3 : Cognitive, Social and Emotional aspects of Design

IT4106 – User Experience Design (UXD)

Level II - Semester 4

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Overview

- The goal of this topic is to introduce relevant cognitive theories, which have been applied in HCI to inform technology design.

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Intended Learning Outcomes

- At the end of this lesson, you will be able to;
  - Explain what cognition is and why it is important for interaction design.
  - Show the difference between various cognitive frameworks that have been applied to HCI.
  - Explain how our emotions relate to behavior and the user experience.
  - Introduce the area of emotion recognition and how it is used.
  - Describe how technologies can be designed to change people's behavior.

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List of sub topics

1.1 Introduction to Cognition
1.2 Cognitive Aspects
    1.3 Cognitive Frameworks
    1.4 Social Interactions
        1.4.1 Remote Conversations
        1.4.2 Conversations, Co-Presence and Social Engagement
1.5 Emotional Interactions
    1.6 Emotional Design
1.7 Affective Persuasive Technologies

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Cognition

1.1 Introduction to Cognition

- Mental processes relating to the acquisition, storage, manipulation, and retrieval of information.
- These cognitive processes include thinking, knowing, remembering, judging and problem solving.
- These are higher level functions of the brain and encompass language, imagination, perception and planning.

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1.2 Cognitive Aspects

- There are many kinds of cognition
  - thinking, remembering, learning, daydreaming, decision-making, seeing, reading, writing, and talking
- *Experiential cognition* vs *reflective cognition*

	Experiential	***reflective***
What	A state of mind where people perceive, act, and react to events around them intuitively	involves mental effort, attention, judgment, and decision-making, which can lead to new ideas
Examples	driving a car, reading a book, having a conversation, and watching a video	designing, learning, and writing a report

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1.2 Cognitive Aspects

- Cognition has also been described in terms of specific kinds of processes. These include the following:
  - Attention
  - Perception
  - Memory
  - Learning
  - Reading, speaking, and listening
  - Problem-solving, planning, reasoning, and decision-making
- Many of these cognitive processes are interdependent.
  - For example, when reading a book, one has to attend to the text, perceive and recognize the letters and words, and try to make sense of the sentences that have been written

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Attention

- A cognitive process that allows people to focus on a specific stimulus in the environment
  - Involves selecting things on which to concentrate, at a point in time, from the range of possibilities available, allowing us to focus on information that is relevant to what we are doing
- The extent to which this process is easy or difficult depends on
  - Has clear goals
  - The way information is presented

South Carolina

City	Motel/Hotel	Area code	Phone	Rates Single	Rates Double
Charleston	Best Western	803	747-0961	$126	$130
Charleston	Days Inn	803	881-1000	$118	$124
Charleston	Holiday Inn N	803	744-1621	$136	$146
Charleston	Holiday Inn SW	803	556-7100	$133	$147
Charleston	Howard Johnsons	803	524-4148	$131	$136
Charleston	Ramada Inn	803	774-8281	$133	$140
Charleston	Sheraton Inn	803	744-2401	$134	$142
Columbia	Best Western	803	796-9400	$129	$134
Columbia	Carolina Inn	803	799-8200	$142	$148
Columbia	Days Inn	803	736-0000	$123	$127
Columbia	Holiday Inn NW	803	794-9440	$132	$139
Columbia	Howard Johnsons	803	772-7200	$125	$127
Columbia	Quality Inn	803	772-0270	$134	$141
Columbia	Ramada Inn	803	796-2700	$136	$144
Columbia	Vagabond Inn	803	796-6240	$127	$130

Pennsylvania
Bedford Motel/Hotel: Crinaline Courts
(814) 623-9511 S: $118 D: $120
Bedford Motel/Hotel: Holiday Inn
(814) 623-9006 S: $129 D: $136
Bedford Motel/Hotel: Midway
(814) 623-8107 S: $121 D: $126
Bedford Motel/Hotel: Penn Manor
(814) 623-8177 S: $119 D: $125
Bedford Motel/Hotel: Quality Inn
(814) 623-5189 S: $123 D: $128
Bedford Motel/Hotel: Terrace
(814) 623-5111 S: $122 D: $124
Bradley Motel/Hotel: De Soto
(814) 362-3567 S: $120 D: $124
Bradley Motel/Hotel: Holiday House
(814) 362-4511 S: $122 D: $125
Bradley Motel/Hotel: Holiday Inn
(814) 362-4501 S: $132 D: $140
Breezewood Motel/Hotel: Best Western Plaza
(814) 735-4352 S: $120 D: $127
Breezewood Motel/Hotel: Motel 70
(814) 735-4385 S: $116 D: $118

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Perception

- Refers to how information is acquired from the environment via the five sense
  organs and transformed into experiences.
- Information should be readily perceived in the manner it was intended
  - Grouping items together and leaving spaces between them
  - Using blank space when grouping objects

