

Perceptual Psychology

知覺心理學

Course Code: 702013001

Instructor: Erik Chihhung Chang

Semester: Spring 2027

Course Description

How does the brain turn light waves into a recognizable face, air pressure changes into a melody, or chemical molecules into the flavor of a morning coffee? Perception is not merely a passive recording of the world; it is an active construction of reality. This course bridges the gap between sensory physiology and conscious experience.

We will dive deep into the mysteries of the **Visual System**, exploring how we perceive form, color, depth, and motion, and how attention shapes what we see. Crucially, we will also explore **Perception for Action**, analyzing how the brain processes sensory information not just to recognize objects, but to guide our movements and interactions with the environment.

Beyond sight, we will examine the **Auditory System**, unraveling the mechanisms behind pitch, sound localization, and Auditory Scene Analysis. Finally, we will extend our inquiry to the **Cutaneous and Chemical Senses**—touch, pain, taste, and smell—to understand how the brain integrates these diverse signals. By integrating neuroscientific theory with psychological phenomena, students will learn to "see," "hear," and "feel" the mechanisms behind their own daily experiences.

大腦是如何將光波轉化為一張可辨識的臉孔，將氣壓變化轉化為一段旋律，或是將化學分子轉化為晨間咖啡的風味？知覺不僅僅是對世界的被動紀錄；它是對現實的「主動建構」。本課程旨在搭建感官生理學與意識經驗之間的橋樑。

我們將深入探討視覺系統的奧秘，探索我們如何知覺形狀、顏色、深度與運動，以及注意力如何形塑我們所見的事物。我們也將探討知覺與行動下的內在表徵，分析大腦如何處理感官資訊，使其不僅用於辨識物體，更能引導我們的動作以及與環境的互動。

除了視覺之外，我們將檢視聽覺系統，解析音高、聲音定位以及「聽覺場景分析」背後的機制。最後，我們將探究的範圍延伸至皮膚感覺與化學感官——觸覺、痛覺、味覺與嗅覺——以了解大腦如何整合這些多樣的訊號。透過整合神經科學理論與心理學現象，學生將學會如何去「看見」、「聽見」並「感受」自身日常經驗背後的運作機制。

Textbook

- **Required:** Goldstein, E. B. & Cacciamani, L. (2022). *Sensation and Perception* (11th Ed.). Cengage Learning.

Course resources

- Google Classroom:
<https://classroom.google.com/c/ODIONTc3MzczMjI3?cjc=riykotsn>
- Course github: <https://github.com/audachang/perception>

Recommended Readings

The following list includes recommended supplementary readings (English and Chinese translations where available) to enrich your understanding of perceptual phenomena:

- Ackerman, D. *A Natural History of the Senses.* (感官之旅)
- Zeki, S. *Inner Vision: An Exploration of Art and the Brain.* (腦內藝術館)
- Sacks, O. *The Man Who Mistook His Wife For a Hat.* (錯把太太當帽子的人)
- Sacks, O. *The Island of the Colorblind.* (色盲島)
- Sacks, O. *An Anthropologist on Mars.* (火星上的人類學家)
- Crick, F. *The Astonishing Hypothesis.* (驚異的假說)
- Ramachandran, V. S. *Phantoms in the Brain.* (尋找腦中幻影)
- Pinker, S. *The Language Instinct.* (Chinese: 語言本能)
- Goleman, D. *Focus: The Hidden Driver of Excellence.* (Chinese: 專注的力量)
- Carter, R. *Mapping the Mind.* (Chinese: 大腦的秘密檔案)
- Dawkins, R. *The Selfish Gene.* (Chinese: 自私的基因)
- Johnson, M. H. *Developmental Cognitive Neuroscience.* (Chinese: 發展的認知神經科學)

Grading Policy

Component	Description
Midterm Exam (40%)	Covers Chapters 1–6. Includes multiple-choice (80%) and short answer questions (20%).
Final Exam (40%)	Covers Chapters 7–14. Includes multiple-choice (80%) and short answer questions (20%).
Student Presentations (10%)	Group presentations on supplementary materials (books, demos, or media) from previous weeks.
Participation (10%)	Based on attendance and active participation in class discussions.

