STUDIO X SPACE | MUSIC | MATTER | VIBRATION

Course Syllabus

Instructor: Jonathan Tyrrell – jtyrrell@uwaterloo.ca
Studio Hours: Mondays and Thursdays, 9:30am – 12:30pm and 1:30pm – 5:30pm
Office Hours: By appointment

Iannis Xenakis on Site at Persepolis Polytope, 1971

*Beasts of silence pressed forwards from the clear
loosened forest from their nest and den;
and it was not in cunning that they came
so quiet within themselves, and not in fear*

*but in listening. Shrieking, roaring, braying
seemed to wane within their hearts. And wherever
a shelter could receive this, even the slightest,*

*a dwelling forged from darkest of desires,
with entrance pillars that begin to quiver–
there you made them temples in their hearing.*

- Rainer Marie Rilke, *The Sonnets to Orpheus*

*The thunder rumbles, we've taken refuge in our
tent. And again his face is radiant, peaceful. He
uses his watch to calculate meticulously the
number of seconds between the brutal bursts of
lightning that tear apart the night and the explosions
of thunder as they grow closer and closer to us.
When the storm is at last directly above our heads
he leaves the tent, half-naked; he runs and
disappears little by little into this grandiose
spectacle of sound and apocalyptic light.*

- Mâkhi Xenakis
Iannis Xenakis: Composer, Architect, Visionary

1. INTRODUCTION

The first passage above describes a world that comes into being through sound. When struck by the hand of Orpheus, the Lyre resonates everything into a vibratory existence. Trees, creatures, rocks, architecture – the biotic and the abiotic – nothing is untouched by the tremors of his making. In this studio we aim to perceive architecture not as frozen music but as vibratory matter. We wish to understand buildings as resonant frames of emplacement in such a world that Rilke conjures: "to make them temples in their hearing". We wish to investigate the link between deep listening and architectural intuition.

Studio X will explore the intersection of space, music, matter, and vibration. It is from this crossing that the studio gets its X moniker. We also observe that X is phonetically unique in the English alphabet as the only letter that acts as a voiced coronal fricative ("z" sound), and the only hybrid consonant-fricative ("ks" sound). We also borrow the 'X' from one of our many muses: Iannis Xenakis. As an engineer, architect, composer,

and theoretician, Xenakis remains one of the most compelling polymaths of the 20th century. Underpinning his approach to composition in architecture and music was a near-spiritual engagement with mathematics (geometry and probability in particular) which can be seen in his many charts, notations, and graphs that capture an obsessive quest for a fundamental compositional order that is rigorous, and yet decidedly non-platonic.

But as evidenced by the introductory quote above (a memory of a family holiday from his daughter Mâkhi) Xenakis was also very much someone who was in the world, and was moved by its forces. He carried physical and psychological scars from a traumatic youth, a visceral experience which he tried to articulate in mathematics and music, as well as in his polytopes: a series of site-specific installations using immersive sound and light. It is because of his ability to work with rational thought and visceral experience, with both abstraction *and* affect, that we hold Xenakis as Studio X's prime muse.

The Case For Sound

> *As a rule, vision both decodes size as length, width and height, and organizes distance by the way objects obscure one another or change their relative size. In contrast, hearing decodes size as the global metric of volume because sound permeates air as a fluid, flowing around objects and into crevices. We cannot see volume, but we can hear it.*

> - Barry Blesser and Ruth Salter, "Spaces Speak, Are You Listening?"

> *Anyone who has become entranced by the sound of water drops in the darkness of a ruin can attest to the extraordinary capacity of the ear to carve a volume into the void of darkness. The space traced by the ear becomes a cavity sculpted in the interior of the mind.*

> - Juhani Pallasmaa, "The Eyes of the Skin"

Sounds, at their core, are disturbances in the environment. Our ears register difference, change, deltas. But we also feel these disturbances through our entire bodies – on the surface of our skin, in our bones, and within the architecture of our psychic interior. Sound collapses space and connects the inner and outer worlds, the intimate with the public. As Raymond Murray Schafer puts it: "sound is a way of touching at a distance."[1]

