

Psychology 390/392 section 1 Research in Human Cognitive Neuroscience, Winter 2019

Location: PAS 2259

Time: Tues 8:30-10:20, Thursday 8:30- 10:20

Instructor: Professor Mike Dixon

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Course is listed on Desire to Learn

<https://learn.uwaterloo.ca>

Expanded Course Description

This course is a lab course that will introduce students to some of the techniques used in conducting experiments in human cognitive neuroscience with a particular emphasis on psychophysiology. Students will be taught how to program a simple experiment and accurately acquire response time data. They will be taught how to gather a number of psychophysiological measures. The psychophysiological measures acquired will reflect brain-body relationships e.g., how psychological reactions can influence heart rate, and changes in skin conductance (i.e., sweat increases or decreases related to the processing of external information). Students will be taught how to apply these different measures to conduct research in a number of diverse areas including a slot machine simulator, video game playing, and distortions of body schema. Students will gain experience by collecting data on themselves and their lab team members (the data is solely for educational purposes not for formal research).

This course is first and foremost an experiential learning course where students will learn by doing. After being introduced to the theory and practice of these experimental techniques (and completing labs to solidify their learning), students will be asked to work in small teams, program their own experiments, and collect sample data on themselves and team members and write up a final report on their self-generated project. As an experiential learning course, this course will allow you to: practice and apply techniques of psychological measurement and quantitative analysis; collect data to assess the validity of

a hypothesis; experience and evaluate research from the standpoint of a study participant, and from the standpoint of an experimenter.

Course Requirements and Evaluation: 4 Labs and a Final Report

Marks in this course will be based on 4 labs (lab 1 = 10% lab 2 = 20%, lab 3 = 10%, and lab 4 = 20%), and the final project report (40%). All labs and the final report will be submitted via electronic drop boxes on the *Learn* site.

A note on Late Lab and Final Reports. All late Reports will be penalized. For every day that an assignment is late, 10% will be deducted from your assignment grade. For example, if you received 100% on lab report 1 but handed it in two days late you would receive 80% on this lab.

LABS:

10% Laboratory Report 1: Students will work in pairs and learn to program in SuperLab. Each student will submit via *Learn's* electronic dropbox, a program that they have created using SuperLab, along with an excel workbook containing both raw and analyzed response time and error data. Part of Lab 1 will involve answering a short answer quiz on LEARN.

20% Laboratory Report 2: Students will work in teams of 5 or 6. Each member of the team will record their heart rate, filter their heart rate, and record beats per minute as they play a simple (non-violent) video game. Using Powerlab and "LabChart" software students will then learn to analyze their heart rate and graph the results in Excel. Then each team member will write up their own individual APA-formatted Method Section outlining the apparatus and procedures used in the video game study. Finally, they will analyse the data on the vagal tone changes of a person (me!) at rest, and under mental stress. Files for the video game (Chart and Excel), word files for the method section, and excel files for the vagal tone analysis will be submitted via the electronic dropbox on *Learn*.

10% Laboratory Report 3: Students will work in teams of 5 or 6. Using Powerlab and LabChart software students will record Skin Conductance Responses for an experiment involving an illusion involving a distortion of body schema (the "rubber hand" illusion). Each student will submit via electronic dropbox on *Learn*, the LabChart files which they recorded and an excel file summarizing their results. They will also complete a short-answer quiz as part of this lab.

20% Laboratory Report 4: Students will learn more complex data analytic techniques involving analyzing the physiological responses of people playing on a slot machine simulator. Students will learn how to analyze event-related individual psychophysical responses to wins, losses, and a special type of slot-machine loss called a "near miss". Each student will submit via *Learn's* electronic dropbox the LabChart files they analysed and an excel file with the relevant data analyses.

Final Report - Worth 40% of student's mark.

Students will work in pairs or teams of three. Each student will create an experiment (typically in SuperLab), interface the experiment with Powerlab (the psychophysiological data acquisition system), collect sample data using either electrocardiogram variables (heart rate, inter-beat intervals, vagal tone), or skin conductance changes as the dependent variables, and analyse these data. Each student will: write a 250 word abstract, write a brief (4 page double spaced) introduction summarizing research on their topic, write a 3-4 page method section, write a 2-page results section summarizing their findings, and a 4-page discussion, followed by references in APA format. Before conducting the experiment, all projects must be approved by Dr. Dixon or by the T.A. A one-page proposal must be submitted via electronic dropbox for approval prior to any programming or data collection. This proposal is due on Mar 12th. The final lab report is due in the exam period on April 17th and must be submitted via electronic dropbox.

