NTNU – Trondheim
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Department of Psychology

Examination paper for PSY1012/PSYPRO4112
Cognitive Psychology I

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ENGELSK

Answer 2 of the following 3 questions:

1. Discuss the role of context in language processes

2. What is the difference between sensation and perception? Give two examples.

3. Explain at least three examples of a cognitive bias or a heuristic.
   What does that mean for decision-making?
   In your judgement, is human decision making just great, the best that can be expected, or just plain lousy, and what are the reasons for your judgement?

BOKMÅL

Svar på 2 av følgende 3 spørsmål:

1. Drøft betydningen av kontekst i språkprosesser

2. Hva er forskjellen på sansing og persepsjon? Gi to eksempler

3. Forklar minst tre eksempler på en kognitiv skjevhet eller en heuristikk. Hva betyr det for beslutningsprosesser?
   Ut i fra din vurdering, er menneskelig beslutningstaking flott, det beste som kan forventes, eller rett og slett elendig, og hva er årsakene til denne vurderingen?

NYNORSK

Svar på to av følgjande 3 spørsmål:

1. Drøft tydinga av kontekst i språkprosessar.

2. Kva er skilnaden på sansing og persepsjon? Gje to døme

3. Forklar minst tre døme på kognitiv skeivheit eller ein heuristikk.
   Kva har det å seie for avgjerdsprosessen?
   Ut i frå din vurdering, er menneskelege avgjerder flott, det beste som kan forventast, eller rett og slett elendig, og kva er årsaka til denne vurderinga?

Sensorveiledning i PSY1012/PSYPRO4112 VÅR 2015.

- Begge oppgaver teller like mye (50/50)
- Studentene trenger ikke bestå begge oppgaver, man kan gjøre en helhetsvurdering
- I vurdering av besvarelsene skal forankring i pensum, sensorveiledningen og karakterskalaen tillegges like stor vekt.
- Sensor gjøres oppmerksom på at det var problemer med tilgang/forvirring omkring pensumboken (Robert Sternberg: Cognition) i begynnelsen av semesteret, slik at flere var nødt til å benytte Robert Sternberg: Cognitive Psychology. Besvarelsene skal derfor kunne forankres i begge disse bøkene, som er nesten helt identiske.

Answer 2 of the following 3 questions:
1. Discuss the role of context in language processes
Drøft betydningen av kontekst i språkprosesser. Dette er i utgangspunktet en åpen oppgave, der kandidaten har mulighet til å diskutere språk i ulike kontekster. Kontekst forstås i vid forstand, slik at kandidaten f. eks kan drøfte talepersepsjon vs. skriftspråk, modalitetseffekter, språkforståelse, lingvistisk relativitet, språk i sosial kontekst eller kjønn og språk. Relevant del av pensum er kapittel 9 og 10 i Robert Sternbergs *Cognition* eller *Cognitive Psychology*.

2. What is the difference between sensation and perception. Give two examples.
Sensation and perception although closely related, have distinct qualities that set them apart.

Sensation is the stimulation of a sensory receptor which produces neural impulses that the brain interprets as a sound, visual image, odor, taste, pain, etc. Sensation occurs when sensory organs absorb energy from a physical stimulus in the environment. Sensory receptors then convert this energy into neural impulses and send them to the brain.
Perception is when the brain organizes the information and translates/interprets it into something meaningful (selective attention) or something that can be made sense of or rationalized by us. Furthermore, perception is how one "receives" this feeling or thought, and gives meaning to it through memories and emotions. Perception is mainly *how* our brain interprets a sensation. Information is obtained through collector, receptor, transmission, and coding mechanisms. Sensation and perception compliment each other to create meanings from what we experience, yet they are two completely different ways of how we interpret our world.

How Does Stimulation of the Senses Become Sensation?
Sensation doesn't automatically occur; sensory processes must first convert stimulation into neural messages before any other processing can be formed. This process of transferring energy is termed transduction. For example, transduction in your ear occurs in the cochlea. It begins with the detection of stimuli by a sensory neuron, then activating receptors, and finally converting the stimuli into a nerve signal that is processed by the brain. Stimuli detectors are important because one of their abilities is to alert us to changes. They also hold authority in sensory adaptation; the absolute threshold, the terminal threshold, and the difference threshold. Sensory adaptation is the reduction of sensory responsiveness when exposed to stimulation for an extended period of time. (ex. a swimmer diving into a cold pool and eventually adapting to the temperature). However, not all stimuli can be detected. There are those sensations that we can detect are above our absolute threshold (the minimum amount of stimulation needed to produce a sensory experience).