Black Hills Forest	Peters Landing	Jefferson Farms	Devlin Hall
Cheyenne River	Public Health	Psychophysics	Positions
Social Science	San Bernardino	Political Science	Hubard Hall
South San Jose	Moreno Valley	Game Schedule	Fernadino Beach
Badlands Park	Altamonte Springs	South Addision	Council Bluffs
Juvenile Justice	Peach Tree City	Cherry Hills Village	Classical Lit
Results and Stats	Highland Park	Creative Writing	Sociology
Thousand Oaks	Machesney Park	Lake Havasu City	Greek
Promotions	Vallecito Mts.	Engineering Bldg	Wallace Hall
North Palermo	Rock Falls	Sports Studies	Concert Tickets
Credit Union	Freeport	Lakewood Village	Public Radio FM
Wilner Hall	Slaughter Beach	Rock Island	Children's Museum
Performing Arts	Rocky Mountains	Deerfield Beach	Writing Center
Italian	Latin	Arlington Hill	Theater Auditions
Coaches	Pleasant Hills	Preview Game	Delaware City
Mckees Rocks	Observatory	Richland Hills	Scholarships
Glenwood Springs	Public Affairs	Experts Guids	Hendricksville
Urban Affairs	Heskett Center	Neff Hall	Knights Landing
McLeansboro	Brunswick	Grand Wash Cliffs	Modern Literature
Experimental Links	East Millinocket	Indian Well Valley	Studio Arts
Graduation	Women's Studies	Online Courses	Hugher Complex
Emory Lindquist	Vacant	Lindquist Hall	Cumberland Flats
Clinton Hall	News Theatre	Fisk Hall	Central Village
San Luis Obispo	Candlewood Isle	Los Padres Forest	Hoffman Estates

Webmaster	Curriculum	Student Life	Dance
Russian	Emergency (EMS)	Accountancy	Gerontloge
Athletics	Statistics	Mc Knight Center	Marketing
Go Shockers	Award Documents	Council of Women	College Bylaws
Degree Options	Language Center	Commute	Why Wichita?
Newsletter	Future Shockers	Small Business	Tickets
Gelogy	Intercollegiate	Thinker & Movers	Career Services
Manufacturing	Bowling	Alumni	Doers & Shockers
Management	Wichita Gateway	Foundations	Core Values
UCATS	Transfer Day	Corbin Center	Grace Wilkie Hall
Alumni News	Job Openings	Jardine Hall	Strategic Plan
Saso	Live Radio	Hugo Wall School	Medical Tech
Educational Map	Beta Alpha Psi	Staff	Softball, Men's
Physical Plant	Liberal Arts	Aerospace	McKinley Hall
Graphic Design	Counseling	Choral Dept.	Email
Non Credit Class	Biological Science	Alberg Hall	Dental Hygiene
Media Relations	Duerksen Fine Art	French	Tenure
Advertising	EMT Program	Spanish	Personnel Policies
English	Religion	Parents	Instrmental
Graduate Complex	Art Composition	Wrestling	Nrsing
Music Education	Physics	Philosopy	Opera
Advising Center	Entrepreneurship	Wichita Lyceum	Sports History
Medical School	Koch Arena	Fairmount Center	Athletic Dept.
Levitt Arena	Roster	Women's Museum	Health Plan

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Memory

- Involves recalling various kinds of knowledge that allow people to act appropriately.
  - Recognize someone's face, remember someone's name, recall when they last met them, and know what they said to them last
- Impossible to remember everything
  - Filtering process
    - Encoding determines which information is paid attention to in the environment and how it is interpreted
    - The context
- People are better at recognizing things than recalling things.
- Some kinds of information is easier to recognize than others.

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Learning

- Closely connected with memory
- *Incidental vs Intentional*
  - *Incidental learning* : occurs without any intention to learn.
    - Recognizing faces, streets, and objects
  - *Intentional learning* is goal-directed with the goal of being able to remember it.
    - Studying for an exam, learning a foreign language
- Learning by doing

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Reading, Speaking, and Listening

- The ease with which people can read, listen, or speak differs depending on the person, task, and context .
- Applications developed to capitalize/support them
  - Interactive books
  - Speech-recognition systems
  - Speech-output systems
  - Natural-language interface
  - Interactive apps
  - Tactile interfaces

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Problem-Solving, Planning, Reasoning, and Decision-Making

- These are processes involving reflective cognition
  - Thinking about;
    - What to do
    - Available options
    - Consequences
- How people make decisions when confronted with information overload
  - Theories of decision-making involves weighing up the costs and benefits of different courses of action.
    - Exhaustively process the information and making trade-offs between features
    - Such strategies are very costly in computational and informational terms
  - People tend to use simple heuristics when making decisions
    - E.g in s super market, buying brands that they recognize, that are low-priced, or that offer attractive packaging

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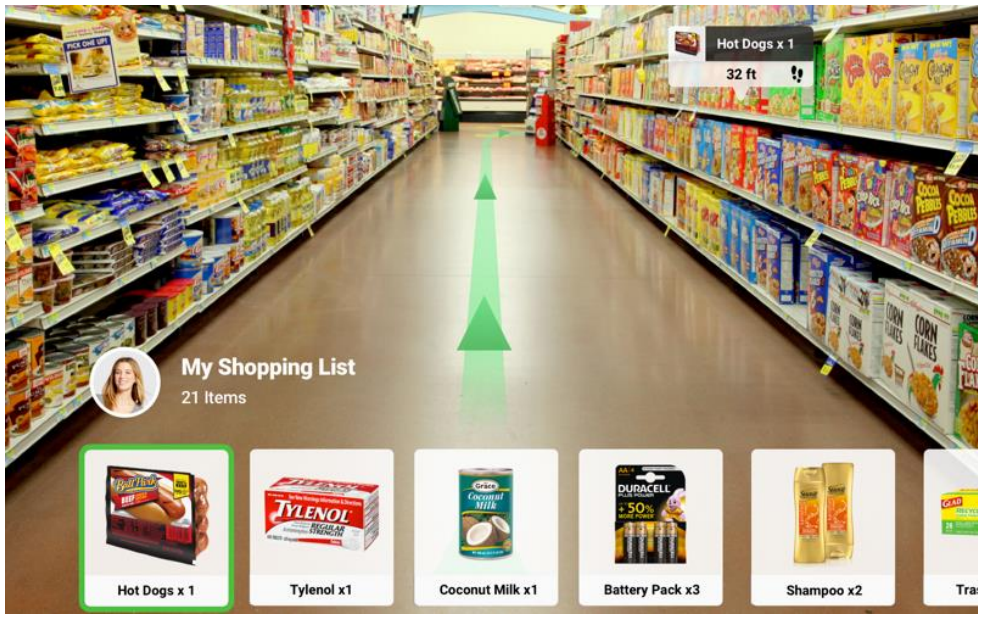
Problem-Solving, Planning, Reasoning, and Decision-Making

