Spatial UX

a user experience course for spatial interactions

Fall 2024 Thurs 11a-1p
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Course Technical Topics

Network Architecture · AI & Natural Language Programming · APIs · Sensors & Actuators · Computer Vision & Tracking · Speech Recognition, & Voice · Natural Interfaces · Embodied Interactions

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Overview

Spatial UX is the user experience guide to the physical world beyond the screen. From gesture, speech, audio, projection mapping, smart homes, and even interactions on the web, Spatial UX will guide you through how to think about user experiences in the real world. You will learn to create designs based on the context of location, proximity, scale, and social contexts. The course provides a conceptual framework, and technical toolkit, for thinking about **user experience spatially**, but also provides the technical how-to, to make these experiences quickly realized with a suite of low code tools, namely Procession.

We'll focus on "natural user interactions." This course will expose you to the latest techniques and technologies for designing experiences beyond the screen (such as large language models for speech and live camera image recognition, and gesture recognition). This is a must for anyone who's serious about making embodied interactions in our real world beyond phone and computer screens.

Social ~~User~~ Experiences

Spatial ~~User~~ Interfaces

Our goal will be to counter the dominant practice of what I'll refer to as "flat computing," **individualist computing** on a screen between little window boxes that flatten reality, fragment meaning, and decontextualize the origins of online content.

The Future of Spatial UX

We're at a particularly interesting time for user experience design. Interactions have the increasing potential to be spatially contextual and embodied in the environment using the spatial, tangible, and impromptu potential of web connectivity. The recent emergence of **low-code tools** and **LLMs** are making it easier than ever to string together, design, and prototype these physical technologies. **Multimodal AI** is allowing for more natural interactions that can be interpreted outside of a screen, mouse and keyboard.

Change Over Time to Natural User Interfaces - we are currently between GUI and NUI

The rise of "**Spatial Computing**" points to greater focus on digital interactions that take place in the context of the physical world. This class is not a VR course. It will focus instead on interactions interpreted and embodied in the environment: gesture, speech, presence, projection and audio.

The field of user experience now must evolve to the physical and spatial context of the world which architects have learned to grapple with over centuries.

Spatial UX aims to heighten our connection to the physical world and each other by designing **digital interactions beyond the screen**: with social experiences and spatial interfaces, designing interactions that engage the five senses and all three dimensions.

Natural Interface Procession by Spatial Pixel [link]

We will be leveraging Spatial Pixel's natural language programming environment to build your interactions.

Course Expectations

1. **Be brave!**
   This class is for you, not for me. Be courageous in addressing the problems you care most about, rather than trying to fulfill the assignment. This course requires a tolerance for ambiguity, a tolerance for assignments that have more than one possible answer and a willingness to go outside of your comfort zone. Addressing the uncertainty and ambiguous problems is as key to this class as it is to design and entrepreneurship in emerging fields like spatial ux.

2. **You'll get out what you put into it**
   Learning in this course requires engaging with the material, trying things that haven't been tried, adjusting, and trying again. The more you put in, the more you will get out of this course.

3. **Computers for work and not distraction**
   I will sometimes ask for you to completely put away computers and phones. Participation in discussions and in-class activities is critical to your learning and the dynamics of the class.

Course Goals

Push forward the field of Spatial UX.
Understand user experience as it exists today and the emerging technologies that allow for spatial experiences. Recognize yourself as active participants in defining where that future of technology heads and be critical of the status quo.

↑ Develop technical capabilities.
Understand and explore techniques using programming, spatial computing and multi-modal AI capabilities.While you won't exit this as fluent software engineers, you should have a good sense of how to hack together prototypes and break down a technical problem and think through various methods to solve it. Activities will include workshops, tutorials, live help sessions, lectures, technical prototyping, and demos.

Assignments & Grade Breakdown

Projects	SCALE & SENSE	Points Grade
Project 1	Hand & Sight	25%
Project 2	Body & Hearing	25%
Project 3	Street & Sixth	25%
	Class Participation	25%

GUEST LECTURES
Hand: Michelle Cortese, Senior Design Manager @ Meta, VR @ NYU ITP Marcelo Coelho @1:30p Head of Design at Formlabs and Faculty at the MIT Body: Lauren Bedal, Physical AI, Choreographer, Multimodal AI Mike Szivos, SOFTLab Chrisoula Kapelonis, Product Designer at Google Nest Place: Daniel Rosenberg Munoz, CMU Mindful Experience Design Numina, Laura Fox and Streetlife Ventures Paul McConnell, Head of Strategic Design / Experience at Arup

