Prolegomenon

What is the relationship between epistemology and technology in the context of educational design? This course attempts to answer this question by tracing an arc through a particular set of histories in educational research, focused on agent-based computing in STEM education. Specifically, we will engage in scholarly conversations about how cognitivist, socio-cultural, democratic and critical theoretical perspectives have shaped (and continue to shape) the design of agent-based computing environments for complex, scientific, disciplinary engagement in educational settings.

Agent-based computing involves the use of virtual agents as computational actors, which can be controlled through simple rules. Agent-based programming languages have been around for a few decades, and have revolutionized educational computing by making it possible for even young children to learn programming (e.g., Logo, SCRATCH, etc.). At the same time, scientists and computer scientists also use agent-based computing for complex disciplinary inquiries. In particular, multi-agent systems - where users can create and control the individual-level behaviors of thousands of agents, which then interact with each other to give rise to complex, emergent patterns (e.g., NetLogo) - have been shown to be very useful for modeling and simulating complex systems that are notoriously challenging to understand otherwise.

Since 2004, I have been studying, designing and developing open-source, agent-based and multi-agent-based computing systems for K-12 science and STEM education. This work has focused on K-12 classrooms as well as public spaces and museums. During our course, in each class (except the final class), we will read three articles, two of which will provide theoretical foundations
and the relevant epistemological anchors. A third paper - a publication from my research lab - will serve as a “case study” of how these anchors can shape both the design of agent-based computing systems for learning within and across STEM disciplines as well as the conduct of the research study using such systems. Drawing upon my own scholarship will allow us to dive deeper beyond the published article by discussing how the peer-review process and informal epistemological conversations with scholars in the field also shape technology design and research.

No background in computer programming is required for taking this course. The course will introduce you to the basics of agent-based computer modeling, although the focus will be on understanding the relationship between their design and epistemological commitments. We will meet as a class six times and the dates are specified below. Each meeting will last between 2.5 - 3 hours. The goal of the course will be to produce a collective concept map of emerging connections across key concepts and themes that will be identified by the group through discussions and reflections.

Course Project and Expectations

Students taking this course will be required to develop a Reflective Design project throughout the course. This project will have two components:

- Design a rapid prototype of an agent-based computer model or simulation, including physical and/or embodied modeling activities, with specific educational objectives in mind. This can be done either as a group project or an individual project. You do not have to design a new simulation from scratch; you can choose existing, open-source simulations and models from repositories that you will be introduced to. This is also an opportunity to design computational simulations that do not necessarily involve the computer. Class time will be allotted for this work. **40 Marks**

- Write a reflection paper (5 pages, single-spaced, not including references), that a) describes the epistemological conversations and dilemmas that you experienced during the design process, and b) explains the epistemological commitments that are implicit in your designed software, learning environment and/or activities. **40 Marks**

In addition, students will be expected to contribute actively in class discussions and small group discussions. **20 Marks**

Feb 26: Intuition, Activity and Conceptual Change


Feb 27: Computing as Experience


Mar 1: Aesthetics, Representation and Objectivity


Mar 4: Critical Theory and Educational Computing


Mar 5: Figured Worlds and Public Computing


March 6: Epilogue