Tentative Weekly Schedule

Week	Topic	Lecture Contents & Readings
1	Introduction to Perception	Lecture: Sensation vs. Perception, Bottom-up vs. Top-down processing, Psychophysics methods (Thresholds, Scaling). Read: Ch 1
2	Basic Principles of Sensory Physiology	Lecture: Structure of the Neuron, Action Potentials, Synapses, Neural Coding (Specificity vs. Distributed). Read: Ch 2
3	The Eye and Retina	Lecture: Light properties, Anatomy of the Eye, Phototransduction, Rods vs. Cones, Dark Adaptation, Neural Convergence. Read: Ch 3
4	The Visual Cortex and Beyond	Lecture: LGN organization, Receptive Fields (Center-Surround), Simple/Complex cells in V1, Cortical Magnification, Dorsal vs. Ventral streams. Read: Ch 4 Student Presentation: <i>The Man Who Mistook His Wife for a Hat, The Astonishing Hypothesis</i>
5	Perceiving Objects and Scenes	Lecture: Gestalt Laws of Organization, Figure-Ground segregation, Scene Gist, Regularities in the environment. Read: Ch 5 Student Presentation: <i>The Island of the Colorblind</i>
6	Perceiving Objects and Scenes (Cont.)	Lecture: Face Perception (FFA), Viewpoint invariance, Neural decoding of object categories. Read: Ch 5 Student Presentation: Hubel's <i>Eye, Brain and Vision</i>
7	Visual Attention	Lecture: Selective vs. Divided attention, Inattentional blindness, Feature Integration Theory (Binding Problem). Read: Ch 6 Student Presentation: <i>The Beauty of the Brain</i> (Zeki), Gestalt Theory
8	Midterm Exam	Scope: Chapters 1–6
9	Taking Action	Lecture: Perception-Action loop, Mirror Neurons, Parietal Reach Region, Affordances. Read: Ch 7 Student Presentation: Gestalt principles and illusion demonstrations
10	Perceiving Motion	Lecture: Motion Agnosia, Corollary Discharge Theory, Motion cues, Biological Motion. Read: Ch 8 Student Presentation: <i>Focus, Visual Search</i>

Week	Topic	Lecture Contents & Readings
11	Perceiving Color	Lecture: Physics of color, Trichromatic Theory, Opponent-Process Theory, Color Constancy. Read: Ch 9 Student Presentation: <i>The Mirror Neuron System</i> , Affordances
12	Perceiving Depth and Size	Lecture: Oculomotor cues, Monocular cues (Pictorial), Binocular Disparity (Stereopsis), Size-Distance Scaling. Read: Ch 10 Student Presentation: Nancy Kanwisher's Neural Portrait, Motion Illusions
13	Hearing: Physiology and Perception	Lecture: Pressure waves, Ear anatomy (Cochlea, Basilar Membrane), Place Theory vs. Temporal Coding. Read: Ch 11 Student Presentation: <i>An Anthropologist on Mars</i> , Color Deficiency
14	Hearing in the Environment	Lecture: Auditory Localization (ITD, ILD), Auditory Scene Analysis, Precedence Effect. Read: Ch 12 Student Presentation: Stereograms, Size Constancy
15	Perceiving Music & Speech	Lecture: Phonemes, Spectrograms, Speech Segmentation, Broca's/Wernicke's Aphasia. Read: Ch 13 & 14
16	Final Exam	Scope: Chapters 7–14

Supplementary Materials Guide

Week	Books, Media, and Demos
1	<i>A Natural History of the Senses</i> ; Signal Detection Theory Demo; Lecture on Perception & Awareness.
2	<i>The Man Who Mistook His Wife for a Hat, The Astonishing Hypothesis</i> ; Action Potential, Double Slit Experiment, Mind-Body Problem.
3	<i>The Island of the Colorblind</i> ; Mantis Shrimp Eyes, Receptive Fields.
4	<i>Hubel's Eye, Brain and Vision</i> ; LGN & Striate Cortex Structure; Beau Lotto's Optical Illusions.
5	<i>The Beauty of the Brain</i> (Zeki); Gestalt Theory (Wertheimer); M.C. Escher; Origami.
6	Review Gestalt principles and illusion demonstrations.
7	<i>Focus, The Secret Life of the Emotional Brain</i> ; Inattentional Blindness, Change Blindness, Visual Search.
9	<i>The Mirror Neuron System</i> ; Ian Waterman's Missing Body, Affordances, V. Ramachandran, Jill Bolte Taylor.
10	Nancy Kanwisher's Neural Portrait; Motion Illusions (George Mather, Michael Bach).

Week Books, Media, and Demos

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| 11 | <i>An Anthropologist on Mars</i> ; Primate Color Vision Evolution, The "Dress" Phenomenon, Color Deficiency. |
| 12 | Stereograms (Bela Julesz), Charles Wheatstone, Size Constancy, Cyclopean Perception. |
| 13 | Békésy's Traveling Wave, Cymatics (Evan Grant), Psychology of Hearing demos. |
| 14 | <i>The Man Who Mistored 2000 Operas</i> ; Shepard's Tone, Motion-Bounce Illusion, Daniel Kish (Echolocation), Auditory Scene Analysis. |
| 15 | <i>The Language Instinct, The Science of Words</i> ; Helen Keller, Aphasia (Wernicke/Broca), AI Voice Generation. |
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