HCI

Date :

1. The Design of Everyday Things — Don-Norman's Principles.
   1. Make things visible
   2. Provide a good conceptual model

Visibility
More visible. functions are, more likely. It is that user will do a

- Req Validation
- Feasibility study.
  - Technical Feasibility
  - Non-Tech Feasibility
- Requirement Elicitation
- Comparison of data-gathering techniques.
-

HCI Lecture (20/02/23)

- Where to place M ?
  Refer ○ → to determine where to place M.
  Insert Ms in front of all Ps that are not part of argument strings.

Date : 20/02/23

→ Place M's in front of all PIs that select commands.
You need to figure out where the function is located, then the action happens. So it requires some processing from our side.

Before you input something, we need some feedback.

Rule 1 : deletion of anticipated M
- If operator following M is fully anticipated in an operator immediately preceding that M, then delete the M.

Rule 2 : deletion of within cognitive units
- If string of MK → cognitive unit, delete all Ms except first.
Eg. MKMKMKMK → MKKKK for (100)

GOMS (Goals, Operators, Methods, selection)
→ Hierarchical cognitive process is assumed.
→ Both assume error-free and logical behavior.
→ KLM vs GOMS
Linear & sequential vs hierarchical

Date :

- **Goals** → what user wants to do.
- **Operators** → specific steps a user is able to make & assign a specific execution time
- **Methods** → well-learned seq of subgoals
- **Selection Rule** → give options to select method. (Guideline to decide b/w multiple options)

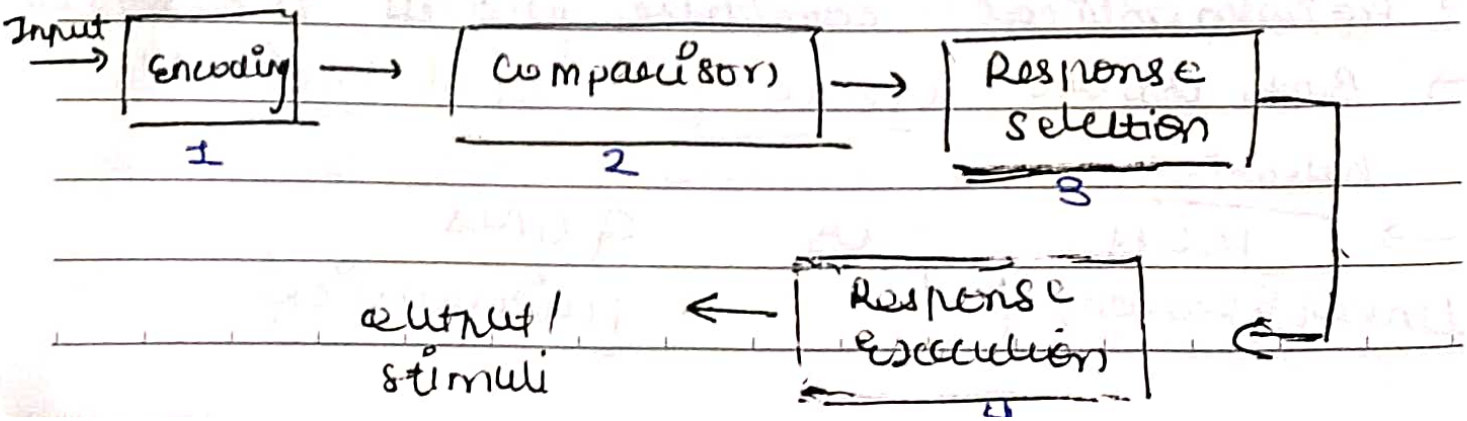
Goal → select a method → Retrieval of motor movement → Execution

COGNITIVE PROCESSING

cognition refers to the process by which we become **acquainted with things**.

- **cognition** → **gain knowledge**
- Have understanding of
  1) how human deals with info
  2) how computer deals with info.
- Treat **human** → as a processor of information.
  - ⇒ sight, hearing, touch, smell, taste

Model of Human processor



Card, Moran & Newell — Psychology of HCI.

