Characteristics of Technological Systems--What are they?

Definition of Technological Systems

- Contain messy, complex, problem-solving components

- Socially constructed AND Society Shaping
  - Different people responsible for different parts

Definition of Technological Systems

- Technological systems include:
  - Technical objects
  - Natural resources
  - People (designers, operators, and customers)
  - Organizations
  - Scientific and technical knowledge
  - Legislation
  - Norms of culture/society

Definition of Technological Systems

- Social forces are NOT relegated to the "surrounding environment," they are part of the system
- *People* within a technological system have freedom to move, change, make mistakes, etc. which the *objects* in the system do not have.

How do Technological Systems emerge, move, and change?

- Thomas Hughes: identified a pattern of the evolution and change of technological systems
- As systems emerge and grow, they develop *momentum* which cements their structure.
- 5 phases of development of a system
  - Approximate order
  - Full of starts and stops

How do Technological Systems emerge, move, and change?

- Phase 1: **Invention**
  - Radical invention which brings about a new system
  - Usually developed by independent inventors (especially in the 1800s & early 1900s)
    - Improvement on an invention which wasn't framed right
    - Distance themselves from popular problems/questions
    - Often had a solution looking for the right problem.
  - Example: Edison's light and power system

How do Technological Systems emerge, move, and change?

- Phase 2: **Development**
  - Bring invention to life with economic, political, and social characteristics
    - Without these, the invention would go nowhere.
    - Makes it important
    - Begin to find financial backers and interested parties
  - Develop and test the invention under real-world stresses
    - Fine-tuning, exploring the capabilities of the invention, making it ascetically pleasing
  - The invention is not yet as system at this point, but it has not been taken over by another system.
  - Edison—worked out the pieces of the power system so it could be marketed

How do Technological Systems emerge, move, and change?

- Phase 3: **Innovation**
  - The development of associated manufacturing, sales, and service facilities.
  - The invention now becomes a system—
    - Companies are developed
    - Relationship between components is worked out
    - Develop new ways of doing business or manufacturing
  - Goal is to increase the amount of *control* they have over the things which surround the invention
  - At the end of this phase, the inventor fades out of the picture—it is too big to be controlled by one person
  - Edison—developed utility companies, manufacturing companies, and swapped stock for equipment

How do Technological Systems emerge, move, and change?

- Phase 4: **Technology Transfer**
  - Where the technological system is transferred to other situations or locations
  - Systems are now larger than one company or series of companies
  - Requires *standardization* of the system:
    - Must standardize connections, communications, etc
    - Ability to function in different geographic locations
    - Legislation and regulation
  - Power system: AC vs DC, single power grid, consumer safety

How do Technological Systems emerge, move, and change?

- Phase 5: **Growth, Competition & Stabilization**
  - Where technological systems grow to capacity, deal with competition, and then stabilize
  - Economy of scale: companies want to grow so their services will be more efficient
  - Power: organizations want to be bigger and more powerful
  - Drive to Diversify: want to control a bigger portion of the system
  - Economic stability: invest in a wide variety of things
  - Reverse Salients…

Reverse salients

- Components of the system which have fallen behind or are out of phase with others
- Limit the potential of the system
  - Eg. Shipping industry
- If a critical problem cannot be solved, a radical shift usually happens and a new, competing system develops
  - Eg. DC to AC

How do Technological Systems emerge, move, and change?

- Once in place, technological systems have **momentum**
  - Won't easily change its ways
- People and companies are invested:
  - Companies have time, equipment and $$ invested
  - Users are comfortable and knowledgeable about the current system and resist change

Technological Systems

- What can thinking about technology as "technological systems" do for us?

Boundary Workers

- Boundary workers are the people who fill in the gaps in communication and labor *within* and *between* systems
  - Ship example (captains used knowledge of astronomy)
  - Telegraph messenger boys
  - Meter readers
- Boundary workers are part of the system

Technological and Scientific Literacy

National Science Foundation—
Public Understanding of Science Survey

True or false?

- Cigarette smoking causes lung cancer.

  True

- The continents on which we live have been moving their location for millions of years and will continue to move in the future.

  True

- All radioactivity is man-made

  False

True or false?

- The center of the earth is very hot.

True

- The oxygen we breathe comes from plants.

True

- Lasers work by focusing sound waves.

False

True or false?

- Electrons are smaller than atoms.

True

- Antibiotics kill viruses as well as bacteria.

False

- The earliest humans lived at the same time as dinosaurs.

False

Public Understanding of Technology-

Knowing how it works

Vs.

Knowing how it serves, alienates, helps, or has meaning for you

Technological Literacy : Knowing how technology works

- Not important to day-to-day living
- Use a phone without knowing how it works from an object-world perspective

Technological Literacy: Knowing how to interact with technology

- People need to know how to interact with technology to be fully incorporated into society
- Technological illiteracy is a big problem
  - "cyberghetto"—the poorest neighborhoods can't afford textbooks in their schools, let alone computers