Embodied Computation stands for an approach to design which treats the physical and the computational aspect of the construct as one and that extends the process of design into the lifetime of the built artefact through the combination of the physical design of the construct and the continuous updates of the software part.

At the core of architecture is the physical construct, its form, scale and materiality as it relates to the humans that inhabit it. We will explore the concept of embodied computation as it relates to architectural body and the changes that computation can bring to it. In comparison to the more established anthropomorphic robotics approach, the architectural body is much larger in scale and surrounds us. This is in contrast to the anthropomorphic object to object interaction so ingrained in human computer interaction. We will explore computational principles that steer formal processes, that become embedded in physical form through sensing feedback and control, or through acting upon the world as a computational social construct.

The seminar is focused on a prototype development and subsequent experimentation with the prototype to explore concepts of embodied computation and how it relates to human occupation. The seminar is structured into a series of design responses to concepts such as the model. Hands on work in computational design such as developing code in processing, parametric design, and physical prototypes are introduced and supported.

The emphasis is on learning new methods of developing design, and a strong motivation to tackle new knowledge and work in an experimental design setting is expected. Besides the development of the computational design a final report/paper is required to document, reflect and summarize the work. Ideally this paper is the basis for a submission for publication to a conference in the field of computation such as acadia, ecaade, caadfutures, or similar emerging ones.

Define a design experiment

Develop a design experiment as your semester project. Create a design speculation centered on a hypothesis linked to embodiment of a computational construct in physical form and its relationship to its human inhabitants. How does the construct communicate and/or react, what form of communication does it use, light sound motion or form? How are sensors distributed throughout the physical construct what do they see or hear? How does the architectural construct respond or shape the interaction with its human coun-
terparts, what time frame does it follow, second, minutes, days, or years?

**Model**

Develop a computational model for your design experiment that links the design ideas with key parameters and the design context. "Model" stands here for an abstract conceptual set of dependencies that are embodied in an algorithmic, parametric construct, and material construct.

**Embodied Computation Prototype**

Develop an embodiment of your design experiment bridging physical and computational realm, carefully considering its generation and materialization and its link to humans and its scale of occupation. Integrate the computational as a continuum between idea and deployed construct. Determine criteria on which to evaluate your prototype and integrate any findings into your design. Depending on the scale of your prototype consider developing a "selective" prototype, that keeps key components and relationships of a full scale prototype but configures them into a prototypal scale.

**Experiment**

Use your prototype to play through different usage scenarios and document the results. Evaluate your construct based on your set criteria and make adjustments as necessary.

**Final Report**

The final report has to be a technical and conceptual report modeled after short research papers, reporting on your findings in a way that allows others to understand and possibly retrace your steps.

**Bibliography:**


Mindell, D., “Our Robots, Ourselves – Robots and the Myths of Au-
tonomy”, Viking, 2015.


Geometry foundation:

Conference proceedings:
Rob | Arch 2012 conference proceedings, Sigrid Brell-Cokcan, Braumann, Johannes.

Rob | Arch 2014 conference proceedings, Wes McGee, Monica Ponce de Leon

Fabricate 2014 - conference proceedings - Fabio Gramazio, Matthias Kohler, Silke Langenberg

Michael Fox, Miles Kemp, “Interactive Architecture”

Valentino Braitenberg, “Vehicles, Experiments in synthetic Psychology”.

IJAC - Architectural Robotics: Catalyzing New Design Opportunities. Guest editors: Michael Fox, Aaron Sprecher, Doug Noble, Mike Christenson, Anton Harfmann, Aaron Temkin, Nancy Cheng
http://multi-science.atypon.com/toc/ijac/10/3

António Brandão Moniz, Robots and humans as co-workers? The human-centered perspective of work with autonomous systems

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


Philip DeCamp, George Shaw, Rony Kubat, Deb Roy, “An Immersive System for Browsing and Visualizing Surveillance Video”, Proceed-
Design Experiment definition

**Week 1**

**Tuesday:** Feb 7  
Introduction – “Embodiment Computation” assignment ONE – design experiment

**Lab:** Feb 14  
Sketching in code - hands on lab processing

**Model**

**Week 2**

**Friday:** Feb 17  
Models of design - Presentation assignment ONE – handout assignment TWO - “Model”

**Lab:** Feb 21  
Embodiment in electronics -Arduino hands on lab

**Week 3**

**Friday:** Feb 24  
Fabrication and geometry - update, discussion of “Model” assignment

**Lab:** Feb 28  
Prototyping, fabrication, design geometries, parametric design

**Embodied Computation Prototype**

**Week 4**

**Friday:** Mar 3  
Presentation “model” assignment– handout “Embodied Computation Prototype”

**Lab:** Mar 7  
Algorithmic constructs, control flows

**Week 5**

**Friday:** Mar 10  
Lecture geometry - update, discussion “Embodied Computation Prototype” assignment

**Lab:** Mar 14  
Hands on help with Embodied Computation Prototype

**Week 6 - Midterm**

**Presentation “Embodied Computation Prototype”**

**Friday:** Mar 17  
Presentation assignment “Embodied Computation Prototype” – handout

**Spring Break (March 12-20)**

**Experiment**

**Week 7**

**Lab:** Mar 28  
Search space, design space, design metric - update, discussion “Experiment” assignment

**Week 8**

**Lab:** Apr 4  
Programming and modelling topics – based on students’ projects

**Week 9**

**Lab:** Apr 11  
Programming and modelling topics – based on student’s projects

**Week 10**

**Lab:** Apr 18  
Material computation - update on “Experiment” assignment

**Week 11**

**Lab:** Apr 25  
Final presentation “Experiment” – handout final paper assignment

**Week 12**

**Lab:** May 2  
Hands on help final project – based on student’s projects

**Outlook – embodied computation – robotics**

**Final Paper due May 18th**