

Lecture 8:

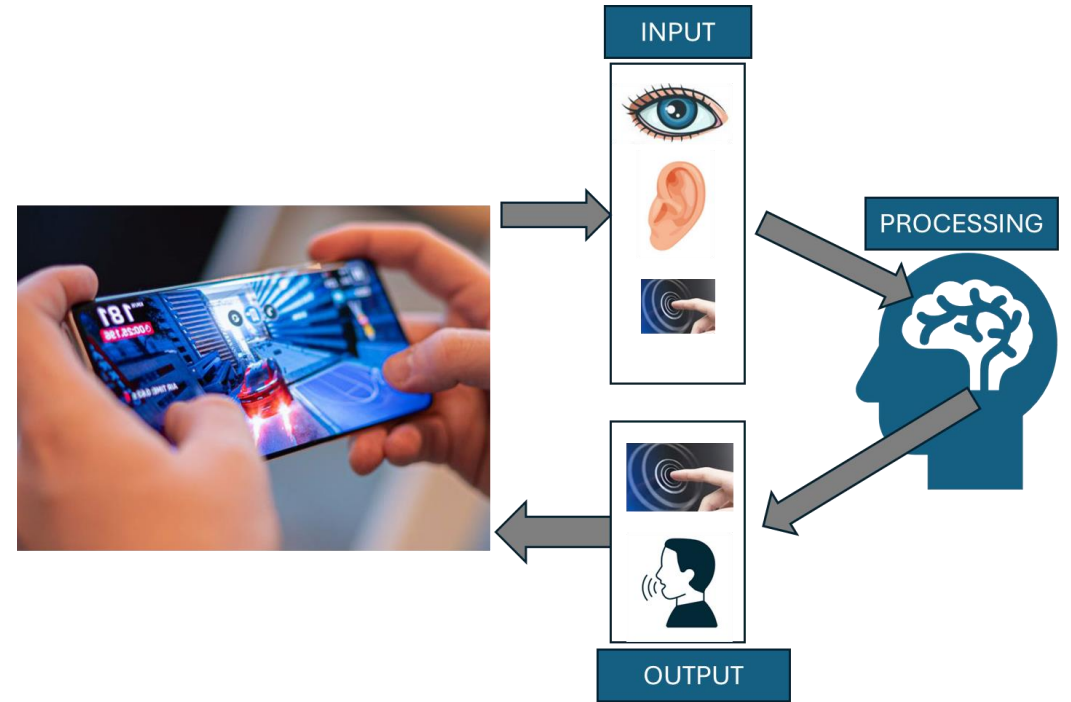
Human Cognition

Logistics

- Homework-1 is up, due on Sunday.
- All slides until last week + reading resources are up.
- Please do catch up with your readings.
- Next quiz on Friday the 14th Feb (covering basics of humans).
- Mid-sem exam scheduled
 - 01 March 2025 (Sat); 8:00-10:00 am; Location:TBA

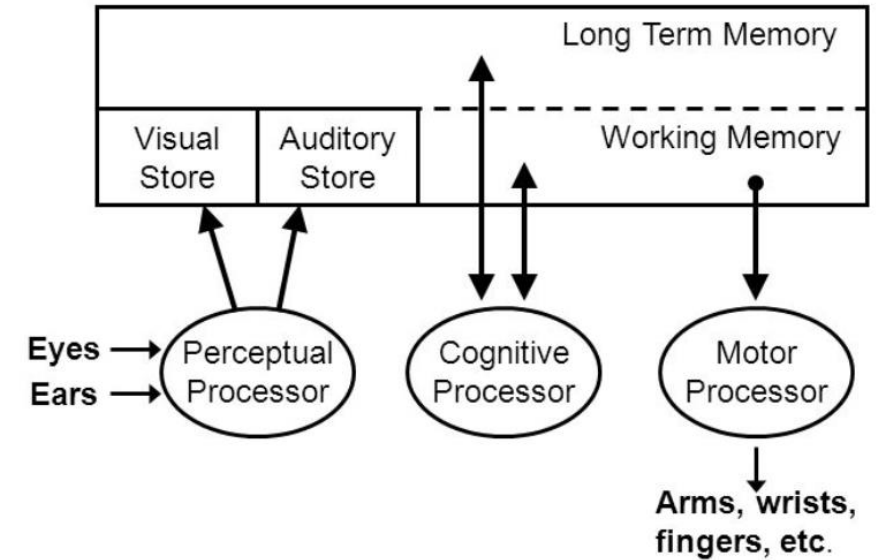
Recap

- Humans as processors
- Inputs → Senses
 - Vision, Hearing, Touch
- Outputs
 - Motor, speech, brain signals, biomarkers, gaze/emotions
- Today: Processing
 - Attention, memory, learning, decision making, problem solving
 - Motivation, emotions, behaviors
 - All the things that comprise “mind”



