Creative/Embodied Computation

Syllabus

4.117/8 Spring 2021
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credits: 9 (3-0-6)G (3-0-9)UG
W25 via Zoom Meeting ID: 949 5056 9666

Description: The relationship of material artefacts to people is changing with the ubiquity of computation. Mechanical solutions relying on analog computation are increasingly replaced with algorithmic feedback and control systems and even learned control strategies. Although increasingly ubiquitous, the impact of these changes is still largely found in the realm of engineering and product design. In consumer electronics it has lead to the disappearance of single purpose built physical artifacts, which are now incorporated into apps used on physically generic universal touch screen devices. The course is focused on developing designs that reclaim the physical nature of embodied computation and the spatial relations that computational-physical hybrids can develop with people in architecture. Edward T. Hall (Hall 1969) introduced the term Proxemics to describe the effect of human use of space and Birdwhistell (Birdwhistell 1970) the term Kinesics or also commonly referred to as body language meaning the nonverbal communication of the body and the face. The hypothesis is that with a shift in design from focusing on form towards behavior the human-architecture relationship can be redefined as one of each having equal agency. New challenges arise from this in how to develop non-verbal forms of architectural articulation to embrace emerging autonomy at architectural scale. This is also to be understood as a direct juxtaposition to current trends towards formal primitivism and superficial anti-tech motions in design by exploring the expanded conceptual design canon rather than getting stuck in stylistic camouflage.

A sequence of assignments will develop prototypes that are framed around questions of human occupation of computational constructs and the shift from material form towards behavioral entities.

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Fabricate a physical object (A) at 1-1 scale driven by an agenda of your choice that engages with the human body in space. Test and document your interaction with it. Translate your physical object into a parametrically defined form in Grasshopper (B). What is the role of the object in defining a person’s relationship to space? Discuss how the object’s agenda is embodied in your physical object’s form.

As an extension to your initial embodied form substitute at least one formal static feature of your object with an actuated one using the arduino platform and actuation provided. Reflect on how variability of your form has an impact on the character of the piece. Does flexibility expand its agenda? Does change make it more arbitrary? Does a person engages with your object in space differently? Consider the architectural potential of your actuated object. Think of it more as an entity with character than as a component. It must be a singular standalone installation, conceptually complete as built. How does it actuate, where does it derive its energy from, how do you setup and exploit the singular degree of freedom for change?

Further develop your project with the addition of sensing and its careful integration into the physical setup of your arrangement – How did you capture the presence and action of people from your object arrangement? Is it through visual cues, through direct or indirect measures of matter like vibration or changes in the distribution of forces or temperature? Is it a boolean type sensing or a gradient? How do you define the threshold for triggering the actuated state change? How does the sensing range enable the object to include space beyond its physical reach - and how does it affect its physical form?

For the final assignment link your physical prototype (as far as it is available) through firefly to an interactive grasshopper or processing geometry. Explore a layer of autonomy through simple decision making based on sensor readings and memory. This extends

Final technical paper write up of the overall project development.
References:

A. Bajcsy, D. Losey, M. O'Malley, and A.D. Dragan. Learning Robot Objectives from Physical Human Interaction. Conference on Robot Learning (CoRL), 2017


Duffy, Brian R., 2003, “Anthropomorphism and the social robot”, robotics and autonomous systems 42


Fox, Michael, Kemp, Miles, “Interactive Architecture”, 2010, Princeton Architectural Press


Hall, Edward T. (Edward Twitchell), 1914-2009 ”Beyond culture”.


CODED BIAS: A DOCUMENTARY, Directed by Shalini Kantayya about poet and computer scientist Joy Buolamwini and how she uncovers racial and gender bias in AI systems


Nagpal, Radhika, Programmable Self-Assembly Using Biologically-Inspired Multi agent Control, AAMA, 02, Bologna Italy


Learning Objectives:
The course consists of four assignments expanding the concept of embodied computation from matter to behavior. Students should be able to engage with an increasing level of design research through iterative prototypes and move fluidly between different modes and scales of operation. At the core of the course is the Experimentation with different physical and electronic media to develop design prototypes and to reflect critically on its implications for design. A technical final paper is expected in documenting the final outcome and semester progress.

Completion Requirements:
Completion of each of the assignments, rigor in process and clarity in representation, as well as the overall progress of the semester (including attendance) will be fundamental to completing the course.

