Multimodal Perception and Cognition Examination

Medialogy 7th Semester

Monday 13 January 2014, 09.00 - 12.00

Instructions and information

- You are not allowed to bring any written material or electronic devices into the examination room.
- You have 3 hours to complete the examination.
- Write your answers on the writing paper provided. Do not hand in more than one answer to any given question. Do not write your answers on the question paper. Write your answers in blue or black ink.
- There are 20 questions on this examination paper.
- The maximum number of marks for each question is 10.
- Full marks can be obtained by answering 10 questions completely correctly.
- **Do not hand in answers to more than 10 questions.** Only 10 answers will be marked by the examiners.
- You must get at least 50 marks in total to pass.
- The table below shows how the total number of marks obtained will be mapped onto grades on the 7-step scale.

Mark range	Grade
0 – 24.5	-3
25 – 49.5	00
50 – 59.5	02
60 – 69.5	4
70 – 79.5	7
80 – 89.5	10
90 – 100	12

NOTE: If you are a student at the Esbjerg campus or Aalborg campus, you are expected to be able to answer questions 1 – 10. However, you may choose to answer any questions on the paper that you wish.

DO NOT TURN OVER UNTIL TOLD TO DO SO!

Question 1

a. [4 marks] Name four general approaches that scientists have adopted in order to understand human cognition.

b. [6 marks] What are *event-related potential (ERPs)*? Briefly describe the procedure that is used to measure them. Is measuring ERPs an appropriate way to discover precisely *where* in the brain some activity is occurring? Explain your answer. What advantage does using ERPs to measure brain activity have over, say, fMRI?

Question 2

a. [5 marks] In the photograph above, the girl and the boy are physically approximately the same height. Explain why the boy on the right looks so much bigger than the girl on the left. You may find it helpful to draw a diagram.

b. [5 marks] Describe and explain the illusion shown below. How can this illusion be understood to provide evidence in favour of the likelihood principle of perceptual organisation (as opposed to the simplicity principle)?
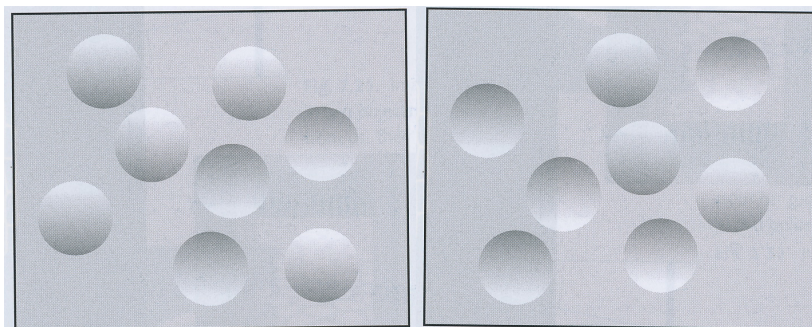
Question 3

Explain the difference between *Vernier acuity* and *grating acuity*. [2 marks] Describe with a graph how each type of acuity develops over the first 6 months or so of life. [3 marks] In adults, which of the two types of acuity is generally better? [1 marks] How can the relative development of Vernier and grating acuity be explained in terms of the parts of the visual system that each type of acuity depends on? [4 marks]

Question 4

In an experiment to test the perception of mismatches between a graphics overlay and an underlying camera feed (augmented reality) due to tracking errors, each test subject is asked to go through a series of 90 trials. The factors involved are the visual scenario used (2 types), and the type of mismatch (3 types). Furthermore, each combination of visual scenario and mismatch type is tested at 15 different levels of severity. The severity of a mismatch is given as an angular displacement measured in degrees. In each trial, the participant is asked to tell if there is a mismatch or not. The time taken to arrive at this decision is logged.

   a. [1 mark] What experimental variables are involved in this setup?
   b. [2 marks] What levels of measurement are involved? Specify the level for each variable given above.
   c. [4 marks] In what way does/can this experimental design incorporate the principles of blocking and replication?
   d. [3 marks] Give at least one way of randomizing the experiment.

Question 5

The data gathered in an experiment comes from a questionnaire only consisting of 7-step Likert scales. One set of questionnaires was filled out by 10 people who tested version A of a product, and another set was filled out by another group of 9 people who tested version B of the same product. Our goal is to find out if there is any difference between the two products.

   a. [1 mark] Does this data come from a balanced or unbalanced, complete or incomplete, experiment?
   b. [1 mark] What is the level of measurement for the explanatory and response variables?
   c. [2 marks] What general family of experiment does this belong to (and why)?
   d. [4 marks] What specific type of statistical test would you employ in the analysis (and why)?
   e. [2 marks] Suppose that the chosen test gives you a p-value of 0.023. How would you use this number to reach a conclusion about the test?