A note on collaboration. Although team members should consult with one another, agree on a final project, and work together on this project, *each individual student will submit their own proposal and their own final report about their agreed-upon project.*

Here are some possible experiments.

1. Electrodermal and heart rate responses to different types of video-games (strategic vs, racing) *NB* video games must be non-violent.
2. Electrodermal and heart rate responses to happy, neutral and sad movie clips.
3. Psychophysical responses to faces showing positive, neutral and negative (angry) faces.
4. Psychophysical responses to classically conditioned stimuli.
5. Vagal tone changes during deep breathing vs mental stress (e.g., counting backwards by 3 from 1486).
6. Lie detection.
7. SCR and Heart Rate reactions to frustration.
8. SCR and Heart Rate responses to different types of music.
9. Restorative effects of Nature scenes, and audio clips

A note on Powerlab and the Imacs. Each powerlab system costs in excess of \$8000. The IMacs cost \$1,300 each. Treat them with extreme care. **NO FOOD OR DRINKS ARE ALLOWED IN THE LAB ROOM.**

Schedule of Topics

Note: All readings will be available within *Learn*. As mentioned all submissions will be via electronic drop box in *Learn*.

Jan 8 Overview of Research in Human Cognitive Neuroscience

- Cognitive Neuroscience using behavioural measures

Jan 10 Overview of Superlab

Reading: [Dixon M. J.](#), Smilek, D., Cudahy, C., Merikle, P.M. (2000)
[Five plus two equals yellow](#) *Nature*, 406, 365.

- programming a Stroop Experiment
- running a Stroop Experiment

Jan 15 Analyzing the data, outlier trimming and rudimentary data analysis/summarization using Microsoft Excel.

Jan 17- Intro to LABORATORY 1 - Strategic and Automatic Influences on Stroop Performance

Jan 17 - LABORATORY 1 in class data collection and analysis.

Jan 22 - LABORATORY 1 in class data collection and analysis.

Jan 24 - Finish LABORATORY 1 complete in-class work on data analysis and short answer quiz

DEADLINE: Laboratory 1 must be submitted by Jan 24 (at or before 11:59 p.m.)

Jan 29

Reading: John L Andreassi, J.L. (2000). Heart Activity and Behavior I: Developmental Factors, Motor and Mental Activities, Perception, Attention, and Orienting Responses. Chapter In Psychophysiology: Human Behaviour and Physiological Response. Lawrence Erlbaum Associates, London

Reading: Laborde, S., Mosley, E., Thayer, J.F. (2017) Heart rate variability Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research – Recommendations for Experiment Planning, Data Analysis, and Data Reporting, *Frontiers in Psychology*, 2

- Psychophysiology of the human heart
- Introduction to Powerlab

Jan 29

- Introduction to LabChart Software

Jan 31

LABORATORY 2 Heart Rate Responses to Playing a Video Game (Tonic effects), and Heart Rate Changes under Mental Stress (Phasic effects)

- Reading: Turner, R. J., Carroll, D. and Courtney, H. (1983). Cardiac and metabolic responses to space invaders: An instance of metabolically-exaggerated cardiac adjustment? *Psychophysiology*, 20, 544-549.

Feb 5

- LABORATORY 2 data collection and analysis for Laboratory 2.

Feb 7

- LABORATORY 2 data analysis and completion of Laboratory 2.

DEADLINE: Laboratory 2 must be submitted by Feb 7th (at or before 11:59 p.m.)

Feb 12

Introduction to electrodermal measures, and recording of skin conductance levels and skin conductance responses (SCRs) using Powerlab.

Reading: Dawson, M.E., Schell, A.M., and Filion, D. (2007). The Electrodermal System. In *Handbook of Psychophysiology*, 3RD Edition, (J.T. Cacioppo, L.G. Tassinari, G.G. Bernston Eds.), Cambridge University Press.