Evaluation Criteria and Grading:
The following criteria will be used for the evaluation of student’s work, both in terms of helping their progress and in final grading. (01) Thesis: How clearly is the student articulating the conceptual intentions? (02) Translation of Thesis: How well is the student using their thesis to develop a design response to given problems? (03) Representation Appropriateness: How well matched is their choice of representational means to their intentions? (04) Prototyping Quality: How accomplished are they with drawing, modeling, digital representation, and prototyping? (05) Oral Presentation Skills: How clearly are they presenting their ideas orally, whether at their desk, in class discussions, or to a more formal jury? (06) Participation in Discussions: How actively and how constructively are they involved in class discussions, both formally and informally? (07) Response to Criticism: How do they effectively take advantage of criticism from instructors, classmates and outside jurors? (08) Auto-Critical Skills: To what extent are they able to critique their own work regularly and effectively? (09) Attendance – attendance to all classes is mandatory, please email beforehand for excused absence. (10) Group work – contributing to the group dynamic and willingness to collaborate

A: Excellent - Project surpasses expectations in terms of inventiveness, appropriateness, verbal and visual ability, conceptual rigor, craft, and personal development. Student pursues concepts and techniques above and beyond what is discussed in class.

B: Above Average - Project is thorough, well researched, diligently pursued, and successfully completed. Student pursues ideas and suggestions presented in class and puts in effort to resolve required projects. Project is complete on all levels and demonstrates potential for excellence.

C: Average - Project meets the minimum requirements. Suggestions made in class are not pursued with dedication or rigor. Project is incomplete in one or more areas.

D: Poor - Project is incomplete. Basic skills including graphic skills, model-making skills, verbal clarity or logic of presentation are not level-appropriate. Student does not demonstrate the required design skill and knowledge base.

F: Failure - Project is unresolved. Minimum objectives are not met. Performance is not acceptable. This grade will be assigned when you have excessive unexcused absences.

Diversity
MIT values an inclusive environment. I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. If this standard is not being upheld, please feel free to speak with me.

Writing Center
The WCC at MIT (Writing and Communication Center) offers free one-on-one professional advice from communication experts. The WCC is staffed completely by MIT lecturers. All have advanced degrees. All are experienced college classroom teachers of communication. All are all are published scholars and writers. Not counting the WCC’s director’s years (he started the WCC in 1982), the WCC lecturers have a combined 133 years’ worth of teaching here at MIT (ranging from 4 to 24 years). The WCC works with undergraduate, graduate students, post-docs, faculty, staff, alums, and spouses. The WCC helps you strategize about all types of academic and professional writing as well as about all aspects of oral presentations (including practicing classroom presentations & conference talks as well as designing slides). No matter what department or discipline you are in, the WCC helps you think your way more deeply into your topic, helps you see new implications in your data, research, and ideas. The WCC also helps with all English as Second Language issues, from writing and grammar to pronunciation and conversation practice. The WCC is located in E18-233, 50 Ames Street. To guarantee yourself a time, see the WCC’s page About Appointments where you can then schedule an appointment online.

Mental Health
As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may impact your ability to attend class, concentrate, complete work, take an exam, or participate in daily activities.

Undergraduates: Please discuss this with Student Support Services (S3). You may consult with Student Support Services in 5-104 or at (617) 253-4861.

Graduate Students: Please reach out to the deans for personal support in the Office of Graduate Education.

For urgent or after-hours concerns, please contact MIT Police
Academic integrity

MIT's expectations and policies regarding academic integrity should be read carefully and adhered to diligently: http://integrity.mit.edu/.

From the Office of Student Citizenship, W20-507, (617) 258-8423

In this course, I will hold you to the high standard of academic integrity expected of all students at the Institute. I do this for two reasons. First, it is essential to the learning process that you are the one doing the work. Failing to do the work yourself will result in a lesser understanding of the content, and therefore a less meaningful education for you. Second, it is important that there be a level playing field for all students in this course and at the Institute so that the rigor and integrity of the Institute's educational program are maintained.

Please review the Academic Integrity policy and related resources (e.g., working under pressure; how to paraphrase, summarize, and quote; etc.) and contact me if you have any questions about appropriate citation methods, the degree of collaboration that is permitted, or anything else related to the Academic Integrity of this course.