Any stimulus that is below our absolute threshold cannot be detected. After a stimulus is over our absolute threshold, we will be able to detect it normally until it reaches the terminal threshold,

where the stimulus is strong enough to be painful and cause damage. There also may be a difference in how strong or weak a stimulus is, but you can't always detect it. If it is, then it exceeds our difference threshold (the smallest amount of stimulus that can be changed and detected half the time). There are three different principals dealing with JND, which are all about stimuli and detection. The first one is Weber's law, which states that the size of JND is proportional to the intensity of stimulus. So, the JND is large when intensity is high, and small when intensity is low.

One thing that affects all these things is the signal detection theory, which states that sensation depends on the characteristics of the stimulus, the background stimulation, and the detector. For instance, a person responding to a stimulus normally would be considered a "hit" in signal detection theory. However, not responding to a stimulus or responding to a non-existent stimulus is called a "miss". This can explain why thresholds vary.

How Are the Senses Alike? And How Are They Different?

Senses all operate similarly, but each receives different information and sends it to a specialized region in the brain. Therefore, different sensations occur because each sense activates a different part of the brain. The brain interprets physical energy from the outside world as nerve signals and processes them into ways that they can be used. These signals are received by the senses:
1. vision: the brain receives light waves from photoreceptors, such as rods and cones, that are transduced into neural signals that are sent away to be interpreted by the brain. We *look* with our eyes but *see* with our brain. 2. hearing allows us, like vision, to locate objects in space. Sound waves with a certain frequency (pitch) and amplitude (loudness) are processed by the brain in the auditory cortex. 3. smell: (olfaction) odors interact with receptors in the nose which transfer a message to the olfactory bulbs located on the underside of the brain, which involves a chain of biochemical events. 4. gustation: (taste) soluble substances to flavors, and 5. skin senses: external contact to touch, warmth, and coldness. However, there are also people with disabilities to these senses, such as blindness and deafness (*see Vision and Hearing*). We also have the vestibular senses and kinesthetic senses. The vestibular senses allow us to keep track of the position of our bodies and surroundings. it also enables us to keep balanced, for instance when running. Kinesthetic senses allow us to keep track of our body parts in relation to each other. We also have the ability to feel pain. The Gate-Control Theory states that we have a neural "gate" that is capable of blocking incoming pain signals. Many people can learn to control pain by psychological techniques such as the placebo effect. All of these senses transduce stimulus energy into the neural impulses.

What is the Relationship between Sensation and Perception?

When you taste pizza you are having a percept, a product of perception. Perception is the mental process that interprets and gives meaning to sensations. Color serves as an example as to how perception differs from person to person. A color may not be the same for everybody, such as red. The color "Red" to an individual might be different to another individual, but we learn at an early age that the specific color is known as "Red". Other examples include illusions and ambiguous figures. Biologically, we have these things called Feature Detectors, which are the cells in the Cerebral Cortex that specialize in taking certain features of a stimulus. The brain combines sensory details into a single percept and this unclear process is referred to as the Binding Problem. Although the binding problem has not been solved, scientists believe that it can be partially accounted for by the brain's control of the firing patterns of neurons that recognize specific elements. Bottom-Up Processing emphasizes characteristics of stimuli, rather than our concepts in their entirety and expectations. Top-Down Processing is the process of perceiving things based off of your concepts, expectations, memories, motivations, goals and information

gathered over time. Perceptual Constancy is the ability to recognize the same object as remaining "constant" under different conditions.

Gestalt psychology argues that perception is shaped by nature, or innate factors that were already built into the brain. It divides our perception into Figure and Ground. Figure is the main part of the stimuli that catches our attention immediately, and ground is the backdrop against which we perceive the figure. Our perception can also be divided into Monocular cues, cues taken from just one eye, and Binocular cues, which rely on the use of both the eyes. Closure (filling in the blanks) is an organizing process identified by Gestalt psychologists. Gestalt psychologists also recognize laws of perceptual grouping, such as the Law of Similarity, Law of Proximity, Law of Continuity, Law of Common Fate, and Law of Pragnanz. These laws are theorized to be automatically built into our brain.