- Instead of providing ever more information to enable people to compare products when making a choice, a better strategy is to design technological interventions that provide just enough information, and in the right form, to facilitate good choices



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Cognitive Frameworks

1.3 Cognitive Frameworks

- A number of conceptual frameworks have been developed to explain and predict user behavior based on theories of cognition.
- Some of them can be identified as;
  - Mental models
  - Gulfs of execution and evaluation
  - Information processing
  - Distributed cognition
  - External cognition
  - Embodied interaction
- Focus primarily on mental processes and how humans interact and use technologies in the context in which they occur

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Mental models

- Used by when needing to reason about a technology
- The more someone learns about a product and how it functions, the more their mental model develops.
- Using incorrect mental models to guide behavior is surprisingly common
  - Many people's understanding of how technologies and services work is poor
  - Their mental models are often incomplete, easily confusable, and based on inappropriate analogies and superstition

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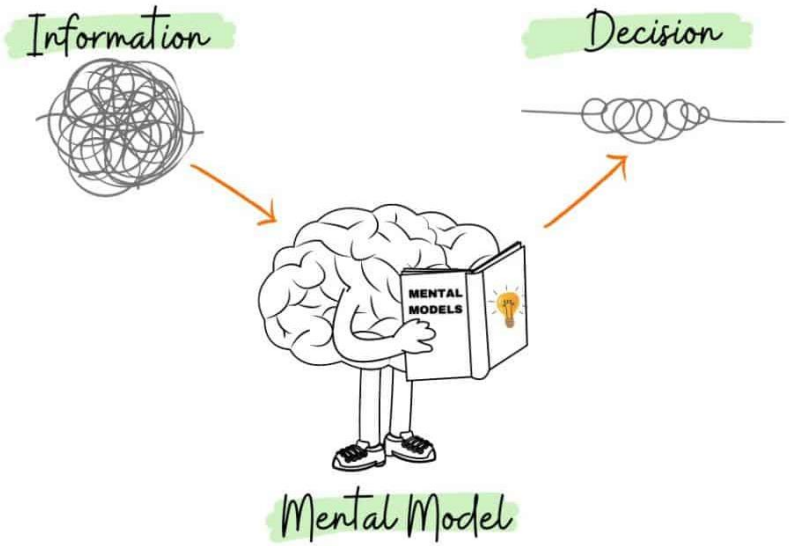
Mental models

- Users create mental models very quickly, often before they even use the software or device.
- Mental models are subject to change.



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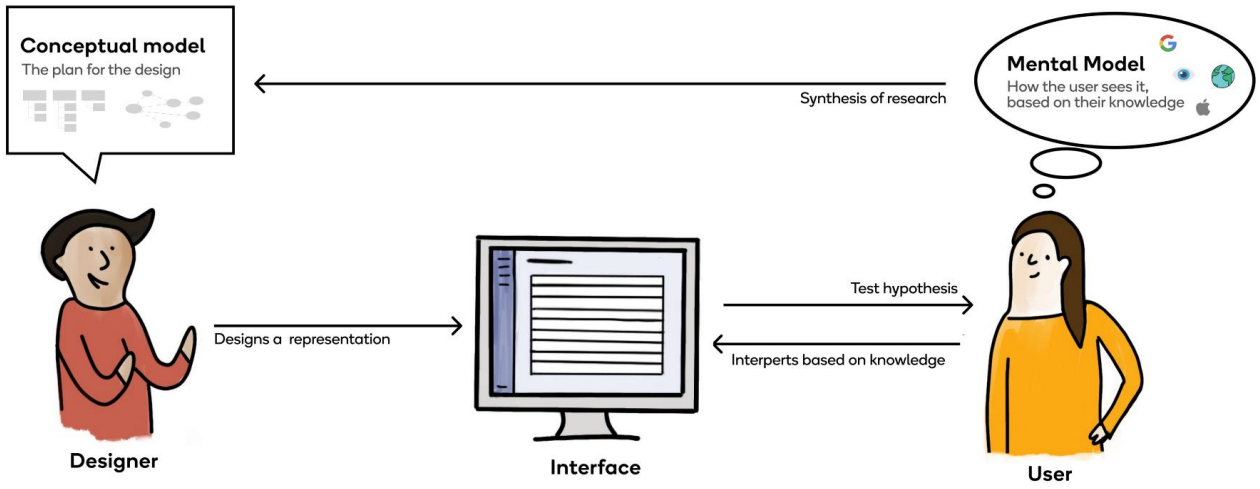
Mental Model vs Conceptual Model

