PSY 401A/501A, *Principles of Psychophysiology*
Spring, 2025, Mondays, 2^{00}-4^{45} P.M.
Room 321 Psychology

Instructor

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Office Hours: 5^{00}-6^{00} P.M. Wednesdays (Zoom Link on D2L)

Course Description and Objectives

This course will provide an overview of the principles, theory, and applications of psychophysiological assessment. The course has three main objectives:

a) to provide an introduction to major psychophysiological measures, covering their physiological bases, proper recording and signal processing procedures, and appropriate interpretation;
b) to provide an introduction to theory and research in major areas of human psychophysiology with specific applications to the study of cognition, affect, and psychopathology; and,
c) to provide an introduction to laboratory techniques and methodological principles in human psychophysiology.

The latter goal will be met through didactic as well as experiential means. For this reason, the course is designed to be taken (but not required to be taken) concurrently with PSY 501B, *Psychophysiology Laboratory*. For those of you who wish to dig deeper into the analysis of psychophysiological signals, you might also consider taking PSY 516 *Analyzing Neural Time-series Data*, offered in alternate spring semesters.

Expected Learning Outcomes

Students will be able to:

a) understand and critically evaluate psychophysiological methods reported in scientific papers;
b) critique the interpretation of findings from psychophysiological research, evaluating the extent to which researchers have appropriately interpreted their psychophysiological findings;
c) Propose or analyze a study that utilizes psychophysiological measures to answer a question of psychological significance.

Course Webpage

Please visit the course webpage (psychophyslab.arizona.edu, courses) for links to:

- Copies of lecture slides
- The reading list with links to download pdfs and access the book electronically
- A copy of the research proposal requirements and guidelines

Any changes to the course content or schedule will be reflected on the course webpage.

D2L

Despite my general dislike of D2L, we will use it for calendar, gradebook, and assignments. Many other materials will be available from the course webpage (psychophyslab.arizona.edu, courses).

Course Structure

The course will involve a combination of lecture, discussion, and demonstrations. I will bring in samples of physiological signals for us to examine, and if you have psychophysiological data you are interested in examining, please let me know. There is no explicit participation requirement, but you will get more out of the course if you ask questions as they arise. We will be covering technical material, and you should feel quite free to interject your questions when they occur to you. Each class period, you will submit a question or comment that arose for you in the context of the lecture, using the class website. Doing so will provide me with feedback in terms of how the material is being understood (or not understood!), and I will answer some of the questions at the start of the next class session.

Readings

Readings will be taken from two textbooks. The *Handbook of Psychophysiology* is a rather expensive but comprehensive handbook that will serve as a great reference for those of you who have continuing interest in the field. This book is

also available as an electronic book (follow link on the class webpage to the reading list for downloads). The other book is out of print, but is available as a pdf, available for download at that same link. Readings will also be taken from other sources, which are available as pdf files for downloading (from that same link). Some required readings are listed for each class session, with optional readings for those wishing to gain more in-depth knowledge about any particular set of topics. Optional readings for any given topic may be of special interest for those of you working with a particular psychophysiological measure, or for those of you writing your required research proposal/report (see below) on the topic.

The main single source of readings for the course is:

Cacioppo, J.T., Tassinary, L.G., & Berntson, G.G (2016). *Handbook of Psychophysiology* (4th edition). Cambridge, UK: Cambridge University Press.

The assigned readings from this text are listed below under the schedule of topics and readings. The other textbook is a programmed-learning text in basic electricity that is available for download from the link above:

Ryan, C.W. (1986). *Basic Electricity: A Self-Teaching Guide* (2nd Edition). New York: John Wiley and Sons.

You should complete Chapters 1-5 of the Ryan programmed text. There will be a pass/fail test covering this material to be administered at the beginning of class 17 February, 2025. You must score above 80% to pass; you may retake the test should you need to do so.

