ENGR 392: Impact of Technology on Society

Lecture 1
Introduction

Lecture 2
Nye Ch1: Can we define technology?
Definition of technology

• Nye defines technology as a **narrative** with 3 parts:

Technology (Narrative)	Intention	necessity/reason to accomplish goal
	Artifact	object used to accomplish goal
	Result	possible outcomes (not always intended) that occur when goal attempted

Ex. Keys locked in car, can retrieve by calling locksmith, opening door with coat hanger or breaking window with rock from ground.

Technology (normative)	Intention	getting in car	Normative
	Artifact	locksmith, coat hanger, rock	Value neutral
	Result	opening door, breaking glass.	Normative

• **Normative**: has value, can be good or bad

Does improved technology mean progress?
Relationship between technology & humanity

• **Notions of progress**: Technological advancement =/= progress

• Historical evolution of how question is answered.

• Does technology mean progress? Positive/negative?

Ex. Technology progressing & cancer progressing: not always good thing.

Historical circumstances	Enlightenment	• Mid-late 18th century (American/French revolution) • Seeks to escape oppression (monarchy/ church/ socioeconomic)

& conceptual components		• Claim to knowledge through science instead of divine (king & church power) • Technology is **instrumental**: means to end (achieve social justice)
	Technocratic	• Early-mid 20th century • Technology is progress, "the rest will take care of itself" [social/political/cultural/moral] • Technology becomes **inherent**: an end in of itself • Automation/industrialization/dehumanization of unskilled workers
	Counter-enlightenment	• 1960s-70s to today • Realization: not all technology is progress Ex. Wars/disasters/Vietnam/3-mile island/Hiroshima • Crisis of legitimacy: decline in confidence of administrations/institutions/leadership • Counter-cultural movements: women/ animal/ nature/ climate [rights]

• Does improved technology mean progress? [Marx answer = yes, but Progress towards what?]

• What society we want to live in? [democracy?]

• Technological progress =/= social progress

Nye ch2: does technology control us?
Are technologies deterministic?

Technological determinism	technology determines structure of society | Technology>society	
	Hard technological determinism	(T>S) (one-way influence) technology has will/logic that forces its creation & shapes society
	Soft technological determinism	(T<>S) (two-way influence possible) **Technological momentum**: technology can be shaped in infancy, but when matures/spreads/is acceptable/gains momentum = harder to change Ex. No choice in using ICE today: practicality vs necessity
Constructivism	**All the way down Social Constructivism**	(S>T): technology is reflection of social values; society has 100% control & determines technology creation Ex. Turtle holding the world, what's holding turtle? Another turtle.
	Co-constructivism	(S<>T): technology is reflection of social values, but society does not control it

Ex. Japanese refuse to adopt guns in favor of swords (because lacks symbolic value to warriors), but adopted later [soft tech det example]

Ex. Amish refuse to adopt technologies that they do not want (phone, car, etc) [social constructivism/ good hard tech det counter example]

• Nye argues against technological determinism by previous 2 ex.

• "Awareness of tools/machine does not automatically force society to adopt or keep them"

• **Reification**: making something real, considering objects having abilities

Ex. technology amplifies pre-existing social context

Ex. Introduction of vacuums increase housewife work instead of reduce

Lecture 3
Nye Ch7: work: more, or less? Better, or worse?
Machines replacing people

• Process in industrialization: mechanization/centralization/automation of manufacturing: caused loss of blue collar and creation of white collar [jobs]

• Farms/agriculture > cities

• Labor unskilled workers > automation

Taylorism	• Human activity now a science, dehumanization > humans are cogs in machine • Individual tasks organized into rational sequences in order to increase efficiency • Took agency from workers, provoked strikes
Fordism	• Assembly line, mass production of identical machines in short time
Lean production	• Application of Taylorism, but teams have tasks & more say in decision making • More quality control, better communication, decreased production time, just in time deliveries

• **Luddite**: person against/unfamiliar with technology

• Efficiency creates proletariat (working class) & displaces current working classes > but creates new/other classes/jobs

• Marx: contradiction in industrialization: more automation > more efficiency > less workers > less buyers > market will crash > workers will rise against bourgeoisie & form communism [never happened]

• Industrial revolution > computer/AI revolution > Nye says no need to worry > market will shift to create new classes

Do artifacts have politics?
3 ways technology can have political values

Technology as form of social order	• All the way down social constructivism is wrong • Artifact values gone • Social order remains	New York overpass	Overpasses designed low on purpose not to allow bus to pass to restrict access to places to bus users (blacks) (intended racial prejudice)
		McCormick factory	Expensive inefficient molding machines installed to replace workers & stop them from forming unions, (workers reinstated after union broke)
		Handicapped technology	MTL metro not designed to allow wheelchair access at every station (unintended prejudice)
Highly compatible technology		Solar & alternative technologies	Allow for decentralization & individual empowerment (like democracy)
Necessarily political technology	• Legitimate non-technological critique • Reject technology because of politics it forces	Nuclear energy	Requires militarised, centralized, authoritarian, hierarchal government to operate
		Ship at sea	Requires a captain & crew that obey orders > authoritarian governance