- A mental model represents a person's thought process for how something works
- A conceptual model is the actual model that is given to the user through the interface of the product.



https://uxdesign.cc/understanding-mental-and-conceptual-models-in-product-design-7d69de3cae26?gi=f051cb901793

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Bridging Mental models and Conceptual models

- People are resistant to spending much time learning about how things work.
  - Design technologies to be more transparent by providing;
    - Clear and easy-to-follow instructions
    - Appropriate online help where users can ask how to do something
    - Background information on how to make the most of the functionality provided
    - Affordances of what actions an interface allows
  - The concept of transparency has been used to refer to making interfaces intuitive

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Bridging Mental models and Conceptual models

- Anchoring the conceptual model in what your users experiences
  - Research and understand customer expectations first
  - Use terminology they are familiar with
  - Leverage the interface patterns that they already use
  - Test early, and iterate
  - Re-evaluate the conceptual model at every step in the process
- Introduce your customers to a new conceptual model
  - Help your users relate to new concepts
  - Leverage a familiar model from the natural world
  - Use 'perceived affordances'
  - Educating the users
- Introduce a completely foreign conceptual model by taking the user on a journey
  - Have an end goal in mind, but break this down into considered stages to gradually influence the customers' mental model

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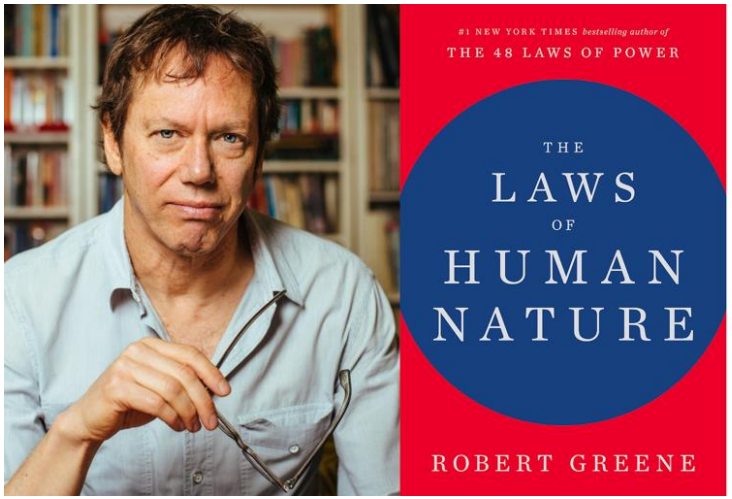
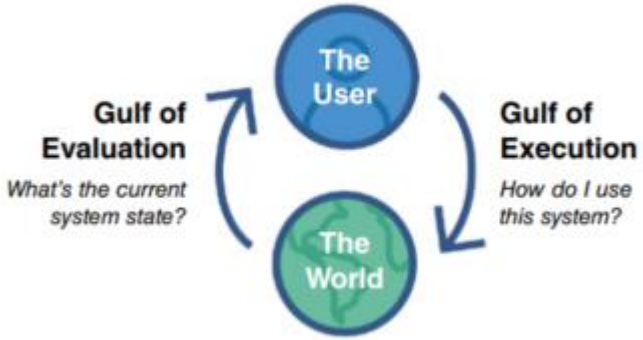
"Everyone understands the need for change in the abstract, but people are creatures of habit. Too much innovation is traumatic, and will lead to revolt…respect the old way of doing things. If change is necessary, make it feel like a gentle improvement on the past." **— Robert Greene**



Gulfs of execution and evaluation

- The gulf of execution and the gulf of evaluation describe the gaps that exist between the user and the interface
  - The gulf of execution, describes the distance from the user to the physical system
  - The gulf of evaluation, is the distance from the physical system to the user
  - Designers and users need to concern themselves with how to bridge the gulfs to reduce the cognitive effort required to perform a task



Source: https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution. Used courtesy of the Nielsen Norman Group

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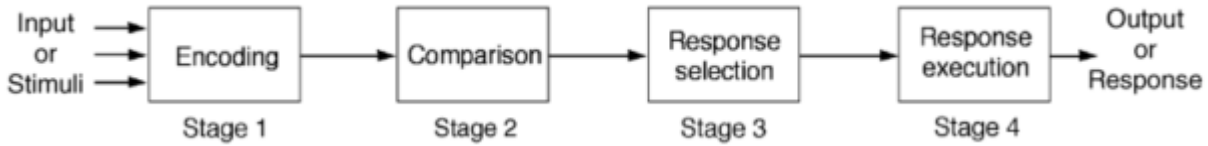
Information processing

- Another way of conceptualizing how the mind works is to use metaphors
  - Conceptualizing the mind as a reservoir, a telephone network, a digital computer and etc.
- Mind as an information processor
  - Information is thought to enter and exit the mind through a series of ordered processing stages
  - Within these stages, various processes are assumed to act upon mental representations.
- Human processor model



Source: P. Barber (1998). Applied Cognitive Psychology. London: Methuen. Used courtesy of Taylor & Francis

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Distributed cognition

- Most cognitive activities involve people interacting with external kinds of representations, such as books, documents, and computers and also with each other.
- The distributed cognition approach was developed to study the nature of cognitive phenomena across individuals, artifacts, and internal and external representations
    - It involves describing a cognitive system, which entails interactions among people, the artifacts they use, and the environment in which they are working.

