**3rd February (Sat.)**

# Tohoku University Graduate School of Information Sciences
## Two-Year Master's Program
## International student admission

## Written Examination
## Group 6　Psychology and Philosophy

- Select 3 out of 12 questions from these areas: psychology (sensation and perception, cognition, learning and memory, personality, psychometrics) and philosophy (history of philosophy). Applicants for either psychology laboratories (cognitive psychology, human learning and memory, visual cognition, cognitive psychology of communication) must select from the six questions of Psychology I, Psychology II, Psychology III, Psychology IV, Psychology V, and Psychology VI. Similarly, applicants for philosophy laboratories (philosophy of human information, philosophy of logical analysis) must choose from the following 6 questions: Philosophy I, Philosophy II, Philosophy III, Philosophy IV, Philosophy V, and Philosophy VI.
- On each answer sheet, fill in your examinee's number in the Examinee No. box, and in the Question No. box, fill in the question number you are answering in the sheet.
- Six answer sheets are enclosed, including a spare. If there is not enough paper space even with the spare answer sheets, the reverse side of the paper should be used.
- After the examination, all question and answer sheets will be collected. Submit them according to the instructions of the examiner.
- Examination hours: 10:00 -13:00

Psychology I

An experiment was conducted to investigate the capacity of human visual working memory in the following way. A fixation point and several color patches were presented on the display. After 1 second, all color patches disappeared from the display. Then, one of the initially presented color patches reappeared on the display for 0.25 seconds, but the location of that color patch was displaced horizontally from the initial position. This displacement $\Delta$ was used as an experimental variable and was systematically varied from 5 degrees to the left to 5 degrees to the right relative to the initial position. Furthermore, the number of color patches (N) to be presented on the display was used as a parameter, and N was one of four types of parameters: 1, 2, 4, and 6. One color patch presented on the display consisted of one color, and when two or more color patches were presented, each color patch was set to have a different color. Participants' task was to report the direction of the displacement of the color patch. Answer the following questions.

A) For each number N of color patches, a typical psychometric function was obtained by plotting the proportion of rightward judgments as a function of displacement $\Delta$. When the slopes of each psychometric function were compared, the slope gradually decreased with the increase of N (Fig. 1). Compared to the conventional view of visual working memory, explain what new things can be said about the mechanism of visual working memory from these results.

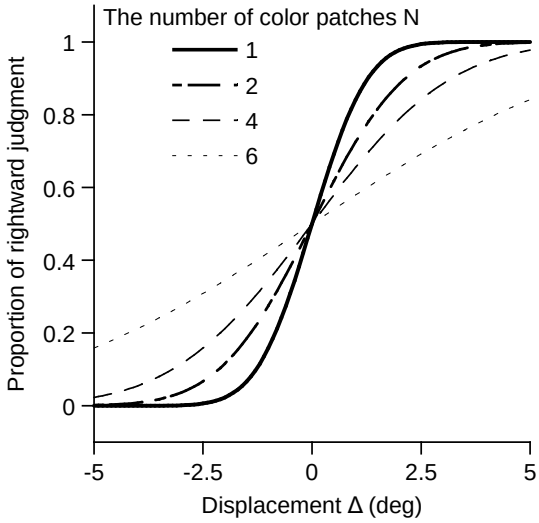


Figure 1. Proportion of rightward judgments as a function of displacement. A negative value for displacement represents a shift to the left.

B) Compared to traditional visual working memory experiments, the displacement $\Delta$ used in this experiment was small. Focusing on this difference in the amount of displacement, use Figure 1 and explain why there is a difference from the conventional view of visual working memory mentioned in Question A.

C) Based on the explanation given in Question B, describe the possible mechanisms for allocating visual working memory resources.

