

## U3 - HCI Models & Theories

User Profiles - collection of info associated with a user.

- describes the user needs, preferences & any challenges they might face.
- information includes age, gender, edu background, computer literacy, memory capacity, interface layout, color schemes, context of use (when, why, where)

Importance

- ↳ helps in UCD, ensuring system meets all the requirements proposed.
- ↳ improves user satisfaction by custom & personalised interfaces.
- ↳ usability testing by focusing on their unique needs.

Categories of users

① Novice / Beginner

- ↳ little to no experience with system
- ↳ rely on tutorials, help & documentation

② Intermediate

- ↳ somewhat familiar with basic functionalities

↳ expect fast workflows & use shortcuts

③ Expert

- ↳ have all knowledge of the system. e.g. using a computer

- ↳ prefers advance features.      ① turn on    ② internet,    ③ troubleshoot send emails problems.

User Profiles are essential for creating effective and user friendly interfaces.

e.g.: udemy app.

using fitness app can be app.

Goal and Task Hierarchy Model. (GTH)

- ↳ cognitive model (mimics human brain) used in HCI.

- ↳ breaks down complex tasks into smaller, more manageable subgoals, creating hierarchical structure.

Goal - high-level objectives / outcomes that user wants to achieve.

Subgoal - a smaller & more specific goal that adds to overall goal.

Task - specific actions that users take to achieve goal.

Hierarchical structure - A tree-like structure where higher level goals are broken into lower-level <sup>sub</sup>goals / subtasks

Advantages / Importance

- ↳ Improve user experience by understanding how user think & breaks tasks.
- ↳ Enhance usability by identifying bottlenecks in the task flow.
- ↳ Effective task analysis
- ↳ By visualising users mind, designers can make decisions about layout, navigation, & architecture interface.

|                                    | Example                         | Online Shopping                            |
|------------------------------------|---------------------------------|--|
| Limitations                        | Goal - Purchase a Product       |  |
| ↳ oversimplification               | subgoal - ① find filter keyword | ② Add to cart ③ Checkout                   |
| ↳ lack of context                  |                                 | select click login summary pay             |
| ↳ limited error handling           |                                 |  |
| <u>Difference</u>                  |                                 |  |
| Goal                               | long-term                       | focus on end result & strategic            |
| Task                               | short-term                      | focus on action to be performed & tactical |
| Become an engineer                 |                                 | high level detail                          |
| Study for engineering exams        |                                 | low level detail                           |
| Linguistic model                   |                                 | qualitative                                |
| Ex. Voice assistants (Siri, Alexa) |                                 | quantitative (no. of tasks)                |

- ↳ these models help computers understand and respond to human language
- ↳ makes human interaction with computer more natural & intuitive.

Ex. Voice assistants (Siri, Alexa)  
 Chatbots (GPT, Gemini)  
 Search engines (Google)

Syntax - rules & structure of commands to ensure user actions are accurate

Semantics - ensuring system responds correctly to users input

Grammar - how user forms sentences/commands

### Physical & Device Models

- ↳ focus on relationship bet<sup>n</sup> human physiology & devices used to interact

Physical capabilities - range of motion, strength required to use keyboard, mouse.

Device constraints - limitations of hardware (screen size)

Ergonomics - design of devices to fit human body mechanism, minimizing strain & max. comfort.

Accessibility - Designing for users with disabilities

Eg. Smartphone keyboard.

GOMS (Goals, Operators, Methods & Selection rules)

↳ a predictive model used to evaluate user performance & usability of a system.

↳ objective of GOMS model is to built a cognitive task analysis & to compare user interface design.

Goals - outcome that user wants to achieve.

Operators - basic operations / actions performed by user.

Methods - Different ways a user can accomplish the goal.

Selection rules - Guidelines for choosing best method for achieving goal.

GOMS helps to improve usability.

Predicting user performance, creates interface that are -

(Time + Errors) (Efficient, effective, learnable, Memorable, Satisfying)

GOMS has 2 goal decompositions methods:

① CLOSE - METHOD

② LT - METHOD

Eg. Goals - Close the window

Action/Operation/Operators - Move mouse to close button  
Click mouse button

Methods - Mouse based method or alt + F4 key.

selection rule - mouse based method / function keys

Norman's 7 stage Model.