The sonic realm is an active space of inquiry. To 'sound out' an object or space is not to ask about something ephemeral, it is to ask about materials: their density, profile, finish, geometry; their connections, details, and seams. It is to inquire about interactions of matter with matter and the atmospheres in which these interactions occur. 'Sounding out' is also a political act, to test the veracity of a held truth. Friedrich Nietzsche famously uses the image of the tuning fork as a method for auditing the presuppositions of his time: "Another mode of convalescence […] is sounding out idols. There are more idols than realities in the world: that is my 'evil eye' for this world; that is also my 'evil ear'. For once to pose questions here with a hammer, and, perhaps, to hear as a reply that famous hollow sound..."[2]

Advocating for the study of sound in the education of an architect would seem necessary to some and absurd to others. Vitruvius was clear about the requirement for architects to study music, both as a means of understanding mathematical proportion, and in order to achieve maximum clarity and dramatic effect in the

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[1] Schafer, R. Murray, "The Soundscape: Our Sonic Environment and the Tuning of the World", p. 11
[2] Nietzsche, Friedrich, "Twilight Of The Idols"

design of theatres.[3] But more importantly sound and space have been *reciprocally entangled* for much of the history of architecture. Ancient sacred spaces almost always exhibited special acoustic properties. The caves at Lascaux, famous for their paintings also produced otherworldly reverberant effects that could be used in ritual performance.[4] Archeologists have discovered numerous bronze-age structures across Europe which have resonant frequencies of around 110 Hz. Standing waves at this frequency would have amplified and distributed the male voice in shamanistic ceremony, giving it an otherworldly presence. Sound is associated with many creation myths around the world, and the sound of water, in its many guises, plays poignantly in the deepest parts of our consciousness as a fundamental creative force: "What was the first sound heard? It was the caress of the waters."[5]

In the middle ages the evolution of chant was shaped by the long reverberation times and incredibly charged aural atmospheres of the cathedral: "Here each sound, even a pin dropped at the end of the nave some 40 meters away, generates a full range of harmonic overtones . . . the nave is so sound-sensitive that one becomes aware that every body movement creates an impact on the volume of air in the chamber".[6] In fact it has been argued that polyphony (layering more than one note together at the same time) as a musical invention was the result of the time delay experienced while singing monophonic music in large gothic spaces.[7] With the invention of linear perspective in the Renaissance, vision becomes architecture's dominant sense. Aside from some marginal examples in the works of Athanasius Kircher and others, sound studies generally falls outside of architectural/spatial discourse before showing a resurgence in the latter half of the 20th century.[8]

Our particular agenda in focussing on sound and architecture ranges from the practical to the philosophical, and the explicit to the esoteric:

1) We are interested in **aural awareness,** in tuning our aural sense such that we are more attentive (in the broadest sense of the word) to the spaces we make, and the larger environments in which they are situated, while at the same time rejecting the split between objective modes of aural analysis (acoustics) and experiential ones (affect). We are interested in how deep listening puts us squarely in the world, not separate from it. Deep listening requires *presence*.

2) We wish to explore how sounds reveal, and are contingent upon, the precise **physical properties** of the spaces or vessels from which they emanate. Think of the way an instrument maker works toward achieving the most affectively-charged sounds by way of a deep understanding of materials, joinery, and forces.

3) We are interested in how **trans-disciplinary practice can enrich our intuition** for formal and spatial composition. Specific emphasis is placed on the **temporal dimension** of sound and music, and how it can help us to better understand and design for the affective and experiential aspects of architecture.

4) We are interested in the **social and political dimensions** that sound studies opens up, and the critical tools and methods it offers. Our aim is to reveal how sound, and in particular soundscape studies can become a lens for understanding a much broader range of topics.