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> information enters & exits through series of ordered processing stages.

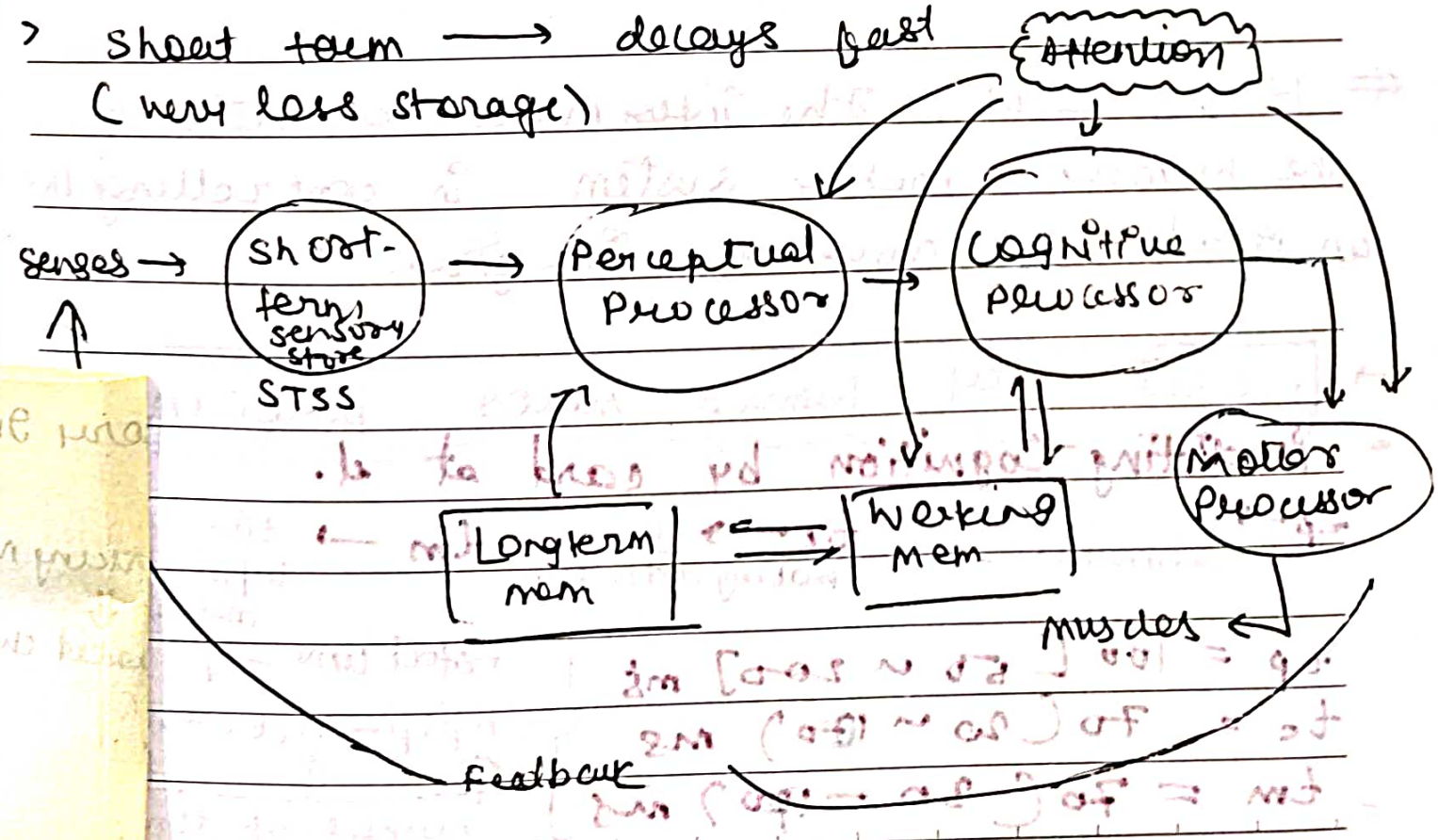
> Information Processing analysis
trace mental operation → outcome for particular cognitive task.

