

Music & Cognitive Neuroscience

Spring 2025

Schedule	Date	Wednesday
	Time	10:10 am – 12:00 pm EST
	Location	Schermerhorn 200C
Instructor	Name	John Thorp
	Email	jnt2136@columbia.edu
	Office Hours	By appointment https://calendly.com/jnt2136/30min

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Course description

This seminar will provide a broad survey of how principles of cognition are represented in music and the ways music has been used to study those principles in the psychology and neuroscience literature.

Detailed description

Music is an incredibly powerful and elusive force in our lives. This course will provide an in-depth look at: the forces that shaped the evolution of music cognition; how various aspects of music are represented and computed in the brain (harmony, groove, emotion, events), and broadly how these representations and computations extend to other human activities and aesthetics (curiosity, humor, magic). Each class will consist of a student discussion of a theoretical or review paper as well as an empirical extension or challenge to that theory. This should provide a relatively holistic overview of the approaches and topics of cognitive neuroscience broadly, while also allowing us to fully consider the myriad components of the human experience stored within and exemplified through music.

Teaching philosophy

The central philosophy of my approach to teaching is to treat each of you as an active, embodied agent. My classroom is interested in deliverables in so far as they offer insight into your learning process and create opportunities for reflection and critical thinking. I believe the role of higher education is not exclusively to prepare you all for the current job market, but to prepare you to create and adapt to jobs that don't yet exist. As such, I have built an approach focused on the critical problem-solving necessary for an informed citizenry. Through these means, I encourage us to collectively resist the industrialization of the classroom that has gripped education within the past century. If any of these ideas are exciting to you, I encourage you to come to office hours for some readings.

Communicating with me

For all concerns, email me, your instructor, with subject line

3461: <Subject>

It's almost always helpful to put a **bolded, direct, answerable question** somewhere in the email.

Learning objectives

The overall learning objectives for this class are

- **Critically engaging with primary literature**
 - It is the responsibility of us all as scientists to assess the validity and contribution of empirical results. The only way to develop this ability is to regularly engage with and discuss scientific articles.
- **Facilitating discussion on primary literature**
 - Communication of scientific results is a crucial component of their dissemination. Here, we'll practice critically reading articles, summarizing the authors' main points, and facilitating discussion with your peers.
- **Engaging in the creation of scientific ideas, materials, and resources**
 - All this should only build to our own novel ideas and contributions towards the scientific enterprise.

Course Components

The course can be separated into 4 interdependent components:

- Preparation and application of material (as assessed by Canvas Posts)
- Citizenry in the course (as assessed by Class Participation)
- Deep engagement with and communication of primary articles (as assessed by the Class Presentations)
- Working with and creating primary materials of doing science (as assessed by Final Project)

Assessment	Canvas Posts	Class Participation	Class Presentations	Final Project
Percentage of Final Grade	30%	20%	20%	30%

Canvas Posts

Every student will be responsible for posting a discussion post on Canvas before class. These are intended to motivate you to come to class with questions in mind so we all might more readily engage with the material. This discussion post should be 1-2 paragraphs. Each response will be graded out of 5 points: 2 points for posting **24**

hours before class, and one point for each unique contribution that can be brought to class. These discussion points can be (but are not limited to):

- questions about the evidence supporting theoretical commitments
- questions clarifying the difference between alternative theories
- questions of application and generalizability of the findings or theory
- questions about the rationale behind the design, proposing alternative designs
- future points of inquiry and suggestions for follow-up
- comments on particularly interesting or surprising results
- questions about the analysis you were confused by
- anything you would feel comfortable bringing up during discussion of the papers that week.

Again, 3 points are necessary to achieve full credit on the post. Brief feedback will be given on posts at the beginning of the semester.

Class Participation

You are expected to contribute to the discussion in class every week. The Canvas Posts are intended to lower the threshold of contribution, as you all will be walking in with at least three points to contribute with. If you anticipate this being a challenging category for you, initiate a conversation with me as early in the semester as possible. I am committed to this course being a safe environment for us all to challenge each other in the beautiful and always imperfect project of engaging with nature through science.