Evaluation

Students in 401A will be evaluated separately from those in 501A. Your grade will be determined by:

- The electricity test (passing gives you 20% of the total points; failing = no points);
- Attendance (10%);
- Your grade on a research proposal/report (40%, details will be available on the course webpage, due May 5, 2025, 2 pm, via D2L)
- Your performance on a take-home final (30%, due 11 May, 2025, 11:59 pm, via D2L). The take-home final will be given to students on the last day of class.

Late papers or exams will receive a 10% reduction in possible points for each day such papers or exams are late.

The research proposal/report will have different requirements for those enrolled in 401A versus 501A. Full details will be available later in the semester. In short, 401A students will propose a research study. Those in 501A will have this option to propose a research study, or an option to analyze data they may have access to, and to present the analysis in the form of a methods/results section.

Your letter grade will be determined in the following way: The highest total score (based on the electricity test, attendance, the research proposal/report, and the take home final) attained by any student in the class (for 401A and for 501A, considered separately) will become the reference score for grading. There will therefore be one reference score for 401A, and one for 501A. The student(s) with this highest total score will receive a grade of 100%. All other students will receive a percentage grade based upon this highest score, and the following scale will be applied:

90% & above = **A**
80%-89% = **B**
70%-79% = **C**
60%-69% = **D**
Below 60% = **Fail**

Incompletes

Short of major medical illness or global catastrophe, there is virtually no reason I will award an incomplete grade for this course. Incompletes merely move a crisis from one time to another.

Absences

In general, if you need to miss class, you will lose attendance credit for that day. You can get notes and a video podcast of that day's lecture and activities from the course website.

If you are feeling unwell you should not attend class in-person. Please see the University of Arizona Class Absence Policy and note that you should email the instructor with a copy to the dean of students to let us know of your need to miss class. If you do this prior to class, you can still receive credit for attendance if you watch the recorded lecture and submit your lecture-related questions for that lecture.

University Policies and Other Information

Accessibility and Accommodation

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu) to establish reasonable accommodations. We can then plan how best to coordinate your accommodations.

Diversity and Inclusion

Diversity unites and moves us forward. The diverse backgrounds, experiences and perspectives that each student brings to this class will be viewed as a resource, strength, and benefit. In this class, we have a unique and important opportunity to learn from the information and ideas shared by each other, and we also a responsibility to do so with sensitivity and respect. Ideally, science would be objective. However, as you will learn, much of science is subjective and is historically built on a small subset of privileged voices. It is important to make note of this and to think about how significant research findings may be biased by their nature of being carried out on a typically small, non-representative sample of participants.

I would like to create a learning environment for my students that honors diverse identities (including race, ethnicity, gender, age, class, sexuality, nationality, religion, ability, etc.) and supports a diversity of experiences, thoughts, and perspectives. To learn more about the UA's commitment to diversity and inclusion, please visit https://diversity.arizona.edu.

Preferred Name and Gender Pronouns

This course affirms people of all gender expressions and gender identities. If you would prefer that a different name from your legal one or the one that appears on the class roster be used, the university has established guidelines that allow students and employees to indicate their chosen or preferred first names. Please see the following link for more information: http://lgbtq.arizona.edu/use-chosen-or-preferred-names. I want to be sure that I refer to you in your preferred way. If you prefer a name other than the one on the class roster, please let me know. I will try our best to remember your preferred names and pronouns, but please also feel free to give me a reminder. Also, students are able to update and edit their pronouns in UAccess.

Academic Integrity

Students are expected to adhere to the UA Code of Academic Integrity as described in the UA the Academic Integrity policy: https://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity . Cheating or plagiarism on the exam or the paper will result in a failing grade for the course, a notice will be sent to the Dean's office, and expulsion from the University of Arizona can result. Plagiarism is defined as any case where one person tries to take credit for the ideas or work of another, including fellow students, or published authors.

