Introduction to Psychophysiology, PSY 5360M, Spring 2018

Section 251: Tues & Thurs 11:00 am – 12:20 pm, UAC 205

Instructor: Dr. Logan Trujillo, Ph.D., logant@txstate.edu, Office: UAC 274, Phone: (512)-245-3623, Office Hours: Tues/Thurs 12:30-1:50 pm, Wed 1 – 4 pm, & by Appt.

Course Description: This course will provide an overview of the principles, theory, and applications of using physiological measures to study mental processes. This course will illustrate how the use of psychophysiological measurements can enhance our understanding of brain/mind/behavior relationships.

Reading Materials (Required)

- Cacioppo, J.T., Tassinary, L.G., & Berntson, G.G. (2007). Handbook of Psychophysiology (3rd edition). Cambridge, UK: Cambridge University Press.
    - This book is available as an e-book with chapter pdf downloads via the Texas State University Library at

      http://libproxy.txstate.edu/login?url=http://dx.doi.org/10.1017/CBO9780511546396
- Ryan, C.W. (1986). Basic Electricity: A Self-Teaching Guide (2nd Edition). New York: John Wiley and Sons.
    - This book is out of print but PDFs of the relevant chapters will be made available to the students by the instructor via TRACS.
- Instructor-provided assortment of papers available on the course TRACS site.

Course Goals and Learning Objectives: By the end of the course, students should be able to:

1. Demonstrate knowledge of the philosophical and theoretical foundations of brain/mind/behavior relationships
2. Understand and explain the basic human neurophysiology and associated electrical principles that underlie the sources and characteristics of physiological signals.
3. Understand and explain the basic techniques and main findings of several major contemporary approaches to psychophysiological research.
4. Assess and critique published psychophysiological research.
5. Demonstrate practical ability to record and analyze physiological data (including advanced signal processing and brain source localization techniques).
6. Apply psychophysiological principles, methods, and techniques to the empirical understanding of brain/mind/behavior relationships.
7. Communicate psychophysiological research and data via written research proposals and oral presentations.

Lectures & Readings: The Course Outline (see below) lists the various topics and readings corresponding to each class lecture. Instructor lectures will be mainly focused on methods and broad applications; specific applications will be covered by student presentations (see below). It is highly recommended that, whenever possible, you complete the assigned readings *BEFORE* the corresponding lecture. (Note that students will only be responsible to read the readings for instructor lectures and lab exercises, and not the readings for student presentations; see below.) Course lectures will be made available for online download the day of class via TRACS. These lectures are for your own personal use. Please be aware that these lectures are intellectual property and must not be posted elsewhere online (except by me) or distributed in any other way (including written transcripts or "notes" formats) without written consent from me. Violation of these terms will be considered a breach of the university honor code, and violators will be penalized accordingly.

IMPORTANT NOTE: we will be covering technical material, and you should feel quite free to interject your questions when they occur to you. Please let me know when something we discuss is not clear. It will enable me to provide additional information when needed or to explain a concept in different terms. I also ask you to give me feedback on your learning in informal as well as formal ways such as assignments or exams or course evaluations.

Assessment of Student Learning:

Basic Electricity Exam (200 points, 20% of final grade). An online pass/fail test over the relevant material presented in class and readings. Students must score above 90% to pass and may retake the test once.

Lab Participation and Reports (5 labs @ 60 points each, 300 points total, 30% of final grade). Five labs will be required. After a short in-class introduction, labs will be conducted by groups of 4-5 students either during class or during an agreed upon time outside of class. All labs will be supervised by the instructor and/or trained graduate student assistants. Students will then independently generate a short, 2 – 3 page write up of what was done and the corresponding results.

Research Project Proposal and Presentation (Paper = 250 points, Presentation = 50 points, 300 points total, 30% of final grade). This will be focused on a specific topic of interest chosen by the student. Students will construct a formal research proposal (APA style; 10-15 pages, double spaced) that uses one or more psychophysiological techniques. Students will also give a brief (5-10 minute) in-class presentation of the proposal during the time normally reserved for the final exam. A brief prospectus of the proposal for my approval will be due to me a few weeks before the due date (see Course Outline).

