Interaction Design

DECO1200
Outline

Introduction to Cognitive Models
  What are cognitive models? Why do they matter?

Cognitive Processes
  What are the different types of cognition?

Conceptual Models for Cognition
  What are the different types of cognitive models?

Information Design
  How do cognitive models affect design?
What is Cognition?

Cognition is what goes on in our heads. Thinking, sensing, understanding, learning, reasoning, planning, imagining, decision making, problem solving, using language, etc.

Experiential vs Reflective Cognition
Experiential: perceiving, acting and reacting to events
Reflective: thinking, planning and decision-making
Cognitive Models

What are cognitive models?
Cognitive models are models of human cognition.

How are cognitive models developed?
Psychologists and cognitive scientists study how humans perceive, think, act in laboratory tests.

What do cognitive models tell us?
Cognitive models tell us about human cognitive strengths and weaknesses, i.e. what humans are good and bad at.
Benefits of Cognitive Modelling

Cognitive models can help interaction designers in a number of ways:

Inform design decisions
  Help designers produce better designs

Extend human capabilities
  Help designers produce systems that build on what humans are already good at

Compensate for human weaknesses
  Help designers produce systems that can help people do things that that find difficult
Cognitive Processes

Cognitive is often described as processes

Attention
   Paying attention to what’s important in the world

Perception
   Perceiving and recognising things in the world

Memory
   Remembering useful things about the world

Learning
   Learning new things about the world

Using Language
   Listening, speaking, reading and writing

Problem-Solving
   Planning, reasoning and decision-making
Attention

Selecting things to concentrate on
  Depends upon a person’s goals and the information available in the person’s situation

Goals
  The goals that a person is trying to achieve can greatly affect what people will consider important.

Information
  How information is presented can greatly effect what people attend to in an interface.
Inattentional Blindness

What is inattentional blindness?

In a famous psychology experiment subjects were asked to monitor the passing of a basketball between two teams. During the video a woman wearing a gorilla suit or carrying an umbrella walks across the scene. After watching the video subjects were asked if they noticed anything out of the ordinary. Typically, 50% of the subjects did not report seeing the gorilla.
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Design Implications of Attention

Make information salient when it’s needed
  Use techniques like animation, color, decoration, ordering, sequencing and layout to draw attention.

Avoid cluttering up an interface
  Interfaces that are plain are much easier to use because it is easier for users to find important information.
Perception

Getting information from the environment
Information is sensed and transformed into experiences through pattern recognition

Vision is the dominant sense for humans
Interestingly, when trying to remember things, recalling the smell can often be the most powerful perception to unlocking a difficult memory

During perception sense data is combined
Perceptions often involve multiple senses making multimedia a powerful interaction design tool
Care must be taken to ensure perception is successful
e.g. a slight mismatch is lip-sync is unnerving
Design Implications of Perception

Information needs to be represented in ways that are easily recognised

- The meaning of icons and symbols should be obvious
- Sounds should be easily distinguished from each other
- Text should be easily distinguished from its background
- Speech should be easily distinguished and understood
- Tactile feedback should be distinct and appropriate
Memory

Recalling knowledge and experiences
Memories are recalled to support cognition and take appropriate actions

Memories do not store every detail
Typically, memories of experiences do not contain every sight, smell, sound etc.

Memories aren’t perfect
We forget things we’d like to remember and we remember things we’d like to forget

Context is important
Context can greatly affect what we remember and can lead to the construction of false memories
Strategies for Remembering

Mnemonics
Mnemonics turn unmemorable sequences into easily remembered phrases
  e.g. Many people find it difficult to remember the order of the compass directions in a clockwise order is NESW, especially the positions of east and west, a mnemonic is “Never Eat Shredded Wheat”

Sequencing
Memory experts have developed strategies to remember long sequences of things, e.g. sequences of playing cards
  One of the most common is to construct stories to remember sequences, the more bizarre the stories the more memorable they become
The Magic Number
7 ± 2

One of the most famous psychological theories is that short-term memory can contain 7 ± 2 chunks of information. A chunk is a piece of easily remembered information like a number, a word or a phrase. Some strategies for remembering work by building larger chunks using more memorable elements.

