THE UNIVERSITY OF BRITISH COLUMBIA
School of Human Kinetics
Human Kinetics 468
Winter 2007
Human Motor Performance

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Lectures:	Tuesday & Thursday: 9:30-10:50 am Room: WOOD 2
Labs:	Tue, Thu: 3:30-5:30, Wed: 2:00-4:00 pm (HKIN Computer Lab)

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.

HKIN 330 provides an analysis of the processes that control the acquisition, representation and execution of a skillful act. This course draws upon the frameworks offered by neurophysiology, biomechanics, and experimental psychology, with particular emphasis on a behavioural analysis of movement. The focus of this course is upon the mechanisms and principles which govern motor control as well as the research methods commonly used in motor control research.

The lectures will focus upon issues in human motor control from a behavioural level of analysis and will complement the assigned readings and results from formal group labs. Students of this course will gain an understanding of the current state of knowledge and its development, and an appreciation of a number of contemporary issues in motor control.

Structure

This will be a 3-credit course with a lecture on Tuesday and Thursday and laboratory activities. The dialogue will focus upon concepts, principles, and research in human motor control from a behavioural level of analysis and will complement the assigned readings.

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 appear on exams**. In addition, material will be covered in the lectures that will not appear in the readings.

Laboratories

Students are required to perform laboratory experiments during the course. The purpose of the labs is to complement and reinforce some of the concepts covered in the course, as well as to introduce experimental work in motor control. Students are expected to attend and complete all assigned labs.

Lab handouts will be provided for each lab activity. These handouts will provide a description of the lab activity, as well as an outline of the type of information (e.g., data, presentation of results, activity questions) that students are expected to know. Although no formal reports are required for the labs, students have the option of submitting informal reports to the teaching assistant for feedback. If a student wishes to submit an informal report for feedback, the report must be submitted no later than 2 weeks after the completion of the lab.

Course Learning Objectives

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

1. Discuss fundamental principles and concepts in the study of human motor control.
2. Discuss how chronometric methods are used to study motor control processes.
3. Discuss factors that influence information processing and decision-making.
4. Discuss the role of vision in the control of movement.
5. Discuss open loop processes in the control of movement.
6. Discuss speed-accuracy relations and their underlying principles.
7. Discuss the "degrees of freedom problem" and its theoretical solutions.
8. Discuss dynamical systems principles that are involved in movement coordination.
9. Explain and demonstrate how the scientific method can be used to answer questions about motor control.
10. Discuss the rationale of research methods and experiments and the links between theory and experiment.
11. Be able to facilitate active learning, critical thinking, and problem solving skills in the behavioural analysis of human movement control.

Required Readings

There is no required textbook for HKIN 468.
Required readings (listed below) **will be available for download as Adobe PDF files from the HKIN 468 WebCT course website.**

Bernier, PM., Chua, R., & Franks, I.M. (2005). Is proprioception calibrated during visually guided movements? *Experimental Brain Research, 167,* 292-296.

Carlsen, A.N., Chua, R., Inglis, J.T., Sanderson, D.J., & Franks, I.M. (2004). Can prepared movements be stored subcortically? *Experimental Brain Research, 159*, 301-309.

Goodale, M.A., & Westwood, D.A. (2004). An evolving view of duplex vision: separate but interacting cortical pathways for perception and action. *Current Opinion in Neurobiology, 14*, 203-211.

Goodale, M.A., & Milner, D.A. (1992). Separate visual pathways for perception and action. *Trends in Neuroscience, 15*, 20-25.

Grea, H., Pisella, L., Rossetti, Y., Desmurget, M., Tilikete, C., Grafton, S., Prablanc, C., & Vighetto, A. (2002). A lesion of the posterior parietal cortex disrupts on-line adjustments during aiming movements. *Neuropsychologia, 40,* 2471-2480.

Kelso, J.A.S., Southard, D.L., & Goodman, D. (1979). On the nature of human interlimb coordination. *Science, 203,* 1029-1031.

Leuthold, H., Sommer, W., & Ulrich, R. (2004). Preparing for action: Inferences from CNV and LRP. *Journal of Psychophysiology, 18*, 77 –88.

