PSYC 592-008 – Music and the Brain

Mondays, 10:30am – 1:10pm. Music Theater Building 1008

Instructor

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Office Location

David King Hall, Room 2055

Office Hours

Wednesdays, 10:00am-11:50am,

Grade Criteria

Grade	Percent
A	90-100%
B	80-89.9%
C	70-79.9%
D	60-69.9%
F	Below 60%

Course Overview

Music undeniably impacts our daily lives. The earliest known human instruments date back at least 40,000 years. No known culture exists that is without some form of music. Yet, how music impacts the brain is relatively unknown. Over the past two decades, there has been a major increase in the number of studies investigating how different aspects of music, such as pitch, melody, harmony, and rhythm influence and impact neuronal functioning. This course will provide an overview of our understanding of how music influences brain functioning, and vice versa. From here, we will explore new clinical for music in treating and influencing neuronal pathologies. Altogether, this course will provide a comprehensive understanding of this fascinating and evolving topic.

Evaluation Criteria

Paper Reviews (25%): The content of this course will primarily focus on discussion. The initial run of classes will consist of plenary lectures on various stimulation methods. Once these lectures are over, we will switch to a seminar style, in which we will review brain stimulation papers every week. Two papers will be assigned each week, available on Blackboard. You are required to read both papers, pick one, and write a review/critique of that paper on Blackboard. **Reviews must be posted by 7pm on Sunday evening**. These reviews will contribute to your grade for the course.

Paper Presentations (25%): Once the paper reviews begin, one of you will give a presentation each week on one of the papers* (two presentations per class). The presentation should take the form of a powerpoint lecture, in which you discuss the background of the paper, the methods, results, and conclusions, along with your commentary. You will be able to sign up for your **two papers** on the first day of class or any day thereafter. The format of the discussion will take the place of a journal club, and so all students are expected to participate in the discussion. In-class participation is part of your grade (10%).

*If you do not see any papers that are of interest to you, you are free to suggest an alternate paper if you have one in mind. You must speak with me to propose your alternate paper.

Proposal Paper (30%): There is no final exam for this course. Instead, you will be required to write a paper to be turned in by December 19th. The paper will take the form of an experiment proposal, in which you will propose to run a brain stimulation study, using any of the methods discussed in class. The topic of the paper is entirely up to you, but you will be required to write an introduction, methods, expected results, and brief discussion section, with a bibliography. The page limit is 10 pages (not including bibliography).

TMS Practicum (10%): Another feature of this course is a hands-on demonstration of Transcranial Magnetic Stimulation (TMS), one of the methods we will primarily focus on. GMU has a TMS setup on the first floor of DKH. I will provide a technical demonstration one day of how TMS works. A hallmark of the TMS method is called the "Motor Evoked

Potential", or MEP, in which TMS is used to elicit a muscle movement in the hand by stimulating the contralateral primary motor cortex (M1). You will each choose a partner in the class, and at one point during this semester you will each practice eliciting a MEP from each other. You will all be required to arrange with me for a time to try out the TMS demonstration. If, for whatever reason, you cannot receive TMS, an alternative for receiving credit will be determined, on a case-by-case basis.

General Policy

Honor Code: George Mason University has an Honor Code, which requires all members of this community to maintain the highest standards of academic honesty and integrity. Cheating, plagiarism, lying, and stealing are all prohibited. All violations of the Honor Code will be reported to the Honor Committee. See honorcode.gmu.edu for detailed information.
Plagiarism is the unacknowledged use of another person's labor, another person's ideas, another person's words, or another person's assistance. Unless otherwise stated in class, all work done for courses -- papers, examinations, homework exercises, laboratory reports, oral presentations -- is expected to be the individual effort of the student presenting the work. Any assistance must be reported to the instructor. If the work has entailed consulting other resources -- journals, books, or other media -- these resources must be cited in a manner appropriate to the course. Everything used from other sources -- suggestions for organization of ideas, ideas themselves, or actual language -- must be cited. Failure to cite borrowed material constitutes plagiarism. Undocumented use of materials from the World Wide Web is plagiarism. If you are caught plagiarizing or cheating, you will be referred to the honor committee and, if found guilty, will fail the assignment, and, depending upon the severity of the violation, you may fail the class.