Design rules based on 7 ± 2 are only useful when they relate to short-term memory. Typically, user interface design issues are not problems with memory but are problems with recognition.
Design Implications of Memory

Do not overload the user’s memory with complicated procedures
  Keep procedures short and make them consistent

Design interfaces that promote recognition rather than recall
  Menus, icons, organisation, feedback, etc.

Provide users with useful ways to help them support their memory
  Folders, labels, colors, flags, tags, timestamps, icons, etc.
Memory and Security

Many people have to remember passwords and other security information.

Security systems are often based around a number of bits of information that the user must remember.

**Unique IDs**

Short sequences that can be memorised, possibly using mnemonics, e.g. Personal Identification Number (PIN).

**Security Questions**

Questions about unique information that can be recalled when required, e.g. mother’s maiden name, birthplace, names of pets, etc.
Learning can be through first-person “doing” or third-person “reading”.

People find learning through doing to be much easier than learning through reading.
Design Implications of Learning

Design interfaces to encourage exploration
   Allow users to explore possibilities and undo mistakes

Design interfaces that constrain and guide
   Guide users to help them select appropriate actions

Design interfaces to encourage learning
   Provide users with helpful context-sensitive information
Using Language

Language can be used to convey meaning in different ways that have different qualities:
- Writing is permanent, listening is transient
- Reading is quicker, listening is easier
- Written is grammatical, listening is ungrammatical

People differ in their preference and ability to use language:
- Some prefer listening to reading and speaking to writing
- Some have difficulty recognising written language
- Some have difficulty hearing spoken language
Design Implications of Using Language

Keep spoken menus to a minimum
   It’s hard to remember more than a few spoken options

Use accentuation and intonation
   Intonation and accentuation makes natural and artificial speech easier to understand

Allow text to be resized
   Users should be able to resize text to make it easier for them to read
Problem-Solving, Planning, Reasoning

The degree of reflective cognition depends on a person’s experience and skill

Novices tend to act through trial-and-error, exploring and experimenting with ways of doing things

They are likely to be slow, make mistakes and generally be inefficient

Experts tend to reflect more upon what they want to achieve and then select optimal strategies

They are likely to be able to think ahead and consider the consequences of actions
Design Implications of Reasoning

Provide additional information to users who wish to better understand more about the activities they are engaged in.

As users gain experience with a product they may want more information about their activities to support more reflective cognition.
Conceptual Frameworks

Conceptual frameworks for cognition can be used to guide interaction design

Mental Models
Considers the models constructed by users through interaction with a product

Information Processing
Compares the mind to an information processing system, e.g. a computer

External Cognition
Considers the external representations used by people to support decision making
Mental Models

Mental models are constructed by users to understand how things work

Mental models differ depending on the interactions that a person has with a product, e.g. a TV engineer will have a different mental to a TV watcher

Mental models are used to determine what to do to achieve an effect

Sometimes people’s mental models don’t match how the thing they are interacting with works, e.g. thermostats are often misunderstood
Information Processing

Information processing assumes that the mind consists of a number of processes that manipulate representations

- Processes include pattern matching, comparing, scanning, selecting, transforming, etc.
- Representations include images, symbols, rules, mental models and other forms of knowledge

Information processing provides a model for making predictions about cognition

- Cognitive science has provided data about how long processes take and the limits of representations
External Cognition

Externalising information
Reducing information overload
e.g. setting reminders to perform actions

Computational offloading
Using tools to carry out computation
e.g. using a calculator to compute a sum

Annotating and cognitive tracing
Marking and modifying representations to track progress
e.g. crossing things off a to-do list
Information Design

Information design principles use theories and frameworks to produce design rules.

Information design principles often simplify the theories and frameworks to provide specific advice.

GOMS (Goals Operators Methods Selection)

GOMS can be used to describe how a user performs an task in terms of goals (e.g. save a file) and the selection of methods and operators to achieve the goals.

GOMS can be used to produce predictions of the time to complete tasks based on data gathered about cognitive processes.
Summary

Cognitive Models
Understanding cognition to inform design decisions

Cognitive Processes
Cognitive processes include attention, perception, memory, learning, using language, reasoning

Conceptual Frameworks
Conceptual models include mental models, information processing, external cognition

Information Design
Applying theories, models and framework to produce design principles, concepts, rules, analysis and evaluation