Psychology II

To investigate the neural mechanism of stereopsis, we created a visual pattern in which many dots were randomly arranged on a gray background (This is called RDS) and measured the responses of neurons in the primary visual cortex when presenting the RDS with a binocular disparity. We used two types of RDSs: correlated RDS in which white dots were presented for both the right and left eyes, and anti-correlated RDS in which black dots were presented for the right eye and white dots were presented for the left eye. When we measured neural responses by changing the amount of binocular disparity in a RDS, we obtained the results shown in Figure 2. Answer the following questions.

A) Using the two types of RDS described above, the amount of change in vergence eye movements was measured when binocular disparity suddenly changed. When a graph was plotted in which the horizontal axis represents the binocular disparity and the vertical axis represents the amount of change in vergence eye movements, the shape of the graph was similar to that shown in Figure 2. Note that the change in vergence eye movements is 0 when binocular disparity is 0. Describe specifically what changes in vergence eye movements occurred for each of the two types of RDS.

B) When the amount of depth perception was measured by changing the amount of binocular disparity of the anti-correlated RDS, no clear depth was perceived even though the amount of binocular disparity was increased. On the other hand, when the amount of perceived depth was measured by changing the amount of binocular disparity of the correlated RDS, the depth was clearly perceived and increased with binocular disparity. Describe what can be considered about the neural processing of depth detection in the early stages of the visual system.

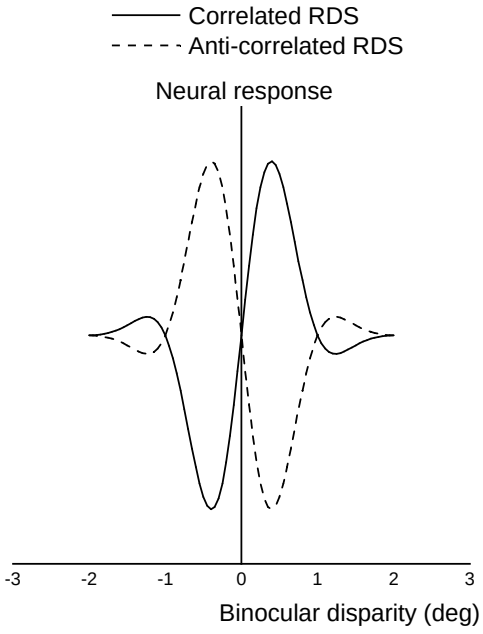


Figure 2. Responses of a neuron in the primary visual cortex to binocular disparity for correlated and anti-correlated RDS. Positive values of disparity represent uncrossed disparity, and negative values represent crossed disparity.

Psychology III

Design an original psychological experiment utilizing Generative AI † and create a research proposal. Clearly articulate the background and reasons inspiring the research, the uniqueness of the study, the academic "question," research objectives and hypotheses. Elaborate on specific research plans (methods, participants, conditions, hypotheses, etc.) and provide detailed descriptions of anticipated results. In addition, explicitly state the type of Generative AI to be used and discuss the reasons and merits for utilizing Generative AI. Furthermore, address any potential issues or concerns associated with the use of Generative AI.

† Artificial Intelligence technology that can automatically generate digital content such as text, images, audio, and videos. Representative examples include "Stable Diffusion," capable of generating images, and "ChatGPT," which can generate text.

Give an explanation for the illusory correlation phenomenon with specific examples and discuss the psychological implications of your explanation.

Explain the points to be considered when creating a questionnaire survey form, including the order and wording of questions. Also, discuss how to deal with satisficing, which tends to be a problem in web surveys.

Psychology VI

Answer both a and b below.

a. Describe Memory Span.

b. Consider and briefly describe an experimental method for measuring memory span.

Philosophy I

Explain Aristotle's term of "energeia."

Philosophy II

Explain Hobbes' term of "state of war."

Philosophy III

Explain Kant's term of "taste judgement."

Philosophy IV

Explain Sartre's term of "engagement."

Philosophy V

Explain the paradox of material implication.

Philosophy VI

Explain the possible world semantics.