Excused absences are permitted, but you must be in contact with me. As we have so few classes, any absence requires a conversation between you and I to ensure you'll be able to stay on top of the material throughout the course. More than one absence will inspire a conversation of whether this is the right time for you to take full advantage of this course.

Discussion Leadership

Students will twice lead the discussion in class. One instance will concern a theoretical paper in the first half of a class period, and another will concern an empirical paper in the second half of a class period (generally). Discussions will be started by a 10-minute presentation from you on the argument of the theoretical paper or main findings of the empirical paper, but the emphasis should be on scaffolding discussion in the class. Papers will be chosen on the first day of class.

Presenters are required to meet with me **at least by the Monday before presenting** to go over the topic. Materials and discussion questions need to be prepared for this meeting. Then, before class, presenters need to review the discussion posts in Canvas to review what the other students would be most interested in discussion.

Most theoretical papers address the following points, which would be useful to cover in a brief presentation:

- **Novel contributions of theory:** What makes this theory different than those that came before? What terminology or concepts are they introducing? What epistemic commitments do they make?
- **Critical evidence:** What evidence does the theory find the most critical to supporting its claims? What evidence does it find most critical to disavowing competing theories?
- **Validity:** Does this theory ring true to us? Do you have experiences that resonate with it? Can you do thought experiments that would seem to negate it?

Most empirical papers address the following points, which would be useful to cover in a brief presentation:

- **Question:** What specific question is being asked in this paper? What constructs are being related to each other? Why do they matter?
- **Alternative Hypotheses:** What hypotheses are being presented? Are there multiple ways the experiment ought to be able to play out? Multiple theories being assessed?
- **Logic:** A crucial step in engaging with the primary literature is assessing the logic with which the psychological constructs are linked to experimental variables. Carefully go through what each element of the experiment or study is supposed to represent, exemplify, or activate. This is a great time to build in discussion questions as to how successful this logic is and to what contexts we expect the results to be able to generalize.
- **Method:** Briefly cover how the study was conducted, particularly if you or any students have concerns about the stimuli, duration, or responding methods.
- **Results:** All critical figures should be walked through. It's very important you are prepared by our meeting to discuss the takeaway of the figures so we can make sure you're prepared to discuss them with the class.
- **Inference:** Points of discussion covering: what have we learned? What would we feel comfortable telling people about the human experience? What studies are we inspired to run next? How is this connected to other material we've covered,

or you've seen covered in other classes? Are there notable weaknesses or strengths of the study?

Final Project

All seminars have a cumulative project of some kind: a 1,500-word op-ed discussing how elements of the primary literature are represented in a piece of music; a substantial analysis project on an existing dataset; a 10-page experiment proposal in APA format; a grant proposal in the form of an F31 Specific Aims & Scientific Background; composing a stimulus set that could be used in an empirical study to measure cognition of various aspects of music.

That I would choose one of these projects as the standard learning goal of the seminar feels arbitrary. All I care about is that you are driven to think deeply and carefully about the process of faithfully representing human experience in a measurable, scientific way. The particular learning goals surrounding that, and the project you'll get to tell future employers or advisors that you developed and finished, is totally up to you.

So, by **Wednesday, February 26**, you need to schedule a time to meet with me for us to discuss what kind of final project you would be inspired by in this class. It can be in the list above, but I encourage you to think outside the box. It does have to be around the same scope of labor, which we can figure out together. There will be a worksheet available on Canvas that you should fill out before coming to our meeting.

By **Wednesday, March 26**, you need to schedule a check-in with me on how your project is progressing. Make this a meaningful check-in, as we can't alter your learning goals or rubric after this meeting. On **Wednesday, April 30th** you will give a 5-minute presentation on your project to the class. The final materials are due **Wednesday, May 7th** by 5 pm.

These check-ins and presentations are each worth 10% of the grade on the final project. The success of these final projects relies on us having consistent contact and iteratively building a challenging but executable project.

Course policies

Grades

Grades will be rounded only to the nearest 0.1%, and assigned letter grades as follows:

A+: 97-100%	B+: 87-89.9%	C+: 77-79.9%	D: 60-69.9%
A: 93-96.9%	B: 83-86.9%	C: 73-76.9%	F: 0-59.9%
A-: 90-92.9%	B-: 80-82.9%	C-: 70-72.9%	

Late work

Canvas Posts and Final Project check-ins that are completed late will be docked 50%. This is to ensure you're coming to class prepared to contribute and are maintaining contact with me about the progression of your project.