Course Schedule

Week	***Class***	***Homework*** *An assignment is due each week within each project.* *All work due prior to following class*
1 4-Sep	**Natural interfaces** What is a "natural interface" What is an interface? Intent vs Command Based interaction The Future of Spatial UX **WORKSHOP** Rube Goldberg Machine	**Project 1: Hand & Sight** • Purchase projector and camera • Tutorial: Procession quick start • Optional Reading: What is Spatial UX? Violet Whitney • Optional Reading: Natural User Interface
2 11-Sep	**Sight & Gesture** The sense of sight Visual understanding and spatial communication. Network Architecture & Low Code Hardware Sensors/Actuators ***Hardware**: Cameras, Motion & Light Sensors, Projectors, Screens, Lights* ***Software**: Hand Tracking, Gesture Recognition, Computer Vision, Object Detection* **WORKSHOP** Using Images & Video ***Spatial UX Diagramming Workshop***	• Tutorial: Using Images & Video • Optional Reading: A Brief Rant on the Future of Interaction Design, Bret Victor [link]
3 18-Sep	**FIELD TRIP: Spatial Pixel Lab, Chelsea NYC** *Days the Spatial Pixel Lab is open to external guests:*	• Tutorial: AI Programming with Procession + Combining Projects
4 25-Sep	Externalism & Situated cognition **DESK CRITS**	• Tutorial: Using Generative AI in an interaction
5 2-Oct	**PRESENTATION** Project 1 Project 2 Intro	**Project 2: Body & Hearing** • Tutorial: Face and Body Tracking • Optional Tutorial: Teachable machine

6 9-Oct	**Sound & Voice** The Sense of Sound How we hear, periphery and attention. Looks Like vs Works Like Prototypes ***Hardware**: Microphones, Sound Sensors, Speakers, Buzzers* ***Software**: speech recognition, speech synthesis, mic, pitch, rhythm, sound libraries* **WORKSHOP** Speech, Sound and Physical Prototyping	• Tutorial: Speech to Text, Text-to-Speech, Translation • Optional Reading: A New Era of Spatial Computing, Lauren Bedal [link]
7 16-Oct	**DESK CRITS**	• Tutorial: Sounds, mic detection, playing sounds, pitch, and other sound controls • Optional Reading: Computer for the 21st Century, Mark Weiser [link]
8 23-Oct	**GUEST** ??	• Tutorial: Using Generative AI Round II • Optional Reading: An exploration in collective interfaces, UX Collective, Pierluigi Dalla Rosa] [link] • Optional Watch: Designing Next Gen User Interfaces, Michelle Cortese [link]
9 30-Oct	**PRESENTATION** Project 2 Project 3 Intro	**Project 3: Street & Sixth** • Tutorial: Connecting IFTTT
10 6-Nov	**WORKSHOP** **Place Based Interfaces** What are Sixth Senses? Network Effects in Interaction & Networked Publics ***Hardware**: Cameras, RFIDs, Proximity Sensing* ***Software**: Location Tracking, Spatial Reasoning with LLMs* Workshop: Place Interfaces	• Tutorial: Connecting Arduinos II
11 13-Nov	**WORKSHOP** **GUEST** ??	• Tutorial: Connecting other APIs
11 20-Nov [Remote]	**DESK CRITS** **REMOTE** Present: Final Design Proposal Spatial UX - Desk Crits Remote Zoom Desk Crit link:	

	https://columbiauniversity.zoom.us/my/ultraviolet	
~~27-Nov~~	**NO CLASS THANKSGIVING**	**NO CLASS THANKSGIVING**
13 4-Dec	**PRESENTATION** Project 3	

Grading

- **Experimentation:**
  - This class involves experimentation, and students should be prepared for hardware failures, software bugs, and more. Assessment will be based on student experimentation, investment in process in addition to the final product.
- **Punctuality:**
  - Work is to be completed at the beginning of class on the due date. Late work may receive a reduced grade. Please let me know if you will be late to class.
- **Groups:**
  - Grades for groupwork are assigned to the group. On rare occasions, individual grades may be awarded for exceptional or deficient performance within a group. All group members must participate equally in group presentations.
- **Attendance:**
  - It is important that you attend every class. Regular attendance is necessary to understand the material and successfully complete the assignments.
  - An absence is “excused” if you are sick and submit a doctor’s note, or have a serious issue that causes you to miss class, such as a family emergency. All other absences are “unexcused.” Students may have up to two unexcused absences per semester. Students with three or more unexcused absences will have their final grade reduced, and may fail the course.
  - If you know in advance that you will be absent for any reason, email the instructors to make arrangements to complete make-up work.

Policies and Academic Integrity

- If you require an accommodation for a disability, please let the instructor know as soon as possible. Some aspects of the course may be modified to facilitate your participation and progress.
- All students are held to the academic policies of the University.
- In this course we will work in a collaborative and open manner freely sharing information, ideas and resources. However, assignments and presentations that are

indicated as individual efforts must adhere to a high standard of academic integrity. In any case, in any context, representing another's work as your own is dishonest.