↳ emphasizes importance of feedback & UCD

Establishing the goal → identify goal

Forming the intention → how to achieve?

Specifying the acting / action sequence → which actions?

Executing the action sequence

Perceiving the system state

Interpreting the system state

Evaluating the outcome

} Gulf of execution

} Gulf of evaluation

Eg. Ordering Pizza from Pizza Hut app

Using a Microwave

Withdrawing cash from ATM

## Cognitive Architectures

- ↳ model that stimulate human cognition / mimics human brain
- ↳ aims to represent processes like thinking, learning & problem solving

## Popular Cognitive Architectures -

ACT-R → focus on cognitive skills, memory & learning

Soar → emphasizes problem solving & learning.

EPAM → focus on memory & learning

Applications - AI, HCI, robotics, education, etc.

## Hierarchical Task Analysis (HTA)

- ↳ break down a complex task into smaller, more manageable subtasks.

Steps - define overall goal

- break down task into subtask & represent them hierarchically

- analyse relationship b/w tasks.

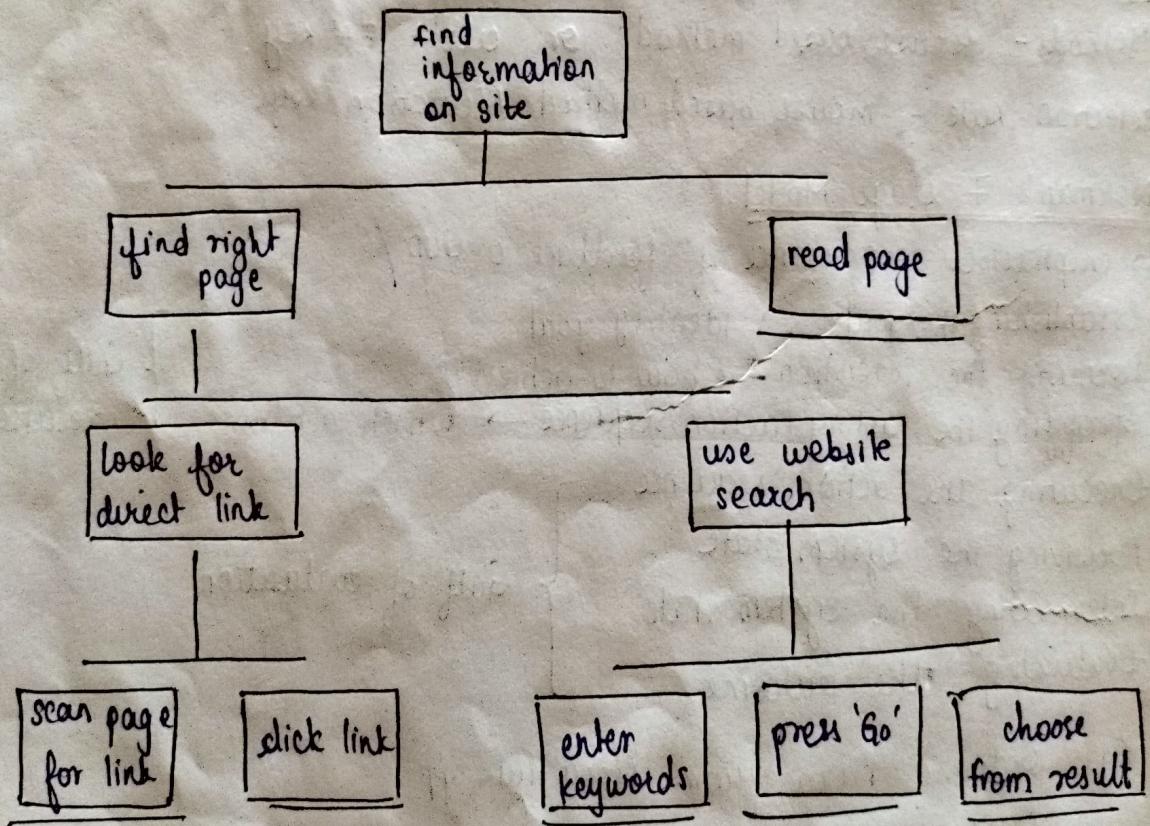
Benefits - Improve interface Design

- Enhance user experience

- Informed Decision Making

- Useful in identifying bottlenecks workflow.

e.g.



