Comp 341/441 - HCI

Spring Semester 2019 - Week 4

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Users & Interaction

consideration of interaction - brief recap

- GUIs tend to present graphical controls for user interaction
  - *buttons, drop-down boxes and menus, sliders...*
- users interact either directly or indirectly
  - *gesturing on a touchscreen...*
  - *pointing device such as a mouse, keyboard...*
- inherent assumption users know required actions for a given application

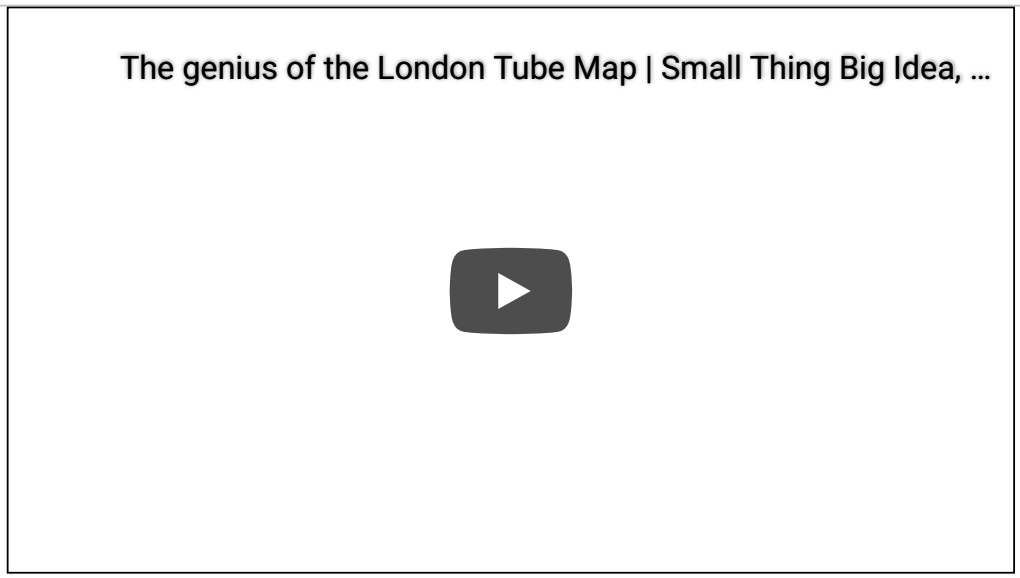
Users & Interaction

hierarchical breakdown - brief recap

- normally a predictable model involving a hierarchical breakdown
  - ***goals**: user's high-level goal for interaction with application*
    - write a letter, take a photo, read a book, book a holiday...
    - goals become ***what*** the user wants to do
    - instead of ***how*** they will do it
  - ***tasks**: allow a user to fulfill their goals*
    - perform some general steps
    - follow a structured path of activities
  - ***actions**: user carries out their tasks by performing interface actions*
    - specific operations in the user interface
    - click a button, select a menu item, drag and drop an element, text entry...