HUMAN INFO PROCESSING

> Three aspects of HIP

1) Perception → visual, audio ... senses
2) cognition → memory, problem solving, learning
3) Motor behaviour → speaking, typing, pointing etc.

> Quantitative measurement for HCI design.
> Repeated task → Habit → Long term mem.
> Short term → decays fast (very less storage)



$\frac{5}{100} = 0.05$

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Working memory capacity → 7±2 things

LTSM → unlimited (difficult to retrieve

> Perceptual processor → Bright v/s dark.

> Cognitive processor → Driving, playing game v/s Idle / reading.

Perceptual → Cognitive → Motor

$T = n_p t_p + n_c t_c + n_m t_m$

↑ time for individual action.

Fitt's Law : The information capacity of the human motor system in controlling the amplitude of movement. ~~in give~~ it

→ Model of human motor performance

• Predicting Cognition by card et al.

t_p → perceiving a stimulus

t_c → time for making a decision

t_m → time for tapping motion.

$t_p = 100\ [50 \sim 200]$ ms

$t_c = 70\ (20 \sim 100)$ ms

$t_m = 70\ (30 - 100)$ ms

total time = T

$= n_p t_p + n_c t_c + n_m t_m$

number of times

$T = a + b \log_2 \frac{2D}{W}$ → distance to target
W → width of target

Fitts

- Determine k_1 and k_2 in MT
- Throughput → measure of performance for rapid, aimed, error free target acquisition task.
- speed v/s accuracy trade off.
→ More number of targets / area ↑, time ↑

Task difficulty $= \log_2(D/W+1)$

$MT = a + b \log_2\left(\frac{D}{W}+1\right)$

Hick Nyman Law

→ Reaction time of person in presence of choices
→ time to react to a stimulus.

⇒ $H = \sum p_i \log_2(1/p_i)$
↳ Probability of making 'i' the choice.

(modelled using Shanon's info Theorem)

⇒ $T \propto H$

⇒ $T = kH$

In prob of all choices is equal.

$T = k \log N$

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Fitts - Digraph Model

→ Proposed to compute user performance for a VK (virtual keyboard) from layout specs

- Layout of keys and positions
- Performance in text entry rate.

→ Visual search time (Hick-Hyman's Law)

$$RT = a + b \log_2 N$$

↑ ↑ → (No. of keys)

Experimentally calculated.

→ Movement time (Fitts Law)

$$MT_{ij} = a' + b' \log_2 \left(\frac{d_{ij}}{w_j} + 1 \right)$$

↑ Movement time from i to j

→ Digraph Probability → Prob of occurrence character pairs / digraphs — determined from a corpus

$$P_{ij} : f_{ij} \Big/ \sum_{i=1}^{n} \sum_{j=1}^{n} f_{ij}$$

→ Principles of Interaction Programming
— Harold Thimbleby

→ $MT_{mean} = \sum_{i=1}^{N} \sum_{j=1}^{N} MT_{ij} \times P_{ij}$

→ Performance → character PS / WPM

→ $CPS_{Novice} = \frac{1}{RT + MT_{mean}}$

→ $WPM = CPS \times \frac{60}{W_{Avg}}$

W_{Avg} → Avg no. of characters in a word. (Eng-5)

→ ST diagram vs flowchart.

→ state transition table.

Bear, Ulysses

Come to your senses

Upload filter video

Date :

State diagrams

Direct Manipulation interfaces

CLI → DMI → interacting with direct interface

CLI → Hard for normal users

DMI → Focus on task rather than tech.

→ No clear distinction b/w i/p and o/p.

→ WIMP ⟹ windows, Icons, Menus, Pointers

→ designer's representation — user's understanding

⟹ Word processor → WYSIWYG

→ Shneiderman → DMI

- Consistency
- Universal usability
- Informative feedback

Undoes for closure

Error prevention and handling

Easy reversal

control over UZ

Reduce short term load

→ Actions → Feedback → [ ]

visibility

→ Permissiveness → using one / two button to do multiple actions. (limited icons → multiple actions)

Petri Networks.

