Perspectives on Technology through Science Fiction

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Abstract

It is important for engineering students to consider the effect technology has on society, yet standard engineering courses are usually purely technical in nature and do not grapple with difficult issues such as questions of resource use, side effects, ultimate goals, and purpose. While engineering courses sometimes ask broader questions concerning how technology affects society, students often do not get an adequate understanding of the "big picture." In order to fully address such questions, engineering students need more than just technical skills. They must understand concepts relating to the fields of sociology, psychology, philosophy, and economics to name just a few. They must also be able to make appropriate value judgements concerning the technology they design.

Science fiction considers the most important questions about technology. A course based on science fiction readings and films can direct the students towards a considered approach to engineering design and development of technology. Such a course provides multiple advantages. First, it can give the students leverage on their own culture. An effective way to understand one's own culture is to first look at a very different culture. Science fiction places the student in another world to examine important human conflicts, issues, questions, and desires. Second, science fiction provides a mental laboratory in which students can perform thought experiments with new technology. Third, a science fiction course can allow engineering students to interact with students in less technical disciplines. This cross-fertilization is often very helpful in working through issues of technology and its interaction with the human society within which it is embedded.

I. Introduction

Archibald Putt has said "technology is dominated by two types of people: those who understand what they do not manage and those who manage what they do not understand." We generally suppose engineers, the designers of technology, understand what they create, but is this truly the case? Even when engineering students learn the technical aspects of design, it is not the whole story. Design of technology is not a simple, straightforward application of scientific principles. The engineer seeks a solution to a problem through a complex process of optimizations and trade-offs. The engineer, as the technology physician, must properly diagnose the problem and select the appropriate treatment that will cure the problem without killing the patient. An engineer who understands technology only as a narrow application of a few scientific principles will be unlikely to comprehend the broad impact technology can have on its environment. As

T.S. Eliot has said in *Choruses from "The Rock,"*

> Where is the life we have lost in living?
> Where is the wisdom we have lost in knowledge?
> Where is the knowledge we have lost in information?

The responsible design and appropriate use of technology requires the designer and user of technology to understand the broad ramifications of any technology in the physical, cultural, legal, economic, historical, and spiritual domains, among others. Thus, engineering education must include not only solid technical instruction, but also broader training in these other realms. The technological solution must be understood in its broader frame of reference, i.e., it must be contextualized.

Engineering educators in particular must recognize the need to ground their students in a wider plane of understanding, encouraging them to take a broad view of their vocation and of their product. While such liberal education is a laudable goal, it is often difficult to effectively convey the importance of a broad understanding of technology. Such perspectival issues can easily get short shrift by the students and even by the instructors in the press to cover all the technical material in a semester course. In this paper, I will examine a number of possible curricular approaches to technology, broadly construed, and then focus on the use of science fiction to study technology issues from a broad perspective.

II. Curricular Approaches to Technology Perspectives

Technology perspectives can be introduced into the curriculum as part of a technical course or in separate courses. These two are not mutually exclusive – one could strategically plan exploration of technology perspectives across the curriculum within technical and non-technical courses.

Perspectival issues can be interwoven throughout a technical course, discussing the issues as they come up. This "just-in-time" curricular approach emphasizes the integrated, holistic nature of reality – one cannot neatly separate the broader issues from the detailed technical aspects. Unfortunately, this approach often shortchanges the larger issues since they are only touched on in passing. Some instructors take a slightly different route, going into more depth on technology perspectives using a more intentional, explicit treatment, often at the beginning or end of the course. Added depth is gained at the expense of direct integration with the technical material, and students often discount the importance of the philosophical issues as "padding" to the technical material in the course. In addition, whether the perspectives content is interwoven throughout or packed into explicit segments, only students majoring in technical areas will benefit. Developing an appropriate perspective on technology is important for non-technical majors as well, since they are users and sometimes managers of technology. Non-technical majors can also add a vital component to discussions of technology, but their input is missed when technology perspectives are discussed in purely technical courses.

There are several ways of exploring perspectives on technology within a separate course. For example, Calvin College, as part of its recent core curriculum revision, will include a Research and Information Technology course as part of its new core. This course will teach basic information technology skills, such as word processing, email, and Internet use, while at the

same time helping the students develop some deeper insights into the technology that they are using. This approach is promising, but such a course runs the danger of becoming a purely skills-development course. One could also work on perspectives on technology in integrative capstone courses, such as an engineering senior design projects course. However, capstones can be narrowly focused since they are usually intended for a specific major. A third possibility is technology from the viewpoint of a particular discipline, such as history of technology, philosophy of technology, or ethics of technology. Even here, the courses are often comprised mainly of students in one particular major.