Video

Design Genius



TED: The Genius of the London Tube Map
Source: YouTube

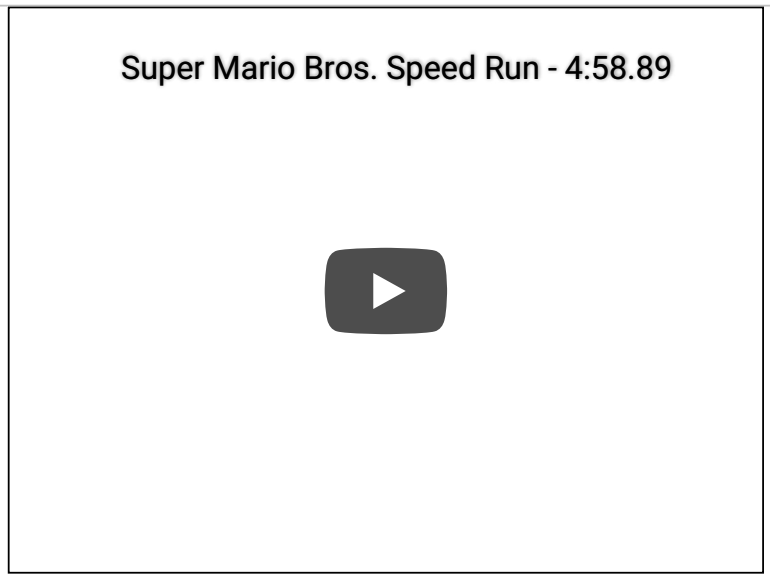
stages of action

Stages of Action

- tends to be easier and quicker for experienced users
  - *tasks are known to achieve goal*
- new users more hesitant at first
  - *uncertain of the required actions to accomplish a task*
  - *may be uncertain of the tasks necessary to achieve their goal*
- some users consult documentation, online tutorials, help forums...
- many simply begin with exploratory approach
- user may continue cycle of exploration through application
- continue until goal completed satisfactorily
  - *or, until the user gets stuck and can't move on*

Video - Users & Interaction

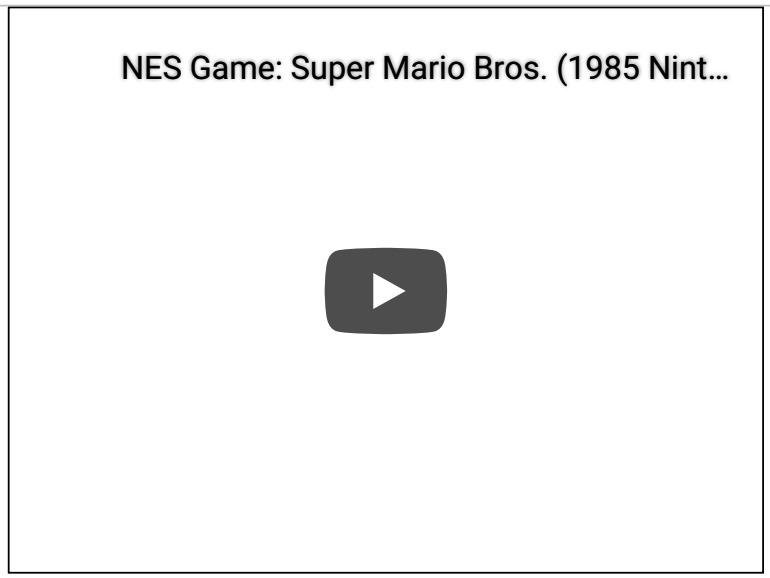
Super Mario Bros. speed run



Super Mario Bros. Speed Run - 4:58.89 - Source: YouTube

Video - Users & Interaction

Super Mario Bros. standard play



NES Game: Super Mario Bros. (1985 Nintendo) - Source: YouTube

Users & Interaction

seven-stage action cycle model

- formalised model named **Seven-Stage Action Cycle Model**
  - *Norman, D. The Design of Everyday Things. Basic Books. 2013.*
- the model consisted of the following steps:
  1. *Identifying an immediate goal*
  2. *Forming an intention to act*
  3. *Determining a plan of specific actions*
  4. *Carrying out the actions*
  5. *Observing the results by perceiving the state of the system and the world*
  6. *Interpreting the results*
  7. *Evaluating whether the actions had the desired results*

Users & Mental Models

intro

- mental models formed as a user learns tasks within an application
- conceptual representation in our user's mind of how a system works
  - *how to operate an application's interface*
- naturally reflects a user's current stage of learning and understanding
- this understanding is subject to change
  - *changes to reflect new learning, experience...*
  - *may diminish or disappear as a user forgets details over time*
- a user relies on a mental model for an application, scenario..,
- user's will also develop expectations based upon such models
- compare a user's mental model to a system's implementation model
  - *can begin to explain usability issues and problems*

Users & Mental Models

elements of a mental model relative to apps & UIs

1. interface appearance
2. interface concepts, syntax, general rules...
3. navigation map
4. plans and strategies for accomplishing tasks and reacting to problems &c.
5. heuristics, conventions...
6. perception of application's implementation model

