Cognition and Emotion

Week 3 - Class 1

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Reminder

Why this course?

• Applications support in activities, involving cognition and emotion;

• Understand the human in human computer interaction;

• For design, testing and evaluation, you must have knowledge of human information processing;

• Prepare for research in HCI.
Last week

Gorilla versus moonwalking bear
https://www.youtube.com/watch?v=Ahg6qcgoay4


https://quickdraw.withgoogle.com
Topics

Attention

- Top-down vs Bottom-up processing
- Attention: selective attention, divided attention
- Attention theories
- Attention and emotion
- Saccades

Emotions and Cognition

- Emotions as prioritizers of thoughts, goals and actions
- Perspectives on the effects of emotions upon cognitive functioning

Based on Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
The attention span of the modern-day Internet user has drastically shortened. Your website should grab your reader’s attention and hold it for as long as it takes to get your message across.

Attention span of an Internet user: 8 seconds

Attention span of a goldfish: 9 seconds

32% of web consumers will start abandoning slow sites between 1 to 5 seconds

www.huckleberrybranding.com
What is attention?

Trying to attend to everything at once is more than the cognitive processes can handle.

Matlin (2010): “Attention is a concentration of mental activity that allows you to take in a limited portion of the vast stream of information available from both your sensory world and your memory”.

**Top-down processing:**
- we pay attention to a specific stimulus

**Bottom-up processing:**
- our attention is captured by an interesting stimulus in our environment

NB: Matlin’s theme 5:
Many cognitive processes rely on both bottom-up and top-down processing
Attention Processes: divided attention

Divided-attention task

• trying to pay attention to two or more simultaneous messages
• respond appropriately to each message
• speed and accuracy suffer

Multitasking

• walking and talking
• reading and IM (instant messaging)
• people may believe that they can multitask, but the research does not support this illusion;
• people perform faster and more accurately if they work on one task at a time.
Divided attention

Multitasking:
strain on attention, working memory, long-term memory.

Extensive research on use of cell phones
For instance in traffic

- Collet et al. (2009)
  - Use of cell phones in simulated driving-task
  - Reaction times were 20% slower than without the cell-phone conversation

- Strayer et al. (2003)
  - Hands-free cell phone conversation
  - Slower in applying brakes
  - Inattentinal blindness
  - Also distracted by hearing cell phone conversation of passengers
Examples

Attention for cell phone

- https://www.youtube.com/watch?v=hjVAC_vpzSI
- https://www.youtube.com/watch?v=tm2lfv3_ELc
- http://www.youtube.com/watch?v=R8-W6o8Eu7c
- https://www.youtube.com/watch?v=wl0JojWH1rQ

Texting in the car

- http://www.youtube.com/watch?v=HbjSWDwJILs&list=PLm8ucpVzZ-bF23tP5fV8Fh_x-R794o4O3
Attention Processes: selective attention

Selective Attention

• *pay attention to certain kinds of information*, while *ignoring* other ongoing information
• simplifies our lives
• people notice little about the irrelevant tasks.
Selective-attention tasks

- Dichotic listening
- The Stroop Effect/Task
- Visual search
- Saccadic eye movements during reading
Selective attention task

Dichotic Listening

• a selective-attention task

• one message presented to left ear and a different message presented to right ear

• shadow one of the messages (listen and repeat)

• people notice very little about the unattended message (for instance switch in language)

Want to try? https://www.youtube.com/watch?v=8B1NqyB_h5E
Attend to the words in your left ear. Write down every word you hear that contains an m or a p without pausing or replaying the video.
(No explanation or results)
Experiment Treisman

• Individuals follow message from one to other ear; so processing occurs

Want to know more:
Coursera, Introduction to Psychology, Steve Joorden
https://www.youtube.com/watch?v=_sZPeqxFfbQ
Dichotic listening

In general, people can process only one message at a time. However, people may process the unattended message if:

1. both messages are presented slowly
2. the task is not challenging
3. the meaning of the unattended message is immediately relevant: Cocktail party effect

(Dichotic = in two separate parts)
Selective attention task

The Stroop Effect

Say out loud the names of the ink colors, ignoring the meaning of the words. Measure the amount of time it takes to go through this list five times. Record that time.

