

Ways of Thinking About Technology (Reinforcing Ideas in Norton and Handy)

The Social Construction of Technology, Technological Determinism, and Technological Systems

1. Paradigms, Communities of Practice and Social Groups

Before we start talking about bicycles, I want us to discuss several important concepts in thinking about technology: paradigms, communities of practice, social groups, and the social construction of technology. These concepts can be helpful in thinking about how implementing a different technology in the face of a well established technology is often so difficult. A paradigm is a conceptual framework that shapes our thinking about a particular subject. (We see this term alluded to in the Handy reading.) The term "paradigm" became a common term through the work of Thomas Kuhn, a physicist who was also a historian of science. He wrote a famous book called *The Structure of Scientific Revolutions*, which examined how paradigms work within science. Subsequently his insights have been carried over into many other areas.

Here is the basic concept. Communities of practice operate according to paradigms, frameworks that shape what they do. For college students, there is the paradigm of what a college course is and how one studies for it. For college professors, there is a framework of teaching courses, interacting with colleagues, attending conferences, writing books and papers that structures what we do. For someone outside the community of practice, what happens inside the community can seem very foreign and odd. The intellectual content of disciplines is also shaped by these frameworks. One important point about communities of practice and paradigms is that because knowledge resides in communities more than in individuals, and because groups hold onto paradigms, it is typically very hard to introduce a radical change into a community. Communities of practice will resist ideas that violate their frameworks. For example in the 15th century, astronomers held to the "geocentric" paradigm that said that the sun rotated around the earth. As some astronomers gathered new data, which we would today see as obviously supporting the idea that the earth revolved around the sun rather than the other way around, most astronomers made those ideas fit into the old "geocentric" model. If two people are operating in different paradigms, they typically will see things differently and won't agree. When two people or two communities are operating under different paradigms, their thinking is said to be incommensurable. That is, there is no standard basis by which the two parties can communicate and compare their ideas. Can you think of examples of paradigms?

I want to introduce one other term "social group," which is a variation of the idea of community of practice. A social group is a group of people who, in the area being discussed, share a common identity (they often perform the same function), and by and large see things the same way.

So one of the first questions we should ask ourselves when we start looking at a specific technology is what communities of practice or what social groups are there. What groups are there that do the same kinds of things and see the situation regarding a technology in roughly the same way? [For those of you who work, this is a good practice to maintain in your job, so that you can understand why people tend to see things differently than you do.]

In this class we will be looking at the "automobile paradigm," and the "bicycle paradigm." We might ask who are some of the social groups that promote the "automobile paradigm" and how do they see the world?

If you hold a paradigm, that will shape your thinking and make you blind to other alternatives. Can we think of examples of what is "automobile paradigm" thinking (and doing)?

The term *social construction of technology* (a term you see in the Norton reading) asserts that any technology does not have a fixed form, but instead is a result of the interactions of all the social groups or communities of practice associated with it. Each social group may have some idea of the characteristics of the technology they want. The resulting technology will reflect which group had the greatest ability to mold the technology in the way it wanted. This idea says that technology is moldable, like silly putty and not fixed. The technology that prevails is not necessarily "the best technology," but the one supported by the social groups that are most able to impose their vision.

2. Technological Determinism

I. Technological Determinism

Another way of looking at technology, in some ways the flip side of the social construction of technology is technological determinism. Technological Determinism has two slightly different, but related meanings.

1. Technology unfolds according to its own inner logic that is independent of other factors.
2. Society adapts itself to the constraints/conditions that technology imposes on it.

An example of (1) would be a statement like "The automobile was the evolutionary replacement of the bicycle."

An example of (2) would be the following statements: "The Internet forces society to be democratic" "The birth control pill created the sexual revolution." "The automobile created the suburbs." It is too simplistic to say that this is

either "true" or "false." There are certain situations where these ideas can be useful. But they can also be excuses for not looking more broadly at society and the world. One could say that China is today conducting an experiment trying to disprove proposition (2). That is to say it wants to have the internet, but it doesn't want to have a democratic form of government. So it is trying to develop its own customized, censored version of the Internet. Can China do that? You will probably see the answer in your lifetime.

In any case, technological determinism tends to give agency to the technology and take it away from individual humans. We might suspect technological determinism in any sentence where the subject is technology.

"Cell phones make people less aware of their surroundings."

One can soften this by saying instead:

"Cell phones encourage people to be less aware of their surroundings."

So the social construction of technology says societies create technology, while technological determinism says technologies create societies. Do these two ideas contradict one another? One scholar has said that technologies are both shaped by society and society shaping. I think of this as being like Escher's ["Drawing Hands"](#) print.

3. Socio-technical Systems

No technology functions in isolation. Rather it functions as part of a complex assemblage of both technical and social elements, which is called a socio-technical system. Here are things to consider to begin tracing out a socio-technical system:

Factors of Production:

Materials-What are the materials used in the technology and where do they come from?

Workforce-What kind of workforce is required to produce the technology in question?

(Consider both engineers/scientists and those involved in manufacturing)

Capital equipment-What kind of production equipment is needed?

Components-What components are needed and where do they come from?

Consumption:

Consumers-Who are the consumers of this system and how are they convinced to consume it?

Do these consumers have to have certain characteristics?

Adjunct/infrastructural technologies-Are there other technologies that are necessary for the technology under consideration to function?

Supporting institutions/organizations-Are there other institutions that support the technology? These organizations might be non-profits, universities,

lobbyists...

Role of government/the military -Does the government play some role (directly or indirectly) in supporting this technology? This might be through funding, through laws, or other aspects of public policy. Of course government has many levels, and we should think of federal, state, and local government.

Cultural values/norms-Are there values or social norms which support the technology? What sort of meaning do people in society attach to the technology?

Assumptions: Are there ways in which this technology has become a tacit assumption of society?

Competing/Colliding Technologies—are there other technologies that compete with this technology or shape how we respond to this technology? How do they do that?

These elements are systematically related.

For example, the Iphone is made using a [distinctive labor system--a Chinese labor system](#), and Apple executives seem to believe that that system is essential for the production of Iphones. When Steve Jobs was alive, he told President Obama that Iphones could not be made in the US.

A change in one element of the system might be expected to ripple through the system and lead to changes in other elements. (See [this example](#) from a few years ago suggesting what increased wages paid to fast-food workers might mean.)

Very often key elements that are necessary for a technology's functioning are hidden from us in our everyday usage of a technology. Thinking in terms of technological systems reminds us of these elements and all the things that are implicated in our use of a technology. For example, as we drive our car, there is a gravel mine somewhere that was used to build the road we drive on. When we use our Iphone, there is a lithium mine somewhere that mined the lithium that makes our batteries work. And there was a committee somewhere that set the standards for how Iphones communicate with one another.

Scholars of sociotechnical systems have claimed that a socio-technical system is most malleable early in the history of the technology and that it gets more rigid as time goes on. (It is said to have acquired momentum.)

Before Class: Put some of the key elements you see in the automobile into this padlet.

For Class Discussion: Do you think that today, it is easy to introduce major changes into the automobile socio-technical system? Why or why not? The Inflation Reduction Act has plans major incentives for electric cars. What challenges exist to the rise of the electric car? Would it be easily possible to dramatically reduce American's dependence on the automobile? What kinds of changes do you see possible in various parts of the automobile socio-technical system? How would they ripple into other areas?

For Class:

What are the key elements of the bicycle socio-technical system? (Let's not spend too much time on the production of bicycles.). Write down ten specific elements of the bicycle socio-technical system. How do these elements compare with the car socio-technical system?