

4.648/4.649 // 21A.507/21A.519

a HASS-A subject

Resonance: Sonic Experience, Science, and Art

Fall 2014 MIT

Thursdays 1-4

Room 3-133

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Course Description

The world around and within us resonates. Indeed, the audible frequencies are but a tiny component of what William James dubbed the “blooming, buzzing” world. This subject cuts across the pillars of MIT to interrogate sound — via resonance — through approaches in the humanities, arts, sciences and social sciences.

Though the origins of the word *resonance* attach to sound — “the reinforcement of sound by reflection or by the synchronous vibration of a surrounding space or a neighboring object” (OED) — a wider definition points to any movement that unfolds in sympathetic response, making resonance a term that itself resonates across a range of sites and scales in the sciences, humanities, and arts. This class is dedicated to exploring such zones — zones where *resonance* prompts us to think about how we hear (or don’t), how we measure or describe phenomena (whether in wavelengths or through artistic evocations, or both), how we record / compress / and distribute resonating materials (whether those are cell walls, phonographs, or catgut), and how (or whether) we can be certain about what we think we know about the world. Though this course has its center in sound as an aesthetic, social, and scientific object, we ask more general questions as well, investigating, to begin, how resonance was created as a term of art and analysis in music theory and in science. We explore how a vibratory account of the universe, social and cosmic, has made it possible to *think* new things: that reality itself is comprised of oscillating materials, that achieving proper health can be done by getting one’s vibrations in order, that the modern world is suffused with the shock of too many vibrations, or that feedback is cool. We also inquire into how resonance has made it possible to *hear* new things: sound played or relayed through gramophone or telephone, sound delivered from the underwater world, sound representing the frequencies of the relic radiation of the Big Bang, sound conducted by arm bones, sound newly synthesized from such abstractions as mathematical formulae or data-driven algorithms.

Students are invited, as the syllabus unfolds, to see if they can key readings to particular frequencies, to discern whether revelatory patterns emerge. What kinds of phenomena seem to matter at very low, infrasonic, frequencies? At very high, ultrasonic frequencies? Within the range of so-called “audible” frequencies? For whom? Why? What kinds of science happen at which frequencies? Which kinds of art? How does medium matter? We attend to sound audible and inaudible, resonances measured and induced, sound heard, unheard, and inferred.

Requirements

Attendance at class meetings is essential. The subject introduces materials and speakers across several schools at MIT (SHASS, SA+P, and the School of Science). It requires attention and discussion to clarify the disciplinary origins of claims about resonance, and the fertile areas that lie between or beyond our disciplines of knowledge. There are no prerequisites for this class. Students will engage with the material in the classroom together, but will be required to produce a personal project as a final research product.

Required Reading

The following two books will be ordered for the COOP but are in the MIT Library and can readily be found. In addition, articles and book excerpts listed in the syllabus are posted on Stellar: <https://stellar.mit.edu/S/course/4/fa14/4.648/index.html>

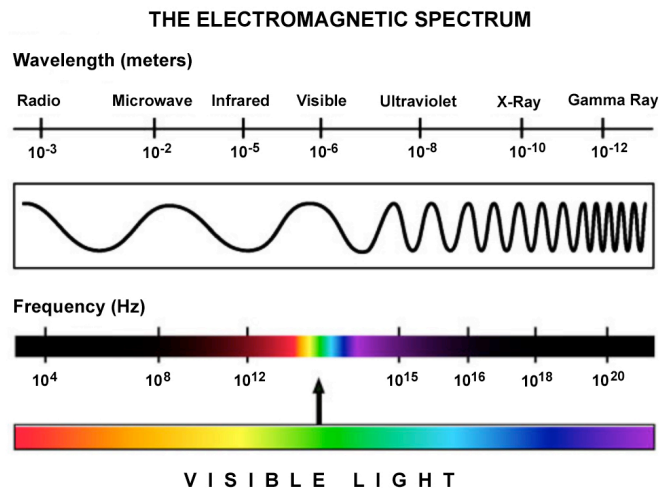
Augoyard, Jean-François and Henry Torgue, eds. *Sonic Experience: A Guide to Everyday Sounds* (Montreal: McGill-Queen's University Press, 2006).