Attention

- Perceptual memory stores whatever we perceive
- Attention is the ability to actively process the per
- Limited resource: we selectively “attend to” som
- So, what do we pay attention to?
 - Top-down / endogenous: affected by internal state, task goals, decision to make, etc.
 - Bottom-up / exogenous: From external environment, based on “saliency” (e.g., surprise, biases/interests) [non-salient are ignored]
 - When the latter gets in the way of former, distractions happen
 - Getting attention back after a distraction takes time, can also be disastrous
 - Multi-tasking does not necessarily work (Attention is divided; errors go up)
- Some people have impaired attention (ADD/ADHD)

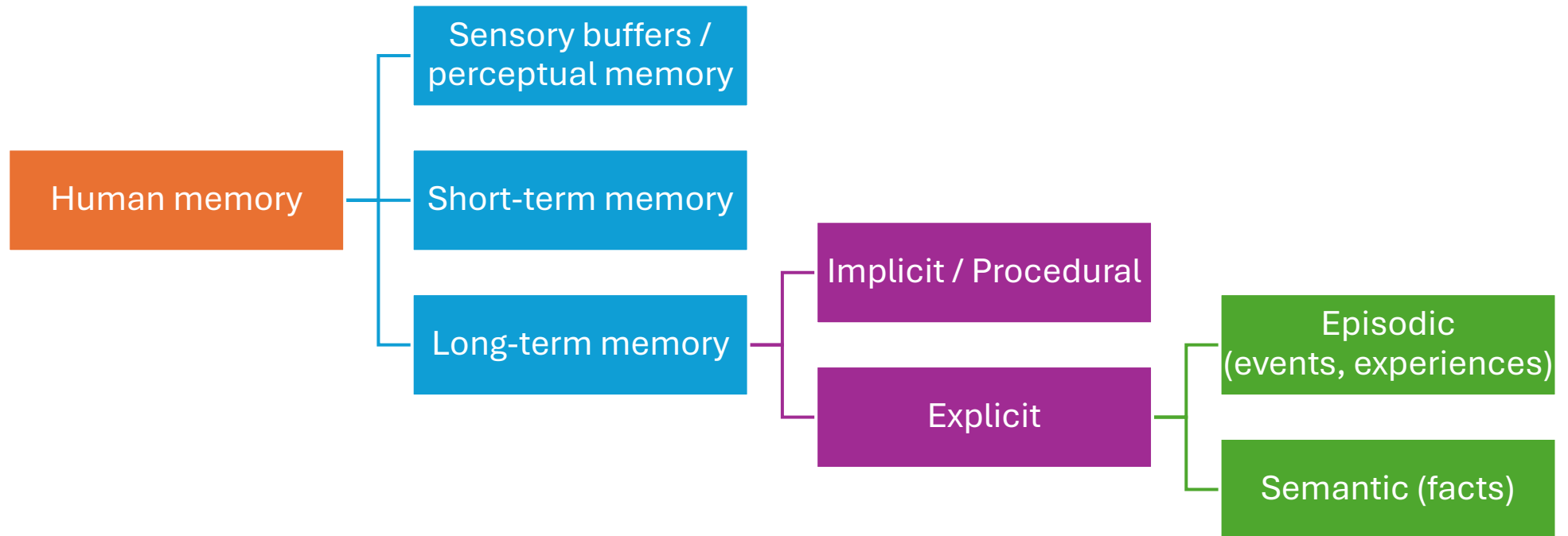


Attention in HCI

- Limited resource
- Interfaces need to draw attention to the right things
 - E.g., what is different / unique draws attention
- Too much clutter → compete for attention, hard to focus
- Help decide quickly where to pay attention
- Minimize distractions
 - Clippy, chatbots that annoy, pop-up windows
 - Marquee, moving text, etc.
- People overlook too much irrelevant stuff as “noise”
 - Useful stuff might be ignored
- Attention diffuses; need to keep people alert/engaged

Memory

- Process/ability to store and retrieve information




Short-term memory

- Let's play a game: remember the following sequence of digits
- Write it down now

9733015217

Short-term memory

- Now remember this (do not write down)
- 
- Check the previous one: 9733015217
- Now write down the letters you memorized!