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[3] See Books 1 (Education of the Architect) and 5 (Sounding Vessels) in Vitruvius, "The Ten Books on Architecture"
[4] Blesser and Salter, "Spaces Speak: Are You Listening?" p. 74
[5] Schafer, R. Murray, "The Soundscape: Our Sonic Environment and the Tuning of the World"
[6] As quoted in Sheriden and Van Lengen, "Hearing Architecture: Exploring and Designing the Aural Environment" p. 39
[7] Rasmussen, S. E., "Experiencing Architecture" p. 230
[8] See Ripley, Colin, "In The Place of Sound" p. 4 for a recent history of the sound|space nexus.

Approach

For this studio we require no formal musical training or technical knowledge of sound production. We do however require you to listen with a level of attentiveness that you may not be accustomed to. And so while we will be working intensely together on projects we will also have moments of extreme attentiveness. We will visit some sites in the area where we can listen to spaces deeply and come to know their sonic character. We will listen, discuss, and analyze various muses and musics. We will draw and make with the ambition of working ambidextrously between sound and architecture. And though we don't require training we do wish to work directly with the creation of sound. Therefore the following projects will be supported with workshops on recording and production where necessary.

2. LEARNING OBJECTIVES

1. Develop an acute aural awareness for buildings and their environments.
2. Become familiar with key terms of reference for the anatomy of sound and its relationship to space.
3. Use trans-disciplinary practice to develop new creative approaches to, and sharpen our intuition for, architectural composition.
4. Expand our awareness of material properties and methods of making.
5. Develop a rigorous and creative engagement with theorists and makers (architects, artists, composers, poets) whose practices and methods open up new territories of the formal, temporal and material imagination.
6. Develop a compelling and speculative approach to programs and events and how these might be enhanced through the architectural frame.
7. Participate actively in seminar and studio discussions at a high level, foster critical debate and inquiry and hone the art of concise oral and visual presentation.
8. Develop the beginnings of a critical voice in relation to architecture that can be explored and built upon in graduate studies and initiate research and creation methods that can be used for further study beyond the studio.

3. STUDIO STRUCTURE

The studio will be organized into 4 projects – the first three of which will be done in groups, and the last individually. **P1: The Idea of Soundscape** will launch you directly into gathering, processing, and composing with sound. Your task will be to choose a site in the Galt area from which you will draw out a sonic profile, a soundscape. You will then be asked to bring these recordings back to the studio where you will compose a 3-5 minute sonic portrait accompanied by a notational montage. The sonic portrait should be thought of as re-presentation. The aim is not simply to document what is there but to re-compose it anew.

P2: Resonant Vessel will ask you to translate between music and architectural form. You will select a musical passage from our collective list and analyze it in terms of its spatial and physical character. Particular emphasis will be placed on how it changes over time - how it expands, contracts, torques, releases, sustains, attacks; what kinds of volumes it implies, and what material analogues it suggests. From there you will construct an architectonic response in the form of a small vessel, which will act as a physical maquette for a resonant space. As a follow-up to this exercise you will photograph your vessel under well considered

lighting conditions and use it as a basis for an architectural collage which will be scaled and re-inserted into your site from P1.

Reverence for the spiritual power of the voice is inseparable from the archaic world view. The Oracles of Ancient Greece, interpreters of divine revelation, were famous for prophesizing in exhaustive episodes of unintelligible speech. The source of the sound, voice or otherwise, was also inseparable from the space which modified it, as in the Cave of the Sibyl at Cumae, Italy. **P3: The Oracle Chamber** will ask you to construct, in groups of three, an installation using sound, space, material, and light: an Oracular Chamber which will be exhibited in the school.

The final project, **P4: The House of the Refrain** will ask you to design, envision, and ensonorize a cultural space dedicated to, and embodying the voice and compositional ethos of, one of our studio muses (Iannis Xenakis, Olivier Messiaen, Orpheus, Tanya Tagaq, Evelyn Glennie, Brian Eno, Bjork, Glenn Gould, Miles Davis, Karlheinz Stockhausen, etc.) You will synthesize the most cogent aspects of the previous three projects, and extrapolate them into an architectural proposition that inhabits the intersection of Studio X's four elements (sound, space, matter, and vibration).

