodical, task-directed
 - models: build + evaluate a formal model
- user or participant-based testing (harder & time-consuming, but more valuable):
 - **qualitative methods**: observation, interviews, questionnaires, think aloud, ethnography, focus groups
 - **quantitative usability evaluation**: descriptive studies, experiments

only after iteration, move to
hi-fi prototyping +
implementation

PAPER PROTOTYPE

- why paper prototype?
- lo-fi prototyping is fast and affordable
- focus on interaction
- test big ideas early
- get honest feedback because users underestimate investment
- apply Fudd's first law of creativity: "To get a good idea, get lots of ideas"
- challenge: it's hard to simulate quick interactions and context
- running a session consists of:
 - **subject**: ideally a stakeholder
 - **facilitator**: speaker who explains purpose & encourages user to verbalize thought process, but doesn't explain system
 - **computer**: organizes paper model, improvises modifications on the fly
 - **observer**: notes hesitations, confusion, possible solutions

THEORY OF HCI + TYPES OF INTERFACES

HUMANS

- People use **Technologies** to undertake **Activities** in **Contexts**
- **short-term memory** stores info for a few seconds
 - limited to 7+2 pieces, can improve with chunking
 - **long-term memory** allows for “unlimited” storage of memories and skills
 - **attention** is concentration of mental effort on sensory or mental events
 - affected internally by stress, arousal, task complexity, object tracking limits (4)
 - everyone’s **mental models** are incomplete, unstable, limited in accuracy, without firm boundaries, unscientific, parsimonious
 - thinking through them for requirements informs design
 - **interaction metaphors** evoke mental models in users of system’s structure/operation (trash bin on desktop)

GUI SOFTWARE ARCHITECTURE

- GUIs combine WIMP features + other graphical objects
- WIMP GUIs influence today’s GUIs for good (uniformity) and bad (stagnation)
- OOD well-suited to UI programming; natural metaphor
- MVC divides application into **model** of core functionality and data + **view** displaying info to user + **controller** handling user input

SOCIAL INTERFACES

- sociality is built on **communication**
- human interaction is complex, has both verbal and nonverbal social cues
- important to understand interactions: within the system (traditional CS), between users and system (HCI), among users (sociology)
- key aspects of social media include social networking and sharing content

INTERACTION

- cognition is distributed across multiple people, tools, artifacts (i.e. shopping with list)
- Norman’s interaction framework
 - **domain**: the area of work under study (graphic design)
 - **goal**: what you want to achieve (create red triangle)
 - **task**: how you go about doing it using operations or actions (select fill tool, click over triangle)



- assume errors will be made in **execution/evaluation** loop, so design to minimize error and error costs
 - fix **slips**, errors in executing action, with better interface designs
 - fix **mistakes**, errors in formulating intention/action, with better understanding of system
- common interaction styles (each have pros/cons): command line, menus, natural language, Q&A, form-fills, WIMP (window, icon, menu, pointer)
- HCI history is about understanding paradigm shifts, e.g. batchprocessing, GUI, microprocessor, cloud computing

WEB DESIGN

- nonlinear structure of hypertext (linked pages) is powerful, but potentially confusing for users due to:
 - cognition and content
 - navigation and structure
- unique web design challenges: deep links, bandwidth/network issues, browser inconsistencies, ties to particular technologies (JavaScript), casual use
- design process and heuristics still similar to other interfaces → focus on task organization and info
- **Jacob’s law of web user experience**: users spend most of their time on other websites
 - so people like and respond to familiarity

GUIDELINES FOR HCI

Nielsen’s heuristics

- provide feedback
- speak the user’s language
- clearly mark exits
- be consistent
- prevent errors
- minimize user memory load
- provide flexibility/shortcuts
- simplify design
- use good error messages
- embed help and documentation
- + use appropriate affordances (*manipulability*)
- + create visibility (*obviousness*)

Nielsen’s web design mistakes

- bad search
- PDFs
- not indicated visited links
- non-scannable text
- fixed font size
- pages titles with low SE visibility
- info that looks like ads
- violating design conventions
- opening new browser windows
- not answering users’ questions

Fitts’s law: time to hit target on screen, depends on distance between cursor/target, target size

$$T_{(time\ to\ move)} = k * \log_2 \left(\frac{D}{S} + 0.5 \right)$$

What influences screen layout

- users have limited short-term memory
- use attention-grabbing techniques (color, motion, sound) sparingly
- prime user to complete tasks
- visual perception
- Gestalt principles: proximity, closure, continuity, part of a whole, similarity
- depth perception
- shape/color consistency
 - potential issues: color blindness and saturation
- pattern recognition