In this course, we will explore the varied nature and practices of computation in design – in particular, the ways in which design meaning, intentions, and knowledge are developed and communicated through sensing, thinking, describing, and making computationally. We will consider the notion of computation broadly to include computing done by machine as well computing done by hand. The course is also an introduction to the different perspectives and research being done by faculty within the Computation Group in the Department of Architecture.

All classes will be taught remotely this semester. The emergency circumstances that necessitate remote instruction for this subject and many others at MIT are unfortunate and unanticipated. However, we will make the most of the current situation to understand more how computational design works, or doesn’t, in remote environments. This is a first time experiment for all of us!

Remote learning notwithstanding, the primary goal 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 goal 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.

Requirements and Grading
Class attendance and participation: 20%
Completion of weekly assignments and readings: 80%

Sept 1 **Introduction**
Assignment 1: Worldmaking (readings)

Sept 8, 15 **Worldmaking** (Porter)
This module focuses on the making of conceptual design “worlds” and how design meaning and intent are constructed and communicated within and between worlds. A game – a variation of the Silent Game – will be introduced as a research paradigm for formulating and testing a hypothesis about the nature and activity of design.

Assignment 2: Silent Game Redesign (project)
Assignment 3: More Worldmakings (readings/videos)

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.

Assignment 4: Academic writing (reading)

Sept 22, Sept 29 **More Worldmakings** (Nagakura)
In this module, we extend the concept of worldmaking using simple games and rules to worldmaking using contemporary technologies. We will be introduced to advanced digital technologies for spatial representation and design intelligence. How do these computational techniques help us understand, represent, and communicate architectural (or other) objects? What kinds of representations or “ways” are possible or effective, and for what purposes?

Assignment 4: Spatial Representation and Design Intelligence (project)
Assignment 5: Visual Calculating I (readings)

Oct 6, 20 **Visual Calculating** (Stiny)
In this module, we continue our inquiry into representing and understanding designs 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.

Assignment 6: Visual Calculating II (project)
Assignment 7: Self-Assembly and Programmable Materials (readings)
Oct 27  **Self-Assembly & Programmable Materials**  (Tibbits)
In this session, we enter new territory to consider computation for *making* physical, real-world things, as opposed to computation for *representing* real-world things or the designs for them. In particular, we explore the production and making of physical things as a self-governing process: i.e. things that make themselves. We will be introduced 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.

Assignment 8: Calculating the Way We Make I (readings)

Nov 3, Nov 10  **Calculating the Way We Make**  (Sass)
In this module, we continue the theme of physical making. We will address questions related to design learning (cognition) and making (embodiment) by doing. We will learn about design and reflect on design through physical artifact making.

Assignment 9: Calculating the Way We Make II (project)
Assignment 10: Computing Histories (readings)

Nov 17  **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.

Assignment 11: Design Knowledge I/ In the Mind and in the Making (readings)

Dec 1, Dec 8  **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.

Assignment 12: Design Knowledge II/ In the Mind and in the Making (project)
The Writing and Communication Center (WCC)

The Writing and Communication Center offers free one-on-one professional advice from communication experts with advanced degrees and publishing experience. The WCC can help you further develop your oral communication skills and learn about all types of academic and professional writing. You can learn more about the WCC consultations at [http://cmsw.mit.edu/writing-and-communication-center](http://cmsw.mit.edu/writing-and-communication-center) and register with the online scheduler to make appointments through [https://mit.mywconline.com](https://mit.mywconline.com). Please note that the WCC hours are offered on Monday-Friday, 9:00 a.m.-6:00 p.m., and fill up fast.

Some faculty already require their students to consult with the WCC’s communication experts on their papers, technical reports, and presentations — doing so is a good way not only to improve the quality of their students’ work but also help students grow as academic writers and communicators.

The WCC has decades of experience preparing thousands of undergraduate and graduate students, as well as postdoctoral scholars and faculty, for positions in research, academia, and industry. We provide expertise in scientific and engineering writing, such as journal articles, scientific posters, and dissertations, as well as oral presentations and slide design.