III. A Science Fiction and Technology Course

A course that combines perspectives on technology with a focused study of science fiction literature offers an interesting solution to the problem of introducing students to broader issues of technology. Many students have a personal interest in science fiction and are attracted to such a course. In addition, science fiction can be studied in a variety of media (feature film, short story, novel, etc.) that makes for an exciting course. Science fiction has been used to study social issues[1], psychology[2], history[3], and of course, the genre itself has been the subject of much literary study and critique. Although most work in the area of using science fiction to teach has been focused on younger students, Williamson's *Teaching Science Fiction: Education for Tomorrow* is a seminal work useful for all levels of education[4].

Science fiction asks the most important questions about technology. What are the benefits of a technology (real or imagined), and for whom? Is the benefit perceived or actual? What are the harms of a technology? Some very good science fiction often revolves around the unintended consequences of technology that were not foreseen by the technology creators or users – from the man who is replaced by his own machine, to the explorer who accidentally destroys an intelligent life form through carelessness. Through exploration of unintended consequences, science fiction teaches us that human problems are never purely technical and never have purely technical solutions. Engineering solutions must always take a holistic approach that incorporates all pertinent aspects of reality: economic, aesthetic, and so forth. Science fiction explores the fundamental nature of technology and its relationship to humanity – to art, culture, literature, music, economics, language, religion, science, history, and more. In works like "The Ship Who Sang" by Anne McCaffrey, films such as *Blade Runner*, and in the episode "Best of Both Worlds" from *Star Trek: The Next Generation*, science fiction asks what it means to be human. The first explores a woman whose physically frail and deformed body is augmented with technology to the point where she effectively becomes the machine she controls: a starship. The second examines a human-like robot that doesn't know it is a machine and suffers an emotional breakdown upon learning the truth. The third looks at a man who is assimilated into a collective machine-like community of aliens, almost losing his humanity in the process.

The questions considered above are certainly among the important questions to ask concerning technology. However, does science fiction literature allow exploration of *all* the important arenas concerning technology? Isaac Asimov believes so, telling us "science fiction is that branch of literature which is concerned with the impact of scientific advance upon human beings."[5] Neil Postman has proposed six essential questions[6] that must be asked concerning technology:

- What problem does the technology represent a solution to?

- Whose problem is it?
- What problems will this technology create even as it solves a problem?
- What people or institutions will be hurt by the new technology?
- What people or institutions will profit from the new media or technology?
- What changes in language semantics will be affected by the technology?

Our earlier questions concerning harms and benefits essentially cover the first five of Postman's questions. His last question concerning language is the forte of science fiction, which treats us with strange new terms for incredible technology inventions from the author's imagination.

Science Fiction develops a considered approach to engineering design and the development of technology, exploring design from a broad perspective. It demonstrates the folly of allowing technology to develop for its own sake, in the name of "progress." Indeed, it questions whether technology actually represents progress. In works such as *Diamond Age* by Neal Stephenson, "'Repent Harlequin!' said the Ticktockman" by Harlan Ellison or in the film *THX-1138*, we see individuals subverting a culture that has succumbed to technology. Their acts of subversion put technology back in its place as a tool of humanity. Science fiction highlights the fundamental nature of humanity and the reflection of that nature on the technology created by man. We can see this interplay of humanity and technology influencing each other in Laura Anne Gilman's "Clean Up Your Room!" as well as in Larry Niven's "Cloak of Anarchy" where human depravity is no longer kept in check when technology fails. Lest we think that one can easily and simply discern between good and evil in technology, consider the film *Blade Runner*, where the main character, Deckard, first believes life is rather clear-cut: "replicants are like any other machine - they're either a benefit or a hazard. If they're a benefit, it's not my problem." However, as the film progresses, Deckard finds that replicants (human-like robots) cannot be neatly categorized as good or evil, human or machine. He learns that some good may be found in technology gone wrong, and that even "good" technology can have defects. Science fiction asks the engineer to count the cost of technology – its terrible demands for efficiency and profit. It asks the engineer to build a *complete* design matrix that considers *all* design alternatives and *all* the consequences of a considered solution – beyond design characteristics such as low cost or high strength, the complete design should include characteristics such as justice, stewardship, and mercy.

Investigating perspectives on technology through science fiction literature provides four distinct advantages. First, as a fish does not objectively discern the water, it can be difficult to discern characteristics of one's own culture. Thus, it is helpful to provide some "leverage" on one's culture by stepping outside it in some way. Historical or global studies can provide this service, but science fiction is particularly helpful in providing this step "outside" when thinking about technology. Science fiction transports the reader to another world, or their own future world, and there the reader can examine her own preconceptions and cultural conditioning in contrast to the perspectives of the characters in the story. Second, science fiction, in fashioning this other world, also provides a mental playground, or workshop, in which we can construct thought experiments about current or future technologies and what their effects might be. It frees the mind to conceive of possible side-effects that one might not recognize otherwise. Third, many issues that might be too sensitive to allow for unbiased consideration in their immediate social context receive a fresh look when placed in a science fiction context. Fourth, science fiction courses are multi-disciplinary in nature. Students from a wide spectrum of majors are drawn to

them: from English to Economics majors, from biologists to philosophers. Such a rich mix of interests and backgrounds provides a wonderful milieu in which to discuss technology.

