

## Music and Language (Psychology 1353), Fall 2010

Mondays & Wednesdays, 4:00 – 5:30 pm

Location: WJH 4

Website: <http://my.harvard.edu/icb/icb.do?keyword=k72181>

(please check often for updates and changes)

Instructor: L. Robert (Bob) Slevc, PhD.

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Office hours by appointment

### Overview

Music and language are among the skills and activities that most uniquely define us as human. As far as we know, every human culture uses some form of music and of language and has done so for a very long time: bone flutes have been discovered dating from about 40,000 years ago and singing probably emerged even earlier, along with spoken language, sometime in the Paleolithic era.

In contrast, there seem to be no non-human animals that make use of music and language to anywhere near the extent that we do. This means that the processing of music and language are unlike many other impressive aspects of perception and cognition (e.g., vision or memory) in that we can learn only a limited amount from studies of other species. But processing music and language are, in a sense, similar feats—both involve the conversion of complex auditory sequences into meaningful units and structures—and so much can be learned from comparative work on these two complex abilities. Importantly, we can learn both from aspects that are shared in the processing of music and language and from aspects that are distinct.

This idea that there might be a relationship between music and language is not a new one, but goes back at least as far as Plato. Charles Darwin suggested that music and language both evolved from an early form of musical communication, and others have drawn parallels between the actual moment-to-moment processing of music and language. (One such thinker is Leonard Bernstein, the well known conductor/composer/musician, who drew a number of links between music and language in an interesting—if sometimes wildly speculative—series of lectures here at Harvard in 1973.) However, it is really only in the last 10 or 15 years that experimental work in psychology and neuroscience has begun to go beyond speculation and start to carefully investigate the similarities and differences between the perception and cognition of music and of language.

The goal of this seminar is to explore this recent experimental work on the relationship between the perception and cognition of music and language with the overall goal of coming to a better understanding of our impressive ability to make sense out of sound. We will focus on six general areas in which a music/language relationship has been proposed: sound, rhythm, melody, structure, meaning, and evolution.

Prerequisite: Science of Living Systems 20 or its predecessors plus any Tier 2 course.

### Required Readings

Patel, A.D. (2008). *Music, Language, and the Brain*. New York: Oxford University Press.

This book provides the general organization for the course as well as specific arguments for music-language relationships. You will not need this book until the third week of class (9/20) so

you should have plenty of time to obtain it from the Coop, the Harvard Bookstore, or from your favorite online bookseller.<sup>1</sup>

In addition to this book, we will read a variety of primary articles each week. Links to most (hopefully all) of these articles will be posted on the course website, but any readings that are not available electronically will be placed on reserve at Lamont Library.

## Course Requirements and Grading

### • *Course participation* (12%)

This is a seminar course, so classes will follow a discussion format where we review and discuss the topics and readings. It is therefore important that you attend class and participate in discussions. I know that life can be complicated and so you may miss one class without penalty as long as you contact me *in advance* to arrange an appropriate makeup assignment.

### • *Discussion questions* (12%)

Each week (starting with Week 2), you should submit two discussion questions on the course website. One of these questions should focus on a specific reading or sub-topic (for example, this could be something about the experimental design used in one of the assigned articles). The other question should be a bigger-picture question about the topic (this needs not be some vast philosophical issue—though it can be—but should be a general question pertaining to the week’s topic). These are intended to help stimulate class discussion (hence the name), so please try to make them interesting.

These questions must be posted by midnight **each Sunday**. If you have trouble with the website, you may email me your questions. Note that I will not accept late discussion questions.

### • *Discussion leading* (15%)

Each student will present and lead the discussion of an article at some point during the semester. This will involve giving a brief summary of the paper and how it fits within the overall topic, as well as leading the following discussion. To prepare for this, you should compile a list of key points from the article as well as a list of criticisms and/or issues that seem worth discussing.

We will choose/assign papers in class on 9/13.

### • *Reaction papers* (25%)

For five of the six topics we will cover (sound, rhythm, melody, syntax, meaning, & evolution), you should pick one specific article and write a 1-2 page (single spaced) reaction paper. In these papers, you should not simply summarize the article, but should express your reaction to the material. You could do this in a variety of ways; for example, you might talk about how the article relates to other readings/issues, you might talk about how it could be extended, or you might critique aspects of the article. These papers are due at the beginning of class *on the day that we discuss the article you write about* (i.e., your paper must be turned in before the class

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<sup>1</sup> On the off chance that your favorite online bookseller is Oxford University Press (OUP.com/usa), you can save 20% with sales promo code 28822. Here is a direct link to the discounted title:

<http://bit.ly/bZcmyg>

discusses the article you are reacting to). Although these are intended to be relatively informal papers, I will mark down for poor spelling and grammar so please proofread your work.

