Chapter 1:

- **Computer:** any interactive system with digital computation components.
- **Interaction:** communication or dialogue or collaboration between two parties (Offer mode of operation and connect with interface)
- **Interface:** present instructions to human and translate instruction from human to machine.
- **Human-Computer Interaction (HCI)** is the study of the principles and methods with which one builds effective interfaces for users.
- Human-computer interaction is a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.
- A basic goal of HCI is to improve the interaction between users and computers by making computers more usable and receptive to the user's needs.
- HCI is concerned with:
    - methodologies and processes for designing interfaces.
    - methods for implementing interfaces.
    - techniques for evaluating.
    - developing new interfaces.
    - developing descriptive and predictive models.
- A long-term goal of HCI is to design systems that minimize the barrier between the human's cognitive model of what they want to accomplish and the computer's understanding of the user's task.
- Professional practitioners (designers) are concerned with designing graphical user interfaces and web interfaces.
- Researchers are interested in developing new design methodologies, experimenting with new hardware devices, and prototyping new software systems.
- Wii used infra-red sensors.
- The key concerns of the designer of interactive systems:
    - Design
    - Technologies
    - People
    - Activities and contexts

- Design: the world of technology and the world of people and human purposes and you try to bring the two together'.
- Interactive systems are things that deal with the transmission, display, storage, or transformation of information that people can perceive.
- A fundamental challenge for interactive systems designers is to deal with the fact that people and interactive systems are different.
- The interface to an interactive system is all those parts of the system with which people meet; physically, perceptually, and conceptually.
    - Physically as touch.
    - Perceptually as senses.
    - Conceptually as concept.
- Designer of interactive system should be considering the following:
    - The whole human computer interaction.
    - the human-human interaction that is often enabled through the systems.
    - interconnected devices.
    - connecting people through devices and systems.
- Being human-centered is about:
    - thinking about what people want to do rather than what the technology can do.
    - Designing new ways to connect people with people.
    - Involving people in the design process.
    - Designing for diversity.
- What interactive system designers do?
    - study and understand the activities and aspirations of people and the contexts within which some technology might prove useful.
    - know the possibilities offered by technologies.
    - research and design technological solutions that fit in with people, the activities they want to undertake and the contexts in which those activities occur.
    - evaluate alternative designs and iterate until a solution is arrived at.
- Sociology: is the study of the relationships between people in society.
- Anthropology: focuses also on the study of culture, biology, and language.
- Both use techniques such as interviews and observation to arrive at their conclusions.

- Cultural studies: which looks at people and their relationship with cultural issues such as identity , but also much more prosaic cultural activities such as shopping, playing computer games or watching TV.
- Psychology is the study of how people think, feel and act.
- Cognitive psychology: “study of how we gain knowledge of things” seeks to understand and describe how the brain functions , how language works and how we solve problems.
- Ergonomics: is the study of the fit between people and machines.
- Community of practice: this term is used to denote groups of people who have shared interests, values and engage in similar activities.
- Design Disciplines:
    - Product design.
    - Graphic design and information design.
    - Human computer interaction.
- Paying attention to the needs of people, to the usability of the product results in reduced calls to customer help lines, fewer training materials, increased productivity , increased sales and so on.
- Machine-centered is easier but more expensive.

Chapter 2:

- We use the acronym PACT (People, Activities, Contexts, Technologies) as a useful framework for thinking about a design situation.
- They need to understand the activities that people want to undertake and the contexts in which those activities take place.
- Activities (and the contexts within which they take place) establish requirements for technologies that in turn offer opportunities that change the nature of activities.
- People
    - Physical differences
    - Psychological differences
    - Social differences (usage differences)
- Mental models=conceptual models, describe the way in which we think about things.
- People develop mental models through interacting with systems.
- Observing the relationship between people actions and the behaviors of the system, reading any manuals or other forms of explanation that come with a system.
- The problem is that it is only through the system image the interface, the behaviors of the system and any documentation that the designer's conception can be revealed.
- Temporal aspects cover how regular or infrequent activities are.
- Some activities will take place as a single, continuous set of actions whereas others are more likely to be interrupted.
- Anything more than 5 seconds they will feel frustrated and confused.
- Cooperative or complex activities are whether they can be carried out alone or whether they are essentially concerned with working with others.
- Well defined tasks need different designs from more vague tasks.
- A vague activity means that people must be able to browse around, see different types of information, move from one thing to another and so on.
- Some activities are "safety critical '', in which any mistake could result in an injury or a serious accident.

