2026 Master's Program, Graduate School of Design (General Entrance Examination)
Achievement Test
Question and Answer Sheets

Examination Subject Media Science

Examinee's number

Question 1(1-1, 1-2, and 1-3) must be answered by all candidates. For Questions 2, 3, and 4, select two questions from these three and answer them.

(Compulsory) Question 1: Answer the following three questions.

1-1. Explain the significance of studying visual illusions. (20 points)

(Purpose of the Question) The purpose of this question is to assess the candidate's understanding of the fundamental areas of the psychology of vision.

(Sample Answer) Optical illusions are phenomena that clearly reveal the difference between the physical world and the perceptual world. Therefore, by studying optical illusions, we can clarify the relationship between the physical world and the perceptual world. Furthermore, through this, it is believed that we can efficiently elucidate the functions, characteristics, and mechanisms of the visual system—comprising the eyes and the brain—and thereby examine the mechanisms of vision. In the field of visual design, there is significance in studying optical illusions from two perspectives: design aimed at avoiding illusions and design that utilizes them.

1-2. Explain "what vection is" in as much detail as possible. You may use diagrams if necessary to support your explanation. (20 points)

(Purpose of the Question) The purpose is to have candidates comprehensively describe everything they know about vection, including the definition of vection.

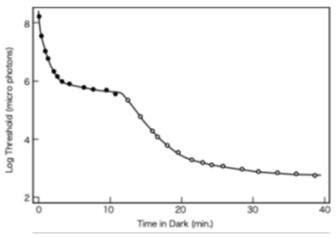
(Sample Answer) When a uniform motion stimulus is presented across a wide field of view, the sensation of movement occurs in the opposite direction to the stimulus's movement. This illusion is called vection (visually induced self-motion perception). Vection also appears frequently in everyday life. Today, we see people performing parts of their daily lives, such as work, study, and leisure time, in virtual spaces that resemble the real world. VR engineers are required to understand vection and use it effectively.

Our brains are equipped with the basic premise that "the world is standing still." The world rarely moves unless we ourselves are moving. The most efficient way to make sense of the "world is moving," which comes in as visual information but does not actually occur, is to create the sensation that "we ourselves are moving." In other words, we move ourselves to create a situation in which the visual information that "the world is moving" is not incorrect. Vection is an illusion that makes sense of the constantly incoming visual information that the world is moving.

The scientific description of vection dates back to 1875, when Ernst Mach wrote that while watching a river flow from a pier, he perceived his own body moving in the opposite direction to the river's current. According to Palmisano et al. (2015), the first appearance of the term "vection" (or its origin) was in a paper by Fischer and Kornmüller (1930). The first quantitative measurement of vection, and the first scientific vection experiment, was a paper published by Brandt et al. in 1973. In vection experiments, three indicators are often used to represent vection intensity: latency, duration, and subjective intensity (measured by magnitude estimate or rating scale).

1-3. Explain "dark adaptation curve" in as much detail as possible. You may use diagrams if necessary to support your explanation. (20 points)

(Purpose of the question) The process of dark adaptation is fundamental knowledge for studying visual mechanisms.



(Sample Answer) The dark adaptation curve describes the temporal characteristics of threshold detection as the visual system transitions from light to dark adaptation. The horizontal axis indicates time, and the vertical axis represents the detection threshold. Immediately after entering a dark environment, the detection threshold decreases rapidly. Once a threshold is reached, it remains constant for a period of time. Once this plateau phase ends, the threshold begins to decrease again, eventually reaching another plateau at which no further improvement in sensitivity occurs. This overall pattern is shown in the figure below. The initial decrease in threshold corresponds to the increase in cone sensitivity, while the second decrease reflects the increase in rod sensitivity. Activation of rods takes longer. Moreover, cone-mediated detection allows for color perception, whereas rod-mediated detection is limited to achromatic (light–dark) discrimination.

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For questions 2, 3, and 4, **select two questions** and answer them. If you answer all three questions, the two with the lowest scores will be used.

(Elective) Question 2: Answer the three questions below. (70 points)

・Explain the Thatcher illusion (or Thompson effect) and the hollow mask illusion (or hollow face illusion) in as much detail as possible, using diagrams. (20 points)
(Purpose of the Question) The purpose of this question is to assess basic knowledge regarding the perception of human faces.
(Sample Answer) The Thompson effect is a phenomenon in which, when an image created by cutting out the eye and mouth regions of a facial photograph and pasting them upside down is observed upside down, it appears slightly odd; however, when the image is observed right-side up, it is perceived as an expression that appears significantly odd. This implies that while it is possible to process the overall expression by integrating information about facial features when the facial image is right-side up, sufficient information processing cannot be performed when the face is upside down. The Hollow Mask illusion is a phenomenon in which a mask is perceived as a convex face even when viewed from the concave side. This illusion is thought to occur because higher-order knowledge—namely, that faces are convex objects—introduces a perceptual bias toward convexity when interpreting information received through the eyes.
(Figure omitted)

