Lecture 12 – Human Abilities
Memory

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ADMINISTRIVIA

Project

– MSIV - Part A was just due
– MSIV - Part B due on Thurs
– MSIV – Part C (Video) due next Thursday
– design reviews at Friday’s workshop
  • be prepared to show your prototype (if we have questions about how it changed)
  • be prepared to talk about your plans for your presentation/video
MSV

- MSV description posted ~week ago
- Design Competition (next Tues) will be held in this room (DMP 110)
- fantastic design jury!
MSV

— timing:

• presentations: 3:30 – 5:20PM (mandatory)
  – 6 min for presentation / 4 min for questions

• if any team has a tight 5:30PM timeout, let me know now

• will be a break ~ halfway through – opportunity to chat with jury members, socialize

• social directly following in x860, while judging happens

• winners announced at end of social

— testing presentation laptop – today during break
TODAY

– human memory
  • introductory material (Dix)
  • examples of memory in HCI design/research
**MODEL HUMAN PROCESSOR (MHP):**
**ONE MODEL FOR PERCEPTION ➔ MEMORY ➔ COGNITION**

- Cognitive Processor
- Long-term Memory (LTM)
  - Working Memory (WM)
    - Visual Image Store
    - Auditory Image Store
    - Haptic Image Store
- Perceptual Processors
- Motor Processor (action)
- Sensory Buffers
- WORLD

On your own

*“The Psychology of Human-Computer Interaction”, 1983 Card, Moran, & Newell*
sensory memory
- buffers: iconic (visual), echoic (auditory), haptic (touch)
- passes into short-term memory by attention (filtering)

working memory (short term)
- rapid access (~ 70ms) & decay (~200 ms)
  - pass to LTM after a few seconds
- limited capacity ("scratch-pad")
- small capacity (7 ± 2 “chunks”) (Miller, 1956)
  - 6174591765 vs. (617) 459-1765
  - DECIBMGMCM vs. DEC IBM GMC
- “flush” when finished with a task
- or, move into long-term via rehearsal
• **long-term memory**
  
  – huge (if not “unlimited”)
  
  – slower access time (~100 ms) with little decay
  
  – complicated operation that depends on recent access

recall from 344 – attention is the “gateway” to memory
MEMORY: STAGE THEORY

- **working memory is small**
  - temporary storage: decay, displacement

- **maintenance rehearsal**
  - rote repetition
  - information must be meaningful to learn information well

- **answer to problem is organization, e.g.**,
  - Faith Age Cold Idea Past Large
  - In a show of faith, the cold school-age boy ran past the large church and was struck with a great idea
MEMORY: ELABORATION

- attach meaning (make a story) - e.g., sentences
- visual imagery
- organize (chunking)
- link to existing knowledge, categories
causes for not remembering an item?
1) never stored: encoding failure
2) gone from storage: storage failure
3) can’t get out of storage: retrieval failure

interference model of forgetting
- one item reduces ability to retrieve another
- proactive interference (3)
  • earlier learning reduces ability to retrieve later info
  • example?
- retroactive interference (3 & 2)
  • later learning reduces the ability to retrieve earlier info
  • example?
RETRIEVING CONTENT FROM MEMORY

• ability to retrieve information from memory can be influenced by several factors:
  – Practice: how many times info has been used in the past
  – Recency: how recently the info has been used
  – Context: what is present in the person’s focus of attention

• recall
  – info reproduced from memory

• recognition
  – presentation of info that has been seen before
  – easier because of cues to retrieval
RECOGNITION VS. RECALL

• remember nielson’s heuristic #6

• often we want to turn recall problems into recognition problems, e.g.,
  – e.g., command line (recall) vs. GUI (recognition) interfaces
  – typing in a web address (recall) vs. searching for the website in google (recognition)

• the eternal security problem:
  – remembering a username / password usually involves writing it down somewhere
FACILITATING RETRIEVAL: CUES

– cue = any stimulus that improves retrieval
  • example: giving hints
  • other examples in software: icons, labels, menu names, etc.

– anything related to
  • item or situation where it was learned

– can facilitate memory in any system
MEMORY CHUNKING & UI DESIGN

• remember: $7 \pm 2$

• a common guideline is to therefore limit menu items to 7
  – but this isn’t really correct – why?

• how CAN chunking of menu items be beneficial from a memory perspective?

Not enough groups  Too many groups  Just right?
MOTOR CHUNKING: GESTURES

• sequence of actions completed automatically once set in motion
  – e.g., typing the word “the”
    • single gesture for experienced typist
    • three gestures for novice typist
  – e.g., keying in phone numbers, passwords

• haptic analog to visual chunking

• UI guideline: facilitate gestures/phrases that result in haptic chunking
EXPLOITING MOTOR CHUNKING

- Dvorak keyboard layout facilitates chunks:
- common pairs become “rolls”: t h
- other pairs alternate hands: th e m

DIX reading not fully covered

- but you are expected to know:
- material in 1.1 – 1.3
Types of long-term memory:

- **retrospective memory** is memory for people, words, and events encountered or experienced in the past.

- **prospective memory** is remembering to remember or remembering to perform an intended action.
FINDING AND REMINDING

• remember Malone’s *How do people organize their desks?*:
  – how do finding/reminding relate to retrospective and prospective memory?

• in terms of our computer systems today:
  – how do we find things (e.g., a document)?
  – how to we remind ourselves of something that needs to be done (e.g., to revise a document)?
LIFE LOGGING

• designing systems for rich recording of everyday life events

• examples:
  – SenseCam
  – facebook timeline (sort of)
  – Fitness trackers (fitbit, iPhone, misfit, etc.)

• what type of memory does this facilitate?
• what’s the problem with simply capturing all this information?
Chatty Web / Piccy Web (2010)

• problem: people have difficulty navigating rich archives efficiently, and manual curation is very time consuming

• Chatty Web / Piccy Web
  - system to support digital memory aids for students of lectures
  - use attention to identify the most important logs in the record
  - make most important events more salient to distinguish them from the noise
Student users take notes (or photos) during lecture, which are synchronized with the underlying speech record recorded onto the device.

Figure from: Whittaker, S., Kalnakaite, V., Petrelli, D., Sellen, A., Villar, N., Bergman, O., lough, P., and Brockmeier., J. (2010). Socio-technical lifelogging: Deriving design principles for a future proof digital past. Human-Computer Interaction (Special Issue on Personal Memories)
notes adaptively curated via flags made during the lecture and # of retrievals during studying later

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UNDERSTANDING / DESIGNING FOR INTERRUPTIONS

• a common area of HCI research where understanding of human memory factors into design
  – electronic interruptions have increased dramatically in the last two decades (email, IM, mobile phones...)

• **problem**: what was I doing before I got interrupted? (prospective memory failure)

• **importance for design:**
  – when should designs account for interruptions?
  – how can design help users resume their primary task after an interruption?
AM WORKING AWAY…
SWITCH TO MY EMAIL…
DIVERT TO A NEW TASK . . .
FINISH THIS NEW TASK...

Now where was I before I got interrupted???
**GROUPBAR: THE TASKBAR EVOLVED** [2003]

- vertical and horizontal variants
- clicking green group tab restores all of the windows in that Group and brings them to the foreground

- context menu through right-clicking allows users to arrange all windows in that Group according to predefined layouts (here assumes triple monitor display)


USER MANAGES THE GROUP BAR
RECAP TODAY

– human memory
  • introductory material (Dix)
  • HCI research