Class Participation (200 points, 20% of final grade). Students must actively participate in class discussions and give one short in-class presentation (10 – 15 minutes) about a research article in a specific area of psychophysiology. The article will be of the students' own choosing, but the instructor will assign the particular topic area. Students must notify the instructor about their choice and provide the class with a pdf of the article at least ONE WEEK before the scheduled presentation. These presentations will be completed in the first two-thirds of the semester.

Note that students will not be responsible to read the articles for student presentations (except for the article for their own presentation, of course). However, if you want to get the most out of this class, you are HIGHLY ENCOURAGED to read as many of the student presentation articles as possible.

After every assignment is graded, I will provide you with your current course grade via TRACS. If you have any questions about the grading system, please ask me.

Late Policy: Late assignments affect your ability to keep up with the class in your studies. Lab reports and research proposals will be due electronically via TRACS by midnight of the due date. Deadline times are published in the course outline. All assignments will be subject to a 5% point penalty for each day that they are late.

There are instances where late work may be graded with full credit, such as: 1) illness or injury requiring treatment by a doctor; 2) death of a family member; 3) required participation in a University-sponsored activity; 4) jury duty or other required court participation; 5) a field trip or off-campus activity required for a non-elective course essential to the student's degree program; 6) required participation in active military service; 7) official religious Holy Days. In these cases, students must provide documentation of these events for late work to be accepted without penalty.

Policy on Incomplete Grades: An I grade will be assigned only for work that has been interrupted by a serious, unanticipated and uncontrollable event (e.g., illness, death in the family, accident) that is not due to negligence by the student. An I grade will not be assigned as a substitute for, or to allow you to avoid receiving, a failing grade.

Students with Disabilities: If you are a student with a disability who will require accommodations for this course, please contact me as soon as possible or else your accommodations may be delayed. You must provide documentation from the Office of Disability Services (http://www.ods.txstate.edu/).

Academic Honesty: According to the University's Honor Code located at

(http://www.txstate.edu/effective/upps/upps-07-10-01.html)

academically dishonest behavior includes (but is not limited to) 1) ***cheating*** (the use of notes, notations written on your body, clothing, or materials, or any information provided by other people during quizzes and exams), 2) ***plagiarism*** (submitting work completed by someone else for credit, claiming credit for someone else's words or thoughts), 3) ***collusion*** (the unauthorized collaboration with another person in preparing any work offered for credit), and 4) **abuse of course materials** (the mutilation, destruction, concealment, theft, or alteration of materials provided to assist students in the mastery of course content). In particular, initial honor code violations will result in a student-teacher conference and a grade of "zero" for the quiz, exam, or assignment in question; subsequent offenses will result in a course grade of "F," and possible disciplinary action via the Dean of Students.

Classroom Civility: Students and faculty are full partners in fostering a classroom environment which is conducive to learning. Our actions should promote respect for both one another and the traditions of collegiate learning. Class sizes and emphases can create situations in which acceptable behavior in one course may be unsatisfactory in another situation, as for example when collaborative team work can lead to movement and in-class conversation, which may be totally inappropriate in a large lecture class. Texas State policy (PPS 4.02) describes general behaviors that are always disruptive. Examples of such behaviors include but are not limited to: making loud noises, speaking without recognition, making personal threats or insults, eating or drinking in classrooms, sleeping during class, using electronic equipment prohibited by the instructor or disrespectful of other students, using inappropriate or vulgar language, or taking other actions that others might find offensive, demeaning, or disrespectful. As the instructor in this class I will be the judge of behaviors that threaten the civility of the learning environment, and, when appropriate or necessary, I will bring such behavior to the attention of the class or individuals in the class.

Mandatory Reporting of Sexual Misconduct: As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I also have a mandatory reporting responsibility related to my role as an Assistant Professor. It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information you share private to the greatest extent possible. However, please be advised that I am required to report information regarding sexual misconduct to the appropriate Texas State University administration officials.