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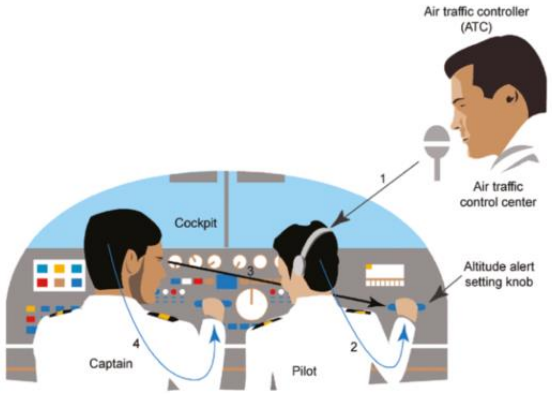
Distributed cognition: cognitive system is an airline cockpit

- The pilot, captain, and air traffic controller interacting with one another
- The pilot and captain interacting with the instruments in the cockpit
- The pilot and captain interacting with the environment in which the plane is flying (that is, the sky, runway, and so on)



Propagation of representational states:
1 ATC gives clearance to pilot to fly to higher altitude (verbal)
2 Pilot changes altitude meter (mental and physical)
3 Captain observes pilot (visual)
4 Captain flies to higher altitude (mental and physical)

A cognitive system in which information is propagated through different media

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Distributed cognition

- A primary objective of the distributed cognition approach is to describe these interactions in terms of how information is propagated through different media.
- In contrast to other approaches, this method focuses not on what is happening inside the head of an individual but on what is happening across a system of individuals and artifacts.

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External cognition

- External cognition is concerned with explaining the cognitive processes involved when we interact with different external representations such as graphical images, multimedia, and virtual reality.
- A main goal is to explain the cognitive benefits of using different representations for different cognitive activities and the processes involved.
    - The main ones include the following:
        - Externalizing to reduce memory load
        - Computational offloading
        - Annotating and cognitive tracing

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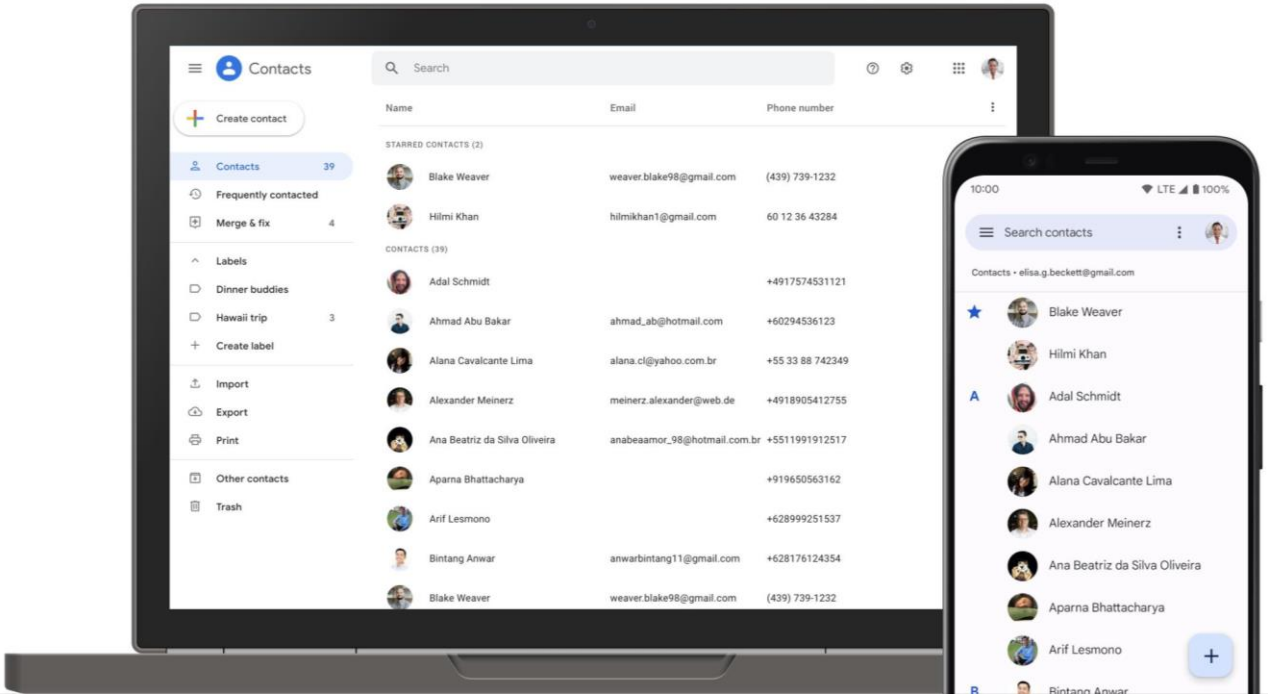
Externalizing to reduce memory load

- There have been numerous strategies developed to reduce memory load by externalizing information.



https://apkpure.com/contacts/com.google.android.contacts

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Computational offloading

- Computational offloading refers to the use of some physical tool in combination with an external representation to allow the user to interact with the tool and work out a computational problem.

