Goal:
→ optimize interaction between human and computers
→ efficiency, usability, safety, satisfaction

HCI

Chapter 1:

Human Computer Interaction (HCI):

→ a field that encompasses various disciplines such as engineering, psychology, engonomics and design.
↓
human factor eng.

→ focuses on understanding, designing, implementing and evaluating the ways humans interact with computing devices.

Ex: process of using smartphone to send a text message.

Interaction → how users navigate phone's interface
→ " " interpret icons and buttons

Interface → design of layout, size and placement of buttons

Interface: point of interaction between user and system
Ex: → GUIs, button, touchscreen, voice commands, windows, widget, monitor.

Interaction: process of communication between the
Ex: → when a users navigates menus
→ select options → inputs text

Diff between Interface and interaction:

* Goals of HCI (4)

1) Functional completeness → nothing missing

2) High Usability → easy to use

3) Aesthetic Appeal → looks good

4) Compelling User experience
UX

→ so great to use

→ you want to keep using it

* Some big changes: mouse
spread-sheet
web browser | smartphone

* Evaluation:

Terminal / Keyboard → GUI → touch based/ hand-held

Challenges of good HCI design:

1) Consideration of:

a) user types

b) task characteristics

c) capability and cost of device

d) Lack of objective

e) changing tech.

2) knowledge in diff. fields
3) balancing simplicity and complexity
4) " user expectation, and innovation.

Principles (7)

1) Know thy users: diff. users based on culture, age, gender
→ their diff. skills, preference.
→ universal usability
(1 website, diff. language so that many users can use)

2) Understand task:
→ identify sequence/structure of tasks and subtasks
→ for experts, tasks are designed with detailed steps

3). Reduce memory Load:
Ex: Pizza app: no need of users to remember their fav orders or past addresses
→ app remembers user details
→ no need to input them every time

Human has short term memory

4) Strive for consistency:

→ diff pages of app → same

→ ms powerpoint and word style same

→ layout / screen → same
button style
size / position

5) Remind users and refresh their memory:

Ex: pizza app:

If users abandon their orders midway, app sends a notification to remind them to complete their purchase

→ bring users back where they left last time (in ms word app)

6) Prevent errors / Reversal of actions:

→ choose from options rather than input text (ex. auto-rickshaw website)

→ review order before finalize, edit

→ confirmation popup before delete / confirm anything

7) Naturalness: → make comfortable and effortless to use

→ how people naturally interact with physical world

WIMP — windows, icons, mouse, pointer

Chapter 2:

Principles	vs	Guidelines
— General / broad		— specific — derived from principles — 2 categories: 1) Domain specific 2) general HCI design

Domain:

1) User type → age, gender, disability, culture, etc
2) Platform type → VR, mobile, desktop, OS
3) App type → Ecommence, game, Social network.

User with disability

a) **Perceivable:**
   i) Provide text-alternatives for non-text content.
   ii) captions and alt for multimedia
   iii) make it easier for user to see and hear content.

b) **Operable:**
   i) make all functionality available from a keyboard
   ii) give users enough time to read and use content
   iii) help users navigate and find content
   iv) Don't use content that causes seizures

c) Understable:

i) make readable/understable texts

ii) make content appear and operate in predictable ways

iii) help users avoid/correct mistakes

d) Robust: i) maximize compatibility with current and future user tools

platform type 2) → a) Fast status information → provide quick updates

avoid overcrowd ← b) efficient use of screen space

similar consistent ← c) follow devices interface patterns

d) large hit targets → button enough big → avoid accidental hit

dropdown menu ← e) minimize typing / pressure on input hardware

f) avoid density of info and object → simple / minimal layout

g) Fience task focus → main task at front/center

h) enable shortcuts

i) keep users informed of his actions

Commerce APP

→ 404 guidelines

→ 4 groups : general (1), input/output form (2), UI element (3), checkout process (4)

3) → a) Checkout process section guidelines:

ex: → shopping cart, shipping address, billing info, order summary, confirmation

General HCI design:

1) Visual Display Layout

- avoid cluttered display
- place important items consistently
- place important items at top center
- structure for easy comparison
- establish level of importance
- optimize display density
- set appropriate page lengths
- " " line "
- use frames when functions must remain accessible

separate in diff frames
→ left: list of tasks
→ right: details of selected tasks

2) Information structuring and Navigation

- no too much info in one single screen
- info organized in a structured manner, easy to navigate
- easy movement of item without being disoriented
- arrange fields in top to bottom/ left to right orders

3) Taking user input

- data-entry consistency
- minimal input actions by user
- minimal memory load on users
- data entry and display compatibility
- clean and effective labelling of buttons and data-entry fields
- don't place semantically opposing entry / selection options close together

ex: save / undo

Ch – 3

⊛ Human Factors (2)

Cognitive Science

- understand how human mind works, thinks, learns and process info.
- explains human's capability

Ergonomics

- explains how our 5 senses take in info from outside world
- process it up to a basic level
- respond to it using our body's motor functions

How human factor knowledge help HCI ?