- Three useful types of context are distinguishable:
  - the organizational context,
  - the social context,
  - the physical environment.
- Technologies: the medium that interactive system designers work with.
- Interactive systems typically consist of **hardware and software components** that communicate with one another and transform some input data into some output data.
- A PACT analysis is useful for both analysis and design activities: understanding the current situation, seeing where possible improvements can be made or imagine future situations.
- Scoping a problem with PACT is done by using brainstorming and other imagine techniques and by working with people through observations, interviews, and workshops.
- It is most important that designers consider all the various stakeholders in a project.

| Technology | Context | Activity | People |
|---|---|---|---|
| input, output, communication, and content | • the organizational context,<br>• the social context<br>• the physical environment. | • Main tasks<br>• Temporal aspects<br>• Cooperation<br>• Complexity<br>• Safety-critical | • Physical<br>• Psychological<br>• Social |

Chapter 3:

- Survey can assist your clue about your problems in different aspects
  - You can highlight main domain your app target.
  - You can focus on some groups of users.
  - You can answer questions vague or has no clear references in your mind.
  - It will solve a lot of issues and argues, debates between you and your team members
- Survey Questions:
  - You must ask about the demographics of the candidate (age, Gender, Specialty, Computer aware or not..etc.)
  - Never ask direct questions
  - Always rely on Multiple choices to your answer.
  - Do not be biased towards some opinion
  - Always illustrate the keywords and your idea in simple language
  - Put some question to measure if the user is well understanding your technology or not.
- Use graphs as much as possible to conduct results.
- Why do we need to understand users?
  - Interacting with technology is cognitive.
  - Need to consider cognitive processes involved and cognitive limitations of users.
  - Provides knowledge about what users can and cannot be expected to do.
  - Identifies and explains the nature and causes of problems users encounter.
  - Supply theories, modeling tools, guidance and methods that can lead to the design of better interactive products.
- Cognitive processes:
  - Attention.
  - Perception and recognition.
  - Memory.
  - Learning.
  - Reading, speaking, and listening.
  - Problem solving, planning, reasoning and decision making.

- Attention:
  - Selecting things to concentrate on at a point in time from the mass of stimuli around us.
  - Allows us to focus on information that is relevant to what we are doing.
  - Involves audio and/or visual senses.
  - Focused and divided attention enables us to be selective in terms of the mass of competing stimuli but limits our ability to keep track of all events.
  - Information at the interface should be structured to capture users' attention.
- Design implications for attention:
  - Make information salient when it needs attending to.
  - Use techniques that make things stand out.
  - Avoid cluttering the interface with too much information.
  - Avoid using too much because the software allows it.
- Perception: How information is acquired from the world and transformed into experiences.
- Senses and Constructivism:
  - Senses (sight, hearing, smell, taste, touch) provide data about what is happening around us.
  - Designing good Web materials requires knowledge about how people perceive.
  - Our brains do not create pixel by pixel images.
  - Our minds create, or construct, models that summarize what comes from our senses.
  - These models are what we perceive.
  - When we see something, we don t remember all the details, only those that have meaning for us.
  - **Context** plays a major role in what people see in an image.
- Gestalt psychology: it implies the idea of perception in context, we don't see things in isolation, but as parts of a whole.