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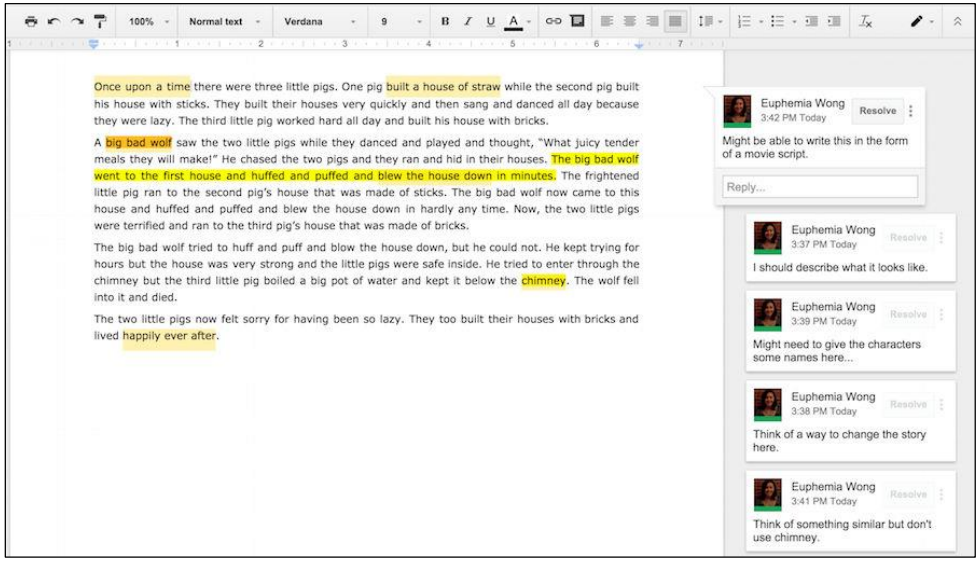
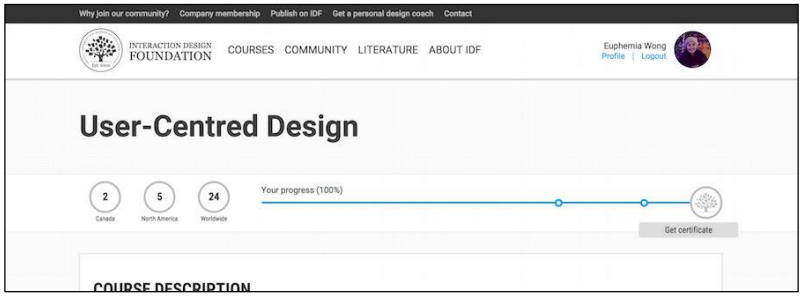
Annotating and cognitive tracing

- **Annotating** involves the explanation or modification of external representations.
- **Cognitive tracing** entails the manipulation of external representations to form new information.





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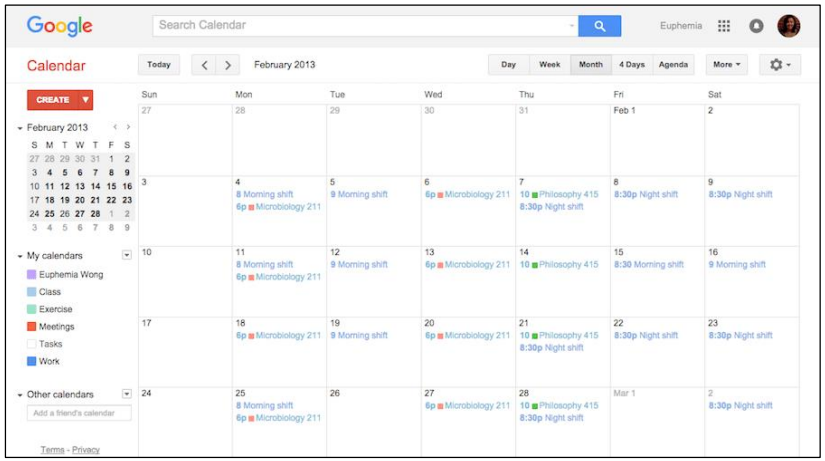
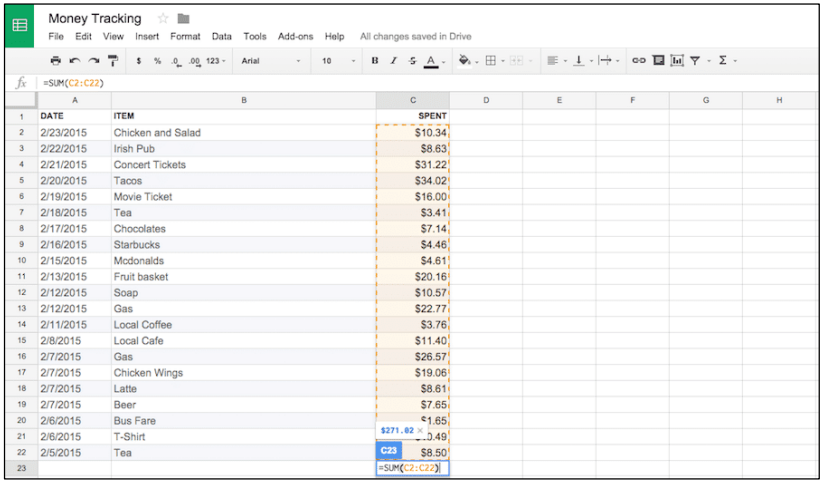
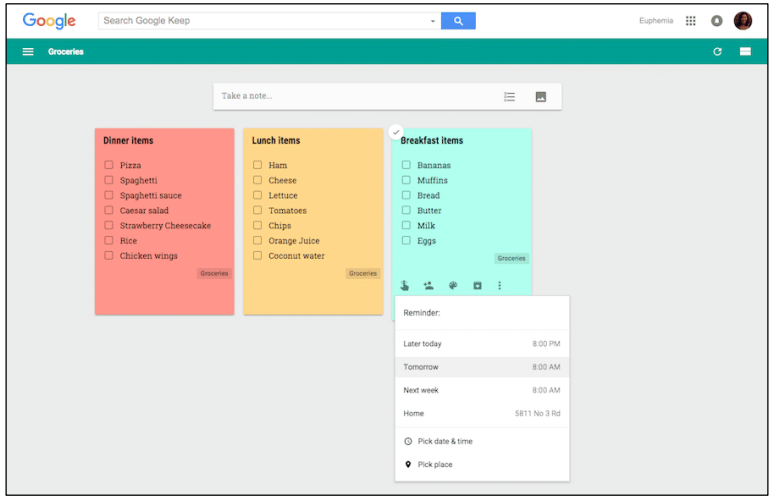
Google's use of External Cognition