Question 6

   a. [4 marks] Explain what is meant by *categorical perception*. Are we better or worse at distinguishing between stimuli that fall into the same category?
   b. [6 marks] Calder and his colleagues used morphed images of faces with different expressions in an experiment that provided evidence that facial expressions are perceived categorically. Briefly describe the methodology used and the results obtained in this experiment.

Question 7

Explain the difference between an *endogenous cue* and an *exogenous cue* [4 marks]. Which of these two types of cue is associated with top-down processing? [1 mark] Which of these two types of cue has the longer-lasting effect? [1 mark] If the effect of a cue lasts 200-500 ms, is the cue likely to be endogenous or exogenous? [1 mark] How can the principle of *inhibition of return* be used to explain the longer-term effect of an exogenous cue? [3 marks]

Question 8

a. [2 marks] According to David Chalmers, what is the "hard problem" of consciousness?
b. [1 mark] Give an example of what Chalmers considers to be an "easy problem".
c. [3 marks] *Dualism, epiphenominalism* and *idealism* are three different perspectives that have been adopted on consciousness. Briefly explain what characterises these three perspectives.
d. [4] Explain, with examples, what is meant by the term *quale*. Briefly describe how a dualist, an epiphenomenalist and an idealist would differ in their perspective on qualia.

Question 9

a. [4 marks] Briefly explain what is meant by the "what" and the "where" pathways in the visual system. Describe approximately where these pathways occur in the brain (you may use a labelled sketch).
b. [4 marks] Briefly describe the phenomenon of *blindsight*. How is the superior colliculus thought to be involved in blindsight?
c. [2 marks] If you are in a dark room and you have a light flashed in one eye, you are unable to tell which eye the light was flashed in. What does this tell us about the relationship between consciousness, monocular cells and binocular cells?

Question 10

a. [4 marks] Briefly describe the experimental procedure and the typically observed results used to invoke the *rubber-hand illusion.*
b. [6 marks] Briefly describe the experimental procedure used by Lenggenhager *et al*. to explore bodily self-consciousness. What did participants typically experience in this procedure? Why does this experience come about?

Question 11

a. [3 marks] Provide a definition of *semantic congruency*.
b. [3 marks] Exemplify a hypothetical experiment on semantic congruency.
c. [4 marks] Explain how and what kind of behavioral and psychophysiological data you could gather for such an experiment.

Question 12

    a. [4 marks] Explain the phenomenon of categorical perception.
    b. [3 marks] Explain what the opposite of categorical perception is. Give an example.
    c. [3 marks] Elaborate on the examples of categorical perception of faces and emotions.

Question 13

    a. [4 marks] Explain three examples of psychophysiological measurements used to monitor affective states or cognitive functions in digital immersive-interactive applications.
    b. [3 marks] Indicate whether each of these signals originate in the central, the autonomic or the somatic nervous system.
    c. [3 marks] Explain what these measurements are being correlated to.

Question 14

    a. [3 marks] Explain what is the research field encompassed by "affective computing", what are its goals and what kind of technologies it intends to integrate.
    b. [4 marks] List and define at least three different affective states and how they relate to each other.
    c. [3 marks] Explain how you see the relation between emotions and cognitive processes.

Question 15

    a. [5 marks] Describe the three main empirical strategies available for the assessment of cognitive processes and affective states when interacting with immersive media.
    b. [5 marks] Give examples for each strategy.

Question 16

    a. [5 marks] Provide an example from the literature representing a situation of conflict between vision and audition, where audition dominates vision.
    b. [5 marks] Provide an example from the literature representing a situation of conflict between audition and touch, where audition dominates touch.

Question 17

    a. [5 marks] What is the spatial and temporal resolution of touch?
    b. [2 marks] Is it equally distributed across the human body?
    c. [3 marks] How does it compare to vision?

Question 18

Choose one paper from the literature investigated in class where a quantitative
experiment related to multimodal perception is performed.

a. [3 marks] Describe the hypothesis of the experiment.
b. [3 marks] Describe the experimental procedure.
c. [4 marks] What are the results?

Question 19

a. [5 marks] Provide a definition of pseudo-haptic feedback.
b. [3 marks] Describe how it was first implemented.
c. [2 marks] how can it be used?

Question 20

a. [4 marks] Provide a definition of crossmodal enhancement
b. [2 marks] Provide an example of audition enhancing touch
c. [2 marks] Provide an example of vision enhancing touch
d. [2 marks] Provide an example of touch enhancing vision

END OF EXAMINATION