Religious holidays

If you will be participating in any religious holidays you know will stop you from being able to attend class, **please reach out to me in the first week of the course** so we can come up with a plan to keep you on schedule. The only other requirement is to choose Class Presentation dates that will not conflict with your expected absences in class.

Health

Many of us have periods in which our mental and/or physical health suffer. As we accumulate more and more responsibilities and relationships in this life, it can often be too easy to feel like every one of them is supposed to be our first priority. Never forget that you alone are your first priority. Please prioritize your mental health and wellbeing and know that there are many resources available to you both within our classroom community and throughout the university:

<https://health.columbia.edu/content/counseling-and-psychological-services>

<http://blogs.cuit.columbia.edu/nightline/>

<https://universitylife.columbia.edu/student-resources-directory#health>

Being healthy and energized is necessary for learning. This course, like any course, can only be helpful to you so long as that necessity is met. I am always open to learning more about how to best tailor the class to that necessity while keeping the progression of the course in mind.

Fostering an inclusive classroom

I strongly aim to foster a learning environment that is supportive of each of your perspectives and set of experiences. In this way, I hope to broaden everyone's understanding of others and their positionality in relation to them. Please reach out to me with any concerns or suggestions you may have to better address your learning needs and to improve the effectiveness and inclusivity of this course. Building trust and mutual respect is a project we are excited to work together with you on.

Students who may require accommodations should contact me before or during the first week of class. You should also contact the Office of Disability Services (ODS) in Lerner Hall before the start of the course to register for these accommodations. The procedures for registering with ODS can be found at <https://health.columbia.edu/content/disability-services> or by calling (212) 854-2388.

Academic integrity

As we are all members of an academic community, it is up to each of us to uphold the academic integrity necessary for our collective development. You can find detailed definitions and examples of this integrity in [Columbia University's Guide to Academic Integrity](#). In short, violations of academic integrity are treated incredibly seriously by both myself and the University.

This specter has donned a new mask recently with the rise of large language models (ChatGPT, Bard, etc.). As these models are still moving targets, it's worth clarifying that **passing off LLM responses as your own is a violation of academic integrity.**

This course is meant to challenge you so as to contribute to your personal growth. If this challenge becomes overwhelming to the point that you feel tempted to pass off others' work as your own, please reach out to me. We're committed to reconciling your personal growth with the progression and content of this course.

Date	Topic	Reading 1 (typically theory)	Reading 2 (typically empirical)
1/22	Introduction	QuALMRI handout on courseworks	–
1/29	Evolution of music	Savage, P. E., Loui, P., Tarr, B., Schachner, A., Glowacki, L., Mithen, S., & Fitch, W. T. (2020). Music as a coevolved system for social bonding. <i>The Behavioral and Brain Sciences</i> , 44(e59), e59.	Huron, D. (2015). Cues and signals: An ethological approach to music-related emotion. <i>Signata</i> , 6, 331–351.
2/5	Harmony	Koelsch, S., Vuust, P., & Friston, K. (2019). Predictive processes and the peculiar case of music. <i>Trends in Cognitive Sciences</i> , 23(1), 63–77.	Cheung, V. K. M., Harrison, P. M. C., Meyer, L., Pearce, M. T., Haynes, J.-D., & Koelsch, S. (2019). Uncertainty and surprise jointly predict musical pleasure and amygdala, hippocampus, and auditory cortex activity. <i>Current Biology: CB</i> , 29(23), 4084–4092.e4.
2/12	Groove	Iyer, V. (2002). Embodied mind, situated cognition, and expressive microtiming in African-American music. <i>Music Perception</i> , 19(3), 387–414.	Vuust, P., Ostergaard, L., Pallesen, K. J., Bailey, C., & Roepstorff, A. (2009). Predictive coding of music-brain responses to rhythmic incongruity. <i>Cortex; a Journal Devoted to the Study of the Nervous System and Behavior</i> , 45(1), 80–92.
2/19	Dopamine	Ferreri, L., Mas-Herrero, E., Zatorre, R. J., Ripollés, P., Gomez-Andres, A., Alicart, H., Olivé, G., Marco-Pallarés, J., Antonijoan, R. M., Valle, M., Riba, J., & Rodriguez-Fornells, A. (2019). Dopamine modulates the reward experiences elicited by music. <i>Proceedings of the National Academy of Sciences of the</i>	Gershman, S. J., Assad, J. A., Datta, S. R., Linderman, S. W., Sabatini, B. L., Uchida, N., & Wilbrecht, L. (2024). Explaining dopamine through prediction errors and beyond. <i>Nature Neuroscience</i> , 27(9), 1645–1655.