Trower, Shelly. *Senses of Vibration: A History of the Pleasure and Pain of Sound* (New York: Continuum, 2012).

Recommended

LaBelle, Brandon. *Background Noise* (New York and London: Continuum, 2006).

Sterne, Jonathan. *The Sound Studies Reader* (New York: Routledge, 2012).



THE SOUND SPECTRUM

infrasonic

1 Hz

(frequency in cycles per second measured in Hertz)

audible human sonic range

1 kHz →

ultrasonic

1 MHz

THE HUMANLY AUDIBLE SPECTRUM

An infant's ear is able to perceive frequencies ranging from 20 Hz to 20,000 Hz; the average adult human can hear sounds between 20 Hz and 16,000 H

Assignments

self-assessments: 1. September 4 & 12. November 20

Assess on an index card what you know about resonance. Locate the source of this understanding, particularly if in a current or previous subject (as in 8.03, for example). We will compare self-assessments done at the beginning and toward the end of the class.

listening assignments: 3. September 18 & 10. November 6

Find a space at MIT, locate yourself comfortably, and *listen*. Attend to the sonic qualities of the space. Are there sounds that at first seemed obvious? Others not audible until further listening? Does your sonic attention function similarly, or different, to “focusing” in the visual domain? Using the *Sonic Experience* keywords, write up your experience in a **2-3-page** report. Offer a speculative conclusion about the auditory characteristics of the Institute – or explain why the space you located was sonically unique. On November 6, you will revisit your site and revise your report.

disciplinary pop quiz (ungraded): 4. September 25

You will be given 4-5 anonymized paragraphs (or sentences) taken from assigned readings – some of which you are not expected to have read yet. You will be asked to attribute each excerpt to a given discipline, if you can, or at least judge whether you are reading “science,” “art,” “anthropology,” etc. We will repeat the exercise with different excerpts in the final week, together with the repeat self-assessment, to examine whether we have expanded your knowledge base and skills in understanding different disciplinary modes of analysis.

symposium report: 5. October 2

Attend the *Seeing, Sounding, Sensing* symposium, and select two presentations to write up in a **4-5-page** essay. Drawing on the readings and class material thus far, imagine you are an Italian futurist (it may help to choose a particular one) who has suddenly been catapulted from Rome 1914 to Cambridge 2014. What surprises you in the two presentations? What do you assume to be a natural continuation from your own activities? And finally, do you agree or disagree with the presenters’ points?

preliminary project proposal: 8. October 23 & 11. November 13

Look ahead to the final research project prompt (see below). Write a **2-3-page** preliminary proposal that outlines your idea for a project. Provide a timeline for how you will approach the research and development of your project, together with a budget if you need materials, equipment rental, or anticipate other expenses. Justify the importance of your project as if you were writing to a grant agency and explain what sonic phenomenon your plan will address. Your graded and revised project proposal will serve as the document to be shared in the in-class project development workshop on **11. November 13**

final research project assignment

Create a sound-based artifact — a recording, an audio essay, a piece of sound art (installation or object). Alternatively, devise an experiment to test or extend any of the scientific and technical protocols we have been exposed to in this class. Produce a well-researched **5-10-page** paper describing your project and giving insight into its disciplinary approach, to hand in with the artifact in the week before exams. For this final research project (whether scientific or artistic), you may use any mode of sound representation/reproduction you like — a wax cylinder, an audiotape, phonograph records, a digital file, sound notation, your own (or someone else’s) voice. You must engage with class readings in your paper. Provide a bibliography (which can of course include discography/ mp3 databases, etc.), formatted in the way you see sources cited here in the syllabus.

final research project presentation in class — 13. December 4 & 14. December 11

Present your work to the class in an effective, 10-minute “sound bite.” Touch on a) the inspiration for your project, b) the assigned readings that contribute to an understanding of it, c) how the project evolved, d) what technical challenges you had to solve, and e) what you consider the results or findings.