States → ○ Transitions → □

Places → connected by directed arc.

has a token

○ Places → States, conditions, resources (Passive)

□ Transition → actions. (Active)

→ Arc → relations

• Tokens → Elements subject to change

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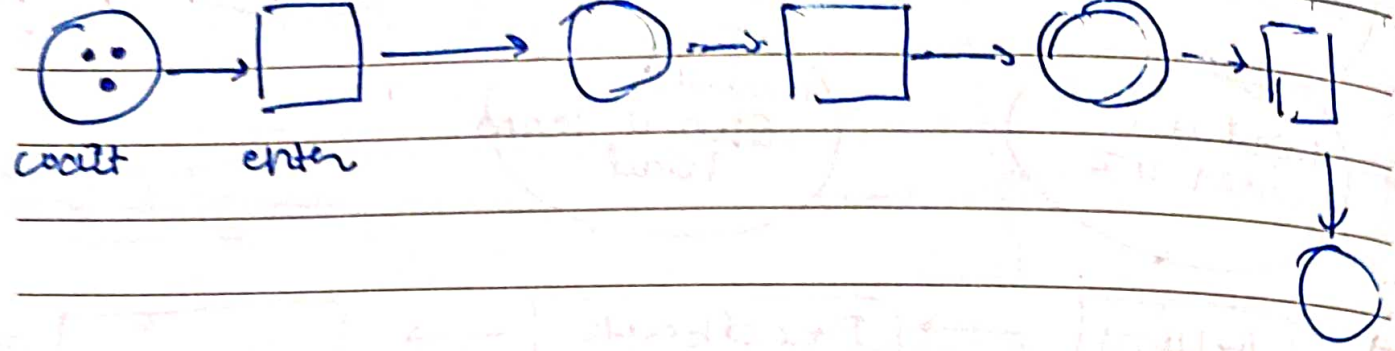
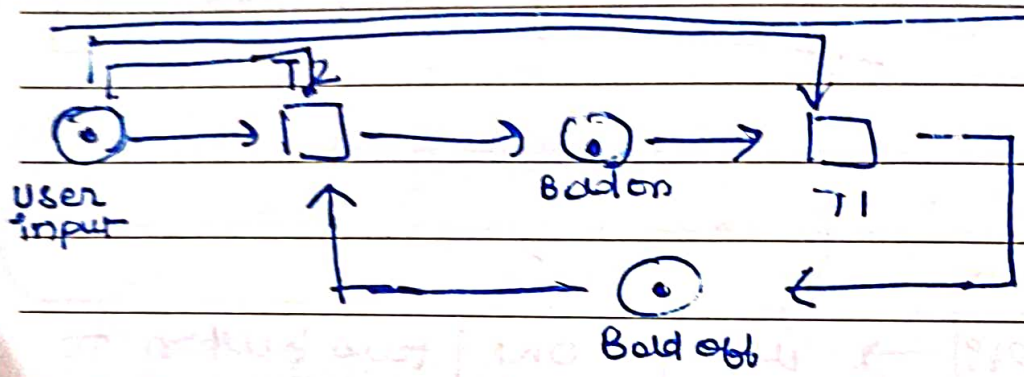




Transition will happen when all input have tokens.

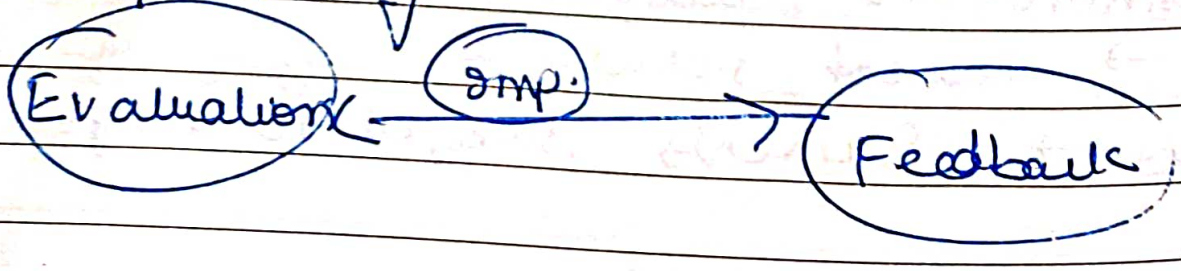
A token → User action.

