**Week1 what is HCI**

**Factor of HCI**: human factor, computer science, social science, cognition, engineering, ergonomics

**UI**:part of system enable in/output, creates intercommunication

**Importance**: critical part; directly influence success of project; bad UI is costly; hard to get right.

**Usability goals**: effectiveness, doing its job; efficiency, helps user; safety; utility; learnability; memorability

**UX**: core component of HCI, focus on feeling&emotion, pleasure& satisfaction when using product, subjective qualities. Desirable: satisfying, engaging, motivating, etc. undesirable: boring, childish.UX is different to usability, can change success of app.

**Theory,principle,guideline**: theory&model: high level,abstract, help to predict outcome&behavior, eg: fitt’s law(time to move from A to B). principle: analyze&compare, focus on user, wide application,eg gold rules; guideline:specific, eg Accessbility des

**10 golden rules**: keep UI simple; speak user language; be consistent&predictable;make things visible&feedback; minimize memory load;design for error(undo); clear exit&close dialogue; include help&document; offer shortcut for experts; make system responsive.

**Week2 interaction design in HCI, conceptual model, metapho**

**Design principle**: visibility:usable operations should be visible; feedback: user should understand what’s happening; constraints: restrict unwanted user interaction, contains: physical/semantic(contextual)/cultural/logical; consistency: similar operation&similar element for similar task, makes UI easier to learn and use, internal&external(within/out app); affordance: perceivable action, what UI suggests, eg push/pull; mapping: spatial/physical/cultural/perceptual analogies.

**Conceptual design**: organize vague assumption of problem to reformulate poorly structured design idea, conceptualize solution; good for orientation: evaluate model by ask about different aspect of design; open-mindedness: explore many alternative to problem; common ground: reduce confusion by creating common terminology.

**Conceptual model**: a highly simplified explaination of how sth works. Benefits: provide high level desc of how system organize&operate, help to make up mind before doing design.

**Normal’s conceptual framework**: How system should work(designer model) -> How system presented to user by interface/manual(system image) <-> User’s understanding of how system works(user’s model). Good interface should have user’s model matches designer’s model. System image should make designer model clear to user, if not, user cant understand system, needs extensive document, lead to error.

**Metaphor**: exploit familiar to understand unfamiliar, provide structure based on real-life aspect that user understand. Eg: desktop-real desk; Advantage: ez to learn new system, help understand conceptual model, support diverse user, helps innovation; Disadvantage: constrain, hinder designs, limit user understanding, may use poor design as metaphor, may break conventional/cultural rules(eg bin on desktop).

**Interaction types**: provide means to conceptualize design space with interactions. **Instructing**: user tell system do what, eg terminal, quick&efficient, good for repetitive action on multiple objects; **Conversing**: user dialogue with system, eg virtual agents. PRO: Provide familiar way to interact, no learning needed. CONS: may be one-sided and trapping in error loop. **Manipulating**: manipulate objects, GUI is direct manipulation. **Exploring**: user move through space, similar to explore in real. **Responding**: system firstly show user stuff relevant to context.

**Direct manipulation**: ez to learn, expert work fast, ez to remember, immediate feedback; CONS: not applicable to all UI, take screen parts limit, overshooting, and sometimes slower.

**Week3 evolution of UI**

**Command based interface**: punch card -> CLI, ezer& faster than menu based system, precise, provide scripting for batch, sometimes better accessibility But hard to remember, difficult to novice, not intuitive. Design and research on form of commands, systax, organization, and consistency(method to label/name commands).

**Desktop user interface**: must be direct manipulation, WIMP paradigm, and desktop metaphor.

**WIMP paradigm**: **Windows**: section of screen can be manipulated by mouse to overcome area limitation; arranged to leverage spatial information organization. Issue: how to let user move fluently, spacing grouping simplicity, switch between windows without distracted. **Icons**: can be similar(thumbnail)/analogical/cultural(x for close), don’t re-invent, use text labels, rollover labels. **Menu**:style:flat/dropdown/popup/expanding/collapsible /contextual, consider depth, breadth, structure and navigation, placement is critical. **Pointing device:** direct/indirect(touch-fast but inaccurate/mouse-not ez to learn but accurate). Addition WIMP: drag&drop, contextual menu, system-wide clipboard.

**Post WIMP UI**: WIMP reduce interaction to other sensory channel. Aspects: naïve physics-illusion of rubber surface when zooming image, body awareness-turn off near face, Environmental awareness-spatial metaphor browsing photo, social awareness-other ppl’s action, like in market.