RED  BLUE  GREEN  YELLOW  GREEN
RED  BLUE  YELLOW  BLUE  RED
YELLOW  GREEN  YELLOW  GREEN  BLUE
RED  RED  GREEN  YELLOW  BLUE
Selective attention task

The Stroop Effect

Name the colors in the rectangular patches below. Measure the amount of time it takes to go through this list five times. Record the time.
Stroop effect

Naming the colour of the ink takes longer when the word represents an *incongruent* colour; naming the colour of the patches is quick.

- Connectionist/parallel distributed processing (PDP) approach; two pathways are activated at the same time (ink colour and meaning of the word), interfere and negatively influence task performance.

- Adults have more practice in reading than naming colours; reading is automatic and involuntary. The more automatic process interferes with the less automatic process.
Selective attention task

Visual search

- find a target in a visual display with numerous distractors
- Relevance: airport security, X-ray examination
Visual search

Variables Influencing Visual Search
Treisman studies

1. The isolated-feature/combined-feature effect

searching for blue Xs; how much time does it take?

Part A

![Diagram of Part A with A1 and A2]
Visual search

And now?

Part B

B1

B2
Visual search

If the target differs from the irrelevant items in the display with respect to a simple feature such as colour, observers quickly detect the target.

When the irrelevant items force you to search for a combination of features (both blue and X), visual search takes longer.
Visual search

Variables Influencing Visual Search
Treisman studies

2. The feature-present/feature-absent effect.
   searching for "circle with the line" or "circle without the line"

Source: Based on Treisman & Souther, 1985.

People can typically locate a feature that is present more quickly than a feature that is absent.
Variables Influencing Visual Search

Royden and colleagues (2001)

- People can quickly locate one moving target when it appears in a group of stationary distractors.
- In contrast, they take much longer to locate one stationary target when it appears in a group of moving distractors.
- It’s easier to spot a movement-present object than a movement-absent object.
The neural basis of attentional control in visual search
M. Eimer, 2014

Attention in the real world: toward understanding its neural basis
M.V. Peelen, S.Kastner, 2013
Saccades and Eye Tracking
Saccadic Eye Movements During Reading

A selective-attention task

Eye movements are important in looking, searching, driving, speaking, and reading

Saccadic eye movement

series of little jumps of the eye
bring the center of the retina (fovea) over the words being read

Roadside joggers endure sweat, pain and angry drivers in the name of fitness. A healthy body may seem reward...

Saccades

In every saccade the eye moves forward ca 7-9 letters

Reading Example:
This person is reading the text for understanding. So even though not every word is fixated, the amount of time spent on each word is indicative of the processing of the word.

Skimming Example:
This person is skimming the text. This is most obvious from the pattern of fixations that are more dispersed and shorter fixation durations that is typical for this type of reading. The main gist maybe understood, but poorer memory for the text usually results.
Measuring Attention by Eye Tracking

Faces draw attention to them on webpages

Study 1: users are clearly drawn to faces when asked to look at pages and report what they remember
Eye tracking and task-performance

Study 2
A Portfolio Summary page was modified to contain either a photo of a woman’s face or no image.

Tasks had answers that could be found by reading information on the page.
Eye tracking and task-performance

Study 2:
Contrary to expectation, a picture of a face in this context actually caused users to do worse on a task involving information adjacent to the face.
Explanations for Attention

Neuroscience Research on Attention

*The Orienting Attention Network*

- selecting information from sensory input
- attention required for visual search
- region: parietal lobe
- identified through studies of brain lesions
Explanations for Attention

Neuroscience Research on Attention

The Executive Attention Network

- used when task features conflict (e.g. Stroop task)
- inhibits automatic responses to stimuli
- prefrontal cortex
- top-down control of attention
- academic skills (e.g., reading)
- meditation
- learning new ideas
- https://www.youtube.com/watch?v=PNbR_nbfK9c
Bottom-up versus Top-down

Bottom-up: data driven (guided by sensory features)
Top-down: concept driven

Diagram:
- Experience -> Knowledge (Expectancies and Desires) -> Perception
- The Senses
- Top-Down Processing
- Bottom-Up Processing
- Stimulus World
Bottom-up versus top-down

Not here!