- ***Final Paper*** (36%)

For your final paper, you should write a 10-15 page paper (not including the reference list) on something relevant to the relationship between music and language. This can be an extension of a topic we covered in class (and can be on the same topic as one of your reaction papers if you like) or can be something that we did not specifically discuss as long as it is related to the overall course material. Your paper can be in either of two formats: a research proposal or a research paper.

- In a research proposal, you should motivate a specific research question and propose an experiment (or set of experiments) that you could use to address/answer that question. Think of this as an application for a small grant: you need to introduce and “sell” your question, propose a specific way (or ways) to answer that question, lay out what you predict the results to be, and describe what those results (as well as what unpredicted results) would mean. Try to keep the scope manageable enough that you could hypothetically do this research as a senior honors thesis.
- In a research paper, you should critically review and synthesize the literature on a specific issue. Think of this as a literature review with an attitude: you should bring together work from a variety of areas and argue for a specific conclusion. Note that you need to include/discuss work that disagrees with your conclusion (a critical review of a topic on which everyone agrees is boring). Imagine that you might submit this review article to a journal where a reviewer (in this case, me) would probably notice if you ignored work that did not fit your position.

In either case, your paper should conform to the style of the APA publication manual and must include appropriate citations (see the section on plagiarism below). Additionally, I encourage you to make use of figures, tables, and examples as appropriate.

To encourage you to start thinking about your paper before the end of the term, you must have your topic approved by me by **Monday, November 15th**, and turn in a 1-2 page outline with an annotated list of at least 15 references by **Monday, November 29th**. The paper itself is due on the last day of the reading period: **Sunday, December 12th**.

### **Other Policies**

- *General Politeness*. Please be to class on time and be courteous with use of electronic devices such as mobile phones and laptops. I have no problem with snacks and/or beverages so long as you try to avoid food that is especially pungent or has loud crinkly wrappers.
- *Attendance*. Because this is a seminar class, your attendance is important. You may miss one class without penalty so long as you send me your excuse *beforehand*, at which point we can arrange for an appropriate makeup assignment.
- *Late Work*. Most late assignments will be penalized by one grade step per day late (e.g., an A-quality assignment turned in within 24 hours after the due date would receive a B+). Late discussion questions will not be accepted.
- *Instructor availability*. The best way to reach me is by email. I will try to respond to emails within 24 hours during the week (I may occasionally take longer over the weekend), but will be

especially prompt if questions are detailed enough to require short and straightforward responses. (N.B., An email saying only “What did we talk about on Wednesday?” or “What did you say was shared between music and language?” is unlikely to get a very prompt or helpful response.) I do not have regularly scheduled office hours, however I am happy to arrange meetings outside of class – please email me to set up an appointment.

• *Plagiarism.* Your work in this class is expected to be your own, and you are expected to properly cite anything from which your work is informed. To be more explicit, you must:

(a) cite the source of any idea, finding, claim, argument, etc. that is not your own *no matter how much you have rephrased from the original source*, and

(b) describe these ideas/findings/claims/arguments *in your own words*. (In the rare instance when a direct quote is necessary, that text should be placed in quotation marks and the reference should include the page number where the quote can be found.)

Neither the Harvard administrative board nor I will tolerate plagiarism. Punishments, even for unintentional plagiarism, include failing the course, suspension, and/or expulsion. If you have any doubt, it is always better to cite.

For more information, see The Expos *Writing with Sources* guide:

<http://isites.harvard.edu/fs/docs/icb.topic657773.files/WritingSourcesHarvard.pdf>

and the Harvard College Handbook chapter on academic dishonesty:

<http://isites.harvard.edu/icb/icb.do?keyword=k69286&pageid=icb.page355695>

• *Accessibility.* Any student needing academic adjustments or accommodations is requested to present their letter from the Accessible Education Office (AEO) and speak with the instructor by the end of the second week of the term, Friday September 10th. Failure to do so may result in the Course Head’s inability to respond in a timely manner. All discussions will remain confidential, although AEO may be consulted to discuss appropriate implementation.

## Schedule and Reading Assignments

The approximate number of pages of assigned reading is listed for each class, but note that this can be misleading as this does not take into account format, text size, conceptual density, etc.

