

Evaluating and Controlling Technology

CSE 312 – Legal, Social, and Ethical Issues in
Information Systems

Stony Brook University

<http://www.cs.stonybrook.edu/~cse312>

Evaluating and Controlling Technology

7.1 Evaluating Information

7.1.1 The Need for Responsible Judgment

7.1.2 Computer Models

7.2 The “Digital Divide”

7.2.1 Trends in Computer Access

7.2.2 The Global Divide and the Next Billion Users

7.3 Neo-Luddite Views of Computers, Technology, and Quality of Life

7.3.1 Criticisms of Computing Technologies

7.3.2 Views of Economics, Nature, and Human Needs

7.4 Making Decisions About Technology

7.4.1 Questions

7.4.2 The Difficulty of Prediction

7.4.3 Intelligent Machines and Superintelligent Humans Or
the End of the Human Race?

Evaluating and Controlling Technology

Questions that we will discuss in this chapter:

- *Does the openness and “democracy” of the Web increase distribution of useful information **or inaccurate, foolish, and biased information**?*
- *How does access to digital technology differ among different populations?*
- *Is computing technology evil? Why do some people think it is? How should we control technology to ensure positive uses and consequences?*
- *How soon will robots be more intelligent than people? What will happen after that?*

7.1 Evaluating Information

The Need for Responsible Judgment

- There is a daunting amount of information on the Web—and much of it is **wrong**:
 - Quack medical cures
 - Distorted history, errors, outdated information, bad financial advice
 - Search engines are replacing librarians, but Web sites are ranked by popularity, not by expert evaluation
 - Wisdom of the crowd - ratings by public of Web site
 - If millions participate, the results will be useful
 - Wikipedia, the biggest online encyclopedia, is immensely popular, but anyone can edit it
 - Can we rely on it?

Evaluating Information

The Need for Responsible Judgment



- **Wikipedia**
 - Written by volunteers, some posts are biased and not accurate
 - Although anyone can write, most people do not
 - Those that do typically are educated and experts
 - Noncommercial and ad-free
 - The English edition has almost four million articles, more than 10 times as many as the long-respected Encyclopaedia Britannica, first published in 1768 and online since 1994
 - Wikipedia is one of the Internet's most-used reference sites
 - The staff of a federal agency removed criticisms of the agency from its Wikipedia article

Evaluating Information

The Need for Responsible Judgment

- Wikipedia
 - Wikipedia's managers developed procedures and policies to reduce the likelihood of inaccurate data
 - Wikipedia saves old versions, so it can restore an article someone has vandalized



Evaluating Information

The Need for Responsible Judgment

- Wisdom of the crowd
 - People ask all sorts of questions on StackOverflow, Quora
 - Problems of unreliable information are not new:
 - Eighteenth century opera stars paid people to attend performances and cheer for them or boo their rivals
 - The Web magnifies the problems
 - Rating systems are easy to manipulate
 - Some health sites on the Web encourage the public to rate doctors, hospitals, and medical treatments
 - When a large number of people respond, they produce a lot of answers, but the average, or median, or most common answer is often a good one
- Vulnerable viewers
 - Less educated individuals
 - Children

Evaluating Information

The Need for Responsible Judgment

- **Narrowing the information stream**
- One good step is to determine who sponsors the site
- Instead of relying on a few sentences quoted from an official news release or a sound bite from a biased spokesperson
 - We can read the full text of government documents—bills, budgets, investigative reports, congressional testimony and debate
- As journals moved online, authors tend to cite fewer articles, more recent ones, and articles from a narrower set
 - The speculation is that researchers using search engines to find articles related to their work select from among the ones that appear high in search results

Evaluating Information

The Need for Responsible Judgment

- **Abdicating responsibility**

- People are willing to let computers do their thinking
- Reliance on computer systems over human judgment may become institutionalized
- Fear of having to defend your own judgment if something goes wrong

I have a spelling checker.

It came with my PC.

It plainly marks four my revue,

Miss steaks aye can knot sea.

Eye ran this poem threw it,

I'm sure your pleased too no.

It's letter perfect in it's weigh,

My checker tolled me sew.

—Jerrold H. Zar, “Candidate for a Pullet Surprise”

a simple spell checker looks up each word **only to discover whether it is in its dictionary**, not that it makes sense.

