4.580 Inquiry into Computation and Design

Fall ’16  Units 3-0-9 (G)  Tuesday 9:30-12:30  Room 9-450A
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This subject explores the varied nature and practice of computation in design – in particular, the ways in which design meaning, intentions, and knowledge are realized through sensing, thinking, representing, and making computationally. It is also an introduction to the different research and perspectives within the Computation Group in the Department of Architecture.

We will consider the notion of computation broadly to include computing done by machine as well computing done by hand. A question serving as backdrop for our discussions is: What makes design a unique computational domain? We will consider what aspects of designing and making are possible, useful, or desirable to compute or automate, and why.

The aim of the course is for students to develop a view of computation and design apart from the specifics of tools and technical skills, and a critical understanding of some of the history of ideas leading to work today.

An additional, important aim of the course is to provide an introduction to academic research, in particular, to the structure and elements of a good research paper. Students will practice reading and responding to academic papers on topics introduced in class.

The semester will be divided into 1-week and 2-week modules. Each module will explore a particular computational design theme and may include a guest faculty speaker. In each module, readings and/or a short, team-based project will expand on the theme introduced.

Prerequisites
None. This is a required subject for first year SMArchS students in Computation. However, it is open to interested students from other areas and departments, depending on enrollment numbers and with permission of the instructor.

Requirements and Grading
Class attendance and participation: 15%
Completion of weekly assignments and readings: 85%

Calendar

Sept. 13  Introduction

Sept 20, 27  Worldmaking  (Porter)
This module focuses on the making of design “worlds” and how design meaning and intent is constructed and communicated within and between worlds. A game – called the Silent Game – will be introduced as a research paradigm for formulating and testing a hypothesis about the nature and activity of design through rules.

Oct 4, Oct. 18  Design, Representation, and Intelligence  (Nagakura)
In this module, we transition from an exploration of the nature and activity of designing using games and rules, to a focus on the things designed – real-world designed artifacts. How can we understand and represent architectural (or other) objects computationally? What kinds of representations – including rules, for example – are possible or effective, and for what purposes? With these questions in mind, our guest will introduce his recent work on representation and cognition.

Our approach to readings from this point on will often be at two levels. You may be asked to understand and evaluate a reading in terms of its specific content and/or you may be asked to evaluate a reading in terms of its structure and coherence as a research paper. Questions relating to the latter are designed to help you understand better the nature of academic research – what makes a good research question and how to explore it.

Oct 25, Nov 1  Visual Calculating  (Stiny)
In this module, we continue our inquiry into the understanding and representation of design and designing. We revisit the theme of rules and rule-making, in particular. We consider the related themes of framing, reformulation, and redescription as essential aspects of design. All are about new and different ways of conceptualizing the world (or “worlds”, in Goodman’s terms). In this module, these themes are examined in a very specific, visual computational context.

Nov 8  Computational Making  (Knight and Vardouli)
In this session, we extend the idea of designing as a visual, active and embodied, rule-based process to the idea of making -- more generally -- as a perceptual, active and embodied, rule-based process for creating and using things. The focus of Computational Making research is not on the end results of making activities, but on the processes and practices of their formation.

Nov 15  Self-Assembly & Programmable Materials  (Tibbits)
In contrast to the previous module, in this session we explore the production and making of things as a “hands-off” process: things that make themselves. Tibbits will introduce us to self-assembly, programmable materials, and 4D printing as autonomous means of production. In these different systems, building information is embedded directly into components and materials which self-configure or transform into structures or shapes without machine or human intervention.

Nov 22  Physical Design Cognition  (Sass)
Computer generated imagery once determined and dominated the ways in which designers explored, evaluated and influenced a design generation. In this session, we will question and discuss the increased use of physical prototyping to explore design. What does this mean for design? Will there be a shift in the ways we compute design proposals?

Nov 29  Human | Machine Computing: Some Foundational Issues and Histories
This session gives a small taste of some of the foundational issues and histories of computation, including the beginnings of CAD, AI, and Cybernetics. Much of this history is rooted at MIT. We will examine the assumptions and aims embedded in different computational approaches and paradigms, and their implications for the way we think about and do computational design today.

Dec 6, Dec 13  Design Knowledge: In the Mind and in the Making
This module concerns the nature of design knowledge – professional, expert, tacit, or otherwise. What is it? How is it? Where is it? Is it in the mind? Is it in the making? We will consider the roles of context and culture in acquiring and communicating design knowledge, especially in relation to computational ideas and practices. We will examine the sensory, experiential, and material aspects of design knowledge and its relation to physical doing and making.