- Five Principles of Gestalt:
  **We organize things into meaningful units using:**
  - Proximity: we group by distance or location.
  - Similarity: we group by type.
  - Symmetry: we group by meaning.
  - Continuity: we group by flow of lines (alignment).
  - Closure: we perceive shapes that are not (completely) there.
- Some argue that too much white space on web pages is detrimental to search makes it hard to find information.
- Design implications (perception aspect):
  - Icons should enable users to readily distinguish their meaning.
  - Bordering and spacing are effective visual ways of grouping information.
  - Sounds should be audible and distinguishable.
  - Speech output should enable users to distinguish between the set of spoken words.
  - Text should be legible and distinguishable from the background.
  - Tactile feedback should allow users to recognize and distinguish different meanings.
- **Encoding** is first stage of memory.
- Context affects the extent to which information can be subsequently retrieved.
- People are very good at remembering visual cues about things than arbitrary material.
- Memory involves 2 processes: recall directed and recognition-based scanning.

Chapter 4:

| **Learning:** | **Design implications:** |
|---|---|
| • How to learn to use a computer-based application.<br>• Using a computer-based application to understand a given topic.<br>• People find it hard to learn by following instructions in a Manual.<br>• Prefer to learn by doing. | • Speech based menus and instructions should be short.<br>• Accentuate the intonation of artificially generated speech voices.<br>• Provide opportunities for making text large on a screen. |
| **Reading, speaking, and listening:**<br>• The ease with which people can read, listen, or speak differs.<br>• Many prefer listening to reading.<br>• Reading can be quicker than speaking or listening.<br>• Listening requires less cognitive effort than reading or speaking.<br>• Dyslexics have difficulties understanding and recognizing written words. | **Design implications:**<br>• Design interfaces that encourage exploration.<br>• Design interfaces that constrain and guide learners.<br>• Dynamically linking concepts and representations can facilitate the learning of complex material. |
| **Problem solving, planning, reasoning and decision making:**<br>• All involves reflective cognition.<br>• Often involves conscious processes, discussion with others (or oneself), and the use of artifacts.<br>• May involve working through different scenarios and deciding which is best option. | **Design implications:**<br>• Provide additional information/functions for users who wish to understand more about how to carry out an activity more effectively.<br>• Use simple computational aids to support rapid decision making and planning for users on the move. |

- Mental models:
  - Users develop an understanding of a system through learning about and using it.
  - Knowledge is sometimes described as a mental model.
  - People make inferences using mental models of how to carry out tasks.
- Gulfs of execution and evaluation:
  - The gulfs ’ explicate the gaps that exist between the user and the interface.
  - The gulf of execution:
    - the distance from the user to the physical system.
  - The gulf of evaluation:
    - the distance from the physical system to the user.
  - Bridging the gulfs can reduce cognitive effort required to perform tasks.
- Information processing:
  - Conceptualizes human performance in metaphorical terms of information processing stages.

Chapter 5:

- Why are some objects frustrating to use?
  - Due to poor design that leads to **confusion** and **error**.
    - They provide no clues or false clues to their operation.
    - They trap the user.
    - They prevent the normal process of interpretation and understanding.
- Well-designed objects:
  - Easy to understand.
  - Easy to interpret.
  - Use visible clues to their operation.
- Poor usability results in:
  - Anger and frustration.
  - Decreased productivity in the workplace.
  - Higher error rates.
  - Physical and emotional injury.
  - Equipment damage.
  - Loss of customer loyalty.
  - Costs money.
- Usability is a measure of the **effectiveness**, **efficiency**, and **satisfaction** with which specified users can achieve specified goals in a particular environment.
- Design Strategy:
  1. Make use of affordance (how do I use it?)
  2. Make use of constraints (why can't I do that?)
  3. Provide a good conceptual model.
  4. Make things visible.
  5. Use a good mapping - a natural one if possible.
  6. Provide feedback (what is it doing now?)
  7. Keep the number of features, actions and controls balanced.
- **Affordances:**
  - The affordances of an object determine, naturally, how it can be used.
  - Just by looking at the object, a user should know how to use it.

