

# **Comp 341/441 - Human-Computer Interface Design**

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Spring Semester 2017 - Week 4

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# Users & Mental Models

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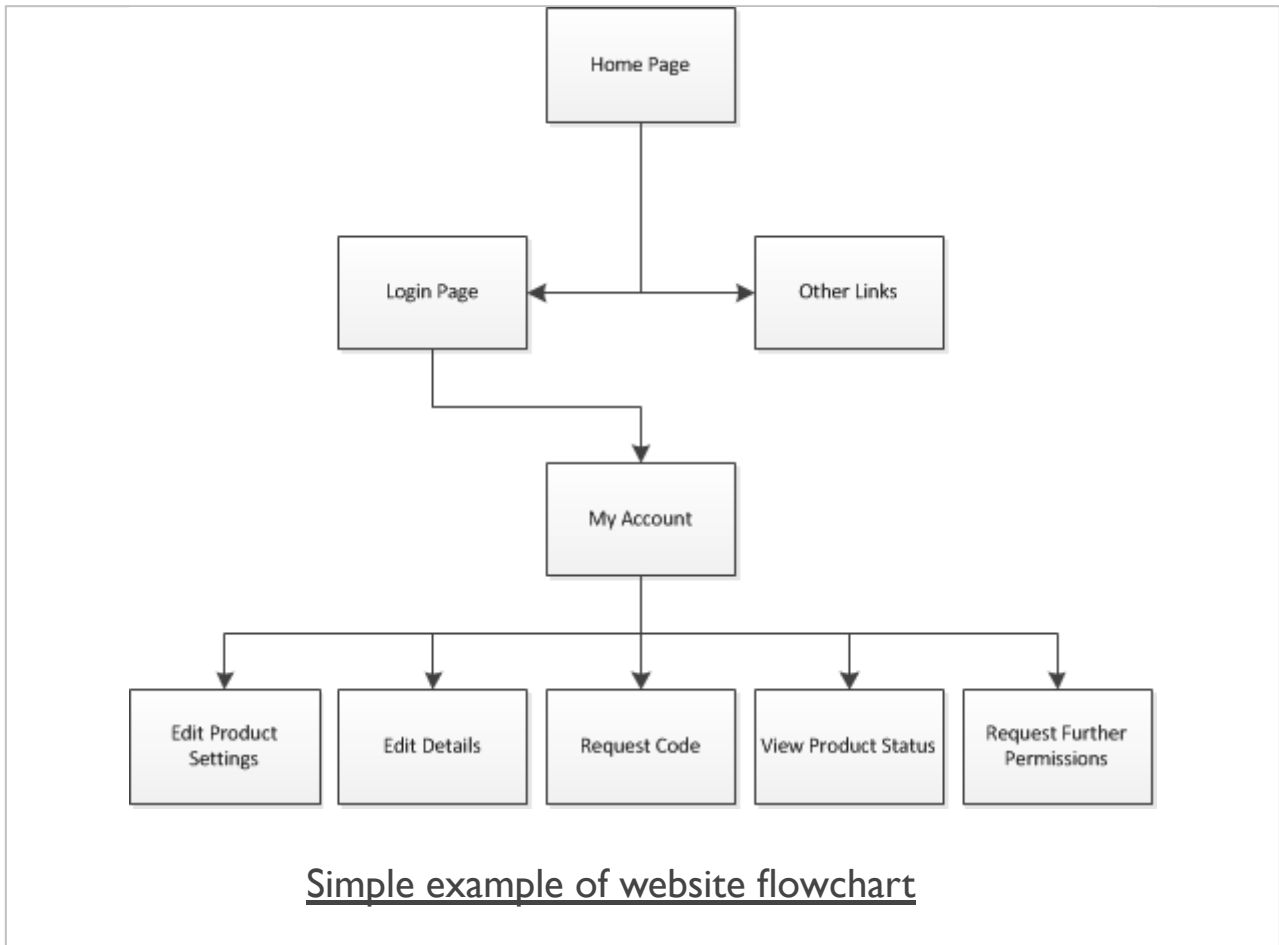
## navigation map