Evaluating Information

Computer Models

- Evaluating Models
 - Researchers and engineers do extensive modeling to simulate both physical systems, such as the design for a new car or the flow of water in a river, and intangible systems, such as parts of the economy
 - Mathematical models do not include equations for every factor that could influence the outcome.
 - They often include simplified equations because the correct ones are unknown or too complicated.
 - Models for:
 - Population growth
 - The cost of a proposed government program
 - When we will run out of a critical natural resource
 - The effects of a tax cut on the economy
 - The threat of global warming
 - When a big earthquake is likely to occur

Evaluating Information

Computer Models

- Evaluating Models

- *How well do the modelers understand the underlying science or theory?*
- *How accurate and complete are the data?*
- **Models necessarily involve assumptions and simplifications of reality**
 - for example, the model of a plane flight does not include the wind, birds, rain
- How closely do the results or predictions correspond with the results from physical experiments or real experience?
 - If the United States adopted a national health system, the predictions varied by hundreds of billions of dollars

Evaluating Information

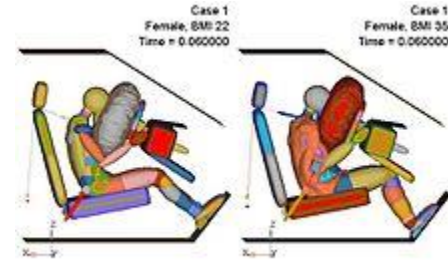
Computer Models

- **Models may not be accurate:**
 - We might not have complete knowledge of the system we are modeling.
 - The data describing current conditions or characteristics may be incomplete or inaccurate.
 - Computing power may be inadequate for the complexity of the model.
 - It is difficult, if not impossible, to numerically quantify variables that represent human values and choices.
 - The U.S. Army Corps of Engineers uses mathematical models to predict how long an artificially constructed or replenished beach will last before waves wash it away
 - Often, the beaches do not last as long as the models predict, partly because the models do not accurately provide for relevant but irregular natural phenomena such as big storms.

Evaluating Information

Computer Models

- Example: Modeling car crashes
 - Car crash analysis programs use a technique called the finite-element method.
 - They superimpose a grid on the frame of a car, dividing the car into a finite number of small pieces
 - Each material is described by density, strength, and elasticity
 - The modeling programs require intensive computation to simulate 40–100 milliseconds of real time from the impact
 - A real crash test can cost several hundred thousand dollars
 - The crash analysis programs allow engineers to consider alternatives—for example, to vary the thickness of steel for selected components, or change materials
 - Crash analysis programs are very close to real tests



Evaluating Information

Computer Models

- Example: Modeling climate
 - The global temperature increase raised concern about the threat of excess global warming, possibly caused by human-induced increase of CO₂ and other greenhouse gases in the atmosphere
 - Climate models, like the car crash analysis models, calculate relevant variables for grid points specified simulated time intervals.
 - The models contain information about: the sun's energy output; the orbit, inclination, and rotation of the earth; geography (a map of land masses); topography (mountains, etc.); clouds; sea and polar ice; soil and air moisture; and a large number of other factors.
 - Equations simulate atmospheric pressure, temperature, wind speed and direction, moisture, precipitation, ocean currents, and so forth.
 - Clouds represent a significant source of potential error in climate simulations