4. EVALUATION

Each assignment throughout the term will be assessed on the following basis:

- Ambition, clarity and appropriateness of the ideas addressed within the work.
- Architectural quality and the technical resolution of the proposition.
- Integrity in the development of the project from initial to final phase.
- Precision and craft of physical artifacts created.
- The effectiveness and the completeness of project documentation and its capacity to communicate the project's intentions in the author's absence.

Project 1: **10%**
Project 2: **20%**
Project 3: **25%**
Project 4: **45%**

Deadlines and extensions: Arch 393 project deadlines can be extended only in cases of illness or incapacity. Requests for such extensions must be made before the project deadline, as soon as is possible, using the request for extension form available from the Undergraduate Student Services Coordinator, accompanied by a medical certificate when necessary, and submitted to the Arch 393 Coordinator. Students must complete all projects, and obtain a passing average in order to receive credit for this course. **A failing grade (less than 50%) in Project 4 will constitute a failing grade for the term.**

Late policy: Assignments that are handed in late will receive a penalty of 5% per calendar day, after 5 days, the assignment will receive a 0%. Only in the case of a justified medical or personal reason will these penalties be waived, and only if these have been officially submitted to the Undergraduate Student Services Co-Ordinator and accepted by the Undergraduate Office.

5. SELECTED COURSE BIBLIOGRAPHY:
(Many of the following are on reserve in the library and some articles will appear on LEARN)

Akiyama, Mitchell, "Transparent Listening: Soundscape Composition's Objects of Study", 2010
Attali, Jacques, "Noise: The Political Economy of Music", 1985
Augoyard, Jean-Francois, "Sonic Experience: A Guide to Everyday Sounds", 2006
Blesser, Barry, and Salter, Linda-Ruth, "Spaces Speak: Are You Listening?", 2007
Cage, John, "Notations", 1969
Droumeva, Milena, Jordan, Randolph (Eds.), "Sound, Media, Ecology", 2019
Gandy, M. and Nilsen, BJ, ed., "Acoustic city", 2014
Goodman, Steve, "Sonic warfare : sound, affect, and the ecology of fear", 2009
Hewett, Lovelace, Kanach, Xenakis, "Iannis Xenakis: Composer, Architect, Visionary", 2010
Kahn, Douglas, "Noise Water Meat: A History of Sound In The Arts", 1999
Kingwell, Mark, "Glenn Gould", 2011
Kircher, Athansius, "Musurgia Universalis", 1650
Labelle, B., and Martinho, C. ed., "Site of sound : of architecture and the ear. 2", 2011
Labelle, Brandon, "Background Noise: Perspectives on Sound Art", 2006
Labelle, Brandon, "Acoustic territories : sound culture and everyday life", 2010
Langer, Suzanne, "Feeling and Form", 1953
Leitner, Bernard, "Ton, Raum = Sound, Space", 1978
Martin, Elizabeth, "Pamphlet Architecture 16: Architecture as a Translation of Music", 1994
McLuhan, M, "Inside the Five Sense Sensorium", 1961
Pallasmaa, J, "The Eyes of The Skin", 2005
Pesic, Peter, "Music and the Making of Modern Science", 2014
Rasmussen, S. E., "Experiencing Architecture", 1959
Reich, Megan A., "Soundscape Composition: Music as Environmental Activism", 2018
Rilke, Rainer Marie, "Sonnets to Orpheus", 1923
Ripley, C., Polo, M., Wrigglesworth, A., ed., "In The Place of Sound", 2007
Schafer, R. Murray, "The Soundscape: Our Sonic Environment and The Tuning of The World", 1977
Sheridan T., and Van Lengen, K. , "Hearing Architecture: Exploring and Designing The Aural Environment", 2003
Small, Christopher, "Music, Society, Education", 1977
Sterne, Jonathan, "The Audible Past: Cultural Origins of Sound Reproduction", 2003
Sterne, Jonathan, "The Sound Studies Reader", 2012
Thompson, E. A., "The Soundscape of Modernity: architectural acoustics and the culture of listening in America", 2002
Thompson, M., and Biddle I., ed., "Sound, Music, Affect : Theorizing Sonic Experience", 2013
Toop, David, "Ocean of Sound: Ambient Sound and Radical Listening in the Age of Communication", 1995
Traber, C, "Bernard Leitner- Sound:Space", 1998
Xenakis, Iannis, "Formalized Music: Thought and Mathematics in Composition", 1963