A committee of faculty from Architecture, Anthropology, and the center for Art, Culture, and Technology may select some student works to appear on the “Resonating MIT” site, created in Spring 2014 to accompany and document 4.373 Sound Installations and Sonic Interventions, a subject taught by Gediminas Urbonas:

<http://resonatingmit.xvm.mit.edu/#!/home>

1. September 4

in class self-assessment

INTRODUCTION: INTO RESONANCE

Veit Erlmann, "Introduction: The String and the Mirror," in *Reason and Resonance: A History of Modern Aurality* (New York: Zone, 2010), 9-27.

Shelly Trower, "Introduction: Hearing Vibrations," "1. Nervous Motions," in *Senses of Vibration: A History of the Pleasure and Pain of Sound* (New York: Continuum, 2012), 1-36.

2. September 11

INVENTING RESONANCE AND AUDITORY MEMORY: ORIGINS IN ART & SCIENCE

Daniel Heller-Roazen, "Of Measured Multitude," and "Remainders," in *The Fifth Hammer: Pythagoras and the Disharmony of the World* (New York: Zone, 2011), 19-40.

Emily I. Dolan, "Lessons at the Ocular Harpsichord," "The Idea of Timbre," in *The Orchestral Revolution: Haydn and the Technologies of Timbre* (Cambridge: Cambridge University Press, 2013), 23-89.

Timothy Lenoir, "Helmholtz & the Materialities of Communication," *Osiris* 9 (1994): 185-207.

J-F. Augoyard and H. Torgue, entries on "Echo," "Phonomnesis," "Remanence," in *Sonic Experience*.

GUEST: EMILY DOLAN

Harvard musicologist

LISTENING:

SEPTEMBER 11 MEMORIAL

Stephen Vitiello, *Sounds Building in the Fading Light* (Creamgarden Records, 2001)

William Basinski, *The Disintegration Loops* (2062, 2002)

John Adams, *On the Transmigration of Souls* (Nonesuch, 2004)

Scott Walker, "Jesse," on *The Drift* (4AD, 2006)

Steinski, "Number Three on Flight Eleven," on *What Does it All Mean?* (Illegal Art, 2006)

3. September 18

RESONATING BODIES 1: HEARTS, CELLS, BRAINS

due: listening assignment

Douglas Kahn, "Thomas Watson: Natural Radio, Natural Theology," Alvin Lucier: Brainwaves," in *Earth Sound Earth Signal Energies and Earth Magnitude in the Arts* (Berkeley: University of California Press, 2013), 25-33, 83-92.

Sophia Roosth, "Screaming Yeast: Sonocytology, Cytoplasmic Milieus, and Cellular Subjectivities," *Critical Inquiry* 35 (2009): 332-350.

Josh H. McDermott and Eero P. Simoncelli, "Sound Texture Perception via Statistics of the Auditory Periphery: Evidence from Sound Synthesis," *Neuron* 71 (2011): 926-940.

GUEST: JOSH MCDERMOTT

MIT cognitive neuroscientist and participant in CAST symposium

LISTENING

Alvin Lucier, "Music for Solo Performer."

Anne Niemetz and Andrew Pelling. 2004. *The Dark Side of the Cell*.
<http://www.darksideofcell.info/about.html>

4. September 25

disciplinary pop quiz (ungraded)

RESONANCE AND NOISE:

MODERNITY REVERBERATING, OR, TOWARD A SONIC URBANISM

Shelly Trower, "Pathological Motions: Railway Shock, Street Noises, Earthquakes," in *Senses of Vibration: A History of the Pleasure and Pain of Sound* (New York: Continuum, 2012): 94–125.

Hillel Schwartz, "Sonotherapies," in *Making Noise: From Babel to the Big Bang & Beyond* (New York: Zone, 2011), 559-604.

Jacques Attali, "Listening," in *Noise: The Political Economy of Music* (Minneapolis, MN: University of Minnesota Press, 1992 [1977]), 3–20.

