

THE UNIVERSITY OF BRITISH COLUMBIA
SCHOOL OF KINESIOLOGY
COURSE SYLLABUS

Program: Kinesiology

Course #: KIN 311 (Formerly KIN 330), Section 001

Term/Year: September – December 2024

Course Title: Sensorimotor Control
of Human Movement

COURSE DESCRIPTION

Central to the relation between brain and behaviour is the problem of how movements are organized and controlled. The scientific field of study concerned with this problem is generally known as Motor Control. Students of motor control have available to them a variety of approaches with which to examine the nature of movement organization and control. These approaches to the study of motor control occur at different levels of resolution, requiring different perspectives, and utilizing different concepts and tools. At a biomechanical level, the student seeks to understand the physical basis for movement and the mechanical factors, or rules that govern human movement. At a neurophysiological level, the student seeks insights into the neuronal machinery and the functional neural interactions that underlie motor control. At a behavioural level, the student seeks to understand the processes underlying movement without reference to their physical instantiation.

KIN 311 draws upon the frameworks offered by neurophysiology, biomechanics, experimental psychology, and cognitive neuroscience, with particular emphasis on a behavioural analysis of movement. The focus of this course is upon the mechanisms and principles which govern sensorimotor control as well as the research methods commonly used in motor control research. Students of this course will gain an understanding of the current state of knowledge and its development, and an appreciation of several contemporary issues in motor control.

PREREQUISITES AND/OR COURSE RESTRICTIONS

Enrolment is restricted to students with 3rd year or higher standing in Kinesiology. KIN 311 builds directly on the foundations established in KIN 211 (formerly KIN 230) and assumes knowledge covered in KIN 211.

COURSE FORMAT

The course will consist of two lectures per week with supplementary tutorials.

Tutorials times will be posted on the Canvas course site. The instructor and TA will be available for assistance during tutorials. Tutorial hours will provide students with the opportunity to seek assistance.

GENERAL LEARNING OBJECTIVES

As part of the learning objectives of this course, students will:

1. Discuss major theoretical issues in the field of sensorimotor neuroscience.
2. Discuss fundamental principles and concepts in the study of human sensorimotor control.
3. Discuss how methods from psychology and neuroscience are used to study sensorimotor control.
4. Discuss factors that influence information processing and motor preparation.
5. Discuss neurophysiological correlates of motor preparation.
6. Discuss internal models in sensorimotor control.
7. Discuss feedback and feedforward processes in sensorimotor control and adaptation.
8. Discuss mechanisms of visual-motor control.
9. Discuss dissociations between perception and action in visual-motor control.
10. Discuss dynamical systems principles in the study of sensorimotor coordination.
11. Discuss the rationale of research methods and the links between theory and experiment.
12. Facilitate active learning, critical thinking, and problem-solving skills in the study of human sensorimotor control.

Additional, more detailed, learning objectives will be presented during lectures.

LEARNING ASSESSMENTS

Mid-Term Exam 1 Lectures Sept 4 ~ Oct 2; Readings 1 – 4	October 16, 2024	20%
Mid-Term Exam 2 Lectures Oct 2 ~ Nov 6; Readings 5 – 7	November 18, 2024	30%
Final Examination All Lectures; Readings 8 – 10	December Exam Period	50%

The Mid-term and Final Exams will consist of short-answer and open-ended questions and will cover lecture material and assigned lecture readings. The Final Exam will be cumulative and inclusive of all lecture material covered in the course.

Students are required to write all exams. Mid-term exams will not be rescheduled for any reason. Failure to write an exam will normally result in a mark of zero for that exam.

Mid-term exam weightings can be re-weighted to the Final Exam only if a student applies and is approved for an [Academic Concession](#) through the Kin Advising Office.

If a student does not contact the instructor and provide the approved concession for absence from a Mid-term, a score of zero will be given on the assessment.

Note that the University sets the date for the Final examination. This course will adhere to the date set by the University. As per University regulations, there will be no exceptions to the date of the Final.

The exam weightings will be used to convert raw marks to a final grade percentage at the completion of the course.