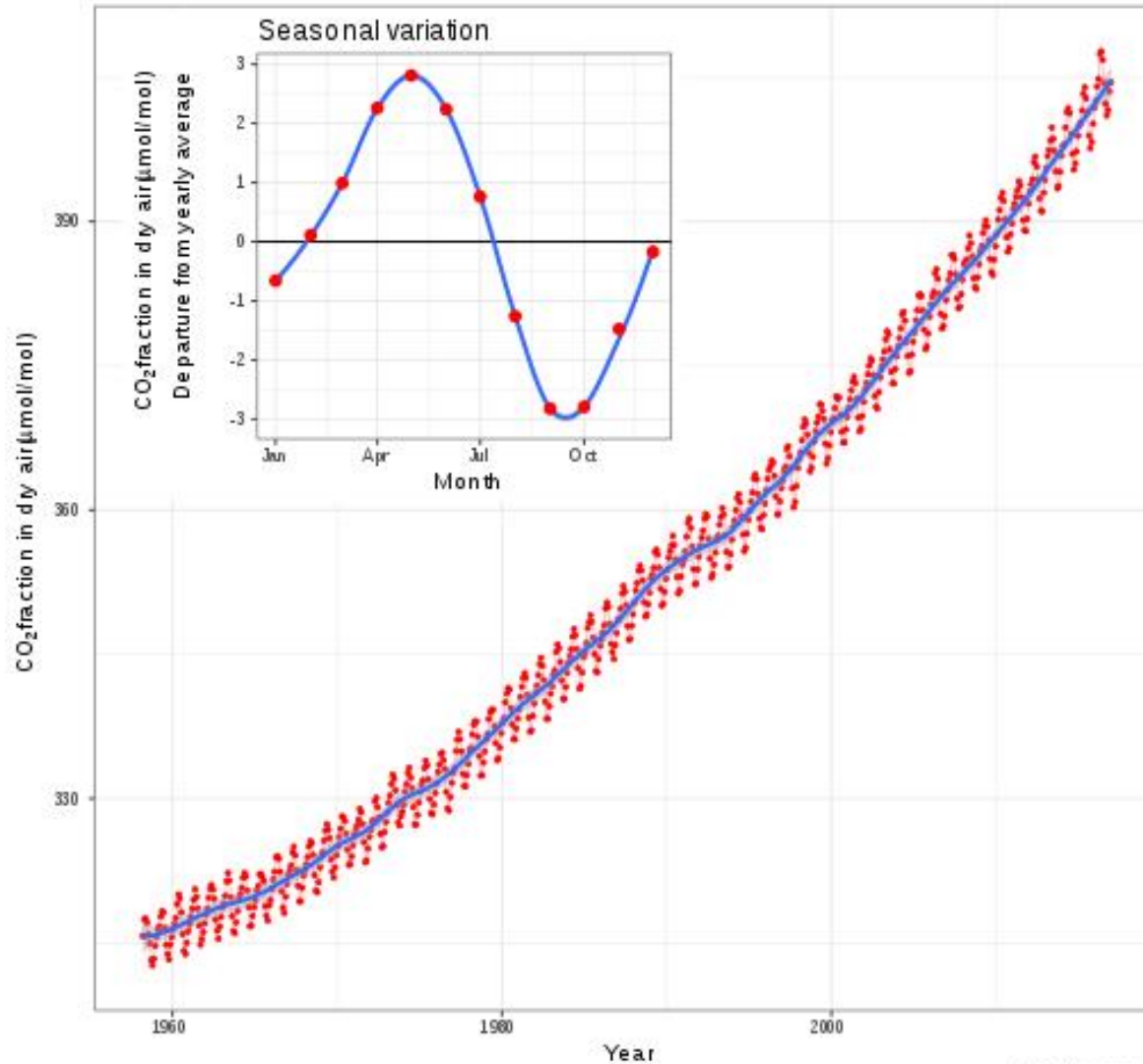
Evaluating Information

- Intergovernmental Panel on Climate Change (IPCC) (established in 1988) is a scientific and intergovernmental body under the auspices of the United Nations set up at the request of member governments, dedicated to the task of providing the world with an objective, scientific view of climate change and its political and economic impacts
- The IPCC produces reports that support the United Nations Framework Convention on Climate Change (UNFCCC), which is the main international treaty on climate change
- The IPCC has concluded that it is “extremely likely” that human activity has had a substantial warming effect on climate

Evaluating Information

Monthly mean CO₂ concentration

Mauna Loa 1958 - 2016



Data: NOAA/CIRES

Evaluating Information

- IPCC acknowledges that the underlying complexity of the problem still hampers the accuracy of projections for future climate change.
- *"Even the extremely powerful computers of today are not sufficient to achieve an ideal level of resolution (grid size) and to include simulation of more processes that affect climate"*

7.2 The "Digital Divide"

Trends in Computer Access

- New technologies only available to the wealthy
 - The term *digital divide* refers to the fact that some groups of people (the “haves”) enjoy access to and regularly use the various forms of modern information technology, while others (the “have-nots”) do not
 - Poor children and children of some ethnic minorities had less access to computers both in schools and at home
 - In the early 1990s, only about 10% of Net users were women
- The time it takes for new technology to make its way into common use is decreasing
- Cost is not the only factor; ease of use plays a role
- Entrepreneurs provide low cost options for people who cannot otherwise afford something
- Government funds technology in schools
- As technology becomes more prevalent, the issues shift from the haves and have-nots to level of service

The "Digital Divide"

Trends in Computer Access

- In 1990, 22% of households in the United States owned a computer.
- In 2001, 84% of homes with children in middle and high school had Internet access.
- By 2000, 98% of high schools had Internet access.
- Access to broadband connection is a newer version of a digital divide.
- Without broadband access, it is more difficult to find employment opportunities.
- According to Connected Nation, in 2011 only 46% of low-income households with children and 37% of low-income minority households with children had broadband at home, compared to 66% of households nationally.