		<i>United States of America, 116(9), 3793–3798.</i>	
2/26	Emotion in Music	Meyer, L. B. (1956). <i>Emotion and meaning in music</i> . University of Chicago Press.	Warrenburg, L. A. (2020). Comparing musical and psychological emotion theories. <i>Psychomusicology, 30(1), 1–19.</i>
3/5	Basic Emotions	Kragel, P. A., & LaBar, K. S. (2016). Decoding the nature of emotion in the brain. <i>Trends in Cognitive Sciences, 20(6), 444–455.</i>	Cowen, A. S., Fang, X., Sauter, D., & Keltner, D. (2020). What music makes us feel: At least 13 dimensions organize subjective experiences associated with music across different cultures. <i>Proceedings of the National Academy of Sciences of the United States of America, 117(4), 1924–1934.</i>
3/12	Constructed Emotions	Barrett, L. F. (2017). The theory of constructed emotion: an active inference account of interoception and categorization. <i>Social Cognitive and Affective Neuroscience, 12(1), 1–23.</i>	Cespedes-Guevara, J., & Eerola, T. (2018). Music communicates affects, not Basic Emotions - A constructionist account of attribution of emotional meanings to music. <i>Frontiers in Psychology, 9, 215.</i>
3/19	Spring Break	-	-
3/26	Musical Anhedonia	Belfi, A. M., & Loui, P. (2020). Musical anhedonia and rewards of music listening: current advances and a proposed model. <i>Annals of the New York Academy of Sciences, 1464(1), 99–114.</i>	Kathios, N., Sachs, M. E., Zhang, E., Ou, Y., & Loui, P. (2024). Generating New Musical Preferences From Multilevel Mapping of Predictions to Reward. <i>Psychological Science, 35(1), 34–54.</i>
4/02	Event Segmentation	Shin, Y. S., & DuBrow, S. (2020). Structuring Memory Through Inference-Based Event	McClay, M., Sachs, M. E., & Clewett, D. (2023). Dynamic emotional states shape the episodic

		Segmentation. <i>Topics in Cognitive Science</i> . https://doi.org/10.1111/tops.12505	structure of memory. <i>Nature Communications</i> , 14(1), 6533.
4/09	Neural Synchrony	Cheng, S., Wang, J., Luo, R., & Hao, N. (2024). Brain to brain musical interaction: A systematic review of neural synchrony in musical activities. <i>Neuroscience and Biobehavioral Reviews</i> , 164(105812), 105812.	Konvalinka, I., Vuust, P., Roepstorff, A., & Frith, C. D. (2010). Follow you, follow me: continuous mutual prediction and adaptation in joint tapping. <i>Quarterly Journal of Experimental Psychology</i> (2006), 63(11), 2220–2230.
4/16	Curiosity	Chu, J., & Schulz, L. E. (2020). Play, curiosity, and cognition. <i>Annual Review of Developmental Psychology</i> , 2(1), 317–343.	Hsiung, A., Poh, J.-H., Huettel, S. A., & Adcock, R. A. (2023). Curiosity evolves as information unfolds. <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 120(43), e2301974120.
4/23	Comedy Magicians	Hurley, M. M., Dennett, D. C., & Adams, R. B. (2013). Humor and Mirth. In <i>Inside Jokes</i> . MIT Press.	De Cruz, H. (2024). Wonder and the Origins of Magic. In <i>Wonderstruck</i> . Princeton University Press.
4/30	Final Presentations	-	-

