CPSC 444:
ADVANCED METHODS IN
HUMAN-COMPUTER INTERACTION

Lecture 12 – Human Abilities
Memory
Joanna McGrenere

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

HUMAN MEMORY (WELL-COVERED IN DIX READING)

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
    • DECIBMGM 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

On your own

*“The Psychology of Human-Computer Interaction”, 1983 Card, Moran, & Newell
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

FORGETTING IN LONG TERM MEMORY

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±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?

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

MORE EXAMPLES OF HCI DESIGN RELATED TO MEMORY

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 do 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

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]

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

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

• user manages the GroupBar

USER MANAGES THE GROUPBAR

RECAP TODAY

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