Users & Mental Models

interface appearance

- users form visual images of the **places** they encounter and repeatedly use within an interface
  - *e.g. various pages, screens, tabs, windows...*
- for most users, recall of mental images will be vague and inherently imperfect
  - *excluding those with eidetic memories*
- interface familiarity leads to familiarity with general layout
  - *frequency of use is also important*
- a user is unlikely to be able to sketch in detail an application's interface from a mental model

Image - Users & Mental Models

Super Mario Kart - 1992

Super Mario Kart - 1992

Image - Users & Mental Models

Mario Kart 64 - 1996

Mario Kart 64 - 1996

Image - Users & Mental Models

Mario Kart 7 - 2011

Mario Kart 7 - 2011

Users & Mental Models

Mario Kart through the years...

Super Mario Kart - 1992	Mario Kart 64 - 1996	Mario Kart 7 - 2011
		

Users & Mental Models

interface concepts, syntax, general rules...

- application is designed to solve a problem or meet a specific requirement
- syntax and rules required known as either
  - ***application domain***, ***business domain***, *or* ***problem domain***
- **problem domain** may actually be pretty small
- user may only need to know a handful of concepts
- more complex and involved applications can be designed with inherent assumption of
  - *experience and prior-knowledge*
  - *a thorough understanding and awareness of required domain*
- awareness of problem domain gained via
  - *education, training, experience...*
- other applications may need to communicate and highlight their domain's concepts
  - *games, e.g. role-playing and fantasy, often seen as extreme example*
- simpler games also require adaptation to their domain's objects, goals...

Users & Mental Models

interface concepts, syntax, general rules...cont'd

- many scenarios only require a user's cursory understanding of an application
  - *e.g. users may not need to know about URLs to use a web browser*
- semi-automated apps following pre-defined paths reduce user learning curve
  - *online ticket sites, package delivery...*
- many complex applications, e.g. MS Word, still allow a user to get started quickly
  - *users may be unaware, or even care, about advanced options*
  - *learning can be built upon initial, cursory understanding and usage*