### Week 1: Introduction

9/1 (Mon) – **No class**

Although this course normally meets on Monday and Wednesday, a scheduling conflict means that we will hold the first course meeting on Wednesday, September 8th.

9/8 (Wed)

First meeting; this syllabus

### Week 2: Background

9/13 (Mon) – *Music*

(45 pp)

Cross, I. (1998). Music and science: three views. *Revue Belge de Musicologie*, 52, 207-214.

Koelsch, S. & Siebel, W.A. (2005). Towards a neural basis of music perception. *Trends in Cognitive Sciences*, 9, 578-584.

Peretz, I. (2006). The nature of music from a biological perspective. *Cognition*, 100, 1-32.

Sacks, O. (2006). The power of music. *Brain*, 129, 2528-2532.

9/15 (Wed) – Language

(15 pp)

Holt, L.L. & Lotto, A.J. (2008). Speech perception within an auditory cognitive science framework. *Current Directions in Psychological Science*, 17, 42-46.

McQueen, J.M. (2007). Eight questions about spoken-word recognition. In M.G. Gaskell (Ed.), *The Oxford Handbook of Psycholinguistics* (pp. 37-53). Oxford University Press. (Note: available online at <http://www.mpi.nl/publications/escidoc-58905/>)

### Weeks 3 and 4: Sound

9/20 (Mon)

(78 pp)

Patel, Chapter 2

9/22 (Wed)

(37 pp)

Moreno, S., Marques, C., Santos, A., Santos, M., Castro, S.L., & Besson, M. (2009). Musical Training Influences Linguistic Abilities in 8-Year-Old Children: More Evidence for Brain Plasticity. *Cerebral Cortex*, 19, 712-723.

Slevc, L.R. & Miyake, A. (2006). Individual differences in second language proficiency: Does musical ability matter? *Psychological Science*, 17(8), 675-681.

Wong, P.C.M. & Perrachione, T.K. (2007). Learning pitch patterns in lexical identification by native English-speaking adults. *Applied Psycholinguistics*, 28, 565-585.

Wong, P.C.M., Skoe, E., Russo, N.M., Dees, T., & Kraus, N. (2007). Musical experience shapes human brainstem encoding of linguistic pitch patterns. *Nature Neuroscience*, 10(4), 420-422.

9/27 (Mon)

(35 pp)

Alossa, N. & Castelli, L. (2009). Amusia and Musical Functioning. *European Neurology*, 61, 269-277.

Jones, J.L., Lucker, J., Zalewski, C., Brewer, C., & Drayna, D. (2009). Phonological processing in adults with deficits in musical pitch recognition. *Journal of Communication Disorders*, 42, 226-234.

Poepfel, D. (2001). Pure word deafness and the bilateral processing of the speech code. *Cognitive Science*, 25, 679-693.

Zatorre, Belin, & Penhune. (2002). Structure and function of auditory cortex: music and speech. *Trends in Cognitive Sciences*, 6(1), 37-46.

9/29 (Wed)

(38 pp)

Deutsch, D., Henthorn T. and Dolson, M. (2004). Absolute pitch, speech, and tone language: Some experiments and a proposed framework. *Music Perception*, 21, 339-356.

Deutsch, D., Henthorn, T., Marvin, E., & Xu H-S. (2006). Absolute pitch among American and Chinese conservatory students: Prevalence differences, and evidence for a speech-related critical period. *Journal of the Acoustical Society of America*, 119, 719-722.

- Gill & Purves (2009). A biological rationale for musical scales. *PLoS One*, 4(12), e8144.
- Hove, M.J., Sutherland, M.E., & Krumhansl, C.L. (2010). Ethnicity effects in relative pitch. *Psychonomic Bulletin & Review*, 17(3), 310-316.
- Nan, Y., Sun, Y., & Peretz, I. (in press). Congenital amusia in speakers of a tone language: association with lexical tone agnosia. *Brain*.