Universal basic income: solution to next revolution (biggest job displacement, up to 40% because of AIs)

Lecture 4
The Intersection of Culture, Gender, and Technology
Relationship between gender & technology

4 ways gender & technology are associated

Technology association with gender	Concept of technology has gender connotations	• tools are male hunter innovations, technology = male • technology = male vs nature= female
Technology reinforcing gender systems	Reification of gender roles	• cooking/sewing seen as feminine tasks > men won't learn • sex specific toys for kids (barbies for girls, GI joes for boys) • women refused access to car > supposed to stay at home • men excluded from high-tech electronic manufacturing (requires small hands) • women in military aviation > require strength for position (although no longer relevant)
Technology subverting gender systems	Technology used to eliminate gender restrictions	• mechanization reduce need for physical strength > women in military/ police • water used for domestic chores, getting water is women task > indoor plumbing eliminates this need and its connotations • TV can reinforce/subvert gender roles by showing woman at home/ outside
Technology altering nature of gender & sex	Biological alteration of gender	• women modify childbirth experience with anaesthesia • women overcome infertility to allow for post-menopausal birth • hermaphrodites have one of their genitalia removed at birth to give a gender • Binary categories of male/female are social construction, male & female is a spectrum * See essentialism vs constructivism

Essentialism	• Gender determined by sex • Male = masculine & female = feminine
Constructivism	• Gender independent of sex • Gender = socially constructed

History of Feminism
Fight for equality

1st wave (suffrage)	• Equality due to similarity to men	• Early 20th century • Right to vote • Equality through fairness > behave like men, so should be treated like men
2nd wave (difference feminism)	• Essentialism • Equality despite differences from men	• 1960s, reaction to 1st wave • women liberation movement • men/women biologically defined & different > ex. women care more > but still want equality (just cause)

3rd wave (anti-essentialism)	• Social constructivism • anti-essentialism	• 1980 to today, reaction to 2nd wave • inequalities socially constructed > ingrained in institutions > ex. Gender expectations • anyone can become anything they want to be (man says he's woman)

The trouble with 'women in computing'
Relationship between gender & technology

• What's wrong with STEM & the pipeline metaphor

• **Pipeline metaphor**: losing people (women & minorities) along line (school > work)

• current solutions > increase social/academic support for students > mentoring/role models

• Metaphor not useful & counterproductive: creates misunderstanding > overemphasizes supply side problem (women & minorities) & instead of looking at other things to change STEM (technological side of equation)

Lecture 5
Technologies as Forms of Life
Why people are not concerned with moral/political values of technology

2 reasons:

Technocracy	• increased technology = progress
Makers create & Users define (false belief)	• Engineers make things > don't care about consequences > society choses to do good/bad with them **ex. Knife** • technology is normative > can be good/bad

• Technologies are NOT politically neutral > they shape interactions we have with world

Ex. Guy driving on street, slows down to have conversation with pedestrian, but cannot because they can't hear each other & causing traffic so he has to drive away

Ex. Assumed everyone drives in LA, man repeatedly arrested because walking during the night

• we are unaware of how technology shapes our life & our choices are limited

Technological somnambulism	technological determinism if we are asleep		
	we can wake up from this accidental state and make decisions	Technology assessment	• Cause > effect (technology = cause) • Reactionary ex. Study Impact of car crash (does not prevent the crash)
		Real-time technological assessment	• ethical/legal/social concern in R&D

Beyond Engineering – How Society Shapes Technology
Non-technical forces affect outcomes of technology

Classic Economy/market theory	• Consumers make rational decisions based on self-interest
	• Most efficient technology wins
What actually happens	• Accident causes less efficient technology to take over

• ICE vs Steam engine:

ICE	• small, lightweight, powerful • not designed to operate at car speed, needs transmission, starting engine is complicated	• GM & Ford = mass production, low prices, large distribution network
Steam engine	• smooth, quiet, powerful, fewer moving parts, easier to drive • boiler requires attention, needs water refills if no condenser	• Stanley company = small manufacturer, custom & expensive, local market • Horses, hoof & mouth disease, eliminated horse troughs (water source) • war restricted manufacturing output

• QWERTY keyboard: actually slower > key placement to prevent jams > employers bought typewriters with most popular layout & typists would learn only that layout