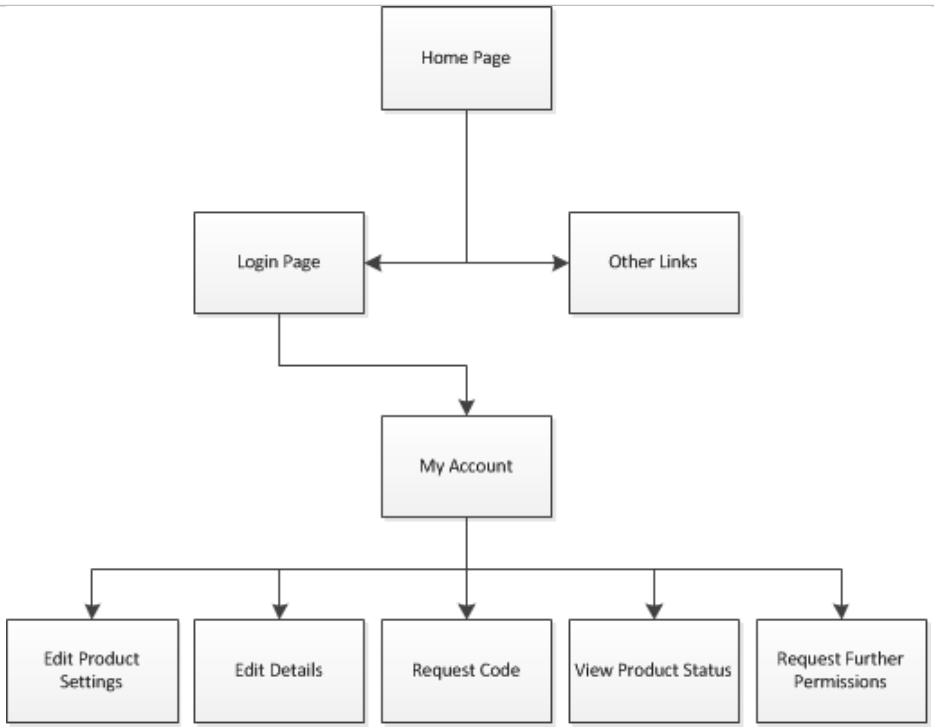
Users & Mental Models

navigation map

- many applications include the notion of places
  - *pages, screens, tabs, windows...*
- a **navigation map** will be formed by a user
  - *allows a user to differentiate between these places*
  - *return quickly to common places*
- navigation becomes a regular action for users in applications
- maps often applied to comparative applications
  - *expectation of similar usage and interaction*
- multiple options for same location
  - *users may not always be aware of competing routes*
  - *preferred routes often take precedence*