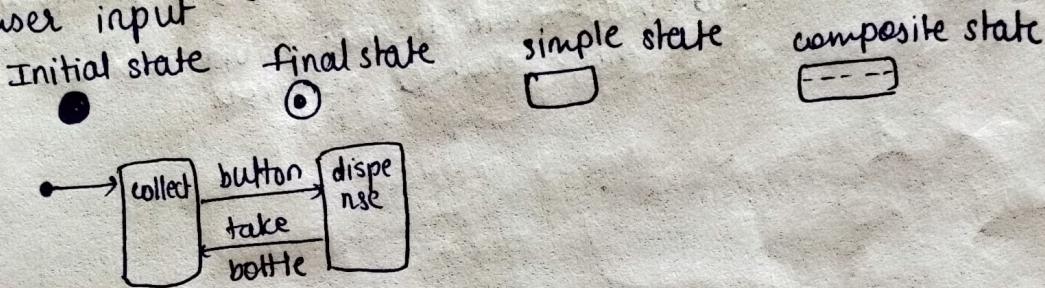
## Uses of Task Analysis

- ↳ Understanding how users interact with system
- ↳ Helps in designing system that satisfy user needs.
- ↳ Provides usability testing
- ↳ Creates user manuals & training programs by highlighting critical steps in task
- ↳ Provides error prevention

## Diagrammatic Dialog Design Notations

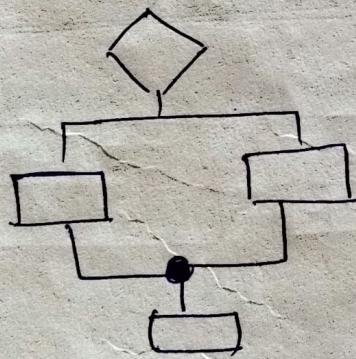
Flowcharts & state diagrams are used to represent the flow of interaction between user & the system.

- ① State Transition diagrams -  
shows how system moves from one state to another based on user input



- ② flowcharts -

Shows sequence of steps involved in user system interaction



eg. e-commerce website

States -

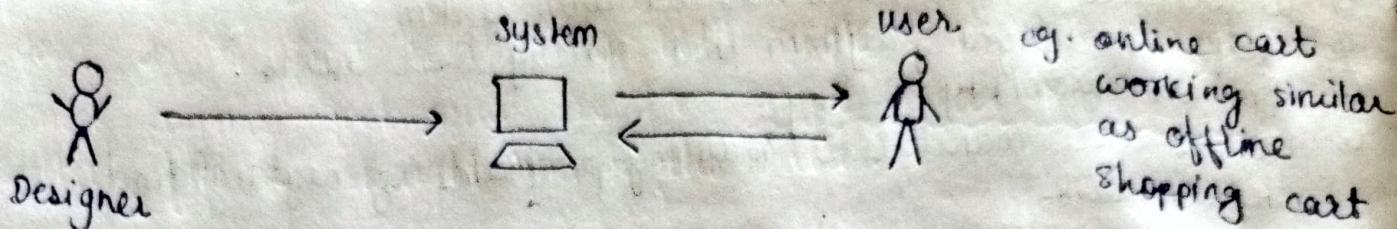
Start Checkout

Shipping info Payment info

Review order

Confirm purchase

Mental Model - ideas that ppl have about how things work



These models help user to understand, what to expect from system & how to interact.

Why do they matter?

- ① User expectations
  - ② Ease of learning.
  - ③ Error reduction. eg before deleting permanently, there is always a warning.
  - ④ Faster interaction.
- eg : Online shopping Cart
- but new system does not provide this warning, then high chances of errors.