・List two types of eye movements and explain them in as much detail as possible using diagrams. (20 points)
(Purpose of the Question) The purpose of this question is to assess basic knowledge of eye movements involved in processing visual information.
(Sample Answer) A saccade is a typical eye movement in which both eyes move in the same direction, causing the gaze to jump (the eyes rotate rapidly). It occurs to bring the area of interest into the fovea. Saccades occur two or three times per second, with a latency of 200–300 ms between successive saccades. It is believed that visual input is suppressed while a saccade is occurring; this is known as saccade suppression. Smooth pursuit is a movement in which the eyes rotate smoothly and continuously to keep a relatively slow-moving object within the fovea. Both eyes move in the same direction. As the object's movement speeds up, saccades begin to intermingle with smooth pursuit.
(Figure omitted)

・Explain random-dot stereograms in as much detail as possible using diagrams. (30 points)
(Purpose of the Question) This question tests the candidate's understanding of basic techniques used in binocular stereopsis research.
(Sample Answer) This is a stereoscopic vision research technique devised by Béla Julesz around 1960. It uses images composed of random dot patterns in which black and white dots are present in equal proportions (50% each). The images for the left and right eyes contain no shape cues, but there is a lateral shift in certain parts; when the two images are fused by both eyes, the perception of convex or concave shapes is obtained through stereoscopic vision. In this case, the images do not contain any pictorial depth cues. Random-dot stereograms demonstrate that, in stereopsis, it is not necessary to detect corresponding objects in each eye before binocular fusion occurs. Because they create a condition that eliminates depth cues other than binocular retinal disparity, they are frequently used in stereopsis research.
(Figure omitted)

(Elective) Question 3: Explain in as much detail as possible examples of how sensory and perceptual psychology is used in the real social world (for example, jobs that make use of sensory and perceptual psychology) (70 points).

(Purpose of the Question) Like the books mentioned below, there are many general and specialized books that explain how sensory and perceptual psychology relates to society and one's own work. Furthermore, the purpose of the questions was to determine whether candidates had seriously considered how to connect these to their future work, even before enrolling. It was also hoped that candidates would describe the potential for using psychology to pioneer new areas in the future.

Sensory and Perceptual Psychology (Series: Psychology and Work 1)
Supervised by Nobuo Ota
Edited by Jiro Gyoba
Kitaoji Shobo

Seven Rules for Selling Advertising
Dentsu Kyushu, Katsuyuki Kazuki, Takeharu Senoo, Toshihiro Wakebe (authors)
Kobunsha

(Sample answer omitted)

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(Elective) Question 4:

1) "Color order system" is a method for quantitatively denoting colors.

・Explain in as much detail as possible what "the color order system" is. (15 points)

・Explain in as much detail as possible the NCS (Natural Color System), which is one of the color order systems. You may use diagrams if necessary to support your explanation. (20 points)

2) In the CIE (Commission internationale de l'éclairage) 1931 RGB and CIE 1931 XYZ color systems, colors are represented using RGB or XYZ tristimulus values. To obtain these tristimulus values, color matching functions are used. Explain color matching functions in as much detail as possible. You may use diagrams if necessary to support your explanation. (15 points)

3) The CIE 1931 RGB color system had two major problems that limited its practical use. To address these problems, it was transformed into the CIE 1931 XYZ color system. Explain in detail what these two major problems were in the CIE 1931 RGB color system, and how each of them was resolved in the CIE 1931 XYZ color system in as much detail as possible. You may use diagrams if necessary to support your explanation. (20 points)

(Purpose of the question)

A color-order system is essential for the quantitative analysis of object colors.
The CIE colorimetric systems and their underlying theory constitute foundational knowledge in color science.

(Sample Answer)

1)

- A color order system is a structured arrangement of colors defined by a set of rules. Such systems allow colors to be specified and communicated effectively. These systems are generally limited to surface (object) colors.
- The NCS represents colors using four perceptual attributes: hue, chromaticness, whiteness, and blackness. Hue is denoted by φ and is based on the four perceptual elementary colors—red, yellow, green, and blue—represented using orthogonal axes (red–green and yellow–blue). For example, a hue consisting of 90% yellow and 10% red is notated as Y90R. Chromaticness (c), whiteness (w), and blackness (s) collectively characterize the color's nuance in terms of saturation and lightness, with the constraint:

  $$c+w+s=100$$

  Thus, specifying any two of these automatically determines the third. In practice, nuance is expressed using only blackness (s) and chromaticness (c), each denoted with two digits. For instance, if s=20, c=30, the nuance is written as 2030. Combining this with the hue yields a full notation such as 2030–Y90R.

2) Color-matching functions represent the amounts of primary stimuli required to achieve a color match with a 1-W monochromatic test light. When the primaries used for matching are 700 nm, 546.1 nm, and 435.8 nm, the resulting functions are the RGB color-matching functions. The primary amounts are normalized relative to the achromatic reference stimulus (the basic stimulus used in matching).

3) The first major problem in the CIE 1931 RGB color system is that its color-matching functions contain negative values. A negative value indicates that, for certain wavelengths, one of the primaries must be added to the test field—rather than to the comparison field—in order to achieve a match. Consequently, the corresponding tristimulus values may also become negative, making the system impractical for general application. This issue was resolved by defining a new set of primaries (X, Y, Z) such that all tristimulus values are non-negative. The second problem concerns luminance representation. In the RGB system, luminance must be computed using all three tristimulus values, with weighting coefficients of approximately 1.0000 for R, 4.5907 for G, and 0.0601 for B. In the XYZ system, this was addressed by defining the X-axis and the Z-axis on the plane described by $R+4.5907G+0.0601B=0$, allowing luminance (and lightness) to be represented solely by the Y component.