Externalizing to Reduce Memory Load



Computational Offloading



Annotations and Cognitive Tracing

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Embodied interaction

- Another way of describing our interactions with technology and the world is to conceive of it as embodied.
- Examples
  - Wearable technology
  - Haptic technology
  - Tangible user interfaces

https://www.kcsitglobal.com/blogs/detail-blog/wearable-technology-the-future-surge

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Social Interactions

1.4 Social Interactions

- A fundamental aspect of everyday life is being social, and that entails interacting with each other.
- People continually update each other about news, changes, and developments on a given project, activity, person, or event, people who work together keep each other informed about their social lives and everyday events, as well as what is happening at work.

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Remote Conversations

- Communicating at a distance via electronic tools that let you correspond with people outside of face-to-face communication.
- Referred to as virtual communication
- Remote communication isn't new, and it certainly isn't limited to virtual teams. You've been doing it for years. It includes things like:
  - Telephone calls
  - Emails
  - Video conferencing
  - Online chats
  - Work operating systems

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Conversations, Co-Presence and Social Engagement

- **Co-presence** is supporting people in their activities when interacting in the same physical space.
- A number of technologies have been developed to enable more than one person to use them at the same time.
- The motivation is to enable co-located groups to collaborate more effectively when working, learning, and socializing. (Smartboards and Surfaces)
- Effectiveness can be compared consider the coordination and awareness mechanisms already in use by people in face-to-face interactions and then to see how these have been adapted or replaced by the technology

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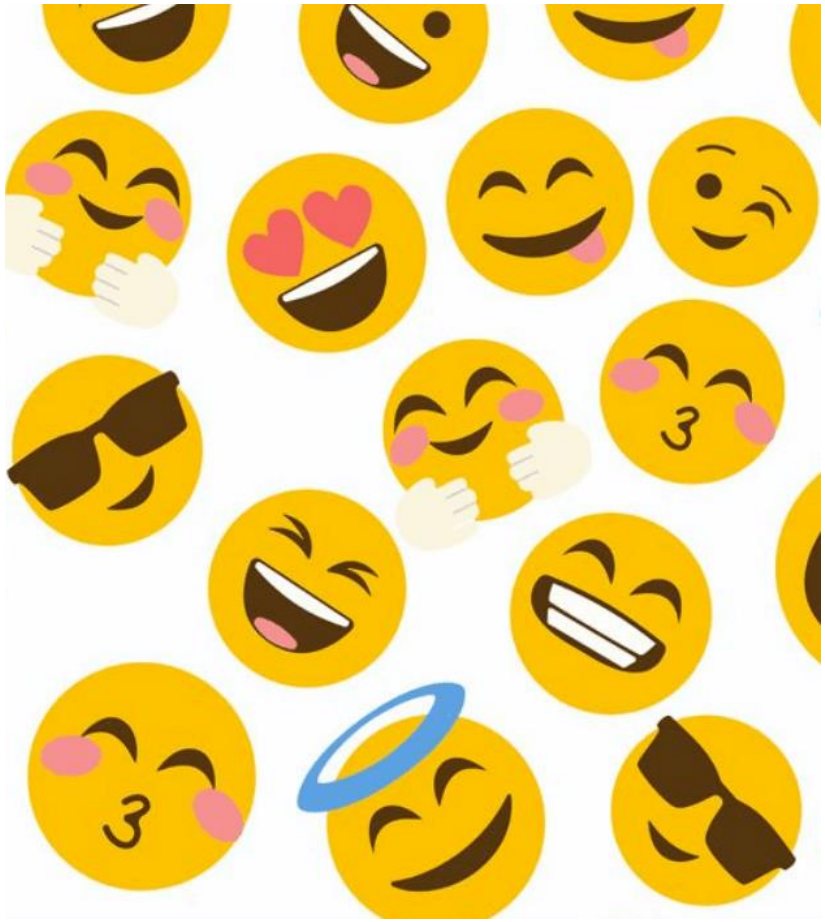
Emotional Interactions

1.5 Emotional Interactions

- Concerned with what makes people feel happy, sad, annoyed, anxious, frustrated or motivated
- Use this knowledge to inform the design of different aspects of the user experience
  - Ex: emojis, feedback, and icons



Emotions and the User Experience

- Emotional design is the concept of how to create designs that evoke emotions which result in positive user experiences.
  - Concerned with what makes people feel happy, sad, annoyed, anxious, frustrated, motivated, delirious
  - Then using this knowledge to inform the design of different aspects of the user experience.
- Examples
  - Advertising agencies - showing a picture of a cute animal or a child with hungry, big eyes on a website
    - The goal is to make people feel sad or upset at what they observe and make them want to do something to help

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Emotions and the User Experience

- UX designers must focus on responses of users in addition to catering the requirements
    - Emotions are continuously changing.
    - Understanding how emotions work provides a way of considering how to design for user experiences that can trigger affect or reflection .
- UX designers must address three levels of cognitive responses when design
    - Visceral—Users' gut reactions to or their first impressions of your design.
    - Behavioral—Users subconsciously evaluate how your design helps them achieve goals, and how easily.
    - Reflective—After they encounter your design, users will consciously judge its performance and benefits, including value for money.