Luigi Russolo, "The Art of Noises" (1913) in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005), 10–14.

Max Neuhaus, "Notes on Place and Moment" (1992).

GUEST: DAVID MATHER
Art History, SUNY Stony Brook

LISTENING

Luigi Russolo, excerpts from *Art of Noises*, 1913.

Erik Satie, *Furniture Music*, 1917–1923: <http://www.youtube.com/watch?v=TZF8ubt569o>

FILM IN CLASS

Theremin, Steven M. Martin, 1993
Max Neuhaus: Times Square, 2002

CAST SYMPOSIUM "Seeing / Sounding / Sensing"

September 26-27

Students required to attend as much of the symposium as possible

5. October 2

due: symposium report

INFRASOUND:

LOW-FREQUENCY VIBRATION, BASS MATERIALISM, KINDS OF DEAF HEARING

Steven Connor, "Edison's Teeth: Touching Hearing," in *Hearing Cultures: Essays on Sound, Listening and Modernity*, ed. Veit Erlmann (Oxford: Berg, 2004), 153-172.

Julian Henriques, "Sonic Dominance and the Reggae Sound System Session," in *The Auditory Culture Reader*, ed. Michael Bull and Les Back, (Oxford: Berg, 2003): 451-80.

Mara Mills, "Do Signals Have Politics? Inscribing Abilities in Cochlear Implants" in *The Oxford Handbook of Sound Studies*, ed. Karin Bijsterveld and Trevor Pinch (Oxford: Oxford University Press, 2011), 320–46.

Sophia Roosth, "Nineteen Hertz and Below: An Infrasonic History of the Twentieth Century"

GUEST: SOPHIA ROOSTH
Harvard History of Science

LISTENING

Stone Love website: <http://www.stonelovejamaica.com/>

6. October 9

RESONATING BODIES 2: VOICES — HEARD, IMAGINED, DECODED

Walter J. Ong, *The Presence of the Word: Some Prolegomena for Cultural and Religious History* (New Haven, CT: Yale University Press, 1967), ∞CAJ excerpts.

Jesper Svenbro, "Archaic and Classical Greece: The Invention of Silent Reading," in *A History of Reading in the West*, eds. G. Cavallo and R. Chartier, tr. Lydia G. Cochrane. (Polity, 1999), 37-63.

Shelly Trower, "2. Psychophysical Sensations and Spiritual Vibrations," in *Senses of Vibration: A History of the Pleasure and Pain of Sound* (New York: Continuum, 2012), 37–72.

Tara Rodgers, "What, For Me, Constitutes Life in a Sound?: Electronic Sounds as Lively and Differentiated Individuals," *American Quarterly* 63, no. 3 (2011): 509-530.

GUEST: RENÉE GREEN

Artist who uses sound, Director of MIT ACT Program

LISTENING

Renée Green, *Wavelinks*, audio excerpt, 1999-2002

Antonin Artaud. 1947. *To Have Done with the Judgment of God*. Radio Play.

Online: www.earlabs.org/label/LC/LC008.htm

Gregory Whitehead. 2006. The Problem with Bodies. On *Music Overheard*, edited by Damon Krukowski. Institute for Contemporary Art.

Parapsychic Acoustic Research. 1999. *The Ghost Orchid: Introduction to EVP*.

National Public Radio, 2010. *The Vocoder: From Speech-Scrambling to Robot Rock*.

Interview with Dave Tompkins:

<http://www.npr.org/player/v2/mediaPlayer.html?action=1&t=1&islist=false&id=126781688&m=126791977>; also <http://howtowreckanicebeach.com/?p=187>

FILM IN CLASS

Excerpts from *Pygmalion*, Anthony Asquith, 1939

Klingon language doc, *Star Trek III: The Search for Spock*, Leonard Nimoy, 1984

7. October 16

DISSONANCE, IMPROVISATION, SILENCE

Janet K. Halfyard, "Mischievous Afoot: Supernatural Horror-comedies and the *Diabolus in Musica*," in *Music in the Horror Film: Listening to Fear*, ed. Neil Lerner (New York: Routledge, 2010): 21-37.

