Comp 388/441 - Human-Computer Interface Design

Week 4 - 5th February 2015

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Human Memory - 1

- context in user interaction is important
  - *helps establish an application in a user's short-term memory*

- predominant models for human memory include
  - *short-term or working memory*
  - *long-term memory*

- inter-related structural nature of working and long-term memory

Human Memory - 2

Short-term, working memory

- conceptually similar to a temporary memory store
- able to hold a limited amount of data
  - *might include words, numbers, symbols...*
  - *related to current user task*
- working memory decays quickly & often lost
  - *we lose focus, switch to another task...*
- rehearsal and repetition of a given task is useful prevention
  - *helps us maintain useful or important information*
- capacity of working memory
  - *"seven, plus or minus two"*
  - *Miller, G. A. "The magical number seven, plus or minus two: Some limits on our capacity for processing information." 1956.*
- 7 numbers for North American local dialling
- harder for most people to hold more than about 7 digits...

Human Memory - 3

Changing limited capacity in working memory

- free up working memory to replay and rehearse new information
- compare with computer memory, and related performance without free memory
- learning is naturally reduced and slows down
- a good example of this is mental arithmetic
- difficult to hold even limited amounts of information and process effectively
- burden on working memory is known as 'cognitive load'
- reduction of cognitive load fosters learning by freeing working memory

Human Memory - Working Memory Video

Why the Human Brain Can't Multitask - Source: YouTube

Long-term memory

- more permanent, persistent store
- allows us to save and recall knowledge, memories at a later date
- store any facts, both good and bad
- also stores procedures and skills
    - *both cognitive and sensory-motor tasks related*
- also permanent memory store
    - *some data will naturally degrade or deteriorate over time*
- may experience some sense of false recall
    - *memory items become confused or combined irregularly*

The very act of memorisation

- the act of intentionally committing something from short-term to long-term memory
- normally achieved through repetition
  - *more frequent we encounter something, more likely we are to remember*
- eg: studying involves actively & intentionally re-reading, rehearsing & practicing
- also need to be able to store other long-term data
  - *important, novel, surprising, and unusual information without repetition*
- exact nature of how this works still remains largely unknown
- such memories are believed to be stored symbolically
- we may not retain exact copy of event or material
  - *instead we create symbolic hooks to allow easier recall of data*

Memory storage & recall

- tend to store information in logical groupings
- psychologists refer to this as **chunks**
- memory most effective when **chunks** are related
  - *these are logical connections or relationships*

- eg: association between a person and related information
  - *their face and name*
  - *their job title and name*
  - *family or colleague associations...*

Human Memory - 7

Memory recognition & recall

- recall of information, events etc normally triggered by a prompt or cue
    - *eg: recognising someone in a crowd may trigger recall of their name...*

- more recent information tends to lead to better recall
    - *known as **recency effect***

- often easier to recall related information as well
- poor, fractured recall shows imperfect nature of long-term memory
- often recall hazy or false data from long-term memory

Retrieval and transfer of new knowledge and skills

- not sufficient to simply add new knowledge to long-term memory
    - *new knowledge needs to be easily retrieved in context*

- retrieval of new skills essential for successful transfer of knowledge and experience
- interface design necessarily needs to incorporate context to help retrieval
    - *examples and practice exercises*
    - *simple mnemonics as a child*

- job learning and training scenarios, role play, troubleshooting exercises...
- link or hook new knowledge to long-term memory

Human Memory - Improving Memory Video
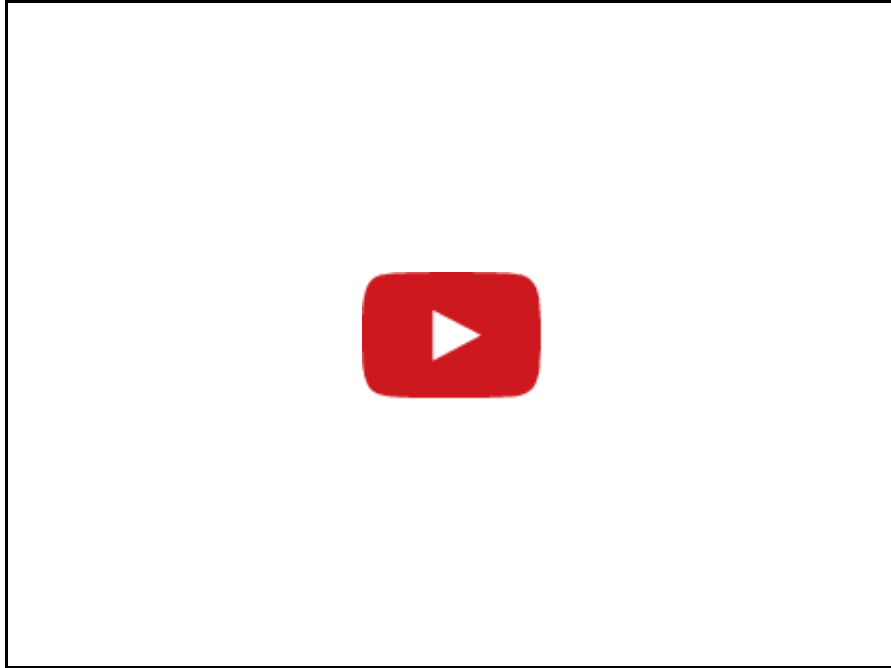
Andi Bell explains the 'link method' memory technique - Source: YouTube

Human Memory - Mind Palace Video

Share | View High Quality

Sherlock Holmes Mind Palace - Source: Critical Commons

Our brain forgets...