Image - Navigation Map

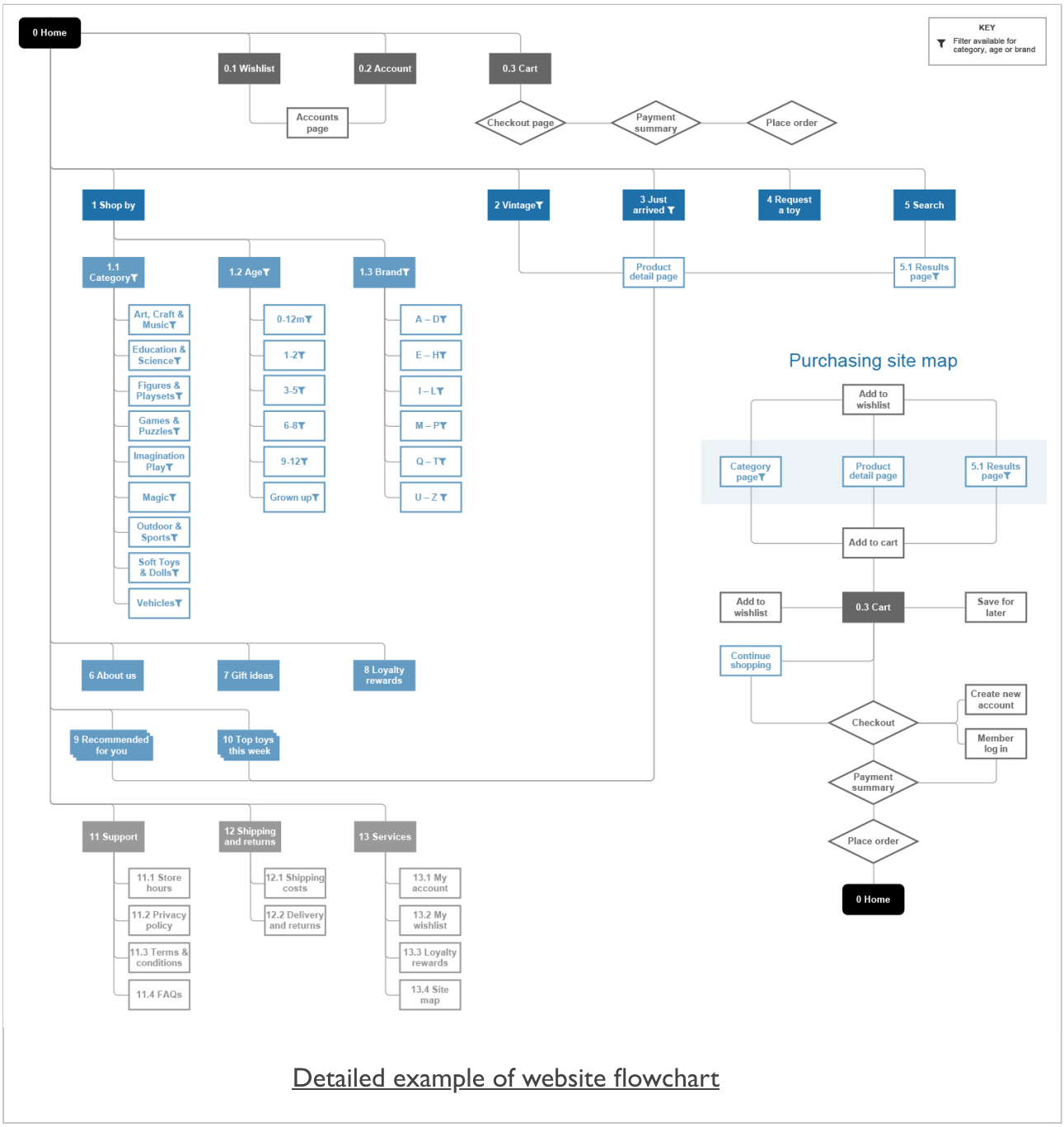
simple website example



Simple example of website flowchart

Image - Navigation Map

detailed website example



Detailed example of website flowchart

Users & Mental Models

plans & strategies for accomplishing tasks & reacting to problems...

- users often memorise **plans of action** for given tasks
- an **action plan** might reflect a simple sequence of required user steps
- a more experienced user may internalise a required conceptual structure
  - *this mental depiction may not be complete or accurate*
- user may not be aware of why a sequence works or not
  - *simply memorised the sequence*
- taught users may know how but not why
- success by trial and error

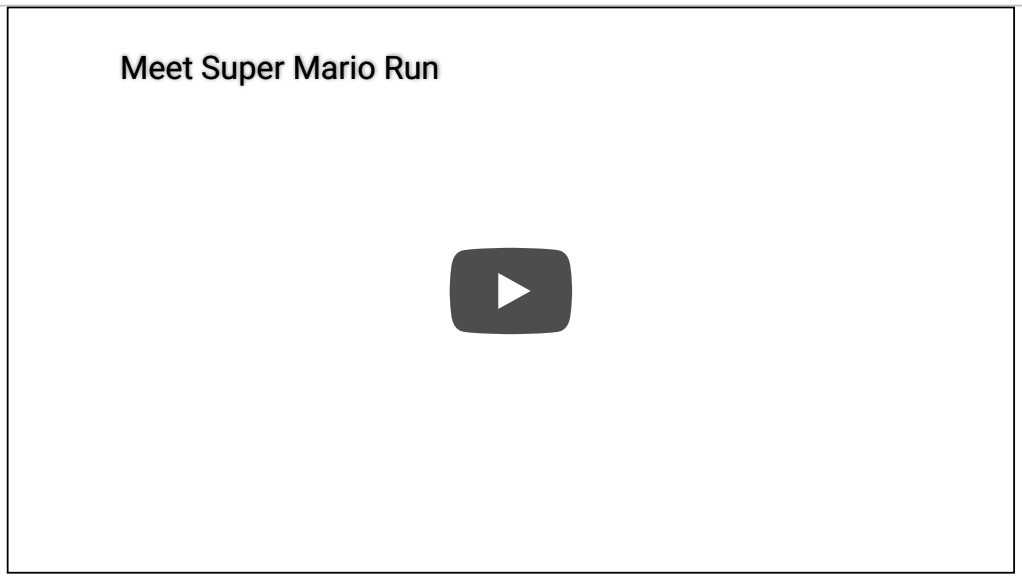
Users & Mental Models

heuristics, conventions...

- general heuristics may be included in a user's mental model
  - *rule of thumb style guidelines*
  - *other conventions acquired from a broader context*
- learned and added from experience
- subsequently applied to a given system
- common UI elements between disparate applications
  - *application and operating system*
  - *allows a user to infer interaction patterns for an application*

Video - Mobile Gaming

Meet Super Mario Run



Source - YouTube

Users & Mental Models

perception of application's implementation model

- users infer patterns for behaviour within an application
- an application's code and implementation will often remain hidden to a user
- does not prevent a user from recognising usage patterns
  - *not always a bad thing for an application*
  - *such patterns can be beneficial for a designer*
- content output and rendering a good example of pattern forming
  - *user adds content to table*
  - *notices data added to top*
  - *infers table output pattern*

Users & Mental Models

communicating a mental model

- mental models are also part of the initial design process
- designers naturally form a conceptual mental model for our own application
- our goal is to ensure a user's mental model matches our own
- we can provide structured learning and education
  - *documentation, training, demos...*
- many users may not read the documentation or follow tutorials
- many users still rely on trial and error