State Chart → Hierarchical state transition diagram.

Prototyping

→ Affinity sorting

→

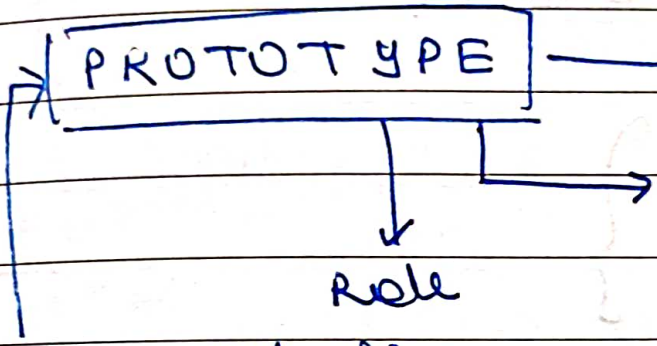


Date : Binary . Binary .

→ See . hold . interact

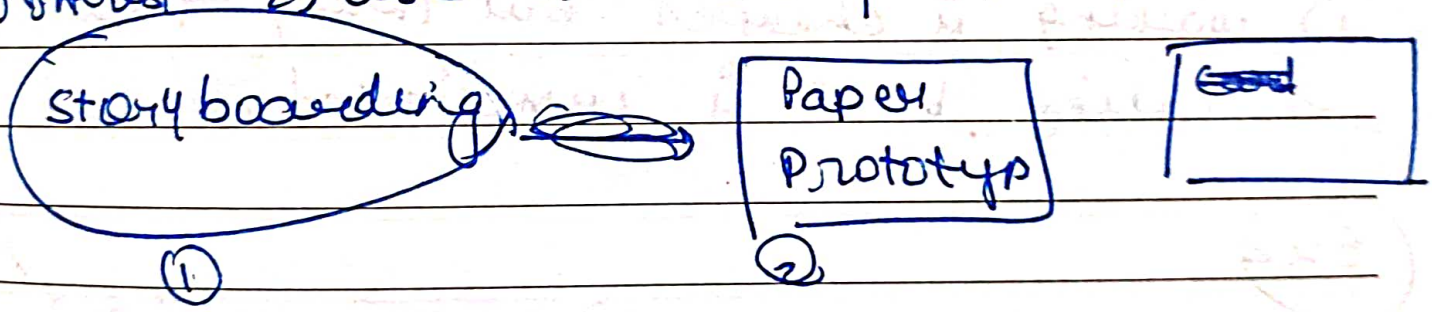
→ Test out ideas

→ Reflection

→ 

What do they tell us?

1) Interest 2) use 3) usability 4) Implementation



→ Affinity diagrams .

operator → elementary cognitive action (assign a specific execution time)

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GOMS

Ex1

- Goal: Go from Hotel to airport
- Operators: walk, takes bus, take taxi, rent car, take train
- Methods:
  - Located bus stop
  - wait for bus
  - get on bus
- Selection rules
  1) walking is cheaper but tiring & slow
  2) Taking bus is complicated abroad.

Ex2

Goal: Move text
- sub goals:
  1) cut text
     1) Highlight text
     2) Do cut cmd
  2) Paste text
     1) Point cursor
     2) Do Paste cmd.

Goals

write operators for each lowest goals. and assign time.

