Virtual Analog Computing

An ATEC/CS cross-listed class

Spring 2013
Course: Special Topics: Virtual Analog Computing
ATEC: ATEC 6390.502
CS CS 6301.502
Instructor: Dr. Paul Fishwick
Location: ATEC Building, Rm. 1.606
Time: Fridays, 7PM - 9:45PM

A Petri net machine encoded in the game of Minecraft

General

How would you represent computer data (big & small), equations, and code if you were told to build rather than to write software? This is the question we will explore in this seminar. Most computing has been analog until fairly recently, and our representations of software artifacts has been limited by cost of deployment.

While our computers are digital, we are analog. Recent research in neuroscience and embodied cognition indicates that we “simulate” when we read and think. This suggests a new approach to software design where we evolve embodied media to design and build software. This media includes 3D games, mixed reality, physical computing, and 3D printing. The idea is to explore new machines in virtual spaces, and to re-envision “software” by making it analog, more accessible, and engaging, for a wide audience.

Motivation

Computing has dramatically shaped our society, and its effects are found not only in the core areas of computer science and engineering, but also within our general culture. For example, people “program” their DVRs, watches, and GPS-powered exercise watches. Programming concepts such as data, sequence, and iteration are widely used without being referenced, or known, as such by the general populace. This need to broaden skills found within computing meshes with a need to remake elements of computing so that they are more generally accessible for a wide audience. One approach to satisfy this need is to reify concepts in computing so that these concepts become tangible and subject to artistic reflection and critique. One example of this approach can be found in the subculture within the game of MineCraft where this subculture creates “digital circuitry” using synthetic, mined blocks. Thus, circuits become working analog machines for the gamers and users, and yet, retain a digital foundation (i.e., the MineCraft game and its programming). This course will encourage students to “reimagine the analog” by exploring fundamental concepts such as data and program structures while simultaneously drawing upon design and artistic talents necessary for synthesizing analog structures.
**Students and Prerequisites**

The student registration goal is to have equal numbers of CS and ATEC students. The only prerequisite is a graduate student standing in CS (for CS 6301.502) or in ATEC (for ATEC 6390.502). For projects, students will be teamed together (CS, ATEC). Students will gain knowledge of combining the technical aspects of the artifacts found in computing (data, code, model) with new approaches to representing those artifacts in embodied spaces.

**References**

The instructor has taught a class called “Aesthetic Computing” since 2000. Virtual Analog Computing captures and reflects the way that this class has been taught over the past three years. The most recent class can be found here: [http://www.cise.ufl.edu/~fishwick/ac/2012](http://www.cise.ufl.edu/~fishwick/ac/2012). More information on the broader area of Aesthetic Computing can be found in the book by that title, MIT Press, 2006. A recent Encyclopedia Chapter can be found here: [http://www.interaction-design.org/encyclopedia/aesthetic_computing.html](http://www.interaction-design.org/encyclopedia/aesthetic_computing.html)

**Syllabus**

This is a graduate seminar class and will involve lectures by the instructor, invited lectures, student lectures, and team demonstrations. Grades will be based on the quality of team presentations, delivered team projects, and participation (both in-class and through social networking). Topics include the following:

- Introduction to Virtual Analog Computing (VAC): building vs. writing – how are they different?
- Concepts in representation: semiotics, analogy, metaphor, morphisms
- Basic concepts of language structure: grammar (text, graph)
- Concepts and definitions of “digital” and “analog” with examples
- History of analog computing
- Embodiment theories (phenomenology, cognition, neuroscience)
- VAC Methodology for producing virtual analog structures
- The mapping problem: semantic networks, basic category theory
- Virtual analog examples for data (“big data”, structures), formulas, algorithms, programs, and models
- Futurist programming interfaces in popular culture (science fiction & fantasy, games, arts)
- The Media Challenge: 2D and 3D game engines, physical computing, 3D printing, mixed reality, audio
- Reviews and critiques of student team projects