Another explanation for perception was made by Hermann von Helmholtz, who recognized the role of learning, or nurture in Perception. His theory of Learning-Based Inference states that perception is mostly shaped by personal experience and inferences made through prior learning. Context, expectations, and Perceptual Set also effect Perception. The Proprioceptive Senses are Kinesthesis, Visceral Sensitivity, Vestibular Sense. The Vestibular sense is when you sense that something is moving around you, and you use your coordinated movement to stop it from moving. An example of this would be when your pencil falls off your desk, and you sense it doing so, so you catch it before it reaches the ground.

Gestalt Psychology and Helmholtz's Learning-Based Inference are not opposing viewpoints in the sense that both are needed to understand our everyday perceptions. Also, both theories require top-down processing and rely on the attention of the subject in order to meaningfully perceive a stimulus. Also, Gestalt psychologists believe that much of perception is shaped by innate factors that are built in the brain.

Although the concept of change blindness wasn't in the book, it's important to know that it's the inability to see changes in an environment. If you aren't paying attention, then you won't notice changes.

Forklar minst tre eksempler på en kognitiv skjevhet eller en heuristikk. Hva betyr det for beslutningsprosesser? I din dom, er menneskelig beslutningstaking flott, det beste som kan forventes, eller rett og slett elendig, og hva er årsakene til dommen din? (Explain at least three examples of a cognitive bias or a heuristic. What does that mean for decision making? In your judgement, is human decision making just great, the best that can be expected, or just plain lousy, and what are the reasons for your judgement?)

Sensorveiledning
General point: I instruct students that it is more important that they should think than that their arguments must be consistent with data they have not yet learned. So if a student proposes an idea that makes sense based on what I can expect the student to know, but that conflicts with empirical data that I can’t expect a student to know, then that conflict should be ignored, and the student should be credited for good thinking.

Sternberg mentions six heuristics:

1) Satisficing is setting a minimum standard, or set of minimum standard along several dimensions, going through possible options one by one, and accepting the first option that meets those standards. Sternberg mentions that satisficing is used more frequently when working memory resources are limited, implying that an advantage of satisficing is that it

demands little of working memory. Sternberg says that satisficing would be poorly suited to diagnosing a disease, but well suited to choosing a car. His example once more implies, rather than makes explicit, that satisficing is useful when there are many choices, and when the cost of examining each choice is high enough that a relatively quick choice is better than the choice that would be best when information costs are ignored. Sternberg further doesn't point out that satisficing is therefore suited for sequential choices, where one option is examined at a time, and only if the present option is rejected will the next option be considered. A student who extracts these more general principle from the example goes beyond just reproducing the text. Sternberg does mention that the acceptance threshold may need to be relaxed if it turns out to be so stringent that finding a match takes too long or is impossible. He doesn't mention how the criterion would be set in the first place, and whether it might be a good idea to make the criterion more stringent for the next choice if the present choice results in a very quick match.

2) Elimination by aspects involves simultaneous comparison of multiple options across several dimensions. Sternberg uses the example of buying a car again, but instead of visiting show rooms and examining cars sequentially (as in the satisficing example) he assumes all the information is available simultaneously. Then apply the first criterion, for example price, and eliminate from consideration all cars that are too expensive. Proceed to the second criterion, eliminate all options that fail to meet that criterion, and iterate until either only one option is left or the list is short enough to apply some other decision strategy. Sternberg fails to comment on how the criteria should be ordered. If the number of options is very large and efficiency is important, it might be best to start with the criterion that eliminates the largest number of options. If the number of options is modest and it is important not to eliminate the best choices, starting with the most important criterion is probably a better idea. Once more, a student discussing these more general considerations goes beyond the text in the book.
3) Representativeness estimates probability according to how representative an event is of the process that produces it. For example, when tossing a fair coin, the exact sequence HTTHTHHTTH would be judged more probable than the exact sequences HHHHHHHHHH or HHHHHTTTTT. However, all three sequences involve 10 individual events with probability ½, so the probability of each sequence is exactly 2^{-10}. The first sequence just looks more similar to other common sequences and thus seems more representative of the process of tossing a coin. Sternberg links the representativeness heuristic to the gambler's fallacy and the hot hand myth, without pointing out that they are contradict each other. The gambler's fallacy is the belief that if a process with a known probability produces many outcomes of one kind, for example a roulette ball lands on red five times in a row, then the alternatives must become more likely. The hot hand myth is the belief, originally found in basketball, that a player who had above average success in hitting the basket in the last few throws is on a winning streak and has a greater chance of success with the next throw. So the gambler's fallacy is that a streak of similar results will be compensated for, while the hot hand myth is that the streak will persist. If both can be attributed to representativeness without any way of predicting which of the two opposing beliefs will apply, then representativeness has little scientific value in this case. A student who notices that goes beyond the text.