Disability Statement: If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Services (DRS) at 703-993-2474. All academic accommodations must be arranged through that office. Please see me as soon as possible about this, as I will not adjust grades for exams after they have been given.

Make-up policy: Make-up exams will only be given if exceptional circumstances are claimed AND substantiated. I must see proof of what you are claiming to verify that it is true.

Add/Drop Deadlines: Please note that the *last day to add classes* is **September 5th**. The last day to drop a course *with no tuition penalty* is also **September 5th**. The last day to drop *with a 33% tuition penalty* is **September 19th**. The final day to *drop with a 67% tuition penalty* is **September 29th**. After September 29th, withdrawal from the class requires approval of the dean and is only allowed for nonacademic reasons.

Official Communications via GMU E-mail: Mason uses electronic mail to provide official information to students. Examples include communications from course instructors, notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly. If class has to be canceled, you will be informed via e-mail. Information will be provided in the e-mail about making up the missed class.

Technology: For this class, you will be asked to give presentations. This will require that you have access to a computer with some type of presentation software (PowerPoint, Keynote, etc.). If you do not have access to a laptop, one will be provided for you to give your presentation on.

Course Schedule:

Date	Lecture topics/Activities
8/29	Introduction to Course – Music and the Brain
9/4	NO CLASS
9/11	Basic Neuroanatomy - what is a brain and how does music change it?
9/18	Basic Neurochemistry – how does a brain work, and what impact does music influence it?
9/25	Seminar Begins
10/23	NO CLASS
12/19	Papers Due

Course Readings

Introduction to Course (8/28)

Zatorre, R. J., Chen, J. L., & Penhune, V. B. (2007). When the brain plays music: auditory–motor interactions in music perception and production. *Nature reviews neuroscience*, *8*(7), 547-558.

Patel, A. D. (2003). Language, music, syntax and the brain. *Nature neuroscience*, *6*(7), 674-681.

Loui, P. (2016). Disorders of Music Cognition. *The Oxford Handbook of Music Psychology*, 307.

Basic Neuroanatomy – what is a brain and how does music change it? (9/11)

Herholz, S. C., & Zatorre, R. J. (2012). Musical training as a framework for brain plasticity: behavior, function, and structure. *Neuron*, *76*(3), 486-502.

Pascual-Leone, A. (2001). The brain that plays music and is changed by it. *Annals of the New York Academy of Sciences*, *930*(1), 315-329.

Basic Neurochemistry – how does a brain work, and how does music influence it? (9/18)

Chanda, M. L., & Levitin, D. J. (2013). The neurochemistry of music. *Trends in cognitive sciences*, *17*(4), 179-193.

Hodges, D. A. (2009). Bodily responses to music. *The Oxford handbook of music psychology*, 121-130.

9/25 Readings – Music and Movement

Fritz, T. H., Hardikar, S., Demoucron, M., Niessen, M., Demey, M., Giot, O., ... & Leman, M. (2013). Musical agency reduces perceived exertion during strenuous physical performance. *Proceedings of the National Academy of Sciences*, *110*(44), 17784-17789.

Stupacher, J., Hove, M. J., Novembre, G., Schütz-Bosbach, S., & Keller, P. E. (2013). Musical groove modulates motor cortex excitability: a TMS investigation. *Brain and cognition*, *82*(2), 127-136.

10/2 Readings – Music and Reward

Salimpoor, V. N., Benovoy, M., Larcher, K., Dagher, A., & Zatorre, R. J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature neuroscience*, *14*(2), 257-262.

Blood, A. J., & Zatorre, R. J. (2001). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proceedings of the National Academy of Sciences*, *98*(20), 11818-11823.

10/10 Readings – Music and Language

Özdemir, E., Norton, A., & Schlaug, G. (2006). Shared and distinct neural correlates of singing and speaking. *Neuroimage*, *33*(2), 628-635.

Moreno, S., Bialystok, E., Barac, R., Schellenberg, E. G., Cepeda, N. J., & Chau, T. (2011). Short-term music training enhances verbal intelligence and executive function. *Psychological science*, 0956797611416999.