Other University Classroom Policies that Apply to this Class

Please familiarize yourself with additional University Policies available here: https://catalog.arizona.edu/syllabus-policies . These include:

- Non-Discrimination and Anti-Harassment Policy
- Threatening Behavior Policy
- Code of Academic Integrity
- Safety on Campus and in the Classroom

Classroom Behavior Policy and the Use of Electronic Gizmos Specifically

It is my intent, and I ask you to join me, in creating a positive learning environment that is free from distractions. Computers or tablets may be used for notetaking and downloading lecture notes. As such they can be useful, but alas, they can also be a potent distraction. Please do not use them for other purposes (e.g. social media, e-chatting/texting, shopping, catching up on email, organizing a flash mob, plotting mass insurrection) or you will be asked to leave the classroom. Please turn your phones to silent mode and do not use them during class or you will be asked to leave the classroom.

Changes in Course Content, Schedule, Requirements

The information contained in this syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor. In fact, the topics and readings are very likely to change, but I will make announcements as they do.

Tentative Schedule of Topics & Readings
Links for all readings available from course website

20 January: Martin Luther King Holiday

27 January: *Overviews*

Cacioppo, J.T., Tassinary, L.G. & Berntson, G.G. (2016). Strong Inference in Psychophysiological Science. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 3-15). Cambridge, UK: Cambridge University Press.

Miller, G.A., (1996). How we think about cognition, emotion, and biology in psychopathology. *Psychophysiology*, *33*, 615-628.

3 February: *Foundations: Basic Electricity, Neuroanatomy and Neurophysiology*

Ryan, C.W. (1986). *Basic Electricity: A Self-Teaching Guide* (2nd Edition). New York: John Wiley and Sons. Chapters 1,2,3,4,5.

Kolb, B., & Wishaw, I.Q. (2016). Neuropsychology. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 26-38). Cambridge, UK: Cambridge University Press.

10 February: *Electrodermal Activity: Basics and Application to Polygraph Testing*

Dawson, M.E., Schell, A.M., & Filion, D.L. (2016). The electrodermal system. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 217-243). Cambridge, UK: Cambridge University Press.

Lykken, D.T. (1959). The GSR in the detection of guilt. *Journal of Applied Psychology*, *43*, 385-388.

OPTIONAL

Lykken, D.T., Rose, B., Luther, B., & Maley, M. (1966). Correcting psychophysiological measures for individual differences in range. *Psychophysiological Bulletin*, *66*, 481-484.

Lykken, D.T., & Venables, P.H. (1971). Direct measurement of skin conductance: A proposal for standardization. *Psychophysiology*, *8*, 656-672.

Lopez, R., Poy, R., Patrick, C.J., & Molto, J. (2013). Deficient fear conditioning and self-reported psychopathy: The role of fearless dominance. *Psychophysiologyy 50,* 210-218.

17 February: *BASIC ELECTRICITY TEST ADMINISTERED AT START OF CLASS*
Catch Up Class: Electrodermal Activity continued, Possibly The Oculomotor System

Iacono, W.G. (2016). Detection of Deception.. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 565-580). Cambridge, UK: Cambridge University Press.

Allen, J.J.B. (2013). Never Trust the Polygraph. *The Writ*, the official publication of the Pima County Bar Association.

OPTIONAL

Wascher, E., Heppner, H., Möckel, T., Kobald, S. O., & Getzmann, S. (2015). Eye-blinks in choice response tasks uncover hidden aspects of information processing. *EXCLI journal*, *14*, 1207–1218. https://doi.org/10.17179/excli2015-696

Stern, J.A., Walrath, L.C., & Goldstein, R. (1984). The endogenous eyeblink. *Psychophysiology*, *21*, 22-33.

24 February: *Cardiovascular Psychophysiology*

Berntson, G.G., Quigley, K.S., Norman, G.L., & Lozano, D. (2016). *Cardiovascular Psychophysiology.* In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 183-216). Cambridge, UK: Cambridge University Press.