Look here

Not here!

Bottom-up attention
http://video.ted.com/talk/podcast/2013G/None/ApolloRobbins_2013G-480p.mp4
Early Theories for Attention

- narrow passageway
- information either passes through bottleneck or is lost
- too simple; underestimate flexibility
- information not lost at just one phase of the attention process
Feature-Integration Theory (Treisman)

1. Basic elements

**Distributed attention**

- register features automatically
- parallel processing
- identify features simultaneously
- low-level processing

**Focused attention**

- slower serial processing
- identify one object at a time
- complex objects
- identify which features belong together
Feature-integration theory

2. Research on the theory

Part A

isolated features, distributed attention, ‘pop out’

combined features: people need more time to find the target when there are a large number of distractors focused attention
3. Current status of the theory

- Not really clear-cut categories. Distributed attention can occasionally resemble focused attention.

- Visual system may use distributed attention to quickly gather information about the general gist of a scene.
Attention and Emotion

Anxiety narrows attention
• when people are afraid or anxious, they focus on what they are afraid of, or on safety;
• disregard for other things

In lab experiments, for instance dichotic listening task: in state of fear attention is drawn away from the message they should track, to words presented to the other ear that are threatening (“death”, “blood”).

(Mathews&MacLeod 1994).
Emotional Stroop task

Naming the ink color of words with **strong emotional significance (not per se negative)**

- trouble ignoring emotional reactions
- Individuals with phobic disorder - slower on anxiety-arousing words than on control words
- victims of rape – slower on words related to rape (Foa et al. 1991)
- people with social phobia – slower with words on confidence, etc.

- suicide
- depression
- addiction
- eating disorders

Matthews 1993: the slowing of colour naming is greatest with words that correspond to the subjects’ greatest anxiety
Emotional Stroop task

Example

HATE
DEPRESSED
CRYING
BULLY
SUICIDE

CHAMPION
EXAM
SKY
CARWASH
WIKIPEDIA
Explaination

- In fear or anxiety nervous system is switched into particular mode of processing
- Attentional bias/narrowing
- Attention is directed to cues in the environment about threat and safety
- Related to particular objects of a person’s anxiety.
Propositions

1. Emotions are “lower” and more primitive ways of seeing the world.

2. Reason (ratio, the power of the mind to think and understand in a logical way) is better than emotions.

Agree/disagree?

Example

Eadweard Muybridge

- 9 April 1830 – 8 May 1904, English photographer important for pioneering work in photographic studies of motion, and early work in motion-picture projection;
- severe head injuries in a stagecoach crash, substantial injuries to the orbitofrontal cortex;
- led to eccentric behaviour afterwards, also lessened conventional social inhibitions.

"Muybridge race horse animated" by Eadweard Muybridge - The sequence is set to motion using these frames, originally taken from Eadweard Muybridge's Human and Animal Locomotion series, (plate 626, thoroughbred bay mare "Annie G." galloping) published 1887 by the University of Pennsylvania. Licensed under Public Domain via Commons - https://commons.wikimedia.org/wiki/File:Muybridge_race_horse_animated.gif#media/File:Muybridge_race_horse_animated.gif
Muybridge

In 1874, Muybridge shot Major Harry Larkyns, possibly the real father of his son.

Act of compulsive jealousy; not affected by other (social) emotions: compassion for his child, the victim, fear of consequences; societal morals, norms, conventions, etc.

No longer rational
Are emotions rational?

1. Are emotions based on substantive beliefs, do they correspond to actual events in the world?
   – Emotions are often the product of rather complex beliefs about real events in the world.