George Lewis, "Improvised Music after 1950: Afrological and Eurological Perspectives" in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005): 272–284.

John Cage, *Silence* (Middletown, CT: Wesleyan, 1961), ∞CAJ excerpts.

John Cage, "Composition as Process: Indeterminacy" (1958) in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox & Daniel Warner (New York: Continuum, 2005), 176–186.

Caroline Jones, "Finishing School: John Cage and the Abstract Expressionist Ego," *Critical Inquiry* 19, no. 4 (1993): 628-665.

Barbara London, "Introduction," in *Soundings* (New York: MoMA, 2013): 8–15.

GUEST: EVAN ZIPORYN

Clarinetist, composer, musical producer, and Director of MIT's Center for Art, Science, and Technology

LISTENING

Charlie Parker live at Birdland, 1950

Score for Jackson Pollock, Morton Feldman, 1950

Cecil Taylor, *The World of Cecil Taylor*, 1960

Bernard Herrmann, "The Shower Scene" from *Psycho*, 1960

Ziporyn, *Hive*, 2007

George Lewis, *The Will to Adorn*, 2011: <http://vimeo.com/33061529>

FILM IN CLASS

Jackson Pollock, Hans Namuth, 1951, excerpt

8. October 23

VISUALIZING SOUND AND SYNESTHESIA

due: preliminary project proposal

Wassily Kandinsky, ∞CAJ excerpts from the writings.

Richard Cytowic and David M. Eagleman, "See with your Ears," and "Inside a Synesthete's brain," in *Wednesday is Indigo Blue: Discovering the Brain of Synesthesia* (Cambridge: MIT Press, 2009), 87-108.

Selections from *See This Sound: Audiovisuology Compendium*, eds. Dieter Daniels and Sandra Naumann (Cologne: Ludwig Boltzmann Institute, 2010), excerpts "Architecture" (43–49), "Color Organ" (77–87), and "Sound Art" (297–301).

GUEST: RICHARD CYTOWIC, MD

LISTENING

Kandinsky's two synaesthesia prompts: Wagner vs. Schoenberg

Alexander Scriabin, *Prometheus* (selection), 1910

Oliver Messiaen, second movement of *Quatuor pour la fin du temps*, 1941

Laurie Anderson selections, 1980s
Marina Rosenfeld, *Anti-Warhol Movement*, 2003

9. October 30

**REPRODUCING / RIFFING ON RESONANCE:
PIANO ROLLS, PHONOGRAPHS, TAPES, CDS, MP3s, AND BEYOND**

Pierre Schaeffer, "Acousmatics" (1966) in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005), 76-81.

Jonathan Sterne, "The MP3 as Cultural Artifact," *New Media and Society* 8, no. 5 (2006): 825-842.

Nick Seaver, "Algorithmic Recommendations and Synaptic Functions," *Limn* 2 (2012):44-47.

GUEST: TOD MACHOVER

Cellist, composer, Opera of the Future group, MIT Media Lab

LISTENING

Éduoard-Léon Scott de Martinville and David Giovannoni. "Au Claire de la Lune," 1860

Pierre Schaeffer, *Etude au chemin de fer* (musique concret), 1948

Jimi Hendrix, *The Star Spangled Banner*, performed live 1970

Maryanne Amacher, *Synaptic Island* from *Sound Characters: Making the Third Ear*, 1999

Tod Machover, *Death and the Powers*, 2011

FILM IN CLASS

Scratch, Doug Pray, 2001

10. November 6

ULTRASOUND AND SONIFIED DATA

due: listening assignment

David A. Mindell and Katherine Croff, "Deep Water, Archaeology and Technology Development," *MTS Journal* 36, no. 3 (2002), 13-20.

Stefan Helmreich, "An Anthropologist Underwater: Immersive Soundscapes, Submarine Cyborgs, and Transductive Ethnography," *American Ethnologist* 34, no. 4 (2007): 621-641.