Bernston, G.G., Cacioppo, J.T., & Quigley, K.S. (1993). Respiratory sinus arrhythmia: Autonomic origins, physiological mechanisms, and psychophysiological implications. *Psychophysiology*, *30*, 183-196.

Porges, S.W. (2007). The polyvagal perspective. *Biological Psychology, 74,* 116-143.

OPTIONAL

Berntson, G.G. (2019). Autonomic modes of control and health. *Psychophysiology,* 2019;56:e13306.

Kromenacker, B.W., Sanova, A.A., Marcus, F.I., Allen, J.J.B., & Lane, R.D. (2018). Vagal mediation of low frequency heart rate variability during slow yogic breathing. *Psychosomatic Medicine, 80*, 581-587.

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.

Kogan, A.V., Allen, J.J.B., & Weihs, K.L. (2012). Cardiac vagal control as a prospective predictor of anxiety in women diagnosed with breast cancer. *Biological Psychology, 90*, 105-111

Ottaviani, C. (2018). Brain-heart interaction in perseverative cognition. *Psychophysiology*. 2018;55:e13082. https://doi.org/10.1111/psyp.13082

Chalmers, J.A., Quintana, D.S., Abbott, M.J., & Kemp, A.H. (2014). Anxiety disorders are associated with reduced heart rate variability: a meta-analysis. *Frontiers in Psychiatry, 5*. DOI: doi.org/10.3389/fpsyt.2014.00080

3 March: *The Skeletomotor System*

Tassinary, L.G., Cacioppo, J.T., & Vanman, E.J. (2016). The somatic system. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 151-182). Cambridge, UK: Cambridge University Press.

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. Psychological Science, 11, 86-89.

OPTIONAL

Levenson, R.W.. Lwi, S.J., Brown, C.L., Ford, B.Q., Otero, M.C., & Verstaen, A. (2016). Emotion. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 444-464). Cambridge, UK: Cambridge University Press.

Seibt, B., Mühlberger, A, Likowski, K.U., & Wyers, P. Facial mimicry in its social setting. *Frontiers in Psychiatry, 6,* doi: 10.3389/fpsyg.2015.01122.

Ray, R.D., McRae, K., Ochsner, K.N, & Gross, J.J. (2010). Cognitive reappraisal of negative affect: Converging evidence from EMG and self-report. *Emotion*, *10(4)*, 587-592.

Dimberg, U., & Thunberg, M. (2012). Empathy, emotional contagion, and rapid facial reactions to angry and happy facial expressions. *PsyCh Journal, 1,* 118-127.

Kaiser, J., Davey, G.C.I, Parkhouse, T., Meeres, J., & Scott, R.B. (2016). Emotional facial activation induced by unconsciously perceived dynamic facial expressions. *International Journal of Psychophysiology, 110*. 207-211.

10 March: *Non-Spring-Break Day Off*

17 March: *The Electroencephalogram, Basics in Recording EEG, Frequency Domain Analysis and its Applications I -- Mood Disorders & Emotions*

Luck, S.J., Kappenman, E.S. (2016). Electroencephalography and Event-Related Brain Potentials. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 74-100). Cambridge, UK: Cambridge University Press. READ PAGES 74-88

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.

OPTIONAL

Allen, J.J.B., & Reznik, S.J. (2015). Frontal asymmetry as a promising marker of depression vulnerability: Summary and methodological consideration. *Current Opinion in Psychology, 4*, 93–97. doi:10.1016/j.copsyc.2014.12.017

Harmon-Jones, E., & Gable, P.A. (2018). On the role of asymmetric frontal cortical activity in approach and withdrawal motivation: An updated review of the evidence. *Psychophysiology*. 2018;55:e12879. https://doi.org/10.1111/psyp.12879

Peterson, C.K., Shackman, A.J., & Harmon-Jones, E. (2008). The role of asymmetrical frontal cortical activity in aggression. *Psychophysiology, 45 (2008), 86–92.*

24 March: ***Frequency Domain Analysis and its Applications II -- Oscillatory and "40 Hertz" Phenomena***

Reznik, S.J., & Allen, J.J.B. (2018). Frontal asymmetry as a mediator and moderator of emotion: An updated review. *Psychophysiology*. 2018;55: e12965. DOI:10.1111/psyp.12965

OPTIONAL

Coan, J.A. & Allen, J.J.B.. (2004). Frontal EEG asymmetry as a moderator and mediator of emotion. *Biological Psychology, 67*, 7-50.