The "Digital Divide"

The Global Divide and the Next Billion Users

- Approximately two billion people worldwide have access to the Web, a fivefold increase over roughly a decade.
- That means that approximately five billion do not use the Internet.
- Non-profit organizations and huge computer companies are spreading computer access to people in developing countries.
- Bringing new technology to poor countries is not just a matter of money to buy equipment; PCs and laptops must work in extreme environments.
- One Laptop per Child is a nonprofit organization that supplies an inexpensive laptop computer specially designed for elementary school children in developing countries
 - The laptop works in extreme heat or cold, extremes of humidity, and dusty or rainy environments.
 - The power requirements are very low.
- Some people actively working to shrink the digital divide emphasize the need to provide access in ways appropriate to the local culture.

7.3 Neo-Luddite Views of Computers, Technology, and Quality of Life

Criticisms of Computing Technologies

- Neo-Luddism or New Luddism is a philosophy opposing or skeptical to many forms of modern technology
 - Neo-Luddism is a movement of non-affiliated groups who resist modern technologies and dictate a return of some or all technologies to a more primitive level
- Computers cause massive unemployment and de-skilling of jobs.
- Computers cause social inequity
- Computers cause social disintegration
 - They weaken communities and families and lead to isolation of people from each other
- Computers “manufacture needs”: we use them because they are there, not because they satisfy real needs.

Neo-Luddite Views of Computers, Technology, and Quality of Life

*Quite apart from the environmental and medical evils associated with them being produced and used, there are two moral judgments against computers. One is that computerization enables the large forces of our civilization to operate more swiftly and efficiently in their pernicious goals of making money and producing things . . . And secondly, **in the course of using these, these forces are destroying nature with more speed and efficiency than ever before.***

—Kirkpatrick Sale

Neo-Luddite Views of Computers, Technology, and Quality of Life

Criticisms of Computing Technologies

- Luddites: In England in 1811–1812, people burned factories and mills in efforts to stop the technologies and social changes that were eliminating their jobs
 - They were weavers who had worked at home on small machines
 - It was the most dramatic symbol of opposition to the Industrial Revolution
 - Critics of technology have adopted it as an honorable term



