

AUDI 412 Spatial Audio

FA2024

Course Details

Credits: 3

Prerequisites: AUDI 202 Studies in Hearing or AUDI 231 Psychoacoustics

Requirements: Junior Standing or Above (JR)

Time: Tuesday, 12:30-3:20 PM

Place: Building 33, 619

Instructor: Teerath Majumder

Instructor Email: tmajumder@colum.edu

Office Hours: Wednesday and Thursday, 10:00-12:00 PM

Course Description

This course focuses on the relationship between sound and space from a scientific and artistic perspective. It reviews the physiological and psychacoustic foundations of spatial hearing, as well as of stereophonic recording and production techniques. Other major topics include: impulse responses, binaural sound reproduction, 5.1 and other surround sound formats, ambisonics and other 3D sound spatialization techniques, microphone and loudspeaker arrays. Examples will be drawn from the history and current artistic practice of spatial audio.

Learning Outcomes

Students who successfully complete this course will have demonstrated

- an understanding of the theory of spatial hearing and sound spatialization,
- an ability to employ spatial audio recording and/or production techniques, and
- a critical awareness of scientific and artistic problems in sound spatialization.

Activities

- Lectures on theories of spatial audio perception and production
- Practical demonstrations and lab work with spatial audio tools
- Visiting spaces suitable for spatial recording and production
- Creative projects
- Discussion and feedback on student works
- Quizzes

Evaluation

Students will be evaluated on their performance in three quizzes, two creative projects, and a final project that has three components: proposal, creative work, and presentation. The assignments will be weighted as follows:

- Quizzes - 30%
- Creative projects - 40%
- Final project - 30%
 - Proposal - 5%
 - Creative work - 20%
 - Presentation - 5%

The grading rubric for the creative projects and the final creative work is as follows:

Meeting technical requirements	5
Purposeful application of tools	3
Creative intent	2
Total	10

The grading rubric for the proposal is as follows:

Description of project	2
Outline of tasks to be completed	1
Timeline of realization	1
References	1
Total	5

The grading rubric for the presentation is as follows:

Description of project	1
Statement of creative intent	1
Process of realization	1
Tools used, how, and why	1
Evaluation of outcome	1
Total	5

If a student is unable to turn in their work by the posted deadline, they must inform the instructor in advance. Otherwise, 10% of the score will be deducted for every 24 hours beyond the posted deadline.

Grading Scale

93% ≤ A ≤ 100%	73% ≤ C < 77%
90% ≤ A- < 93%	70% ≤ C- < 73%
87% ≤ B+ < 90%	60% ≤ D < 70%
83% ≤ B < 87%	0% ≤ F < 60%
80% ≤ B- < 83%	I = Incomplete
77% ≤ C+ < 80%	

Texts

Recommended: Zotter, Franz, and Matthias Frank. *Ambisonics: A Practical 3D Audio Theory for Recording, Studio Production, Sound Reinforcement, and Virtual Reality*. Springer Nature, 2019. <http://library.oapen.org/handle/20.500.12657/23095>.

Instructor will also assign other readings relevant to the topics discussed in class.

Hardware/Software Requirements

- Laptop
- Studio headphones
- Any DAW of choice
- Max (license will be provided)
- Focusrite MixControl (free)
- ZOOM Ambisonics Player Mac/Windows (free)
- Røde SoundField plugin (free)

Communication

Students are encouraged to reach out to the instructor with any questions regarding the course through Canvas messages.

Academic Honesty

Collaboration between students in this course is strongly encouraged. Students are urged to exchange ideas, opinions, and information, and to help each other with research and projects. However, each student is responsible for the completion of their own assignments.

In this class, you will be expected to attribute due credit to the originator of any ideas or words that you incorporate into your own work. **Any borrowed text, code, and sound must be cited.**

Disability

If there are conditions that prevent a student from attending classes or participating fully in academic activities, the student is encouraged to consult Services for Students with Disabilities as soon as such conditions present themselves.

General Reference

School of Audio and Music: William Boris, Associate Director - wboris@colum.edu
(department phone: 312-369-6182)

Semester Schedule

Week	Module	Lecture Topic	Activity	Assignment Due
1	Understanding space	Perception: Localization	Install necessary software	
2		Perception: Acoustics and imaging	Experiments with delay	
3		Physical properties of sound in space	Experiments with delay and levels	Quiz 1
4	Playback	Moving sounds: Types of spatialization, and their advantages and limitations	Research spatialization technologies, preparation for Creative Project 1	
5		Channel based: Speaker configurations and panning	Building an octa panner	Creative Project 1
6		Object based: Atmos	Visit Immersive Audio Lab	
7		Soundfield: Ambisonics	A to B conversion and imaging	
8		Artificial acoustics: Algorithmic reverb	Building a reverb	Quiz 2
9		Artificial acoustics: Convolution	Recording IRs, preparation for Creative Project 2	Final Project Proposal
10		Election day (no class)		
11	Recording	Concepts	Research microphones	
12		Stereo techniques	Apply coverage, LD and TD concepts to record surroundings	
13		Higher order spatial techniques	Preparation for final project	Quiz 3
14	Preparation for final project			
15	Final project presentation			Final Project