4) Availability is judging probability by how quickly examples come to mind, or how many. Given the reasonable assumption that frequent events are easier to remember, availability in memory should be correlated with probability. However, probability judgements by availability should then also be influenced by factors that influence availability without being related to probability, distorting probability judgements. Sternberg's example is the study that found people judging English words beginning with R. K, L, N, or V to be more common than words that had those letters in the third position, contrary to the actual frequencies. They attribute that to it being easier to think of words beginning with a specific letter than words that have that letter in the third position. Sternberg suggests that use of the availability heuristic can explain the conjunction fallacy, where more specific events are thought to be more likely than less specific events. For example, people judge an earthquake causing a big fire in California as more likely than an earthquake in California, even though an earthquake that causes a big fire must be a subset of all the earthquakes in California. The misjudgement is attributed to the added detail of an earthquake causing fire making the description more vivid and thus easier to recall.
5) Anchoring and adjustment occurs when early data bias later estimates in the direction of the early data even if they are irrelevant. The product 8*7*6*5*4*3*2*1, which begins with 8 is judged to be larger than the product 1*2*3*4*5*6*7*8 (if they are presented to different subjects). When people were asked whether the number of African states represented in the UN was larger or smaller than a supposedly random number (actually fudged by the experimenters to be either 25 or 65), a later question what was the exact number was biased in the direction of the supposedly random number.
6) Take the best consists of comparing options on the most valid cue. If the two options are matched, go on to the next cue. Decide as soon as there is a difference. This works very well when cues differ greatly in their validity.

Apart from the biases already mentioned, Sternberg also lists these:

1) Overconfidence, when people claim that 90% of their answers are correct, but actually achieve only 50%. Another example that could be included under overconfidence is illusory superiority, for example 68% of university of Nebraska lecturers believing themselves to be in the top 25% for teaching ability.
2) The sunk cost fallacy occurs when people let past costs influence their choices about future investments. For example, the British and French government continued to invest in the development of Concorde even when it was clear that further investment would just lose more money than cancelling the programme. This is the reason why the sunk cost fallacy is also known as the Concorde fallacy. Another name is "too much invested to quit", oven invoked in those exact words.
3) Hindsight bias occurs when people's memory of past estimates is distorted to confor to what they now know to be true. An early experiment asked students to estimate the probabilities of various possible outcomes of Richard Nixon's visit to China. Some months later, when the outcomes were known, the same students were asked to remember their original estimates. Their memories were distorted in the direction of the actual outcomes.

Sternberg mostly lists heuristics and biases, and makes little attempt to develop a coherent framework. Whatever students offer on what the use of heuristics and existence of biases means for the quality of human decision making is likely to be their own thinking. I don't care whether

they argue that human decision making is great, or the best expect from evolution tinkering with what's available, or whether they argue that it is lousy. All these opinions can be found in the literature. I only care whether they can develop an argument as reasonable as can be expected from a first year student. Sternberg's brief description of bounded rationality and rare reference to working memory may lead students to consider cognitive limitations. They may argue that the use of heuristics could be considered optimal, or at least an acceptable improvisation, when taking into account that a decision rule that trades off the occasional mistake for making more choices may pay off. Or they may decide that the evidence of bad solutions is so pervasive that human decision making can only be judged lousy. Any argument that makes sense is acceptable.