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Expressive Interfaces and Emotional Design

- Designers use a number of features to make an interface expressive
- Emojis, sounds, colors, shapes, icons, and virtual agents are used to
  - Create an emotional connection or feeling with the user (for instance, warmth or sadness)
  - Elicit certain kinds of emotional responses in users, such as feeling at ease, comfort, and happiness.
- Animated icons - a recycle bin expanding when a file is placed , loading (https://lordicon.com/)

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1.7 Affective Computing

- Affective computing is concerned with how to use computers to recognize and express emotions in the same way as humans
- Involves designing ways for people to communicate their emotional states, through technology
- It also explores how affect influences personal health
- Emotional AI - seeks to automate the measurement of feelings and behaviors
  - Analyze facial expressions and voice in order to infer emotions
  - Forecasting what someone is most likely to buy online when feeling sad, bored, or happy

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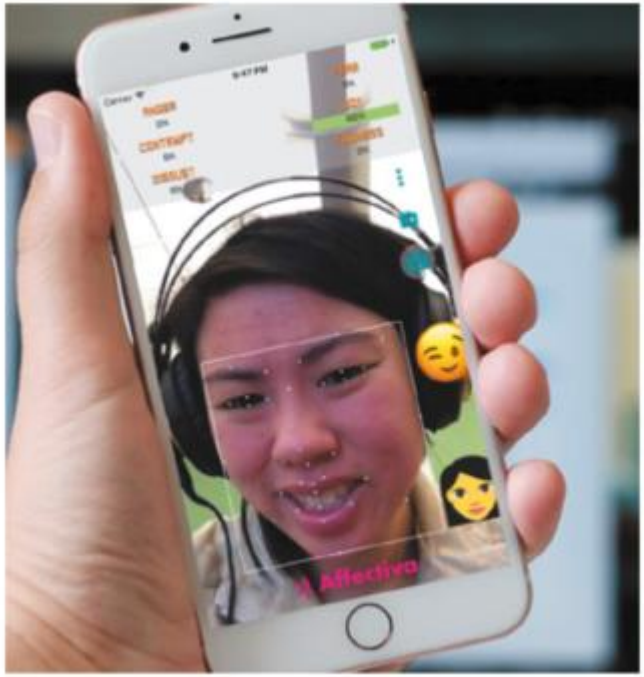
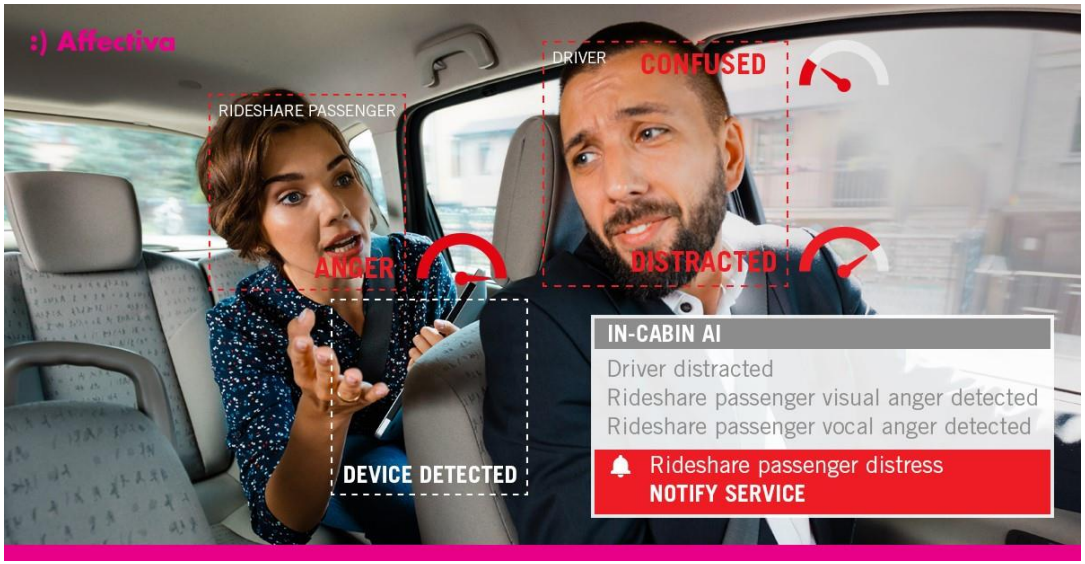
1.7 Affective Computing

- The use of automated facial coding
- Affdex Software
- Affectiva for improving driver safety





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Persuasive Technologies

- Techniques to draw user's attention to certain kinds of information in an attempt to change what they do or think.
  - Pop-up ads,
  - Warning messages,
  - Reminders, prompts,
  - Personalized messages

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