Reading Armel, K.C., and Ramachandran, V. S. (2003). Projecting sensations to external objects: Evidence from skin conductance response. *Proceedings of the Royal Society, B: Biological Sciences*, 270, 1499-1506.

LABORATORY 3 - The rubber hand illusion

Feb 14

Data collection and analysis of Laboratory 3.

Feb 26

LABORATORY 3 - Completion of analysis for Laboratory 3.

DEADLINE: Laboratory 3 must be submitted by Feb 26 (at or before 11:59 p.m.)

Feb 28

Introduction to Macros in LabChart

LABORATORY 4 Analyzing Slot Machine Outcomes: Wins, Losses and Near Misses.

Readings: Dixon, M.J., MacLaren, V., Jarick, M., Fugelsang, J.A., and Harrigan, K.A. (2013). The Frustrating effects of just missing the jackpot: Slot machine near-misses trigger large skin conductance responses, but no post-reinforcement pauses. *Journal of Gambling Studies*, 29, 661-674. doi: 10.1007/s10899-012-9333-x.

Dixon, M.J., Larche, C.J., Stange, M., Graydon, C. & Fugelsang, J.A. (2017, in press). Near-Misses and Stop Buttons in Slot Machine Play: An Investigation of How They Affect Players, and May Foster Erroneous Cognitions, *Journal of Gambling Studies*.

Mar 5 - LABORATORY 4 - Data Analysis for Laboratory 4.

Mar 7 - LABORATORY 4 - Data Analysis for Laboratory 4.

Mar 12 - LABORATORY 4 - Data Analysis for Laboratory 4.

DEADLINE: Laboratory 4 must be submitted Mar 12 (at or before 11:59 p.m.)

DEADLINE: 1 Page Proposal for the final paper must be submitted Mar 12 (at or before 11:59 p.m.)

Mar 14 Begin Work on student projects

March 19, 21, 26, 28, 2, 4th In-class work on the student projects.

DEADLINE: FINAL REPORTS DUE APRIL 17th (at or before 11:59 p.m.)

The Information That Appears on All Course Syllabi...

Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. See the [Office of Academic Integrity webpage](#) for more information.

Discipline

A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. Check [the Office of Academic Integrity](#) for more information. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to [Policy 71 - Student Discipline](#). For typical penalties check [Guidelines for the Assessment of Penalties](#).

Concerns about a Course Policy or Decision

Informal Stage. We in the Psychology Department take great pride in the high quality of our program and our instructors. Though infrequent, we know that students occasionally find themselves in situations of conflict with their instructors over course policies or grade assessments. If such a conflict arises, the Associate Chair for Undergraduate Affairs (Richard Eibach) is available for consultation and to mediate a resolution between the student and instructor: Email: reibach@uwaterloo.ca; Ph 519-888-4567 ext. 38790

Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact Richard Eibach, the Associate Chair for Undergraduate Affairs who will provide further assistance; reibach@uwaterloo.ca.

Appeals

A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to [Policy 72 - Student Appeals](#).

Note for Students with Disabilities

The [AccessAbility Services](#) office, located on the first floor of the Needles Hall extension (NH 1401), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.

Accommodation for course requirements for Psychology courses.

Policies of the Psychology department pertaining to course requirements are available on the [department website](#).

Mental Health Services

Mental Health Services aim is to provide holistic programming and services to help you lead a healthy and balanced life. We strive to provide a secure, supportive environment for students of all orientations and backgrounds.

Students suffering from problems with anxiety, depression, problems with sleep, attention, obsessions or compulsions, relationship difficulties, severe winter blues, etc., may make an appointment by phone or in person. Appointments are usually available within two days of initial contact with one of our medical doctors. All contacts are completely confidential.

Contact Health Services
Health Services Building
Call 519-888-4096 to schedule an appointment
Call 1-866-797-0000 for free 24/7 advice from a health professional
Contact Counselling Services
Needles Hall Addition, NH 2401
Call 519-888-4567 x 32655 to schedule an appointment
counserv@uwaterloo.ca

Territorial Acknowledgement

We acknowledge that we are living and working on the traditional territory of the Attawandaron (also known as Neutral), Anishinaabe and Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes six miles on each side of the Grand River.