- Students who miss deadlines due to valid extenuating circumstances may submit the required work at a later date, as agreed upon with the instructor. University regulations limit such circumstances to serious personal illness and death in the immediate family. Unexcused late projects will not be accepted. Incomplete projects will be evaluated in relation to their degree of completion, and a student will be allowed to present such work only with instructor approval. Lectures and demonstrations cannot be repeated. There is no excuse for late submittals, late attendance at reviews or pin ups, due to printer or computer problems. You have to organize your output ahead of time or find other resources outside the college to complete your work on time. Late work will be accepted only at the discretion of the instructors and is subject to a 5% grade deduction for every 24 hours past the deadline.

Reading & Resources

Spatial UX

- Designing Next Gen User Interfaces, Michelle Cortese [link]
- Ecommerce Omni-channels
- "Spatial Interfaces", John Palmer, [link]
- Fast Company, Best AI Designs of 2024 [Link]

Ubiquitous Computing

- Computer for the 21st Century, Mark Weiser [link]
- Ambient Commons, Malcolm McCullough [link]
- Beyond Telepresence, Violet Whitney [link]
- Everything around you can become a computer, Ivan Poupyrev [link]
- Humane Ted Talk + AI Pin

Interfaces

- A Brief Rant on the Future of Interaction Design, Bret Victor [link]
- Timo Arnall on the fallacy of invisible interfaces, [link]
- Hidden Interfaces for Ambient Computing, Alex Olwal [link]
- Mission Control: A History of the Urban Dashboard, Shannon Mattern, [link]
- The City As Interface, Martijn de Waal [link]
- Performative Materiality and Theoretical Approaches to Interface, Johanna Drucker [link]

Ethics

- “Critical Race Theory for HCI”, Ihudiya Finda Ogbonnaya-Ogburu, Angela D.R. Smith, Alexandra To, Kentaro Toyama, [link]
- Things that Beep: A Brief History of Product Sound Design, Shannon Mattern, [link]
- “From Redlining to Digital”0 min - 18 mins, Chris Gillard [link]

Optimization

- The Power of Defaults, Julian Lehr [link]
- “How long can you work to make a routine task more efficient?”, XKCD, [link]
- Deceptive Designs [link]

Computing

- Samuel Greenguard, *The Internet of Things* (MIT Press, 2015)
- Malcolm McCollough, *Digital Ground: Architecture, Pervasive Computing, and Environmental Knowing* (MIT Press, 2005)
- Dan O’Sullivan and Tom Igoe, *Physical Computing: Sensing and Controlling the Physical World with Computers* (Thompson Publishing, 2004).
- Casey Reas and Ben Fry, *Processing: A Programming Handbook for Visual Designers* (MIT Press, 2014)

Architecture and Urban Design

- Stewart Brand, *How Buildings Learn: What Happens After They’re Built* (Penguin Books, 1994).
- Kazys Varnelis, *Networked Publics* (MIT Press, 2012)
- Keller Easterling, The Internet in 4D
- William H Whyte, *The Social Life of Small Urban Spaces* (The Conservation Foundation, 1980).

Design

- Norman, Design of Everyday Things, ch. 1
- Atomic Habits summary (by James Clear) min 8-11 [link]
- Anthony Dunne and Fiona Raby, *Speculative Everything: Design, Fiction and Social Dreaming* (MIT Press, 2013)
- Yvonne Rogers, Helen Sharp, and Jenny Preece, *Interaction Design: Beyond Human-Computer Interaction* (Wiley, 2011)
- Donald Norman, *The Design of Everyday Things* (Basic Books, 2002)
- Bill Moggridge, *Designing Interactions* (MIT Press, 2007)
- Sara Hendren, What Can a Body Do? How We Meet the Built World (Riverhead Books, 2020)

Sensory Phenomena, Building Science

- James Gibson, “Affordances,” in *The Ecological Approach to Visual Perception* (Routledge, 2014)
- Barbara Erwine, *Creating Sensory Spaces: The Architecture of the Invisible* (Routledge, 2016)
- Lisa Heschong, *Thermal Delight in Architecture* (MIT Press, 1979)

- Daniel Barber, *Modern Architecture and Climate: Design Before Air Conditioning* (Princeton Architectural Press, 2020)

Additional:

- Norman, Design of Everyday Things, ch. 1 [link]
- “How long can you work to make a routine task more efficient?”, XKCD, [link]
- Atomic Habits summary (by James Clear) min 8-11 [link]
- Beyond Telepresence, Violet Whitney [link]
- Mission Control: A History of the Urban Dashboard, Shannon Mattern, [link]
- “How long can you work to make a routine task more efficient?”, XKCD, [link]
- Atomic Habits summary (by James Clear) min 8-11 [link]
- Beyond Telepresence, Violet Whitney [link]
- Mission Control: A History of the Urban Dashboard, Shannon Mattern, [link]

**A note on the diversity of authors:*
*Given the historical context of earlier eras, it's important to acknowledge that the landscape of authors within this field has not always been diverse, and many voices from marginalized communities, particularly people of color and women, were excluded from contributing to the discourse. As a result, many foundational texts lack diversity.**