GENERAL COURSE TOPICS AND SEQUENCE**Lectures*****Introduction***

Motor Behaviour and Information Processing Framework – A Review

Sensorimotor Transformations in Response Selection

[Readings: 1 – 2]

Principles of Stimulus-Response Compatibility and Cognitive Translation
Cognitive and Spatial Coding Effects in Response Selection

Sensorimotor Transformations in Action Preparation

[Readings: 3 – 4]

Electrophysiological Indices of Response Selection and Preparation
Event and Movement-Related Cortical Potentials in Action Preparation
Corticospinal Excitability in Action Preparation

Sensorimotor Transformations in Perceptual-Motor Integration

[Readings: 5 – 7]

Sensorimotor Integration and the Reafference Principle
Forward and Inverse Models in Sensorimotor Control
Internal Models and Sensorimotor Adaptation

Sensorimotor Transformations in Visual-Motor Control

[Readings: 8 – 10]

Visual Systems for Perception and Action
Dissociations between Perception and Action
Intentional and Automatic Processes in Visual-Motor Control

Sensorimotor Constraints in Perceptual-Motor Coordination

Dynamics of Inter-Limb Coordination: A Dynamical Systems Approach

LEARNING MATERIALS

There is no required textbook for KIN 311. Required readings will be in the form of research articles that can be downloaded from Canvas. Students are responsible for assigned readings. The readings contain more material than can be covered directly in class. Students are responsible for this material, and it will be included in exams.

Required Readings

1. Chen J, & Proctor RW (2012). Up or down: Directional S-R compatibility and natural scrolling. *Proceedings of the Human Factors and Ergonomics Society*, 56, 1381-1385.
2. Lee S, et al. (2016). Control-display alignment determines the prevalent compatibility effect in two-dimensional stimulus-response tasks. *Psychonomic Bulletin & Review*, 23, 571-578.
3. Falkenstein M, et al. (2006). Effects of stimulus-response compatibility in Parkinson's disease: a psychophysiological analysis. *Journal of Neural Transmission*, 113, 1449-1462.
4. Duque J, et al. (2010). Evidence for two concurrent inhibitory mechanisms during response preparation. *The Journal of Neuroscience*, 30, 3793-3802.
5. Sarlegna FR, et al. (2010). Force-field adaptation without proprioception: Can vision be used to model limb dynamics? *Neuropsychologia*, 48, 60-67.
6. Williams LE, et al. (2010). Superior size-weight illusion performance in patients with schizophrenia: Evidence for deficits in forward models. *Schizophrenia Research*, 121, 101-106.
7. Brooks JX & Cullen, KE (2013). The primate cerebellum selectively encodes unexpected self-motion. *Current Biology*, 23, 947-955.
8. Striemer CL, et al. (2009). "Real-time" obstacle avoidance in the absence of primary visual cortex. *Proceedings of the National Academy of Sciences*, 106, 15996-16001.
9. Kroliczak G, et al. (2006). Dissociation of perception and action unmasked by the hollow-face illusion. *Brain Research*, 1080, 9-16.
10. Day BL, & Brown P. (2001). Evidence for subcortical involvement in the visual control of human reaching. *Brain*, 124, 1832-1840.

Course Canvas Site: <http://canvas.ubc.ca>

IMPORTANT DATES

Last date for withdrawal without a W on your transcript: September 16, 2024.

Last date for withdrawal with a W instead of an F on your transcript: October 25, 2024.

UNIVERSITY POLICIES

Regular attendance is expected of students in all their classes (including lectures, laboratories, tutorials, seminars, etc.). Students who neglect their academic work and assignments may be excluded from the final examinations. Students who are unavoidably absent because of illness or disability should report to their instructors on return to classes.

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all their actions.

Details of the policies and how to access support are available on the UBC Senate website ([Policies and Resources to Support Student Success](#)).

COPYRIGHT

All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the Course Instructor or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

IN-TERM CONCESSION

If you need to apply for academic concession for in-term work, apply online through Kin Advising: [Academic Concession](#).