• Betamax vs VHS: Betamax was restricted & more things would come out on VHS so it won

• technology is path dependent & unpredictable = technology assessment difficult

• technological assessment should NOT be left to "free market"

Nye Ch3: is technology predictable?
Technology is unpredictable

• the best design does not always win

• best way to invent future is to predict it

• predictions are like flipping a coin, random

• consumers discover next big thing > ex. college students experimenting viagra

• consumers decide when they want > ex. picture phone from at&t in 1968 not adopted

Prediction	New concept/ Idea	• Americans would work 25 hrs a week > work more • Too late to save India from starvation > agricultural productivity • Every family would own airplane > only rich
forecasting	innovation	• district vs individual home heating > district heating more efficient but American values emphasize individual • FM vs AM radio > FM better short distance, am won because of promotions • Betamax vs VHS > VHS won because more things on it
projection	Spread/ expansion of product	• utility/car companies didn't see energy crisis > energy conservation & smaller cars

• innovations > easier to understand, spread faster & more easily

• technologies that were resisted, but accepted later, not used for intended purpose: **radio, pc, telegraph, phonograph**

Radio	• military communication > consumer communication
Pc	• Used for work > used for games
phonograph	• Used for work > used for fun

• technologies are NOT deterministic > technologies are unpredictable shaped by social context

The Lightbulb Conspiracy
Planned obsolescence

• Things are designed to fail in order to make people buy more

• Lightbulb cartel reduced lightbulb life cycle

• Printer has function that breaks printing after 1000 pages printed > software "hack" reverts this

• Apple sued because they made iPod battery fail after ~2 years

Lecture 6

Why Engineers needs Public Policy Training & Practice

Engineers need to be involved in public policy

Crisis of legitimacy	• Counter enlightenment • 1960s-1970s • Science & technology no longer trusted by public • War, Chernobyl, 3mile island, Hiroshima, pesticides
Public understanding of science & technology	• fear of unknown > experts educate public about science & technology > did not work, people understand but don't like • lack of understanding of public from experts
Public engagement with science & technology	• experts educate public but also take feedback (dialog) • engineers work with public

• ex. Ethanol is dirtier overall than fossil fuels because of agriculture

• Choice of regulation/policy made at conception phase by engineers > engineering has public implications > engineers need to be aware of public policy context

• better understanding of public policy > better engineering solutions

• engineering curriculum needs to include public policy

Code is Law

Government not regulating does not mean no regulations > coders determine regulations

• early days TCP/IP determined real world identities/security/anonymity

• driving license = info to be allowed to drive > TCP/IP = info to be on internet?

• anonymity = basic right?

• lack of anonymity today = result of coders choices ex. Targeted ads (Facebook study which could control people's mental state by showing different type of stories)

• Is TCP/IP a threat to > constitution/rights/democracy?

Democracy

Democracy theory, actually a paradox

Democracy type	Definition
Representative (Republic)	• vote for people who vote for laws • majority rules (problem), people have no real democratic control • procedural, still have to follow laws even if disagree with because enacted properly
Aggregative (1 person = 1 vote)	• majority wins (good) & rules (bad) • result actually based on procedure not morality
Constitutionalism (Liberalism)	• codified into law that cannot be overwritten ex. Freedom of expression • problem: not actually democratic, lacks political legitimacy, ex. Supreme court has final say
Deliberative	• attempt to reconcile process & substance by justifying laws with actual reasons

Lecture 7
Midterm (quiz 1)

Lecture 8
Do We Need a Technology Policy?
We already have but not applying

technology vs democracy	• **technocracy**: policy purely rational by experts (economist/scientist)
	• **technocracy**: technocrats rule at expense of legitimate democracy
	• **democracy**: lose rationality at expense of democracy

• technology & public policy inherently interdependent in industrial society

•4 constructive pre-existing & necessary types of policies

Climate setting	• government needs to attract with subsidies/tax breaks to incubate tech • educate to make sure qualified work force ready to take over • provide conditions for sector to exist & thrive by benefitting everyone in society ex. Bombardier/Microsoft cant do things alone w/o subsidies
Surveying	• government gather live global data to the benefit of all ex. Stats Canada gets info that companies could not gather on their own • to remain competitive
Coordinating	• ex. National road/transport system needs to exist for industries to exist • coordination & communication for system to exist to benefit all
Gap filling	• research by government organizations because projects not profitable but could lead to major inventions/ benefit a small amount of people

	• ex. Orphan drugs, research at great cost for small number of affected people • ex. DARPA inventing the internet

• general idea: all done to benefit everyone in society, because individuals or companies cannot bear the cost to do it alone, government has to take the cost