Stefan Helmreich, "Underwater Music: Tuning Composition to the Sounds of Science." in *The Oxford Handbook of Sound Studies*, ed. Karin Bijsterveld and Trevor Pinch (Oxford: Oxford University Press), 151-175.

GUEST: DAVID MINDELL

Professor of Aero-Astro and historian of engineering

LISTENING

Historic Naval Sound and Video, <http://www.hnsa.org/sound/index.htm>
my own recordings, audio and visual, from *Alvin*

Hydrophonia Sound Art Contest - Turn Ocean Noise into Sound Art
<http://synth.me/music-gear/hydrophonia-sound-art-contest-turn-ocean-noise-sound-art>

Polli, Andrea. 2004. *Heat and the Heartbeat of the City*, <http://turbulence.org/Works/heat/>

Jana Winderen, "Aquaculture," from *Energy Fields*, 2010.

11. November 13

due: preliminary project proposal revised

POLITICAL RESONANCE: ORGANIZING SONIC AND ELECTROMAGNETIC SPACE

Alain Corbin, "The Auditory Markers of the Village," in *The Auditory Culture Reader*, ed. Michael Bull and Les Back, (Oxford: Berg, 2003), 117-126.

Paul Stoller, "Sound in Songhay Possession, Sound in Songhay Sorcery," in *The Taste of Ethnographic Things: The Senses in Anthropology* (University of Pennsylvania Press, 1999), 102-122.

David Joselit, *Feedback* (MIT Press, 2007) ∞CAJexcerpt on RCA and the bandwidth wars.

Suzanne Cusick, "Resoundings: Hearing Worlds from the Global War on Terror," presented at "Hearing Modernity," Harvard University Music Department Sawyer Seminar, November 18, 2013.

IN CLASS

Half-hour workshop on final project

HANDOUT

Christian Sandvig, "Cartography of the Electromagnetic Spectrum: A Review of Wireless Visualization and Its Consequences," 34th Research Conference on Communication, Information, and Internet Policy, Arlington VA, October 2006: 1–21.

FILM IN CLASS

Excerpt from *Spectres of the Spectrum* (1999; dir. Craig Baldwin)

12. November 20

in class self-assessment

BIOACOUSTICS AND SONIC ENVIRONMENTS

R. Murray Schafer, "The Music of the Environment" (1973) in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005): 29–39.

David Dunn and René van Peer, "Music, Language and Environment," *Leonardo Music Journal* 9 (1999): 63–67.

David Dunn and Michael Lampert, "Environment, Consciousness, and Magic," *Perspectives on New Music* 27, no. 1 (Winter 1989): 94–105.

Hugh Raffles, "The Sound of Global Warming," in *Insectopedia* (New York: Pantheon, 2010): 318-330.

LISTENING

R. Murray Schafer, *Five Village Soundscapes*, 1977

David Dunn, *Mimus Polyglottos*, 1976

David Dunn. 2006. *The Sound of Light in Trees: The Acoustic Ecology of Pinyon Pines*.

Earth Ear Records; <http://www.acousticecology.org/dunn/solit.html>

David Dunn, *Chaos and the Emergent Mind of the Pond*, 1990

Bernie Krauss, "Biophony – Algonquin Wolves" (ca. 2007)

Global Sustainable Soundscapes Network (see also www.wildsanctuary.com)

Andrea Polli, *Sonic Antarctica*, 2009

(www.gruenrekorder.de)

IN CLASS FILM

Official trailer and clip, *Chasing Ice*, 2012
Excerpt, Galison & Moss, *Containment*, 2013

November 27: Thanksgiving

Over break prepare your presentation and final research project
(see project presentation as described in **Assignments**, pp. 3 + 4)

13. December 4

CLASS PROJECTS

14. December 11

CLASS PROJECTS

15. Exam week:

The assigned exam slot will be used for subject evaluation, self-assessment exercises, and a final review of your instructors!