Cognition and Emotion

Week 2 - Class 2

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Topics

**Sensation and Perception**
- Sensation
- Perception
- Visual perception theories
- Perception and emotion
- *Face perception & speech perception: self study for the exam*

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

1. Sensation (gewaarwording)

- the process in which a sensory receptor is stimulated, producing nerve impulses that travel to the brain, which in turn interprets such impulses as a visual image, a sound, taste, odor, touch, or pain.

- Distal stimulus: e.g. an object

- Proximal stimulus: the information received on the receptors (e.g. visual receptor): e.g. The image of the object on the retina.

2. Perception (waarneming)

- the occurrence when the brain performs organization of information it obtains from the neural impulses, and then begins the process of translation and interpretation. **It is a vital process that helps us rationalize or make sense of the information related to the physical stimulus. Interpretation of what is perceived.**

Visual /optical illusions reveal process
The sensory system

Sight (ophthalmoeception), hearing (audioception), taste (gustaoception), smell (olfacoception or olfacception), and touch (tactioception) are the five traditionally recognized senses.
Vision (1)

We “see” when electromagnetic waves/photons of 400 to 700 nm ($10^{14}$ en $10^{15}$ Hz) reach the eye – just a very small range within the electromagnetic spectrum.
Vision (2)

Many animals, especially insects and birds, can see in the ultraviolet spectrum (10-400nm).

Other animals (some snakes, bats, beetles) can sense heat (infrared) with organs that resemble the visual system.

http://www.seanbluestone.com/interesting/5-extra-senses-that-animals-have-over-humans/

https://bybio.wordpress.com/tag/uv-receptors/
Vision (3)


Audition (1)

- We “hear”:
  - When mechanical waves between 20 – 20,000 Hz. (frequency), created by vibrating objects, reach the ear.
  - Below: low frequency, infrasound; above high frequency, ultrasound.

Audition (2)

Audition (3)

“And only you can hear this whistle?”
Somatosensation, Olfaction, Gustation

Somatosensory system
• thermo(re)ception
• nociception (pain),
• touch (pressure, texture, vibration etc.)

Olfaction
Odorant molecules bind to specific sites on the olfactory receptors

Gustation
Substance in the mouth reacts chemically with taste receptor cells on taste buds

Also:
– Body position: proprioception
– Chemical senses
Homunculus

Humans only sense a small part of the information in their environment

https://psychlopedia.wikispaces.com/Sensation+%26+Perception

The ABCs of Sensation
Crash course Psychology #6
Look at this image for a few seconds
What did you see?
The forest has eyes

Bev Doolittle
From sensation to perception

Sensation: the bottom-up process by which our senses receive and relay outside stimuli

Perception: The top-down way our brains organize and interpret that information and put it into context

Cognition

People’s perceptions differ
Exercise

Describe in one sentence what most strikes you in the next image.

‘I see …’
Possible answers

1. Ik zie licht van de beamer teruggekaatst vanaf het projectiescherm
2. Ik zie een verdeling van lichte tinten in het midden, bruinachtige naar de randen
3. Ik zie overwegend gladde kleurverdelingen, maar in het midden korrelig en aan de rand vlekkerig
4. Ik zie een paar lichte, afgeronde, symmetrische 2D vormen in het midden en een afgeronde driehoek linksonder
5. Ik zie een ruwweg bolronde vorm in het midden en een paar afgeplatte liggende 3D vormen daaronder
6. Ik zie een kopje cappuccino en een krant
7. Ik zie dat het kopje bijna vol is, en de krant is dichtgeslagen
8. Ik zie het zorgeloze begin van een veelbelovende vakantiedag in Italië
9. .....  

Al deze antwoorden zijn mogelijke interpretaties van wat het is waarnaar je kijkt

Bron van dit voorbeeld: Kees van Overveld ‘Van Licht tot Zicht’
An image

We tend to describe what we see as a number of objects

But there are many levels on which we can describe this image

– Physical: illumination, colour, texture ...
– Shape: 2D en 3D shapes, features of shapes..
– Object level: objects their features, relations , ...
– Meaning: message, feeling, ...
Light to meaning

To make sense of the world it is necessary to organize incoming sensations into information which is meaningful: perceptual organisation.
Gestalt psychology helps to explain how we perceive visual stimuli. Humans perceive individual sensory stimuli as a meaningful whole. We tend to actively organize what we see, and understand the world in wholes and patterns. *Gestalt* (shape, form) is a “global whole” which is greater than the sum of its parts and determines its meaning.

Max Wertheimer
Gestalt principles

Rules of the organization of perceptual scenes: Emergence, reification, multistability, invariance

Emergence
Figure – ground articulation
Multistability/ambiguous figure-ground relationship
Gestalt Laws of grouping (1)

http://contentus.net/gestalt-psikolojisinin-icerik-stratejisindeki-yansimalari/
Gestalt laws (2)

Prägnanz:

We tend to order our experience in a manner that is regular, orderly, symmetrical, and simple.

A number of rules or heuristics allow us to predict the interpretation of sensation, often called "gestalt laws".