**Mobile UI**: challenge: small screen, diverse input mode, different context&conditions, fat finger problem. Design issue: need manual dexterity, small screen, context.

**Speech UI**: hands free, accessible, issue: keep continuity(recover from interruption&error), speech recognition, type of voice.

**Interactive UI**: midas touch-no hover, right click, etc, occulation hand over display, fat finger, collaboration.

**Tangible UI**: object used to control AND represent UI. Benefits: direct interaction, spatial reasoning, enlightening, facilitate creativity and good for collaborate, but restricted to single purpose and limited capability.

**VR**: high fidelity, different exp than real, but hard to wear, fatigue&motion sickness, and impossible to simulate all.

**Wearable**: operational when user is on move, hands free.

**Week4 cognition aspects**

**Cognition**: process of knowledge is developed in mind.

**Cog in HCI**: interaction is cognitive, provide knowledge on what user can/cant do, identify&explain nature/cause of problem, provide theory principle guideline on design.

**Experiential cog**: ppl feel&react effortlessly, require certain lvl of expertise. Eg drive, read, watch, talk.

**Reflective cog**: involve mental effort&decision making. Lead to new idea&creativity. Eg design,learn,write report.

**Cognitive process**:

**attention**: involve sense, can be both focused/divided. –make information salient, avoid cluttering, ways to switch

**Perception**: how feeling transform to exp – text be legible icon ez to identify. Attentive: visual scanning&compare. Slow&effort. Preattentive:visual feature in parallel (color, shape), fast&subconscious; But Misperception happens. HCI: user react to spatial/temporal order, understandable

**Gestalt law**: good shape; proximity(close position); closure(interrupt); similarity; continuity.

**Auditory perception**: sounds should be audible/distinguishable, characteristics be confortable, speech should be intelligible.

**Tactile sence&haptic perception**: touch, temperature, feel. HCI: can be input, should select stimulus depend on requirements.

**Multimodel effect**: one modality(sence) can affect another.

**Memory**: recognize>recall->GUI >commandline. More attention &processed -> more remembered. HCI: avoid long procedure, promote recognition, help user identify by provide ways of label.

**Mental model**: internal construction of external world to make predictions. Mental model is often incomplete and erroneous. Design clear instruction and implication (affordance).

**Gulfs**: execution: how user use the system. Evaluation: how system present state to user.

**External cog**: reduce memory load, computational offloading, annotating and cog tracing. Eg shopping list/reminder.

**Week5 requirement gathering**

**UCD**: focus on user&task,empirical measurement, iterative design. Has good functionality, expectation management, ownership.process: requirement-design alternative-prototyping- evaluation-requirement/design alternative(cycle).

**Req gathering**: why: miscommunication, costly if fix made later. Kinds: functional, data, environmental(physical/social/technical/ organizational), user(user profile with characteristics and system use(level of operation)), usability/UX.

**Establishing req**: why develop the system(problem space)? Who are the users? What do they want to do with system? Situation of concern: 1-3 sentence of main goal&main constraint. Problem statement: brief statement capture intend solution, Consists of: form of solution, type of support, activity it support, the users.

**Who user**?: stakeholder: everyone affected by system, larger than users, helps identify group to include in UI design activities.

**Persona**: set of user profile, from real ppl based on research, typical not idealized. Have: persona group, fiction name, job title& responsibility, demographics, goal&task, physical&social&tech environment, summary of what he need, picture. Benefit: help focus decision, inform functionality, help designer on decision, remind team on user. Develop set of persona with 1 primary.

**Scenario**: tell a use story in words of users. Allow designer identify stakeholder&artefact in activity: repeated – important; allower designer explore constraint, context, irritation, facilitator.

**User case**: focus on functional requirement&capture interaction, used in design/capture req, step by step desc of interactions. Essential use cases: division of talks between user& system, focus on user intention&product responsibility, no interaction detail. Eg user intention vs system responsibility. Normal/alt course user case: more detailed, capture user’s goal eg flow steps on how to do sth, alternative provided when one step break down.

**Data gathering**: **Setting goals**: identify user/stakeholder, task-context-rationale, decide how to analyize collected data.

**Decide whom gather from**: how many participants needed, involve all stakeholder groups.

**Relationship with participant**: clear and professional, consent.

**Triangulation**: look at data from >1 perspective, collect >1 type of data/method, eg qualitive: experiment and quantitive: interview.

**Pilot study**: small trail of main study, more than 1 is better.

**Data recording**: Notes: good overview, less intrusive more flexible, helps to focus. But: slow, easy to lose concentration, biases->work in group. **Audio/video**: privacy issue, need to ensure quality.