- **Constraints:**
  - Constraints limit the ways in which something can be used.
  - The more constraints, the less opportunity for error.
  - Physical constrains:
    - The physical properties of an object constrain the possible operations.
  - Culture constrains:
    - Cultural constraints relay on **learned conventions**.
    - Once accepted by more than one cultural group, they become universally accepted conventions.
  - Logical constraints
- **Conceptual model:**
  - Conceptual models are mental models, models that people have of themselves, others, the environment, and the things with which they interact.
  - People form mental models (experience, training, and instruction).
  - A good conceptual model allows users:
    - To predict the effect of their actions.
    - To understand the relationship between the controls of a device and the outcome.
  - A poor conceptual model:
    - Force users to operate by role, blindly.
    - Make it difficult to determine the effects of actions.
    - Make it difficult to figure out what to do in novel situation.
  - Often designers employ metaphors to help the user from a suitable mental model.
- Conceptual model: **Visibility**
  - Visibility is an important principle of design and is used to:
    - Make the operations of device understandable.
    - Act as a reminder of what can and cannot be done.
    - Make the state of the system clear.
  - Visibility is achieved by:
    - Making the correct parts or controls visible.
    - Conveying the correct message.

- When the number of possible actions exceeds the number of controls, some functions become **invisible**, resulting in **complexity.**
- Good visibility leads to objects/devices that are:
  - Easier to understand.
  - Easier to use.
  - Easier to remember.
  - Quick to learn.
- How to make things visible:
  - Employ natural signals.
  - Use good mappings.
  - Good placement of control.
- Principle of visibility
  - It should be obvious what a control used for.

- Conceptual model: **Mapping**
  - Controls and displays should exploit natural mapping.
  - Natural mapping takes advantage of physical analogies and cultural standards.
- **Feedback:**
  - Feedback is sending back to the user information about what action has been done.
  - Systems should be designed to provide adequate feedback to the users to ensure they know what to do next in their tasks.
  - Feedback can be presented visually and aurally.
  - Tactile feedback should allow users to recognize and distinguish different meanings.
- **Manage complexity:**
  - The increase in controls, features, and to make all the controls visible, makes it more difficult which make it harder for the user to:
    - Understand the device.
    - Learn how to use it.
    - Memorize functions.

Chapter 12:

- Interface type: defined by the utilized I/O devices.
- Interaction type : defined by the user experience.
  - **Instructing** (command based)
  - **Conversing** (dialogue based)
  - **Manipulating** (static interaction with the environment)
  - **Exploring** (dynamic interaction with the environment)
- **Instructing:**
  - Instructions can be issued in various ways: typing in commands, pressing buttons, selecting options from menus (one to one).
  - Instruction based software products: Unix, Windows, Linux.
  - Other products: vending machines.
- **Conversing:**
  - User has a dialogue with the system by means of speech based or typed questions-based interface.
  - Simple (speech based) HCIs: tele banking, ticket booking.
  - Advanced HCIs: advisory system, search engines.
  - Advantages: more natural.
  - Disadvantages: boring, unable to handle complex questions.
- **Manipulating:**
  - Interacting with objects in physical or virtual environment by selecting, moving, resizing, opening, and closing them (one to many).
  - Manipulation based HCI design: direct manipulation GUI.
  - Manipulation based product design : toys.
  - Advantage: enables easy learning, remembering, direct results → no need for error messages, encourage exploring → mastery confidence.
  - Disadvantages: too slow for experts.
- **Exploring:**
  - Moving through physical or virtual environment.
  - Exploration based designs: fantasy and other virtual worlds, **Computer Automated Virtual Environment (CAVE)**, **ambient intelligence (smart rooms),** games, designing, learning how to drive.
  - Advantages: : natural HCI.
  - Disadvantages: it causes confusion.