1) Task/interaction modeling

→ explain steps how humans interact to solve a given problem

→ apply actions on object

→ Ex: problem: fixing font

action: menu item selection

object: on highlighted text

2) Prediction, assessment, evaluation of interactive behavior

→ predict how humans might react to various info presentation

Human Problem solving model (2)

1) the overall human ~~solo~~ problem solving model and process :

~~visual~~ :

Information

↓

be aware of something/ see/ hear — Sensation — (extracts basic meaning from it) senses external info (visual) (aural) (heptic) and perception

↓

Perception

↓

memory :
info, procedure, rules, relation, schemas, objective etc

Short term memory ⟷ Long term memory

↓

(what to do) ← Decision

↓

Action

2) More detailed view:

Define problem
↓
Gather knowledge
↓
Consider possible actions
↓
Create plan
↓
Execute plan
↓
Observe results
↓ not solved
Repeat

Problem solved
↓
Terminate

offer action expected

expected display result

Gulf of execution/evaluation :

→ introduced by : — Norman
— Draper

→ Statement :- Users may struggle when interactive systems don't offer expected actions on results.

- mismatch between
  - — user's mental model
  - — system's task model
- — creates gulf

* **GOMS** → Goals, Operators, methods, Selection rules

→ involved hierarchical task modeling

→ mapping operators to subtasks

→ calculate total task performance time

→ predictive performance assessment

* **Visual** 6 parameters :

1 — Field of View (FOV) : angle of what you can see horizontally and vertically

2 — Viewing Distance : How far you're from the screen

3 - Display field of view: angle covered by the screen from a certain distance

4 - Pixel: tiny areas on the screen that make up the image

5 - Display resolution: no. of pixels in image

6 - Visual acuity: how clear you can see things
— varies from person to persons

Detail and peripheral vision:
- center of your vision sees color and detail well
- peripheral vision detects motion.
- displays have uniform resolution
- eyes don't " " "

* Brightness: how much light something emits
* color: How we ~~percieve~~ perceive different wavelengths of light.
* Contrast: diff. in brightness/color between things you see.

Pre-attentive features and High-level Diagnamatic semantic: → color, size, shape, motion, grab quick attention
→ reconnizes automatically in ms.

* Aural : (hearing)

1 – Intensity / volume : how loud sound is
— dB (decibels)

2 – Sound : made up of diff. frequencies that determine ~~feature~~ characteristics like pitch, timbre, directionality

3 – phase : time diff. among sound waves from the same source
— affect spatial perception.

* Characteristics of sound as interaction :

— get attention, guide users
— also distraction — used for input

For noticeable feedback → diff. in volume

— 2 methods : 1) keyword recognition
2) natural language understanding

— challenges : 1) separate relevant info from background noise
2) deal with user annoyance

Tactile : sense of touch through your skin

- feel texture, pressure, vibration, temperature

3 parameters

1 Tactile Resolution : How sensitive your skin is to feeling things.

2 Vibration frequency : speed of vibration felt
optimal for comfort : 250Hz
range : 100 – 300 Hz

3 pressure threshold :
Lightest amount of pressure you can feel (1000 Nm^{-2})

Haptic : more complex touch sensation
- feeling force and movement through your joints and muscles.

4 parameters

1) Degrees of freedom : no. of directions force can be felt

2) Force range : range of force that can be displayed.

3) Operating range: how much movement the device allows.

4) Stability: how steady the force feels.

Multimodal Interaction: Using more than one way of interacting with a device can make it work better.

How?

1) Complementary: phone ring (sound) → someone is calling

screen shows (visual) → who's calling

2) Redundant: phone ring → sound + vibrate

3) Alternative: make a call → either press a button

→ or speak someone's name

Fitt's Law: A model of human movement that predicts the time required to rapidly move to a target area as a ~~target~~ function of the distance to and the size of the target.

* $MT = a + b * ID$
* $ID = \log((A/W) + 1)$

A, b → empinically detenmined constants

MT → movement time A → distance

W → size of tanget

* Tangets should be large
* Distance " " small

Moton control: how well we can move and control things with our hands on other body parts. (mouse)

Control - Display (C/D) Ratio: how much you need to move a control device (mouse) to make something happen on a screen. (cursor)

→ low ratio → no need to move much → good for quick movement

→ high " → need to move more → make precise adjustments