**Observation**: good in any stage, direct: require time and commit from team member, can produce huge data. Indirect: through study records afterward eg diaries, logging, video/photo.

**Silent ob**: discover what user does, but no understanding of decision process, user mental model, user opinion.

**Think aloud**: user talk their state, goal, action. Give insight into user’s thinking, but not ez to talk when doing task, not natual to say loud, talking can change behavior.

**Constructive interaction**: 2 ppl think aloud together, more natual. Give insight into mental model of beginner and pro at same time.

**Interaction logging**: benefit: quantitive data, little effort, remote collection, long term/field study. But: privacy, not used isolation.

**Planning&conduct obs**: how involved u will be, gain acceptance, how to collect data.

**Interview**: **open ended**: not by script, like conversation. Open questions. Rich data, broad issues. But non consistent, cost time.

**Structured**: scripted, consistent, close question. Replicable, short time, but lack richness, only useful vs clear goal/questions.

**Semi**-structured: combine both of above.

**Focus groups**: interview in groups, good for shared issue. Allow diverse&sensitive issue, good at consensus view. But can be dominated by individuals, and asker needs to be experienced.

**Questionnaire**: maybe different for different ppl, need clear instructions. Ez&quick to distribute, quick response, low cost, database collection, reduce analysis time, correct error ezly. BUT: sampling problem if pop.size unknown, preventing individual response >1, email questionnaire sometimes change question. Process: plan, design, template, test, test out group, profit.

**Week6 and 7 design and prototyping**

**Design alternative**: conceptual: outline what ppl can do, what ppl need to know, no detail and constraint. Concrete: concern about detail of design like menu type and graphic. Consider restriction and details. Both alternatives are intertwined.

**Initial concept model**: how to choose interface metaphor, which interaction type is best, do different UI type suggest diff option?

**Storyboard**: visual narrative of action/event sequence the user &product go through to achieve a goal, can be from scenario by breaking scenario into steps, and create 1 scene for each step. Note: Separate sketch min3 max7, sketch labelled with desc, context of interaction need to be visible, only 1 path modelled, correct level of detail in sketch.

**Concrete design**: has many aspects, consider user char. and context. Accessibility and cross-cultural design.

**Why prototype**: get early evaluation&feedback-stakeholder do proto ezer than doc, communicate effectively, test out ideas, ez&quick to change, encourage reflection-clarify vague, proto answer question and support designers in choosing alternative.

**Hori&vert proto**: hori – wide, vert – detail.

**Proto Process**: start early and continue through design process, start with important question then minor, question—fidelity++.

**Lofi**: use a medium unlike real medium eg paper. Quick cheap ez to produce eg paper, post-it note, wizard of OZ. testing: summry& prioritize problem, refine by iteration, move to hifi when good.

**Paper proto**: sketch of interface, capture and explore element of interaction, similar to storyboard but only show UI with detail. Encourage reflection, allow focus, quick cheap, communicate with user. BUT dialog hard to convey, difficult for novel interaction model such as tangible UI or AR.

**Wizard of OZ**: good for complex feature and test futuristic ideas.

**Lofi pro/cons**: PRO: quick revision, more time on improving design before development, evaluate multiple design concept, useful communication device, proof of concept. CONS: limited error checking, poor detailed specification for develop, facilitator driven limited usefulness for usability test, navigational/flow limitation.

**Hifi**: same material with product, look like final system, can be developed by intergrating existing stuff. PROS: complete function, fully interactive, user driven, clear navigation scheme, gud 4 test, evolving specification, marketing tool. CONS: require resource and time, inefficient for proof of concept, users are afraid to criticize, management may think product is ready.

**Screenshot:** pro: visual detail, ez 2 design, design can be final product. Con: no interaction, hard to be criticized.

**Screen storyboard:** more interactive but not all scenario.

**Tool:** create elements, need coding like webUI, can be used for final product.

**Physical:** from lo-hifi, express physical aspect like size weight, ez 2 manipulate and haptic feedback, but limited.

**Week8 and 9 and 10 evaluation**

**Evaluation:** to improve design of UI, involves collecting and analyzing data of real/potential user’s UX with design UI. Focus on both usability&UX, enables designer to check if design is appropriate and acceptable by target user.

**Why:** focus on problem&need of user group, make informd decision on design, fix problem before product sale.

**What:** will user need the design? Eg get early feedback on design,focus on usability issue,how design suit user group.