- less frequently accessed chunks of information or skill processes
  - *more likely to be forgotten*
  - *natural aspect of our brain's memory structure*

- **recency effect** tends to protect daily routines...
- older facts more easily become hazy or unclear
- loss of long-term information is not universal
- highly developed motor & cognitive skills with sense of easy repetition
- some things are simply like **riding a bike**

Human Memory - Video
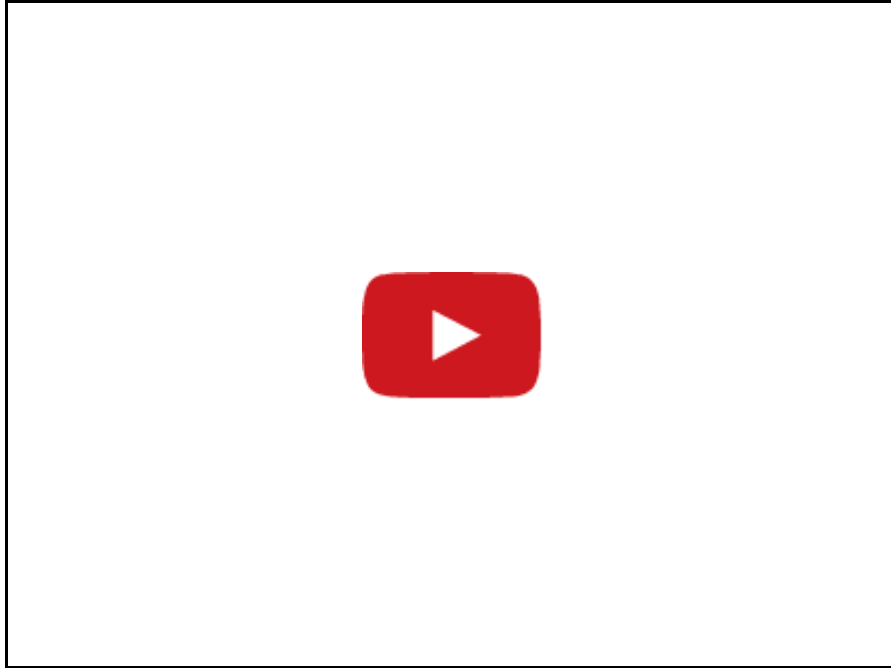
Ten Second Tom from 50 First Dates - Source: YouTube

Design for Memory - 1

Design Considerations - Part 1

- ensure interface is designed to reduce or eliminate need to memorise and recall

  - *interface elements etc within structure*

- Don Norman outlines this concept as the notion of

  - ***knowledge in the world*** *vs* ***knowledge in the head***

- eg: creating menus or lists of options for users is a good example of

  - ***knowledge in the world***

- user will be able to view the menu, read and recognise options, make selection

  - *no need to recall or memorise related information beyond the basics...*

- this same option on the command line requires memory of command...

  - *user would need to recall* ***knowledge in the head***

  - *increases potential for error and application issues*

Design for Memory - 2

Design Considerations - Part 2

- we can guide users through sequenced tasks
    - *provision of defined sequence of steps*
    - *guide user through the task flow step by step*

- present forms and controls in a logical and sequential order
- might even consider a **wizard** style interface
    - *user can navigate multiple pages with standard **next** & **previous** links*

- trying to reduce the amount of navigation details required by the user
- thereby reducing the amount the user needs to memorise and recall

Design for Memory - 3

Design Considerations - Part 3

- interface design enhanced with recognisable icons and names

    - *user can easily find interface elements as they scan a list, menu...*

- icons can act as clarifying elements

    - *icons should represent concrete and recognisable things*

- goal is to make it easier for users to create hooks from working to long-term memory

- user should not have to memorise or struggle to recognise unfamiliar icons

    - *defeats the point of using simpler graphical representations*

- if you use abstract, original icons then add some accompanying text to help the user

Design for Memory - 4

Design Considerations - Part 4

- naming schemes & patterns in UIs are also important
    - *helps users remember & recall information*
    - *arbitrary names are harder to recall than representative names*

- non-representative naming schemes may add to user's cognitive burden
- command line interfaces violate this principle on a regular basis
    - *consider Unix commands **more** & **less***

Design for Memory - 5

Design considerations - 5

- good help system and search tool
  - *allows a user to quickly check and recall lost or forgotten information*
  - *user can quickly reference documentation, check usage pattern or concept...*

- in search and index systems
  - *allow users to use variations, synonyms*
  - *user may not remember the exact term, query, spelling...*

- try to avoid personalised terminology for standard UI elements, interaction concepts

- try to avoid using abbreviations or acronyms unless they are obvious or standard practice
  - *eg:* **GUI**, **WYSIWYG** *are well known examples...*

- be consistent in your UIs application of actions and methods
  - *eg: an action should perform in the same manner from one context to another*

References

- Miller, G. A. *The magical number seven, plus or minus two: Some limits on our capacity for processing information.*. Psychological Review, Vol. 63, Issue 2. PP. 81-97. 1956.