Spydell, J.D. & Sheer, D.E. (1982). Effect of problem solving on tight and left hemisphere 40 Hertz activity. *Psychophysiology*, *19*, 420-425.

Singer, W. (1993). Synchronization of cortical activity and its putative role in information processing and learning. *Annual Review of Physiology*, *55*, 349-374.

Jensen, O., Bonnefond, M., & VanRullen, R. (2012). An oscillatory mechanism for prioritizing salient unattended stimuli. *Trends in Cognitive Sciences, 16*, 200-206.

31 March: ***Functional Neuroimaging: PET and fMRI***

Geuter, S., Lindquist, M.A., & Wager, T.D. (2016). Fundamentals of Functional Neuroimaging. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 41-73). Cambridge, UK: Cambridge University Press.

OPTIONAL

Coan, J.A., Schaefer, J.S., & Davidson, R.J. (2006). Lending a hand: Social regulation of the neural response to threat. *Psychological Science, 17*, 1032-1039.

Farah, M. J., & Hook, C.J. (2013). The seductive allure of "Seductive Allure." *Perspectives on Psychological Science 8(1)*, 88–90.

7 April: ***The Event-Related Potential: Basics and Applications (CNV, early components & P300)***

Luck, S.J., Kappenman, E.S. (2016). Electroencephalography and Event-Related Brain Potentials. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 74-100). Cambridge, UK: Cambridge University Press. READ PAGES 88-99

Johnson, R.J. (1986). A triarchic model of P300 amplitude. *Psychophysiology, 23*, 367-384.

OPTIONAL

Polich, J.(2007). Updating P300: An integrative theory of P3a and P3b. *Clinical Neurophysiology, 118,* 2128–2148.

Donchin, E. (1981). Surprise!...Surprise? *Psychophysiology*, *18*, 493-513.

14 April: ***More Applications of the ERP: P300, N400, ERN***

Kutas, M. & Hillyard, S.A. (1980). Event-related potentials to semantically inappropriate and surprisingly large words. *Biological Psychology*, *11*, 99-116.

Gehring, W. J., Goss, B., Coles, M. G. H., Meyer, D. E., & Donchin, E. (1993). A neural system for error detection and compensation. *Psychological Science, 4*, 385-390.

Hajcak, G. (2012). What we've learned from mistakes: Insights from error-related brain activity. *Current Directions in Psychological Science, 21*, 101–106.

Proudfit, G.H. (2015). The reward positivity: From basic research on reward to a biomarker for depression. *Psychophysiology, 52,* 449–459.

OPTIONAL

Kutas, M. and Federmeier, K. D. (2011). Thirty years and counting: Finding meaning in the N400 component of the event-related brain potential (ERP). Annual Review of Psychology, 62, 621-647.

Trujillo, L. & Allen, J.J.B. (2007). Theta EEG dynamics of the error-related negativity. *Clinical Neurophysiology. 118,* 645-668.

21 April: **(RESEARCH PROSPECTUS DUE)**
Neurostimulation and Neuromodulation

Luber, B. & Deng, Z. (2016). Application of Non-Invasive Brain Stimulation in Psychophysiology. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 116-150).

Cambridge, UK: Cambridge University Press.