IV. Pedagogy

Before discussing the specific pedagogical methods for the course, it is important to note that I have taught the course as part of Calvin College's January Interim term. This is a one-month intensive period during which the students take a single course for several hours each day. The interim is used for experimentation and innovative exploration of topics often outside of the student's major. This unusual feature of Calvin's academic calendar provides a perfect home for a science fiction and technology course.

Science fiction is found in a variety of media, and I have taken advantage of this variety in my course. I typically assign three or four science fiction novels, along with quite a few short stories from a collection. In the most recent incarnation of the course, I used Huxley's *Brave New World*, Miller's *Canticle for Leibowitz*, Lewis' *Out of the Silent Planet*, and Stephenson's *Diamond Age*. Our short story collection was a compilation with commentary by Applewhite Minyard, *Decades of Science Fiction*. I also use feature-length films (such as *THX-1138*, *Contact*, and *Blade Runner)*, as well as a few episodes from the various *Star Trek* series.

A. The Jigsaw Discussion Method

One of the most effective pedagogical tools for the course has been the jigsaw discussion method, which consists of a research phase and a learning phase. After the students have read a particular work, they are assigned to "expert" groups to work through a set of instructor-prepared questions. This is the research phase. It is preferred to have the same number of groups as there are students in each group (such as five groups of five) but this is not necessary. Each expert group works through a different set of questions. The questions can be divided among the groups by chronological section from the readings, by theme, by story element, or any other logical taxonomy. Although a few "easy" questions might be included to stoke the fire, most of the questions should be open-ended. While the expert groups research and answer the questions, the instructor moves from group to group, insuring that they give each question appropriate consideration by prodding and probing where necessary. After the groups have finished the research phase, the students are rearranged into learning groups. Each new group has one expert for each topic (one from each of the previous groups). During the learning phase, the groups allow each "expert" to teach the others what they learned about a particular topic. Students can ask questions during the learning phase, or make brief comments, although they must work more quickly since all the questions from all groups must be covered. The jigsaw method involves every student, giving each one responsibility for learning and teaching material.

B. Student Projects

Three major projects were assigned during the class. The first was a short-story writing assignment. Each student selected a common technology and then wrote an alternate-history treatment of a society in which the technology was introduced earlier that it was actually discovered, such as the gasoline-powered automobile in the early 19th century rather than the 20th. These stories were shared in small groups and the students were allowed to vote on the best

stories. The second project split the class into two groups to debate the proposition: "Resolved that the federal government shall restrict the advancement of technology in the United States." The students were allowed to use any of the literature from the course as evidence during the debate. The third project split the class into several groups, each of which was assigned the task of developing a plan to preserve human culture in the face of a worldwide disaster. Each group was asked to fill in the details of the imaginary catastrophe as well as their prescription for survival of human culture. Using a variety of pedagogical styles keeps the students interested and focused.

V. Conclusion

A course combining science fiction and technology can be very effective in helping students explore the broader issues related to technology and its development. Science fiction is an exciting basis from which to launch meaningful discussions about the nature of technology, its relationship to human culture, and its appropriate use based on a ethical worldview. It provides the four advantages of cultural leverage, a mental playground for thought experiments about technology, a fresh look at tough issues, and a multidisciplinary approach. Science fiction contextualizes technology, helping students see the big picture.

Bibliography

[1] Greenberg, Martin Harry, ed.. *Social Problems through Science Fiction*. New York : St. Martin's Press,1975.
[2] Katz, Harvey A., Warrick, Patricia, & Greenberg, Martin Harry. *Introductory Psychology through Science Fiction*. Chicago: Rand McNally College Pub. Co, 1974.
[3] Roselle, Daniel. ed. *Understanding American History through Science Fiction* Greenwich, Conn.: Fawcett Publications, 1974.
[4] Williamson, Jack, ed. *Teaching Science Fiction: Education for Tomorrow*. Philadelphia: Owlswick Press, 1980.
[5] Asimov, Isaac. Ed. Bretnor, Reginald. *Modern Science Fiction*, New York: Coward-McCann, 1953.
[6] Postman, Neil. "Questioning the Media," speech at *The January Series of Calvin College, 1998*, January 12, 1998.

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