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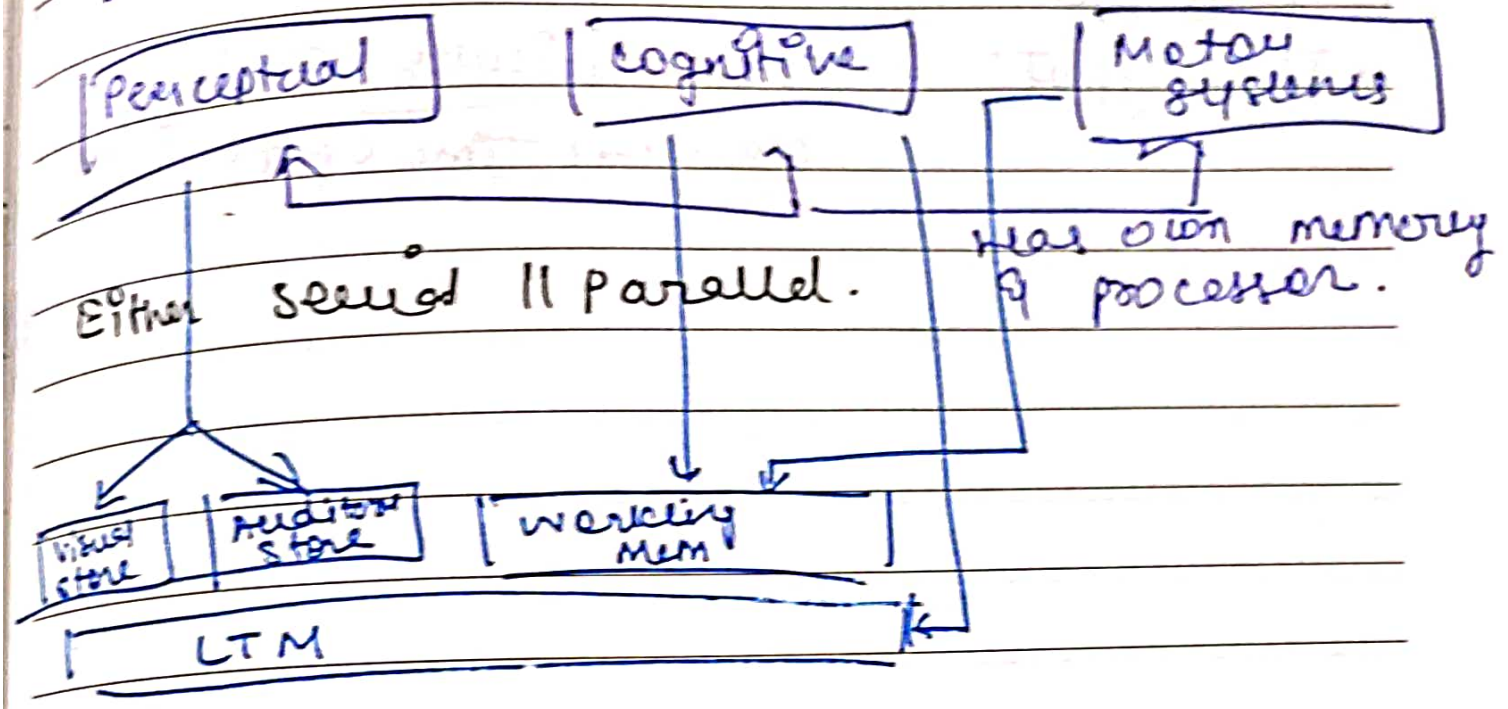
Model Human Processor



Perceptual System

- Perceptual Proc + Visualstore + Auditorystore
  - decay = 200ms
  - decay = 1500ms

Cognitive System

- Uses WM & LTM → make decision & schedule actions → MS
- Cognitive Proc + WM + LTM

Chunk → unit of perception / Mem.

- LTM → Fast read slow write.
  - → Mass knowledge → facts ...
  - → Infinite storage (but can forget due to not finding retrieval cues)

Other similar associations of retrieval cues.

Date :

Fitts Law

- Throughput = $\frac{\text{Task difficulty (ID)}}{\text{Movement Time (MT)}}$ bit/s