### Weeks 5 and 6: Rhythm

10/4 (Mon)	(81 pp)
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Patel, chapter 3

10/6 (Wed)	(30 pp)
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- Goswami, U. (2009). Mind, brain, and literacy: Biomarkers as usable knowledge for education. *Mind, Brain, and Education*, 3, 176-184.
- Hannon, E. (2009). Perceiving speech rhythm in music: Listeners classify instrumental songs according to language of origin. *Cognition*, 111(3), 403-409.
- Schlaug, G., Marchina, S., & Norton, A. (2008). From singing to speaking: Why singing may lead to recovery of expressive language function in patients with Broca's aphasia. *Music Perception*, 25(4), 315-332.
- Wan, C.Y., Demaine, K., Zipse, L., Norton, A., & Schlaug, G. (2010). From music making to speaking: Engaging the mirror neuron system in autism. *Brain Research Bulletin*, 82(3-4), 161-168.
- Yoshida, K., Iversen, J.R., Patel, A.D., Mazuka, R., Nito, H., Gervain, J., & Werker, J. (2010). The development of perceptual grouping biases in infancy: A Japanese-English cross-linguistic study. *Cognition*, 115, 356-361.

10/11 (Mon) – <b>Columbus Day – no class</b>
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*Note:* discussion questions for this week are due on Tuesday 10/12

10/13 (Wed) – Guest discussant/presenter: Adena Schachner	(20 pp)
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- 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, 827-830.
- Patel, A.D., Iversen, J.R., Bregman, M.R., & Schulz, I. (2009). Avian and human movement to music: Two further parallels. *Communicative and Integrative Biology*, 2, 1-4.
- 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.
- Schachner, A. (2010). Auditory-motor entrainment in vocal mimicking species: Additional ontogenetic and phylogenetic factors. *Communicative and Integrative Biology*, 3, 1-4.

### Week 7: Melody

10/18 (Mon)	(57 pp)
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Patel, chapter 4

10/20 (Wed)

(35 pp)

Deutsch, D. (1997). The tritone paradox: A link between music and speech. *Current Directions in Psychological Science*, 6(6), 174-180.

Liu, F., Patel, A.D., Fourcin, A., & Stewart, L. (2010). Intonation processing in congenital amusia: Discrimination, identification, and imitation. *Brain*, 133, 1682-1693.

Mora, C.F. (2000). Foreign language acquisition and melody singing. *ELT Journal*, 54(2), 146-152

Schön, D., Gordon, R., Campagne, A., Magne, C., Astésano, C., Anton, J-L., & Besson, M. (2010). Similar cerebral networks in language, music and song perception. *NeuroImage*, 51, 450-461.

### Weeks 8 and 9: Syntax

10/25 (Mon)

(58 pp)

Patel, chapter 5

10/27 (Wed)

(43 pp)

Fadiga, L., Craighero, L., & D'Ausilio, A. (2009). Broca's area in language, action, and music. *Annals of the New York Academy of Sciences*, 1169, 448-458.

Rohrmeier, M. (2007). A generative approach to diatonic harmonic structure. In: *Proceedings of the 4th Sound and Music Computing Conference, Lefkada, Greece*, pp. 97-100. (Note: available online: <http://bit.ly/aoE7Ev>)

Sammler D, Koelsch S, Friederici AD. (in press). Are left fronto-temporal brain areas a prerequisite for normal music-syntactic processing? *Cortex*.

Tillmann B, Peretz I, Bigand E, Gosselin N. (2007). Harmonic priming in an amusic patient: The power of implicit tasks. *Cognitive Neuropsychology*, 24(6), 603-622.

11/1 (Mon)

(40 pp)

Fedorenko, E., Patel, A.D., Casasanto, D., Winawer, J., & Gibson, E. (2009). Structural integration in language and music: Evidence for a shared system. *Memory & Cognition*, 37, 1-9.

Maidhof, C. & Koelsch, S. (in press). Effects of Selective Attention on Syntax Processing in Music and Language. *Journal of Cognitive Neuroscience*.

Slevc, L.R., Rosenberg, J.C., & Patel, A.D. (2009). Making psycholinguistics musical: Self-paced reading time evidence for shared processing of linguistic and musical syntax. *Psychonomic Bulletin and Review*, 16, 374-381.

Steinbeis, N., Koelsch, S., & Sloboda, J.A. (2006). The role of harmonic expectancy violations in musical emotions: Evidence from subjective, physiological, and neural responses. *Journal of Cognitive Neuroscience*, 18, 1380-1393.

11/3 (Wed) – Guest discussant/presenter: Dr. Psyche Loui (Harvard Medical School) (20 pp)

Loui, P., Wu, E.H., Wessel, D.L., & Knight, R.T. (2009). A Generalized Mechanism for Perception of Pitch Patterns. *Journal of Neuroscience*, 29(2), 454-459.

Loui, P., Wessel, D.L., & Hudson Kam, C.L. (2010). Humans Rapidly Learn Grammatical Structure in a New Musical Scale. *Music Perception*, 27(5), 377-388.

