

The Steampunk Project

Proposal for CATL Scholar Program

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Summary

The following proposal details an ambitious project for expanding teaching and learning about technology and society and the history of computing. The key piece of this plan is to develop an immersive, student-centered, game-based learning module based on the pedagogy of the established and successful *Reacting to the Past* series from Barnard College of Columbia University. This module (which I have nicknamed *The Steampunk Project* after that genre of alternate history science fiction) will examine Big Ideas in "technology and society" through a crucial event that happened in London in 1842: Charles Babbage lost funding to complete a machine that is now recognized as the first computer.

1. The Big Idea

Big Ideas in the computing sciences are usually taught under the umbrellas of "technology and society" and include questions like these: Is technological progress always a good thing? What are the human impacts of technology? What are the newest, most innovative technologies being developed right now, and how will they impact our lives?

The project proposed here is inspired by the simple idea that even the sexiest, most future-looking topics in technology have important historical contexts that are all but impossible to ignore in teaching. For example, students studying the ethics of genetic engineering must study 20th century eugenics movements. Students studying technology as a utopia must study Plato. Students studying the do-it-yourself hacker ethic must read Marx.

Is it possible, however, to "flip" this approach? Instead of looking at history through a rear-view mirror as purely evidentiary, can we take a single critical moment in history and use that to drive the course forward?

2. The Background

Charles Babbage applied for funding from the British government in 1822 for a calculating machine he called the Difference Engine [1,2,13,22,34]. It was a giant mechanical device designed to perform the tedious calculating and printing of large tables of data, such as the astronomical tables used for nautical navigation [12,19], and this was one of the first recorded instances of a government funding science research and development [14,23]. After a dozen years and several course-corrections in scale and design, Babbage enlisted Ada Lovelace (daughter of Lord Byron) to write copious documentation on the Engine

[3,31,35,36]. He designed grand revisions and had several model parts built for the Engine, but still had produced no working prototype. In 1842 the Prime Minister officially withdrew funding. Babbage was lampooned in the press, and his name became something of a joke in London. He died bitter and alone. In 1944, Howard Aiken, developer of the Harvard Mark I computer would say in homage: "Babbage's failure was due solely to one fact: he was 100 years ahead of his time." [15]

The Babbage failure is an appealing story in the (occasionally dry) field of computer science. It is easily romanticized into a tale of a misunderstood genius who toils away on a mad invention with the help of his intrepid female assistant (who also happens to descend from eccentric and flamboyant parentage), all the while being stopped at every turn by a Prime Minister picked from the pages of Dickens' *Little Dorrit*.

But like an onion, the flavor of this story sharpens as the layers are removed:

- Why did Babbage want to build astronomical tables when, by then, everyone was using mechanical ship clocks for navigation? [12,18,19]
- Why didn't Babbage get private funding for his device, like Jacquard did for the loom? [15]
- Why wasn't there more cooperation between scientists trying to build calculating machines? [24]

Asking these questions about the past begins to inform our analysis of the present:

- What could have happened in computing if Babbage had received the funding and built the Engine? Would "the future" have happened sooner? [17,33,30]
- Should government fund science, or should exploratory research and development be left to private industry? [23,25,28]
- What if the government hadn't funded the Internet? Could private industry have eventually developed such a thing on its own anyway?

3. The Implementation

Reacting to the Past is a particular pedagogical model that involves students in "elaborate games" set in a historical period in which there is "intellectual and social ferment"[4]. Students take on roles in a drama, and must use classic texts and primary source documents to inform their performances and achieve the particular objectives of the historical characters they are playing.

Would the Babbage story make an interesting addition to the *Reacting to the Past* series? The Babbage story is certainly set in a time of "intellectual and social ferment": England during the Industrial Revolution. The central question of "should the government continue to fund the Difference Engine?" is a question that students can examine from all sides. In addition, there are numerous primary source documents that would be useful to students in dramatizing this story [1,2,35].

4. The Implications

4.1 Student Impact

The main role of students in a *Reacting*-style game is to actually *play* the game via writing, speaking and debating. The students also *run* the classes in which the game is played. Students in a "technology and society" course or a technology-based senior seminar could certainly benefit from this sort of immersion in historical context. In its present form, the *Imagining Technology* (GST364) course guides students in an examination of the role of technology in contemporary society as a positive and negative agent of change. This has definitely been a "risk-taking" type of course, both for students and faculty. The theme changes yearly, the software [26] and core texts [26,32] are intentionally chosen to be "edgy" and unlike anything the students have seen before. Another course, CIS 450 (*Seminar in Information Systems*), is a research-based course focusing on technology ethics issues. Students study current and enduring social/ethical topics in the field of computing and perform original (examples: encryption export laws, anti-spam legislation, technology policy in developing countries). Both of these courses would be appropriate testbeds for this project (note: I am currently course coordinator for both).