- **Paradigms:**
  - A particular approach that has been adopted by a community in terms of shared assumptions, concepts, values, and practices.
  - We form paradigms through:
    - Questions to be asked.
    - Phenomena to be observed.
    - Findings from experiments to be analyzed.
- **Interface types:**

| Interface type | Advantages | Disadvantages | Research and design issues |
|---|---|---|---|
| Command interface | efficient, precise, and fast. | Large overhead to learning set of commands. | • Form, name types and structure are key research questions.<br>• Consistency is most important design principle.<br>• Popular for web scripting. |
| WIMP GUI | Scroll bars within windows also enable more information to be. | Multiple windows can make it difficult to find desired one. | • Windows management.<br>• How to switch attention between them to find information needed without getting distracted.<br>• Design principles of spacing, grouping, and simplicity should be used. |
| Menus | Flat menu:<br>Good at displaying a small number of options at the same time. | Flat menu:<br>Require several steps to get to the list with the desired option. | • What are best names/labels/phrases to use?<br>• Placement in list is critical. |

| | | | |
|---|---|---|---|
| | <u>Expanding menu:</u><br>Enables more options to be shown on a single screen, more flexible navigation. | <u>Expanding menu:</u><br>Require precise mouse control that can result in overshooting or selecting wrong option. | • Many international guidelines exist emphasizing depth/breadth, structure, and navigation. |
| Icons | Icons are assumed to be easier to learn and remember than commands. | - | • There is a wealth of resources now so do not have to draw or invent icons from scratch.<br>• Text labels can be used alongside icons to help identification for small icon sets. |
| Virtual reality and virtual environments | • Can have a higher level of fidelity with the objects they represent.<br>• Induces a sense of presence where someone is totally engrossed.<br>• Provides different viewpoints. | Head mounted displays are uncomfortable to wear and can cause motion sickness and disorientation. | • Much research on how to design safe and realistic VRs to facilitate training.<br>• How best to navigate through them?<br>• How to control interactions and movements?<br>• How best to interact with information?<br>• Level of <u>realism</u> to aim for to engender a sense of presence. |
| Speech interface | Used by people with disabilities. | - | • How to design systems that can keep conversations on track? |

| | | | |
|---|---|---|---|
| | | | • Type of voice actor. |
| Mobile interface | The use of mobiles has greatly expanded in every field. | - | • Design for small screen real estate and limited control space for those with poor manual dexterity or 'fat' fingers. |
| Shareable interfaces | • Provide multiple inputs and sometimes allow simultaneous input by co-located groups.<br>• Can support more equitable participation. | - | • More fluid and direct styles of interaction.<br>• Core design concerns.<br>• Horizontal surfaces compared with vertical ones support more turn-taking and collaborative working in co-located groups.<br>• Provide larger-sized tabletops does not improve group working but encourages more division of labor. |
| Tangible interface | • Can be held up in both hands.<br>• Allows for more than one person to explore.<br>• People can see and understand situations differently.<br>• Can facilitate creativity and reflection. | - | • Develop new conceptual frameworks.<br>• The kind of coupling to use between the physical action and digital effect.<br>• What kind of physical artifact to use? |

| | | | |
|---|---|---|---|
| Wearable interface | - | - | • Comfort<br>• Hygiene<br>• Ease of wear<br>• Usability |
| Robotic interface | • Pet robots have therapeutic qualities, being able to reduce stress and loneliness.<br>• Remote robots can be controlled to investigate bombs and other dangerous materials. | - | • How do humans react to physical robots designed to exhibit behaviors?<br>• Should robots be designed to be human like?<br>• Should the interaction be designed to enable people to interact with the robot as if it were another human being or more human computer like? |

- **Multimedia:**
  - Facilitates rapid access to multiple representations of information.
  - Can provide better ways of presenting information.
  - Can enable easier learning, better understanding, more engagement, and more pleasure.
  - Can encourage users to explore different parts of a game or story.
- **Robotic interfaces:**
  - **Remote** robots used in hazardous settings.
  - **Domestic** robots helping around the house.
  - **Pet** robots as human companions.
  - **Sociable** robots that work collaboratively with humans and communicate and socialize with them.
- Which interface to choose?
  - Will depend on task, users, context, cost, robustness, etc.