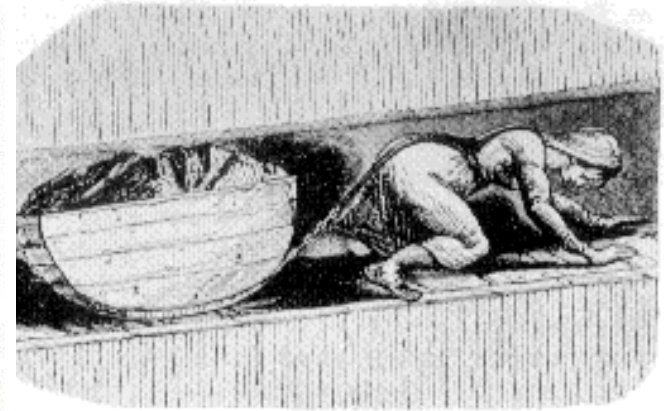
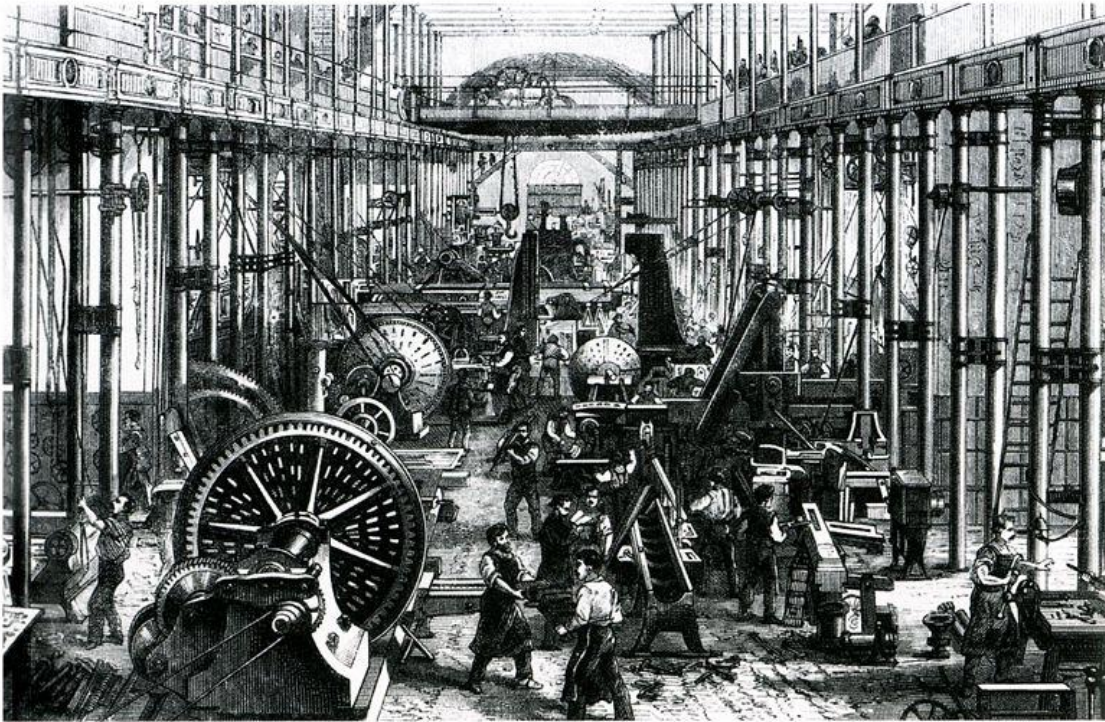
Neo-Luddite Views of Computers, Technology, and Quality of Life

Criticisms of Computing Technologies

- Computers separate humans from nature and destroy the environment.
- Computers benefit big business and big government the most.
- Use of computers in schools thwarts development of social skills, human values, and intellectual skills in children.
- Computers do little or nothing to solve real problems
- Neil Postman, in response to claims of the benefits of access to information, argues that “if families break up, children are mistreated, crime terrorizes a city, education is impotent, it does not happen because of inadequate information.”

Neo-Luddite Views of Computers, Technology, and Quality of Life

- The conditions in computer factories hardly compare to conditions in the sweatshop factories of the early Industrial Revolution



- A computer in the classroom does not replace good parents in the home.
 - But this should not be a criticism of computers!

Neo-Luddite Views of Computers, Technology, and Quality of Life

Views of Economics, Nature, and Human Needs

- What is the purpose of technology?
 - To Luddites, it is to eliminate jobs to reduce cost of production
 - To non-Luddites, it is to reduce effort needed to produce goods and services.
 - Modern transportation and communication reduce the price of products and increase their variety and availability. For example, we can eat fresh fruits and vegetables all year
 - While both statements say nearly the same thing, the first suggests massive unemployment, profits for capitalists, and a poorer life for most workers. The second suggests improvements in wealth and standard of living.

Neo-Luddite Views of Computers, Technology, and Quality of Life

Views of Economics, Nature, and Human Needs

- As we conduct more economic transactions electronically, we lose more local stores, local professional and social services, and convivial public spaces like the downtowns of small towns.
- The fact that consumers want a particular service, store, or product is irrelevant if not enough people are willing to pay the prices that make the business viable
 - The town residents are not willing to pay what it costs to keep the downtown stores in business
- “Involuntary transformation”: no consumer wanted or intended the outcome

Neo-Luddite Views of Computers, Technology, and Quality of Life

Does the technology create a need for itself?