- 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

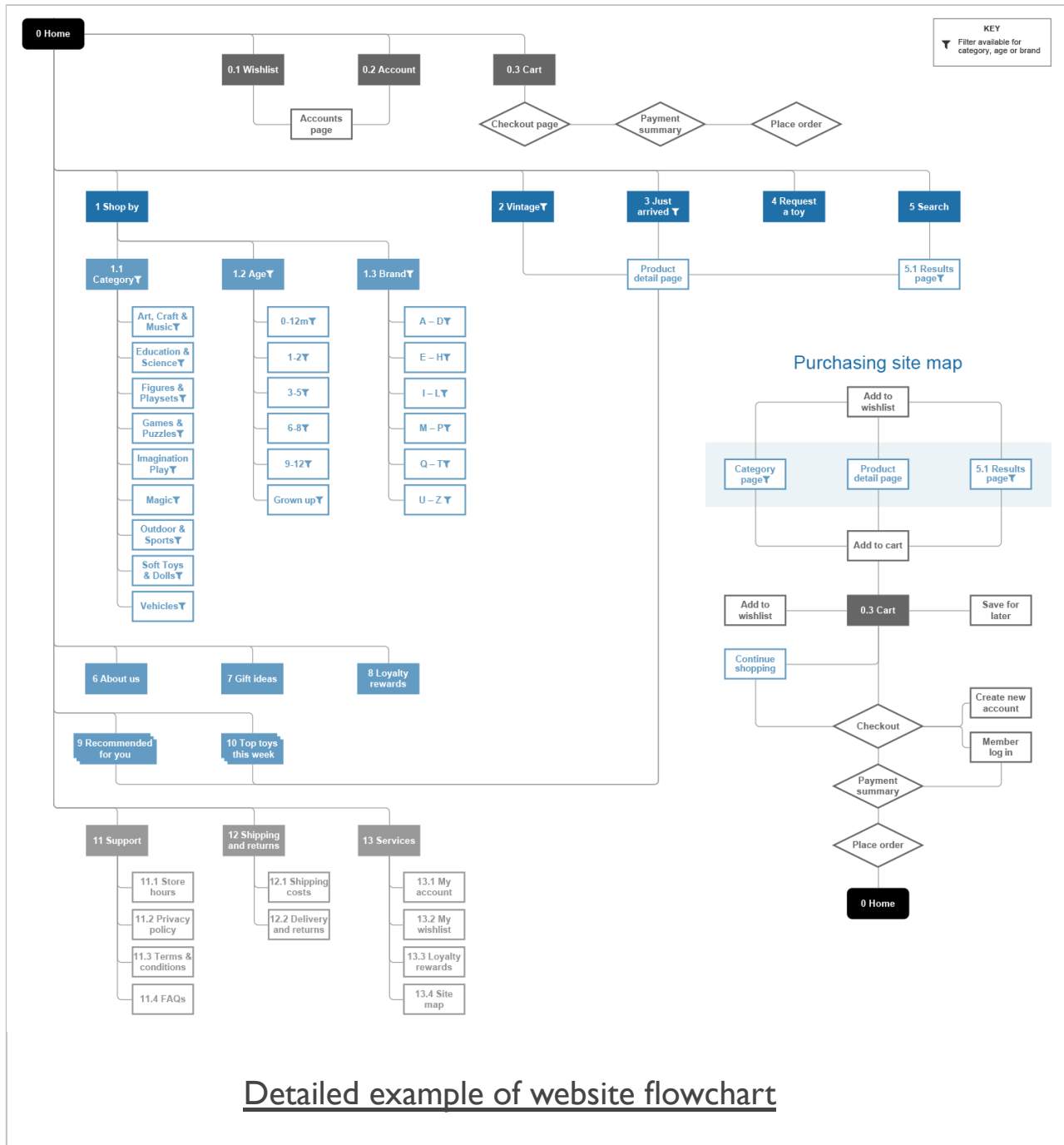
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## simple website example



# Image - Navigation Map

## detailed website example



# Users & Mental Models

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## 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

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## 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

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## Meet Super Mario Run

Meet Super Mario Run



Source - YouTube

# Users & Mental Models

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## 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

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## 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

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## 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

# Users & Mental Models

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## 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

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## 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

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## 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

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## 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

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## working memory - why the brain can't multitask

Why the Human Brain Can't Multitask



Source - YouTube

# Human memory

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## 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

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## 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

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## 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

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## 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

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**a test of memory and recall**



a test of memory and recall...

# Human memory

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## 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

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## 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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