10/16 Readings – The Nature of Music

McDermott, J. H., Schultz, A. F., Undurraga, E. A., & Godoy, R. A. (2016). Indifference to dissonance in native Amazonians reveals cultural variation in music perception. *Nature*, *535*(7613), 547-550.

Zivic, P. H. R., Shifres, F., & Cecchi, G. A. (2013). Perceptual basis of evolving Western musical styles. *Proceedings of the National Academy of Sciences*, *110*(24), 10034-10038.

10/30 Readings – Animals and Music

Patel, A. D., Iversen, J. R., Bregman, M. R., & Schulz, I. (2009). Experimental evidence for synchronization to a musical beat in a nonhuman animal. *Current biology*, *19*(10), 827-830.

Schachner, A., Brady, T. F., Pepperberg, I. M., & Hauser, M. D. (2009). Spontaneous motor entrainment to music in multiple vocal mimicking species. *Current Biology*, *19*(10), 831-836.

11/6 Readings – Music and Development

Zentner, M., & Eerola, T. (2010). Rhythmic engagement with music in infancy. *Proceedings of the National Academy of Sciences*, *107*(13), 5768-5773.

Schlaug, G., Norton, A., Overy, K., & Winner, E. (2005). Effects of music training on the child's brain and cognitive development. *Annals of the New York Academy of Sciences*, *1060*(1), 219-230.

11/13 Readings – Musicians

Gaser, C., & Schlaug, G. (2003). Brain structures differ between musicians and non-musicians. *Journal of Neuroscience*, *23*(27), 9240-9245.

Doelling, K. B., & Poeppel, D. (2015). Cortical entrainment to music and its modulation by expertise. *Proceedings of the National Academy of Sciences*, *112*(45), E6233-E6242.

11/20 Readings – Individual Differences in the Perception of Music

Norton, A., Winner, E., Cronin, K., Overy, K., Lee, D. J., & Schlaug, G. (2005). Are there pre-existing neural, cognitive, or motoric markers for musical ability?. *Brain and cognition*, *59*(2), 124-134.

Loui, P., Zamm, A., & Schlaug, G. (2012). Enhanced functional networks in absolute pitch. *Neuroimage*, *63*(2), 632-640.

11/27 Readings – Music and Therapy

Haslam, C., & Cook, M. (2002). Striking a chord with amnesic patients: Evidence that song facilitates memory. *Neurocase*, *8*(6), 453-465.

Belin, P., Zilbovicius, M., Remy, P., Francois, C., Guillaume, S., Chain, F., ... & Samson, Y. (1996). Recovery from nonfluent aphasia after melodic intonation therapy A PET study. *Neurology*, *47*(6), 1504-1511.

*Benoit, C. E., Dalla Bella, S., Farrugia, N., Obrig, H., Mainka, S., & Kotz, S. A. (2014). Musically cued gait-training improves both perceptual and motor timing in Parkinson's disease. *Frontiers in human neuroscience*, *8*, 494.

*Thaut, M. H., Gardiner, J. C., Holmberg, D., Horwitz, J., Kent, L., Andrews, G., ... & McIntosh, G. R. (2009). Neurologic music therapy improves executive function and emotional adjustment in traumatic brain injury rehabilitation. *Annals of the New York Academy of Sciences*, *1169*(1), 406-416.

12/4 Readings – Disorders of Music

Loui, P., Alsop, D., & Schlaug, G. (2009). Tone deafness: a new disconnection syndrome?. *Journal of Neuroscience*, *29*(33), 10215-10220.

Peretz, I., Ayotte, J., Zatorre, R. J., Mehler, J., Ahad, P., Penhune, V. B., & Jutras, B. (2002). Congenital amusia: a disorder of fine-grained pitch discrimination. *Neuron*, *33*(2), 185-191.

*Martínez-Molina, N., Mas-Herrero, E., Rodríguez-Fornells, A., Zatorre, R. J., & Marco-Pallarés, J. (2016). Neural correlates of specific musical anhedonia. *Proceedings of the National Academy of Sciences*, *113*(46), E7337-E7345.

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