Saffran, J.R. (2003). Statistical language learning: Mechanisms and constraints. *Current Directions in Psychological Science*, 12, 110-114.

### Weeks 10 and 11: Meaning

11/8 (Mon)	(51 pp)
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Patel, chapter 6

11/10 (Wed)	(29 pp)
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Gordon R.L., Schön D., Magne C., Astésano C., Besson M. (2010). Words and Melody Are Intertwined in Perception of Sung Words: EEG and Behavioral Evidence. *PLoS ONE* 5(3), e9889.

Lalitte, P., Bigand, E., Kantor-Martynuska, J., & Delbé, C. (2009). On listening to atonal variants of two piano sonatas by Beethoven. *Music Perception*, 26(3), 223-234.

Steinbeis, N. & Koelsch, S. (2008). Shared Neural Resources between Music and Language Indicate Semantic Processing of Musical Tension-Resolution Patterns. *Cerebral Cortex*, 18, 1169-1178.

11/15 (Mon) – <b>Topic for final paper due</b>	(40 pp)
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Juslin, P. N., and Västfjäll, D. (2008). Emotional responses to music: The need to consider underlying mechanisms. *Behavioral and Brain Sciences*, 31, 559–621. (Note: the commentary starting on p. 575 is optional reading, though you may find it useful.)

Zentner, M., Grandjean, D., and Scherer, K.R. (2008). Emotions evoked by the sound of music: Characterization, classification, and measurement. *Emotion*, 8, 494–521.

11/17 (Wed)	(29 pp)
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Gosselin, N., Peretz, I., Johnsen, E., & Adolphs, R. (2007). Amygdala damage impairs emotion recognition from music. *Neuropsychologia*, 45(2), 236-244.

Koelsch, S. (2010). Towards a neural basis of music-evoked emotions. *Trends in Cognitive Sciences*, 14(3), 131-137.

Matthews, B.R., Chang, C-C., De May, M., Engstrom, J., & Miller, B.L. (2009). Pleasurable emotional response to music: A case of neurodegenerative generalized auditory agnosia. *Neurocase*, 15(3), 248-259.

Strait, D.L., Kraus, N., Skoe, E., & Ashley, R. (2009). Musical Experience Promotes Subcortical Efficiency in Processing Emotional Vocal Sounds. *Annals of the New York Academy of Sciences*, 1169, 209-213.

### Weeks 12 and 13: Evolution

11/22 (Mon)	(57 pp)
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Patel, chapter 7

11/24 (Wed)

(41 pp)

McDermott, J. & Hauser, M.D. (2007). Nonhuman primates prefer slow tempos but dislike music overall. *Cognition*, 104(3), 654-668.

Trehub, S. E., & Hannon, E. E. (2006). Infant music perception: Domain-general or domain-specific mechanisms? *Cognition*, 100, 73-99.

Watanabe, S. & Nemoto, M. (1998). Reinforcing property of music in Java sparrows (*Padda oryzivora*). *Behavioural Processes*, 43(2), 211-218.

11/29 (Mon) – **Outline and reference list for final paper due**

(32 pp)

Mithen, S. (2009). The Music Instinct: The Evolutionary Basis of Musicality. *Annals of the New York Academy of Sciences*, 1169, 3-12.

Patel, A.D. (2010). Music, biological evolution, and the brain. In M. Bailar (Ed.), *Emerging Disciplines* (pp. 91-144). Houston, TX: Rice University Press. *Note*: available online: [http://vesicle.nsi.edu/users/patel/Patel\\_2010\\_music\\_evolution.pdf](http://vesicle.nsi.edu/users/patel/Patel_2010_music_evolution.pdf)

### Week 13: Wrap-up

12/1 (Wed)

(18 pp)

Jackendoff, R. (2009). Parallels and Nonparallels between Language and Music. *Music Perception*, 26, 195-204.

Patel, A.D. (2009). Music and the brain: Three links to language. In S. Hallam, I. Cross, & M. Thaut (Eds.), *The Oxford Handbook of Music Psychology*. Oxford: Oxford University Press (pp. 208-216). *Note*: available online: [http://vesicle.nsi.edu/users/patel/Patel\\_OUP\\_Handbook\\_chapter\\_2009.pdf](http://vesicle.nsi.edu/users/patel/Patel_OUP_Handbook_chapter_2009.pdf)

12/12 (Sun) – **Final paper due**