2. Do emotions help to function effectively in the (social) world?
   – Emotions help to respond adaptively most of the time.

3. Do emotions guide cognitive processes such as perception, attention, memory and judgment in an organized way, or do they interfere and disrupt?
   – Emotions have principled, systematic effects on cognitive processes and lead to reasonable judgments of the world.
   – Emotions structure perception, direct attention, give preferential access to certain memories, bias judgments in ways that help the individual respond to the environment in valuable ways.
Emotions as prioritizers of thoughts, goals and actions

(Simon, 1967)

• Emotions are necessary in any intelligent being;
• They are a solution to a general problem;
• They set the priorities among the many different goals that challenge individual at any given time;
• “interrupt and prioritization principle”: necessary for complex organisms such as humans

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Example

1. Very simple animal behaviour is controlled by reflexes: e.g. tick.
   • Reacts to stimuli (scent- drop from tree; warmth- climb to skin; vicinity of blood- burrow in skin and suck).
   • Purely automatic reaction

2. A “god”: omniscient, omnipotent, has perfect model of the universe and no limitations of resources; could predict results of every actions even in complex universe. No role for emotions.


Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Response to complexity

• Humans act with purpose in a complex world;
• Actions sometimes produce effects that were not anticipated.
• Our resources and knowledge are limited
  – Should we continue, or change our actions and make new plans?
• For many (most) events we have no ready prepared response, skill, habit, or knowledge of the effect.

• When such events occur, our emotions signal them.

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Emotions: bridges toward rationality

- Emotions prompt us, create a readiness to act;
- More effective than random actions or attempt to calculate outcomes.
- Cognitive science recognizes emotions as important for humans that have several motives and operate in a complex world;
- We cannot know everything and cannot control everything.
- Emotions are not irrational; when we have no fully rational solution (not enough knowledge), they “offer bridges toward rationality”.

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006

A PowerPoint diagram meant to portray the complexity of American strategy in Afghanistan certainly succeeded in that aim.

Signaling the nervous system (1)

Emotions involve 2 kinds of signaling in the nervous system
1. Organisational
2. Informational

Organisational signal
- Automatic, primary appraisal, no specific information about objects in the environment;
- Sets brain into mode of organisation, readiness to urge and act in line with specific basic emotion;
- Has a feeling tone but no other content;
- Source in or outside the body, in the environment;
- Automatic “guess” what to do next.

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Signaling the nervous system (2)

Informational signal

Secondary appraisal

Carries information to make mental models of events, their possible causes and implications.

• On the basis of these two kinds of signals we act in accordance with how we feel and with what we know;
• Normally 1 and 2 occur together to produce an emotional feeling with a consciously known cause and object;
• This helps individuals to respond to emergent opportunities and challenges in the environment.

Oatley, Keltner, Jenkins, Understanding Emotions, 2006
Example: fear

• Organisational
  – Interrupts ongoing action;
  – Makes ready physiological mechanisms;
  – Actions for flight or defensive fight;
  – Urge to act;
  – Directs attention to the environment to find signs of danger and safety.
  – Moods are based on the same organisational signals but maintain the brain in a certain mode

• Informational part informs the brain about the thing we are frightened of (which may be insubstantial).

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Effect of emotions on cognitive functioning

How do emotions guide thought processes?

Three perspectives

1. Emotion congruence
2. Feelings as information
3. Processing style

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
1 Emotion congruence

Bower, 1981:

Moods and emotions are associative networks in the mind. In memory **pathways are devoted to each emotion** in which past experiences, related concepts etc. are connected in a semantic network; experience emotion -> associations become available.

-> learning of emotion congruent material (to current emotion) should be easier: material is more extensively integrated into active memory structures and more easily retrieved at time of recall.

*However*, the process is more complex: also impact of tasks that the participants perform, the mood of the participants, participants’ personal characteristics. (Eich &Macauley).

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
2 Feelings as information

Emotions themselves are informative when we make judgments.