Users & Mental Models

communicating a mental model...cont'd

- visual presentation of UI provides cues and guidance to users
  - *how to complete actions and tasks*
- application behaviour provides feedback to the user
  - *whether those actions and tasks have been successful or not*
- hoped that as a user develops familiarity with an application's UI
  - *their mental model will more closely approximate the designers*
- Don Norman refers to the **design model** and **user's model**
  - *refers to product's interface as **system image***
- design model and system image need to align

Video

Hyperlinking

TED: How the hyperlink changed everything
Source - YouTube

Users & Mental Models

a few questions

Q: Choose one of your products, again good or bad, and think of the **user model** that you have developed for this interface?

Q: What influenced the development of that **user model**? For example, was it good or bad design, interaction options, previous experience with similar product interfaces, and so on.

Q: Did further training or experience modify that **user model**? How and why?

Human memory

intro

- 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

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...

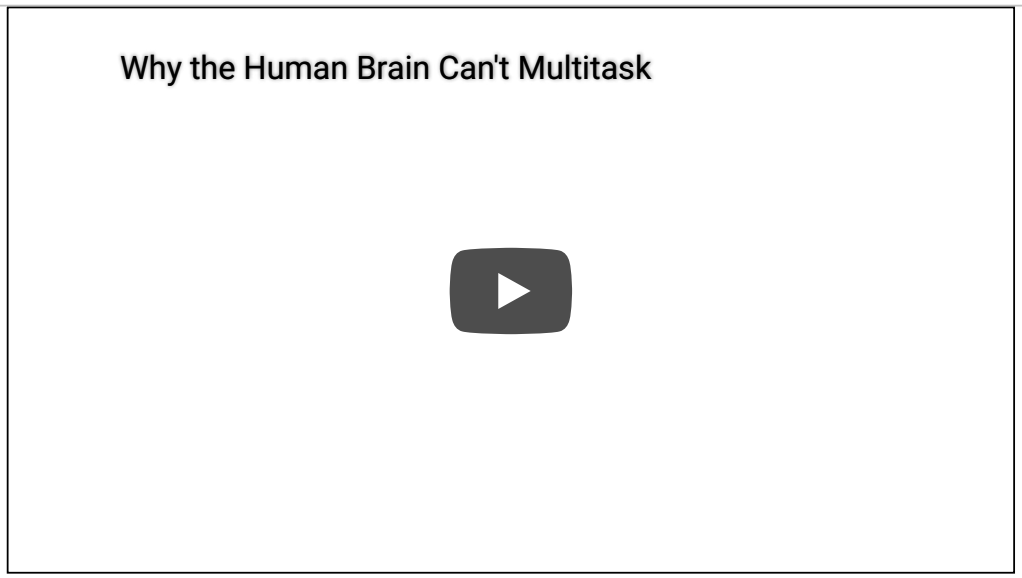
Human memory

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

Video - Human memory

working memory - why the brain can't multitask



Source - YouTube

Human memory

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*

Human memory

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*

Human memory

memory storage and 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

memory recognition and 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

Image - Human memory

a test of memory and recall

a test of memory and recall...

Human 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
- knowledge successfully stored in long-term memory
  - *no use unless we may successfully recall later, as required*
- interface design necessarily needs to incorporate context to help retrieval
  - *examples and practice exercises*

Human memory

retrieval and mnemonics

- interface design necessarily needs to incorporate context to help retrieval
  - *examples and practice exercises*
  - *simple mnemonics as a child*
- mnemonics to help with easier recall
  - *e.g.* ***N.E.C.E.S.S.A.R.Y***, ***SOHCAHTOA***
- might ask users to apply their new knowledge relevant to actual scenarios
  - *job learning and training scenarios, role play, troubleshooting exercises...*
- often see this example within games or education applications
  - *a skill is demonstrated and then the user is asked to practice*
  - *before moving on to the main application or game*
- link or hook new knowledge to long-term memory

References

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