Course Outline (all dates and material covered are approximate and subject to change with notification, except for the electricity exam and final project presentation):

- Indicates lab activities that must be completed within the week following

Date	Content	Readings & Assignments Due
Jan 18	Foundations: Using physiology to study psychological processes	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 1 - Psychophysiological Science – Interdisciplinary approaches to classic questions about the mind
Jan 23	Basic Electricity – Part 1	***Lecture Reading:*** Chapter 1-3 in Ryan, C.W. (1986). *Basic Electricity: A Self-Teaching Guide (2nd Edition)*. New York: John Wiley and Sons.
Jan 25	Basic Electricity – Part 2; Neuroanatomy & Neurophysiology – Part 1	***Lecture Readings:*** 1 – Chapter 4-5 in Ryan, C.W. (1986). *Basic Electricity: A Self-Teaching Guide (2nd Edition)*. New York: John Wiley and Sons. 2 – Cellular organization of the nervous system – from *Fundamentals of Human Neuropsychology*, B. Kolb and I.Q. Whishaw (Eds)
Jan 30	Neuroanatomy & Neurophysiology – Part 2	***Lecture Reading:*** Organization of the nervous system – from *Fundamentals of Human Neuropsychology*, B. Kolb and I.Q. Whishaw (Eds)
Feb 1	Electrodermal Activity	***Lecture Readings:*** 1 – *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 7 – The Electrodermal System. 2 – *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 25 - Emotion and motivation, pp. 581 – 587 & 589 – 590. ***Student Presentation Readings (To Be Announced)***
Feb 2	***TRACS Online Electricity Exam; Due By Midnight***	
Feb 6	Electrodermal Activity: Hands On Experience (In-Class Lab 1 – SCR)	***Lab Reading:*** Lang, P. J., Greenwald, M. K., Bradley, M. M., & Hamm, A. O. (1993). Looking at pictures: Affective, visceral, and behavioral reactions. *Psychophysiology, 30*, 261–173. • Lab report due by midnight 02/13/2018
Feb 8	Cardiovascular Psychophysiology	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 8 – Cardiovascular Physiology *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 25 - Emotion and motivation, pp. 587 – 589.

Feb 13	Cardiovascular Psychophysiology: Hands on Experience (In-Class Lab 2 – ECG)	***Lab Reading:*** Allen, J.J.B., Chambers, A.S., & Towers, D.N. (2007). The many metrics of cardiac chronotropy: A pragmatic primer and a brief comparison of metrics. *Biological Psychology, 74*, 243–262. • Lab report due by midnight 02/22/2018
Feb 15	The Skeletomotor System	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 12 – The Skeletomotor System: Surface Electromyography. ***Student Presentation Readings (To Be Announced)***
Feb 20	The Skeletomotor System: Hands On Experience (In-Class Lab 3 – EMG)	***Lab Reading:*** Principe, C. P., & Langlois, J. H. (2011). Faces differing in attractiveness elicit corresponding affective responses. *Cognition and Emotion, 25*, 140–148. • Lab report due by midnight 03/1/2018
Feb 22	The Electroencephalogram, Basics in Recording EEG & Frequency Domain Analysis	***Lecture Reading:*** Handbook of Psychophysiology, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 3 - Electroencephalography and High-density electrophysiological source localization. pp. 56 - 67
Feb 27	EEG Asymmetry	1 – Allen, J.J.B., Coan, J.A., & Nazarian, M. (2004) Issues and assumptions on the road from raw signals to metrics of frontal EEG asymmetry in emotion. *Biological Psychology, 67*,183-218. 2 – Stewart, J.L., Bismark, A.W., Towers, D.N., Coan, J.A., & Allen, J.J.B. (2010). Resting frontal EEG asymmetry as an endophenotype for depression risk: Sex-specific patterns of frontal brain asymmetry. *Journal of Abnormal Psychology, 119* ,502-512 3 – Peterson, C.K., Shackman, A.J., & Harmon-Jones, E. (2008). The role of asymmetrical frontal cortical activity in aggression. *Psychophysiology, 45*, 86–92. ***Student Presentation Readings (To Be Announced)***
Mar 1	EEG Hands On Experience (Lab 4 – Group 1)	No additional reading for this lab. • Lab report due by midnight 03/22/2018
Mar 6	EEG Hands On Experience (Lab 4 – Group 2)	No additional reading for this lab. • Lab report due by midnight 03/27/2018