Proctor, R.W., & Van Zandt, T. (1994). Human factors in simple and complex systems. Boston: Allyn and Bacon.
Proctor, R.W., Wang, D.D., & Pick, H. (2004). Stimulus-response compatibility with wheel rotation responses: Will an incompatible response coding be used when a compatible coding is possible? *Psychonomic Bulletin & Review*, *11*, 841-847.
Wadman, Denier van der Gon, Gueze & Mol (1979). Control of fast goal-directed arm movements. *Journal of Human Movement Studies*, *5*, 3-17.
Wallace, S.A. (1996). *Dynamic pattern perspective of rhythmic movement: An introduction*. In H.N. Zelaznik (Ed.), Advances in motor learning and control (pp. 155-194). Champaign: IL. Human Kinetics Publishers.

Example Reference Texts

Jeannerod, M. (1988). *The Neural and Behavioural Organization of Goal-Directed Movement*. Oxford: Oxford Univ Press.

Kelso, J.A.S. (1995). *Dynamic Patterns: The Self-Organization of Brain and Behavior*. Cambridge, MA: MIT Press.

Rosenbaum, D.A. (1991). *Human Motor Control*. San Diego, CA: Academic Press, Inc.

Schmidt, R.A., and Lee, T.D. (2005). *Motor Control and Learning: A Behavioral Emphasis (4th Ed.)*. Champaign, Illinois: Human Kinetics Publishers.

WebCT Course Website

The readings as well as some course notes will be available for download as Adobe PDF files from the course website. To access the course website, you must be properly registered in the course, and have a UBC Netinfo account. Visit the WebCT site, www.webct.ubc.ca, for access to the course and for WebCT help information.

Assessments and Examinations

Assessment of learning objectives will be conducted through written examinations.

A **lab exam** will be held at the end of the term to assess knowledge and understanding of theoretical and methodological topics from the labs. Students are responsible for material from all labs.

The **Midterm and Final Exams** will consist of multiple-choice and short answer questions. Greater weight will normally be placed on the open-ended questions. **The Final Exam will be cumulative and inclusive of all material covered in the course.**

Students must write all exams. Failure to write an exam will result in a mark of zero for that exam. 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, no exceptions to the date of the final exam will be made.**

Evaluation Profile and Exam Dates

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

Mid-Term Exam	30%	March 1, 2007
Lab Exam	20%	April 5, 2007
Final Examination	50%	TBA

Lecture Topics and Readings

Topics	Readings
Introduction to Human Motor Control	
Motor Control: A Behavioural Emphasis	
Chronometric Investigations of Motor Behaviour	
Information-Processing Framework	Proctor & Van Zandt (1994)
Response Selection and Reaction Time	Proctor et al. (2004)
Stimulus-Response Compatibility	
Preparation of Movement	
Motor Programs and Preplanned Movements	Wadman et al. (1979)
Evidence for Preplanned Movements	Leuthold et al. (2004)
Electrophysiological and Behavioural Correlates of Preparation	Carlsen et al. (2004)
Basic Principles of Simple Movement	
Speed-Accuracy Tradeoff	
Central and Sensory Contributions to Speed-Accuracy Tradeoff	
Visual Control of Movement	
	Bernier et al. (2005)
Role of Visual Feedback	Grea et al. (2002)
Visual-Motor Integration	Goodale & Westwood (2004)
Two Visual Systems for Perception and Action	Goodale & Milner (1992)
Coordination and Regulation of Movement	
Degrees of Freedom Problem	
Muscle Synergies and Coordinative Structures	Kelso et al. (1979)
Coordination Dynamics	Wallace (1996)
Dynamics of Interlimb Coordination	
Learning Dynamics	

Laboratory Topics and Activities

The lab schedule is listed below. Labs will be held in the HKIN undergraduate computing lab. **Students are responsible for the material covered during lab activities and this material will appear on exams.** Thus, it is imperative that students understand the concepts and research methodologies involved, the rationale underlying the methodologies, the data collection and analyses, and the link between theory, hypotheses, and experiment.

Date	Lab	Activity
Week 1 January 8-12		No Lab
Week 2 January 15-19	**1**	*Choice RT/Spatial Compatibility*
Week 3 January 22-26	**2**	*Simon Effect*
Week 4 January 29-Feb 2	**3**	*Pre-Cueing and Movement Preparation*
Week 5 February 5-9	**4**	*EMG and Kinematic Patterns of Rapid Movements*
Week 6 February 12-16		No Lab
Week 7 February 26-Mar 2		No Lab
Week 8 March 5-9	**5**	*Visual Control of Movement*
Week 9 March 12-16	**6**	*Coordination*
Week 10 March 19-23		No Lab
Week 11 March 26-30	**Tutorial**	**Tutorial Session**
Week 12 April 2-6	**Exam**	**Lab Exam**
Week 13 April 9-13		No Lab