Emotions provide us with a rapid signal triggered by something in our environment (e.g. anger: a state of injustice exists and needs to be changed). Many of the judgments we make are too complex to review all the relevant evidence.

- e.g. how satisfied are you with the current government? Depends on many aspects: current environmental policy, taxes, health care, foreign policy, campaign promises etc.

So complex that we often rely on a simpler assessments based on our current feelings.

Humans can seldom act with full rationality, think through all relevant evidence and principles for sorting out that evidence and arrive at justified position.

Emotions are heuristics, guesses that work better than chance a lot of the time, short cuts to making decisions or taking action.

Oatley, Keltner, Jenkins, Understanding Emotions, 2006
Example feelings as information

Schwarz and Clore: study of weather impact on emotional state of inhabitants in USA, Midwest.

Question (phone): “all things considered, how satisfied or dissatisfied are you with your life as a whole these days”?

2 conditions:
- only rate life satisfaction
- first question on weather on location

Results: participants who were not asked about the weather used their current mood as heuristics; the others realized the impact of the weather on their judgment.

People use their emotions as heuristics when making judgments, except when they attribute those feelings to a specific source.

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
3 Processing style

Different emotions induce qualitatively different forms of reasoning, of considering evidence and drawing conclusions.

• Positive mood facilitates use of existing knowledge structures (e.g. heuristics, stereotypes);
• Negative moods (sadness) facilitate more analytical thought and careful attention to situational details.
• (stereotypes are automatic, effort-saving tools for judging others; used more when emotions make individual lewss systematic, e.g. anger, happiness).

Positive emotions broaden our thought repertoires, enable more creative and flexible thought, help individuals to form important bonds, and explore the environment; enhance creativity (experiment with candle task).

Oatley, Keltner, Jenkins, *Understanding Emotions*, 2006
Assignment 3

Develop *three design guidelines* that support interface designers to consider user emotions, when users’ perception and attention are important for satisfactory use of the application.

- Emotions influence our perception and attention.
- Emotions direct and focus attention on important needs and goals; anxiety narrows attention. When people are afraid or anxious, they focus on what they are afraid of, or on safety, and disregard other things.
- Attention is greater to thoughts and stimuli that have relevance to the current mood state.
- According to Niedenthal & Setterlund, moods and emotions can redirect perception to objects and events that are relevant to current feelings.
Topics

- Working memory
- Short-term memory
Literature

Matlin, M.W. *Cognitive Psychology*

- Chapter 4 *Using Working Memory*
- Chapter 5 *Using Long-Term Memory* (except Flashbulb Memories and Eyewitness Testimony)
Working memory

• “...is the brief, immediate memory for the limited amount of material that you are currently processing; part of working memory also actively coordinates your ongoing mental activities.”

• (older : short term memory)

• Can short and long term memory be distinguished clearly? (Useful for organising and discussing memory research)
Example working memory use

• [https://www.youtube.com/watch?v=F988ZpogRil](https://www.youtube.com/watch?v=F988ZpogRil)
• 1.26.50
• Rudi Carrell - Am laufenden Band (Folge 16) 1975

• [https://www.youtube.com/watch?v=tcoBXDuRxWM](https://www.youtube.com/watch?v=tcoBXDuRxWM)
• 1.23.30
• Rudi Carrell - Am laufenden Band (Folge 37) 1978
Take the test

http://gocognitive.net/demo/working-memory-capacity
Classic Research on Working Memory

George Miller's "Magical Number Seven" (7 ± 2)

- suggested that people can remember about seven items (give or take two)
- Chunk- memory unit consisting of strongly associated components
- proposed that people engage in internal mental processes in order to convert stimuli into a manageable number of chunks

http://www.youtube.com/watch?v=Z0YjOVUt--M

0.55

Ton Sijbrands Wereldrecord Blinddammen 2007 25 partijen simultaan blinddammen (explanation by Douwe Draaisma)
To be continued..

• Help on assignment: in lab hours, Wednesday 30/11/2016