Short-term memory

- Faster to remember, faster to recollect
- Short lived: 15-30 seconds, provided no distractions
- Small capacity: 7+/-2 items or “chunks”
 - How many of you remembered digits broken down into parts?
 - Also why mnemonics work
- What goes into short-term memory: everything!
- Important to remember what you’re working on, goals, options for comparisons, intermediate results, etc.

Short-term memory implications for HCI

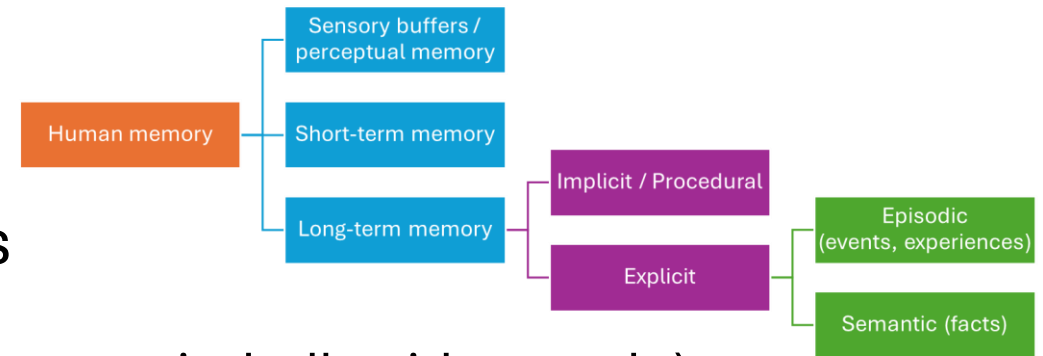
- Don't make people remember (e.g., one screen to another)
- Copy-paste is made for exactly this purpose!
- Show options, intermediate stages, etc.
- Allow for “closure” → people forget to put some tasks to short-term memory for completion
 - E.g., take card after ATM withdrawal (closure happen when cash is withdrawn)
 - Most ATMs give back card before cash, for this reason!

Long-term memory (LTM)

- Lifelong (mostly)
- Stuff from STM goes to LTM by “Rehearsal” / repetition
 - More the repetition, the better/longer we remember
- Distribution of “rehearsal”
 - Not cramming, but periodically rehearsing/repeating
 - 10 min a day is better than 2 hours over a weekend

What goes into LTM?

- Procedural / habitual / how to do things
 - “Muscle memory”
 - Doesn’t need conscious attention (walk absentmindedly, ride a cycle)
 - Flawed, attention is not in use and errors happen
- Episodic memory
 - Events, experiences
 - Serial in nature
- Semantic memory
 - Facts, concepts, etc.
 - Thought to be an interconnected graph (also as frames, sometimes!)
 - Which is thinking of one reminds us of others!
- All these parts are also interconnected!



Limitations of LTM

- Long to learn and store
- Long to retrieve (sometimes we need to reconstruct, go through sequence of nodes to get to what we need)
- Flawed
 - We forget stuff [decay, interference]
 - Retrieval takes time
 - Biased (recency, frequency, saliency, emotional responses)
 - Old habits (old year, instead of new year)

Implications for HCI

- Recognition over recall
- Provide memory aids (DON'T EXPECT USER TO REMEMBER!)
 - Trainings also don't work for the same reason!
- Use of conventions/standards → use rehearsed memory
- Humans are creations of habit
 - Don't change interfaces, if need be, account for its error proneness
- Over time, people can memorize things
 - Allow for shortcuts that are quicker

Thinking: reasoning & problem solving

- Now that stuff is in memory, can be used
- Reasoning → derive new “insights” from prior knowledge
- Deductive reasoning (deduce from facts)
 - If Tuesday, then class. Today is Tuesday. There is class.
 - If Tuesday, then class. Tomorrow is Wednesday. Is there class tomorrow?
- Inductive reasoning
 - Generalizations from seen instances to unseen instances
 - Useful: Helps fill gaps, guess what to expect, etc.
- Abductive reasoning
 - Assigning causes for why something happened
 - We are horrible at this (so, don't leave gulf of evaluation!)

What this means for HCI?

- Reasoning is information heavy
- Prone to confusion and fallacies
- Computers are very good at this stuff
 - There's a lot of scope for computers to support humans on this
 - Information heavy, computers can also help there
- When people don't know an interface:
 - They try to “reason” their way out, “guess” (make inferences), etc.
 - Do not allow for that – humans are horrible at it!!!

Next class

- Problem solving
- Learning
- Motivation
- Emotions
- Then, human errors

Readings:

- “Attention and its implication for HCI”, Claudia Roda
- Finish Dix, Chapter on “Humans”