6. SCHEDULE, STUDIO ATTENDANCE AND CULTURE

Arch 393 is scheduled as follows: Mondays: 9:30-12:30; 1:30-5:30 pm.Thursdays: 9:30-12:30; 1:30-5:30 pm. Students are required to be working in the studio during the above scheduled hours. Repeated absence may be sufficient reason to request withdrawal from the course. Students are also required to attend and participate in all scheduled reviews, and expected to attend all guest lectures and other events.

The School of Architecture building is open 24 hours a day, seven days a week, which allows students to execute their design work in the studio. Working in isolation inevitably undermines the potential of the collective environment of the studio, and is typically detrimental to the quality of a student's work. The development of a healthy studio culture involves intensive production as well as a critical and speculative

dialogue with regard to their own work and the work of others. The studio must be a safe and inclusive environment in which all students can work without unnecessary distraction. Disruptive behavior is strictly forbidden. Headphones must be used if a student wishes to listen to music or other electronic media. The student lounge, gym and basketball court are available to any student who wishes to engage in activities unrelated to studio work.

Reviews: While studio reviews are not evaluated per se (and in particular, the discussions of studio reviews are no indication of grading outcomes) attendance and presentation of work is mandatory. Students who fail to present their work without prior agreement with a studio professor will receive a 10% grade deduction on the project, over and above any late penalties that might apply. It is important for each student to participate not only in the review of their own work, but in the reviews of the work of fellow students. Participation in class reviews and seminars is mandatory.

7. COMMUNICATION WITH STUDIO COORDINATOR

During the course of the term, faculty may need to send communications to Arch 383 students. It is required that each student confirm their current active email address with the Undergraduate Student Service Coordinator during the first week of class. Students may receive general communications from the coordinators regarding studio business by e-mail. It is expected that students check their email daily and that once material has been sent it has been officially received. Copies of all official correspondence will be archived for future reference. Email correspondence directed to individuals may be sent either to their individual accounts, or through LEARN, whereas formal class-wide correspondence will be sent through LEARN. As a result students should ensure that their LEARN account is active. Over the course of the term, students may receive less formal correspondence from individual faculty members regarding various issues pertaining to individual projects, review schedules etc. We do however ask that students do not use email as a means of communicating with faculty members regarding their studio projects or personal issues. Discussions concerning individual projects or any other matter requiring direction, confirmation or advice from faculty should occur during scheduled studio hours unless previously discussed with the instructor, or scheduled at a separate time with the studio coordinators.

8. FIELD TRIP

There will likely be a field trip on October 7th or 10th. The destination will be within a 1-2 hour drive of Cambridge and there will be a small cost to cover transport and any entry admissions. Details will be provided by the second week of term.