- A common criticism of capitalism is that it survives by convincing us to buy products we do not need
- Luddites argue, similarly, that technology causes production of things we do not need
- Do we need to do homework in the backyard or listen to music on an iPod?
- Needs are relative: a patient may need a cell phone to contact the emergency services in an emergency

Neo-Luddite Views of Computers, Technology, and Quality of Life

Nature and human life styles

- Luddites argue that technology has made no important improvements in life.
- Whether a computing device is “good,” by a human-centered standard, depends on whether it meets our needs, how well it does so, at what cost, and how well it compares to alternatives.
- Computing is not the first technology that people disagreed with:
 - Do we need electricity?
 - Do we need automobiles?
 - Do we need hot water on tap, movies, and symphony orchestras?
 - Or do we need nothing more than food and shelter?

Neo-Luddite Views of Computers, Technology, and Quality of Life

Accomplishments of technology

- Increased life expectancy (Worldwide, increased from 30 years in 1900 to 64 in 2006; in US increased from 47.3 in 1900 to 77.9 in 2007)
- Elimination or reduction of many diseases
- Increased standard of living
- Assistive technologies for those with disabilities

Neo-Luddite Views of Computers, Technology, and Quality of Life

Environmental impacts of computing technology

- A large insurance company reduced its use of paper by 100 million pages in a nine-month period by storing its manuals digitally instead of printing them.
- We use email and texting instead of sending letters and cards on paper.
- Between 2001 and 2011, annual consumption of newsprint for daily newspapers in the United States dropped by an estimated 61%, and the number of pieces of first class mail dropped by about 24%

Neo-Luddite Views of Computers, Technology, and Quality of Life

Discussion Questions

- *To what extent are Neo-Luddite criticisms valid?*
- *Can a society choose to have certain specific desirable modern inventions while prohibiting undesirable ones?*

7.4 Making Decisions About Technology

- Each new technology finds new and unexpected uses
 - Some are "bad" uses
- How finely can we make decisions about acceptable and unacceptable technologies?
- Telemedicine: A bad application of technology?
 - Safety problems with such systems
 - Telemedicine might make medical care even more impersonal than it is already
 - Large hospitals might become the “Wal-Marts of medicine”

Making Decisions About Technology

The Difficulty of Prediction

- The history of technology is full of wildly wrong predictions—some overly optimistic, some overly pessimistic
- PC was originally a tool for doing computation and writing documents.
 - No one but a few visionaries imagined most of their current uses
- World Wide Web was invented by physicists.
 - They could not have predicted: social networking, online auctions or movie streaming.

Making Decisions About Technology

The Difficulty of Prediction

- Historical quotes:
 - *I think there is a world market for maybe five computers.*
—Thomas J. Watson, chairman of IBM, 1943
 - *Computers in the future may... only weigh 1.5 tons.*
—Popular Mechanics, 1949
 - *There is no reason for any individual to have a computer in their home.*
—Ken Olson, president of Digital Equipment Corp., 1977
 - *The U.S. will have 220,000 computers by the year 2000.*
—Official forecast by RCA Corporation, 1966. The actual number was close to 100 million

Making Decisions About Technology

The Difficulty of Prediction

- Joseph Weizenbaum (MIT) argued against developing speech recognition technology
 - Mistaken expectations of costs and benefits
 - *“The problem is so enormous that only the largest possible computers will ever be able to manage it.”*
 - Speech recognition software runs on smartphones now.
 - *“... a speech-recognition machine is bound to be enormously expensive,... only governments and possibly a very few very large corporations will therefore be able to afford it.”*
 - Millions of people own smartphones and other devices that include speech recognition.
 - *“What can it possibly be used for?”*
 - Should we decline a technology because of potential abuse and ignore the benefits?
 - New technologies are often expensive, but costs drop as the technology advances and the demand increases

Making Decisions About Technology

Intelligent Machines and Superintelligent Humans - Or the End of the Human Race?

- The term *technological singularity* refers to the point at which artificial intelligence or some combined human–machine intelligence advances so far that we cannot comprehend what lies on the other side
- Some technologists welcome the idea of the human race transforming into an unrecognizable race of superintelligent, genetically engineered creatures within this century
- Others find it horrifying—and others unlikely.
- Computing power of new microprocessors doubles roughly every 18 to 24 months.
 - If the progress of hardware power continues at this rate, then by roughly 2030 computer hardware will be about as powerful as a human brain
- We cannot prepare for aftermath, but prepare for more gradual developments

Making Decisions About Technology

- Limit the scope of decisions about development of new technology
- Decentralize the decision-making process, to reduce the impact of mistakes, avoid manipulation by entrenched companies who fear competition, and prevent violations of liberty