A combination of circles; not complex elements
Gestalt laws (3)

Law of proximity

When we perceive a collection of objects, we will see objects close to each other as forming a group.
Gestalt laws (4)

Law of similarity

Elements tend to be integrated into groups if they are similar to each other.
The human eye tends to build a relationship between similar elements within a design. Similarity can be achieved using basic elements such as shapes, colors, and size.

https://www.interaction-design.org/literature/article/the-law-of-similarity-gestalt-principles-1
Gestalt laws (5)

Law of continuity

Elements of objects tend to be integrated into perceptual wholes if they are aligned within an object. In cases where there is an intersection between objects, two objects are perceived as two single uninterrupted entities.
Gestalt laws (6)

Law of closure

We perceptually close up, or complete, objects that are not, in fact, complete.
Perception: illusions

Escher in Het Paleis

Ames Room illusion

Observer looks through pinhole. Ceiling heights and trapezoid window frames are arranged to fool the observer that she is looking into an ordinary room.
Perception and reliability

Which square is darker? A or B?
Perception and reliability

Our brains complete the perception using expectations and experience.
Illusions: Müller-Lyer illusion

Which line is longer?
Ambiguity
Leaning tower illusion

Ponzo illusion

Twin Towers of Pisa

The visual system treats the two similar images as part of the same scene.
McGurk effect

https://www.youtube.com/watch?v=G-lN8vWm3m0

Visual cues from the speaker’s mouth help us interpret ambiguous sounds.

McGurk effect: compromise between discrepant sources of information
Theories of visual object recognition

Template matching, Feature analysis, Recognition-by-components
Captcha

Completely Automated Public Turing-test to tell Computers and Humans Apart
Visual Object Recognition (1a)

Template-matching model

An incoming pattern is compared to a complete stored pattern
Visual Object Recognition (1b)

Template-matching model - problems
Visual Object Recognition (2)

Feature analysis theories

- A visual stimulus is composed of a small number of characteristics or components: distinctive features
- Distinctive features are compared to stored features for each letter
- Match features
- Match relation between features
- Select match with highest activation
Feature Analysis Theory

Eleanor Gibson’s research
People require more time to decide if letters share many critical features

Hubel and Wiesel's research
Measure response of a single neuron to simple visual stimulus
Depends on location on the retina and orientation
Innate feature detectors help recognize certain features of letters and simple patterns

Visual Object Recognition

Invariance of recognition

Recognition-by-Components Theory

Irving Biederman: Recognition of 3D shapes

- A specific view of an object can be represented as an arrangement of simple 3-D shapes, geons
- 36 categories of geons proposed
- We recognize objects by a specific combination of geons: three should suffice to classify an object

- However: people recognize objects more quickly seen from standard viewpoint.
The Recognition-by-Components Theory: viewer centered approach

Proposes that we store *a small number of views* of 3D objects (rather than one view).
Other views require mental rotation, so more difficult.

Both feature-analysis theory and the recognition-by-components theory can explain some portion of our skill in recognizing objects (but not all..).
Object Recognition: Context

Theories explain recognition of isolated objects.

How do knowledge and expectations aid recognition?
Bottom-up versus top-down processing

**Bottom-up processing**
- Stimulus characteristics are important in recognition
- Very first part of visual processing may be bottom-up

**Top-down processing**
- Concepts, expectations and memory aid recognition
- Helps very rapid recognition, when the stimulus is registered for a short moment, is incomplete or ambiguous

Both work together, for instance in reading: We do not first analyze features of letters, then letters, then words.

**Word superiority effect.** We can identify a single letter more accurately and more rapidly when it appears in a meaningful word.
Top-down processing: reading

Read the text. What can you deduct about recognition of words?

Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

The context of a sentence facilitates the recognition of a word in a sentence.

See discussion on http://www.mrc-cbu.cam.ac.uk/people/matt.davis/cmabridge/
Final day of ski holiday
1: 10 AM
Coffee

2: 10.30-12 AM
off piste skiing

3: 12-13 lunch

4: 13-15.15
looking for skis

5: 15.15 – 15.45
confrontation with angry Germans

6: 15.45 - 24.00
confusion
Checking video next day.....
Overactive top-down processing (1)

- Smart mistakes: overusing strategy top-down processing

- *Change blindness* (failing to detect a change in an object or scene)

- Top-down processing encourages us to assume that the basic meaning of the scene will remain stable

- We do not store a detailed representation of a scene

http://www.youtube.com/watch?feature=player_embedded&v=FWSxSQsspiQ
https://www.youtube.com/watch?v=ubNF9QNEQLA
Overactive top-down processing (2)

- *Inattentinal blindness* (a visible but unexpected object is not noticed; especially when the task is cognitively demanding)

http://theinvisiblegorilla.com/gorilla_experiment.html
Perception and Emotion

Do moods and emotions influence what we perceive?
Niedenthal & Setterlund: “mood congruence”. Happiness and sadness have emotion-congruent effects upon selective perception.

Experiment:
• Mood induction by classical music
  (Vivaldi https://www.youtube.com/watch?v=Yy6Ip3bEC0U, Mozart
  Rachmaninov, Mahler, https://www.youtube.com/watch?v=yjz2TvC2TT4)
• Lexical decision task
  – strings of letters flashed on a screen; some words, in 5 categories: happy (e.g. delight) positive (calm), sad (weep), negative (injury) neutral (habit)
  – Participants in a happy mood identified happy words quicker than sad words;
  participants in a sad mood identified sad words quicker than happy words

Perception and Emotion

- Our current moods and feelings lead us to perceive emotion-congruent objects and events, thus prolonging our experience.

- Niedenthal & Setterlund: moods and emotions can redirect perception to objects and events that are relevant to current feelings.
To be continued...

• See you at the BBG.