9. OTHER OFFICIAL BUSINESS

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for

more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.
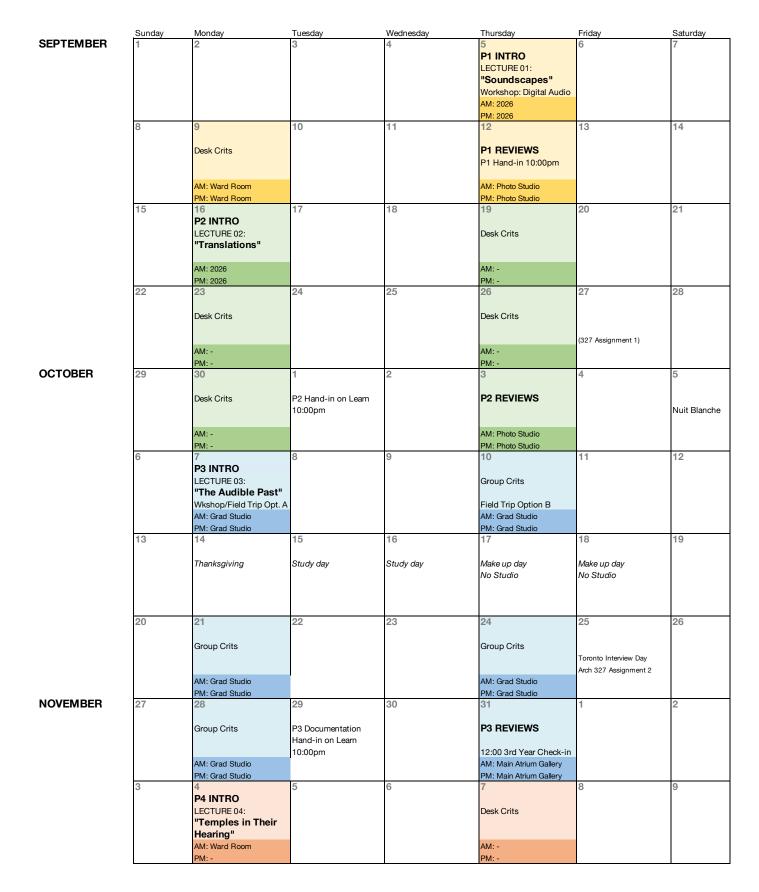
Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

Turnitin.com: Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit the alternate assignment.

ARCH 393 Schedule

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
SEPTEMBER	1	2	3	4	5 **P1 INTRO** LECTURE 01: **"Soundscapes"** Workshop: Digital Audio AM: 2026 PM: 2026	6	7
	8	9 Desk Crits AM: Ward Room PM: Ward Room	10	11	12 **P1 REVIEWS** P1 Hand-in 10:00pm AM: Photo Studio PM: Photo Studio	13	14
	15	16 **P2 INTRO** LECTURE 02: **"Translations"** AM: 2026 PM: 2026	17	18	19 Desk Crits AM: - PM: -	20	21
	22	23 Desk Crits AM: - PM: -	24	25	26 Desk Crits AM: - PM: -	27 (327 Assignment 1)	28
OCTOBER	29	30 Desk Crits AM: - PM: -	1 P2 Hand-in on Learn 10:00pm	2	3 **P2 REVIEWS** AM: Photo Studio PM: Photo Studio	4	5 Nuit Blanche
	6	7 **P3 INTRO** LECTURE 03: **"The Audible Past"** Wkshop/Field Trip Opt. A AM: Grad Studio PM: Grad Studio	8	9	10 Group Crits Field Trip Option B AM: Grad Studio PM: Grad Studio	11	12
	13	14 *Thanksgiving*	15 *Study day*	16 *Study day*	17 *Make up day* *No Studio*	18 *Make up day* *No Studio*	19
	20	21 Group Crits AM: Grad Studio PM: Grad Studio	22	23	24 Group Crits AM: Grad Studio PM: Grad Studio	25 Toronto Interview Day Arch 327 Assignment 2	26
NOVEMBER	27	28 Group Crits AM: Grad Studio PM: Grad Studio	29 P3 Documentation Hand-in on Learn 10:00pm	30	31 **P3 REVIEWS** 12:00 3rd Year Check-in AM: Main Atrium Gallery PM: Main Atrium Gallery	1	2
	3	4 **P4 INTRO** LECTURE 04: **"Temples in Their Hearing"** AM: Ward Room PM: -	5	6	7 Desk Crits AM: - PM: -	8	9

10	11 Desk Crits AM: - PM: -	12	13	14 Desk Crits AM: - PM: -	15	16
17	18 Desk Crits AM: - PM: -	19	20	21 **P4 MIDTERM** AM: Loft Gallery PM: Loft Gallery	22	23
24	25 Desk Crits AM: - PM: -	26	27	28 Desk Crits AM: - PM: -	29 (327 Assignment 3)	30
1	2 Desk Crits AM: - PM: -	3 Last Day of Classes	4 **Plotting Deadline**	5 Desk Crits. (optional) AM: - PM: -	6	7
8	9 P4 Hand-in	10	11 **P4 FINAL REVIEWS**	12	13	14
15	16	17	18	19	20	21

DECEMBER