Mar 8	The Event-Related Potential (ERP) – Basics & Applications	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 4 – Event-related Brain Potentials: Methods, theory, and applications 1 – Trujillo, L.T., Allen, J.B., Schnyer, D.M., & Peterson, M.A. (2010). Neurophysiological evidence for the influence of past experience on figure-ground perception. *Journal of Vision. 20*, 1-21. 2 – Mangun, G. R. (1995). Neural mechanisms of visual selective attention, *Psychophysiology, 32*, 4–18. 3 – Trujillo, L.T., Kornguth, S., & Schnyer, D.M. (2009). An ERP examination of the different effects of sleep deprivation on exogenously cued and endogenously cued attention. *Sleep, 32*, 1285–1297. 4 – Bentin, S., Allison, T., Puce, A., Perez, E., & McCarthy, G. (1996). Electrophysiological studies of face perception in humans. *Journal of Cognitive Neuroscience, 8*, 551–565.
Mar 20	ERP Hands On Experience (Lab 5 – Group 1)	***Lab Reading:*** No additional reading for this lab. • Lab report due by midnight 04/05/2018
Mar 22	ERP Hands On Experience (Lab 5 – Group 2)	***Lab Reading:*** No additional reading for this lab. • Lab report due by midnight 04/10/2018
Mar 27	Magnetoencephalography (MEG) & EEG/MEG Source Localization – Part 1	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 3 - Electroencephalography and High-density electrophysiological source localization. pp. 69 – 84
Mar 29	Magnetoencephalography (MEG) & EEG/MEG Source Localization – Part 2	***Lecture Reading:*** Slotnick, S. D. (2005). Source localization of ERP generators. In T. C. Handy (Ed.), *Event-Related Potentials* (pp. 149–166). Cambridge, MA: MIT Press.
Apr 3	No Class	• Catch-Up Day
Apr 5	No Class	• Catch-Up Day
Apr 10	Advanced Signal Processing – General Issues, EEG Reference, Signal-to-Noise Ratio (SNR), Artifact Rejection & Correction	***Lecture Readings:*** 1 – *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 35 – Biosignal Processing, pp. 834 – 836.

Apr 12	Advanced Signal Processing – Filtering, Latency Jitter, ERP Overlap, Baselines	***Lecture Readings:*** 1 – *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 35 – Biosignal Processing, pp. 849 – 853, 854 – 856. 2 – Spencer, K. M. (2005). Averaging, detection, and classification of single-trial ERPs. In T. C. Handy (Ed.), *Event-Related Potentials* (pp. 209–228). Cambridge, MA: MIT Press. 3 – Talsma, D., & Woldorff, M. G. (2005). Methods for the estimation and removal of artifacts and overlap in ERP waveforms. In T. C. Handy (Ed.), *Event-Related Potentials* (pp. 115–148). Cambridge, MA: MIT Press. • Final Project Prospectus Due
Apr 17	Advanced Signal Processing – Difference Waves, Response Quantification, Plotting, Statistical Analysis	• No additional readings
Apr 19	Advanced Signal Processing – Time Frequency Analysis (Part 1)	***Lecture Reading:*** *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 3 - Electroencephalography and High-density electrophysiological source localization. pp. 65–69.
Apr 24	Advanced Signal Processing – Time Frequency Analysis (Part 2)	***Lecture Reading:*** Herrman, C. S., Grigutsch, M., & Busch, N. A. (2005). EEG oscillations and wavelet analysis. In T. C. Handy (Ed.), *Event-Related Potentials* (pp. 229–260). Cambridge, MA: MIT Press.
Apr 26	Advanced Signal Processing - Principle Components Analysis, Independent Components Analysis, Machine Learning, & Brain-Computer Interfaces	***Lecture Readings:*** 1 – *Handbook of Psychophysiology*, J.T. Cacioppo, L.G. Tassinary, Berntson, Eds. Chapter 35 – Biosignal Processing, pp. 853–854. 2 – Makeig, S. et al. (1999).Functionally independent components of the late positive event-related potential during visual spatial attention. *Journal of Neuroscience, 19*, 2665 – 2680. 3 – Stahl, D. et al. (2012). Novel machine learning methods for ERP analysis: A validation from research on infants at risk for autism. *Developmental Neuropsychology, 37*, 274 – 298. 4 – Birbaumer, N. (2006). Breaking the silence: Brain-computer Interfaces (BCI) for communication and motor control. *Psychophysiology, 43*, 517–532.
Apr 27	No Class	Final Project Papers Due
May 3	Final Exam Class (11:00 am – 1:30 pm)	Student Presentations of Final Projects