OPTIONAL

Hermann, C.S., Rach, S., Neuling, T., & Strüber, D. (2013). Trancranial alternating current stimulation: a review of the underlying mechanisms and modulation of cognitive processes. *Frontiers in Human Neuroscience, 7*. DOI:10.3389/fnhum.2013.00279

Fini, M., & Tyler, W.J. (2017). Transcranial focused ultrasound: a new tool for non-invasive Neuromodulation. *International Review of Psychiatry, 29*, 168-177. DOI: 10.1080/09540261.2017.1302924

28 April: ***Advanced Signal Processing I***

Gratton, G., & Fabiani, M. (2016). Biosignal Processing in Psychophysiology: Principles and Current Developments. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson, (Eds.). *Handbook of Psychophysiology* (4th edition; pp. 628-661). Cambridge, UK: Cambridge University Press. READ PAGES 628-645

Gratton, G., Coles, M.G.H., & Donchin, E. (1983). A new method for off-line removal of ocular artifact. *Electroencephalography and Clinical Neurophysiology, 55*, 468-484.

Cohen, M.X. (2011). It's about time. *Frontiers in Human Neuroscience, 5,* doi: 10.3389/fnhum.2011.00002.

Cook, E.W., & Miller, G.A. (1992). Digital Filtering: Background and tutorial for psychophysiologists. *Psychophysiology*, *3*, 350-367.

OPTIONAL

Cavanagh, J.F., Cohen, M.X., & Allen, J.J.B. (2009). Prelude to and resolution of an error: EEG phase coherence reveals cognitive control dynamics during action monitoring. *Journal of Neuroscience, 29,* 98-105.

Mathewson, K.E., Lleras, A., Beck, D.M., Fabiani, M., Ro, T., & Gratton, G. (2011). Pulsed out of awareness: EEG alpha oscillations represent a pulsed-inhibition of ongoing cortical processing. *Frontiers in Perception Science, 2(99).* doi 10.3389/fpsyg.2011.00099

Muthukumaraswamy, S.D. (2013). High-frequency brain activity and muscle artifacts in MEG/EEG: a review and recommendations. *Frontiers in Human Neuroscience*, *7(138)*, http://dx.doi.org/10.3389/fnhum.2013.00138

5 May: ***(PAPER DUE 2 PM) Advanced Signal Processing II***

Scherg, M. (1990). Fundamentals of Dipole Source Potential Analysis. In F. Grandori, F. Hoke & Romani, G.L. (Eds.), *Auditory Evoked Magnetic Fields and Electric Potentials. Advances in Audiology, 6*, (pp. 40-69). Switzerland: Basel, Karger.

Miller, G.A., & Chapman, J.P. (2001). Misunderstanding analysis of covariance. Journal of Abnormal Psychology, 110, 40-48.

OPTIONAL

Urbach TP. Kutas M. (2002). The intractability of scaling scalp distributions to infer neuroelectric sources. *Psychophysiology*. 39, 791-808.

Makeig, S., Debener, S., Onton, J., & Delorme, A. (2004). Mining event-related brain dynamics. *Trends in Cognitive Sciences, 8,* 204-210.

Debener, S., Ullsperger, M., Siegel, M., Fiehler, K., von Cramon, Y.,& Engel, A.K. (2005). Trial-by-trial coupling of concurrent EEG and fMRI identifies the dynamics of performance monitoring. *Journal of Neuroscience, 25,* 11730 -11737.

Chaumon, M., Bishop, D.V.M., & Busch, N.A. (2015). A practical guide to the selection of independent components of the electroencephalogram for artifact correction. *Journal of Neuroscience Methods, 250,* 47-63.

11 May: ***FINAL EXAM DUE 11:59 PM***

Other recommended sources for the seriously inclined:

Cohen, M.X. (2017). *MATLAB for Brain and Cognitive Scientists.* Cambridge, MA: MIT Press

Cohen, M.X. (2014). Fundamentals of Time-Frequency Analyses in Matlab/Octave. Sincxpress.

Lyons, R. G. (2011). *Understanding Digital Signal Processing* (3rd Ed.). Boston, MA: Prentice Hall.