4.2 Instructor Impact

I conceived of *The Steampunk Project* as a way to continue developing and maturing my own approach to Elon's philosophy of engaged learning. I have been successful in earning a variety of small pedagogical grants at Elon: Project Pericles (2005), Service Learning Scholars (2005), PPEG (2004), Critical Thinking (2004). As a relatively new faculty member, these small grants have been enormously helpful to me as I tried to experiment with different pedagogies.

One of the most significant outcomes of this previous funding was my classroom experiments with the virtual world *Second Life* [26], which resulted in some speaking opportunities and some brief media attention for my work in developing "technology and society" pedagogy using complex social games [5,16]. The *Steampunk Project* is a similar game-based pedagogical experiment, albeit one that will be much more difficult to pull off, and therefore much more appealing as a *leveling up* challenge. (In gaming, a player is motivated to move from simple to complex challenges as part of a process known as *leveling up*, a metaphor too perfect for me not to include here.)

4.3 Wider Impact

It would be very helpful to have the scaffolding and support of an internationally-recognized program such as *Reacting to the Past* during the development of this game module. Aside from pioneering this model of teaching, that organization has a clearly-defined support structure, book contracts with major publishers, and established relationships with dozens of universities. However, the module could still be developed independently by closely following their model. In either case, this is the sort of experiment that would be perfect for publication and broadcast to the larger computer science education community. In fact, the process of disseminating the information for this project has already begun; my *Metaverse* web site (my

research and teaching hub for "technology and society" issues) already includes my annotated bibliography and big questions driving *The Steampunk Project* [27]. I have had some past success with publication of pedagogical experiments [5,6,7,9,10], and I have been successful publishing my work on open source systems [8,11,20,21], which is a closely related to the "technology and society" area of study.

5. The Plan

5.1 *Approximate Timeline*

- April 1-2, 2006: attend *Reacting to the Past* faculty workshop at Michigan State
- April, 2006: make personal contacts in relevant communities: *Reacting* faculty, 19th c historians, Babbage scholars, technology/computer historians.
- Spring-Summer 2006: complete full annotated bibliography of sources, acquire copies of relevant primary source documents. Complete instrument for pre- and post-course student assessment of the experience (see section 2.5.3).
- August 2-5, 2006: attend Reacting Institute at Barnard College
- Fall Semester 2006: GST 364. Transition to steampunk fiction (replaces cyberpunk fiction), establish this year's topical theme: History of Computing, Sumerian-Present. Build basic calculating devices. Host mini-debates to get a sense of student participation, shortcomings of the material, etc.
- Fall Semester 2006: Construct list of roles and descriptions, skeleton of what will become "instructor manual" (likely debates, historical context, etc).
- Winter, 2007: visit London Science Museum (I'd love to meet with Doron Swade, Assistant Director of the museum and author of [34]).
- Spring Term, 2007: CIS 450. Course theme: history of computers with focus on funding. Students conduct investigation of funding of computing by private industry and governments. Host mini-debates to get a sense of student participation, shortcomings of the material, etc.
- Spring Term, 2007: Complete version 1 of "instructor manual", begin student manual.
- Summer 2007: Complete student manual.
- Fall 2007: Pilot of GST 364 as a *Reacting*-style game course.
- Winter 2008: post-mortem, "debugging" (redesign).
- Spring 2008: Pilot of CIS 450 as a *Reacting*-style game course.
- Summer 2008: post-mortem, "debugging" (redesign).

5.2 *Funds*

Funds provided will be used to travel to *Reacting* events, to conferences as needed in order to present work, and possibly for a visit to the London Science Museum if it can be done quickly and inexpensively.

5.3 Evidences of Success

Finally, I appreciate the irony that Charles Babbage lost funding for his Difference Engine because he was unable to show the government that there were any successful outcomes from its initial investment. Let the first lesson of *The Steampunk Project* therefore be: "delineate in advance the expected outcomes of the project, and how those outcomes will be measured".

Expected measurable outcomes of this project will be:

- To develop a set of manuals (student game book, instructor book, set of roles), modeled after the *Reacting to the Past* series;
- To test this pedagogy twice with pre-game objectives (2006-2007), and twice with full-game objectives (2007-2008);
- To compare student performance on similar written work in classes taught before (2004-2006), during (2006-2007), and after (2007-2008) the use of this game module to assess whether (and how) their learning about technology and society issues is affected by immersion in this historical context;
- To compare student perceptions of the course and their learning. This should be based on a pre- and post-course assessment instrument, to be developed in concert with other faculty that have taught with *Reacting* before and have developed such measurement instruments.

6. Conclusion

This experiment in pedagogy will be challenging, risky, and fun. The payoffs for transformative student learning seem as though they will be worth the effort. The material is relevant, and the pedagogical model is solid. While the project will naturally grow and change over time, the plan and outcomes shown here are a good start towards achieving the goal of creating a *Reacting*-style game module for teaching about Big Ideas in computing.

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