**Where:** usability lab-has instruments and observation room, PRO: controlled situation, ideal for 1 precise aspect, many equipments. CONS: not natual situation, hard to sum.

**Where-**2: more effectively in natural settings, as in-the-wild study or field study: in-situ. PRO: more realistic, good 4 long term, good 4 UX. CONS: hard to plan&run, time consuming, task&envirinments is difficult to control.

**When:** throughout design: iterative design check if design match requirement; before deployment if system has good performance; after deployment.

**How:** 1.determine the goals 2.explore the questions-break goals into treatable questions. 3.choose approach&method 4.evaluate,interpret,present data-consider:reliability, validit biase, scope, ethics. Validity: in/external.

**Types:** *controlled setting*-usability, *natual setting*-field study, *analytical evaluation*-not involve users.

**Controlled steps:** 1.determine goals, explore questions, form hypothese2.design experiment3.choose subject4.pilot experiment5.iteritive design6.run exp.7.interpret result.

**Hypothesis:** a claim to predict experiment outcome. Experiment is designed to accept/reject hypothesis.

**Control variable:** ++ external validity, more generalizable. CONs: --internal validity, more variable->less reproducable

**Random variable:** --external validity, ++internal validity.

**Experimental task:** how to elicit a change? Task is usually self evident from question&hypothesis, centre task around variables. Good task: represent activity ppl do with UI, ++external validity, compromise internal one. Discriminate among test conditions, helps to achieve statistically significant outcome, may elicit change.

**Participants:** goal: get generalizable result, even to ppl not tested ->target population. Select participant should represent target pop., select randomly from pop. Select right number: fail to get stat. significance if too few, follow similar research and often 6-12 is good number. For quick feedback 2-3 ppl is enough.

**Assign participants:** within subject: all ppl do all task, PRO: fewer participants-easier to conduct, less variation by participants, no need to balance group. CON: order effect(fatigue), learning effect(familiar); between subject: diff ppl do diff task. PRO&CON: upside down above.

**Matched participant(pairwise) design:** participant match in pairs on certain characteristic(expertise, gender), each pair randomly allocated to each experimental condition. PROBLEM: not-considered variable may affect result.

**Counterbalancing:** learning effect, fatigue effect. To avoid: participants divided into groups, test conditions administered in diff order to each group, order of administering test conditions uses a latin square.

**Questionnaire:** used to collect information on participants, solicit feedback, comment suggestions etc. usually a brief session.

**Pilot study:** always do pilot with several representive users, do it asap, expect major change and plan accordingly. Discover problem in experimental planning can save a lot of time later.

**Field study:** goal: evaluate product with user in natual setting. Used to identify opportunities for new technology, determine design requirements, decide how best to introduce new tech, evaluate tech in use.

**Field study method:** observation, interview, interaction logging, recording forms: notes, photo, audio/video, logging, diaries.

**Observation:** good for identify UI design problem, should observe reasonable number and range of users.

**Interviews:** helps to explore given issue by design to questions accordingly and ask open-ended questions. Problem: time consuming, easy to bias, subjective.

**Retrospective testing:** post user study interview. Perform a test(observation, thinkaloud, etc), record it, and review with user to get clarify, suggestion and avoid erroneous interpretation.

**Critical incidence interview:** discuss critical indicidence encountered by the user, raise issues that are not seen in usability lab tests.

**Week11 CSCW**

**Time/space groupware matrix**

|  |  |  |
| --- | --- | --- |
|  | Same time | Diff time |
| Same place | 1Face2face int. | 2Continuous task |
| Diff place | 3Remote int. | 4Comm.&coordination |

1: system help co-locate users to coop. eg smartboard

2: system let ppl coop in diff time same space. Eg teamroom

3:interact ubiquitously. Eg zoom meeting, real time chat.

4:most common. eg email, group calendar, wiki

**Ethnography**: a requirement gathering technique include participant obs. and interview, by immerse asker into the culture they study, collect comment, incident & artefact.

**Ethnography2**: coop of ppl being observed is required, informants are useful. Data analysis is continuous-refine question as knowledge grow, interpretivist technique. Reports usually contain examples.

**Week12 emotional&persuasive interfaces**

**Emotional UI types:** expressive interface-eliciting positive response; annoying interface-how computer annoy users; Anthropomorphism&interface agents-human like UI; persuasive technology and behavioral change-change ppl’s attitude and behavior. Interactive computing systems designed to change people’s attitudes and behaviors. Eg popup ads, warning msg, prompt, referred as nudging.