Technology Assessment: Product or Process

Different types of tech assessments

Ad-hoc	• believes progress will happen with time (not true) • reactionary, deals with problems after they rise • no formal way to review policy
Classical	• studies potential impacts of tech to provide "neutral & factual input in decision making" • paradox because techs have political values & cannot be objective or neutral
OTA (office of TA)	• scientists employed run their own tests & provide independent analysis • included non-expert perceptions of studied techs • useful to gov. to know which policies to apply based on data/public opinion
PTA (Public TA)	• citizen committee/jury to hold "trials" for tech • final decisions in hands of representative body of citizens
CTA (Constructive TA)	• public incorporated in R&D stages of tech to resolve potential future issues • used rarely, mostly for controversial issues with present application ex. Synthetic biology

• logical progression/trajectory towards more democratic participation in science & tech policy providing legitimate non-technocratic critiques

Perspectivism: 1 person's POV is limited, many different opinions/perspectives by many people leads to "stronger claim to truth" because more people => more objective & rational = better

• Perspectivism is justification to PTA, conclusion: both democracy & technocracy needed

Great Hybrid Car Cover-up

Policy bottleneck

• ex. EPA roadblock: cutting funding of potential tech because of 1 person

By the Grace of Invention
NA standard of living cannot be given to everyone, too many people on Earth

• developing countries can leapfrog harmful techs ex. Skip coal and go to solar

Lecture 9

Leapfrog Energy Technologies
Developing nations need to skip old techs & adopt new ones to avoid destruction

• we must help developing nations not yet caught in harmful techs: because it's our moral duty & out of self interest

Leapfrog tech	definition
Biomass	• used for cooking in developing countries, requires fuel efficient stoves • in form of fuelwood alone its inefficient & causes deforestation • combined with agricultural residue, charcoal or dung it becomes efficient
Electric vehicles	• beneficial for densely populated areas • avoids pollution & emissions in area of use
Wind	• provides clean energy, competitive prices, reduced maintenance, increased efficiency
Solar power	• same as wind

• reason not move to new techs: infrastructure that needs to be changed is too expensive; not true for 3rd world because they have no infrastructure, ex. Skip landlines go to cell phones

• leapfrog important because: can prevent pollution & climate change, developing countries growing fast & catching up to industrialized world cannot make same mistakes (graphs)

Tapping ICT to Reduce Poverty in Rural India
Information made available to everyone, thus increasing transparency

• moral imperative: basic moral duty (food, shelter, medicare)

• tech transfer: taking tech specific to time/place to another social context where it wont necessarily work as intended (it becomes a different tech) ex. One laptop per child, Africans unable to understand computer UI

3 ways ICT can help

Increasing opportunity	• ex. Doctors assess people from afar, info in real time, reduce paperwork, increase time dedicated to people • ex. Milk stations, real-time quality assessment & payment, stops bribes & corruption
Enhancing empowerment	• ex. Internet kiosks made available for government info & services, people no longer have to travel great distance for government registration & now have access to market prices
Improving security	• smart cards that track people's financial history, allows for microfinancing

Designs on Development: Engineering, Globalization, and Social Justice
One world, one peace, against own interest to invade other nation, since depend on it for trade

Case study: Nicaragua, student exchange with US, set up local business to see how much they can make, doesn't work because Nicaragua not free market, people have no disposable income

3 barriers

Over attention to technology	• product over process, no social context • excessive attention to tech or infrastructure • attempt for technical fix • no involvement from people from there
Inattention to power imbalances	• assumption on how tech should be introduced • must take into consideration local economy & way of thinking • must unlearn how things work at home to learn how things work here
Uncritical use of problematic models of development assistance	• failure to respect local culture, think they are lagging behind, missing something • belief that OUR system is better than theirs, try to convert them to free market capitalism (liberalism)

Paternalism	• limit nation's liberty & authority for its own good
Liberalism	• liberty & freedom of expression • colonialism (India) for the good of people being colonized (paternalism) • enforcing to create different socioeconomic India • failed policy, forcing people to be free
Neoliberalism	• WTO, IMF, World Bank • create global economic policies that force people to follow their ideology, no direct intervention but setting up context that gives nations no choice

	• "economic partnership", forcing nations to enter free market, increasing their debt & reducing their spending, forcing them to privatize their utilities, education, etc. • forcing people to be free through economic policy • one size fits all, everyone becoming the USA

Differentiated technology responsibility

Polluter pays principle (PPP)	• fair because you correct what you cause • doesn't take into account past pollution, problem of past generations, won't solve global warming
Beneficiary pays principle (BPP)	• pay for your ancestors • not fair because not responsible
Egalitarian principle (EP)	• everyone responsible equally • cap & trade system: global pollution limit, assigned credit per nation per capita, can sell leftover credits, incentive to pollute less

Lecture 10
It's a flat world after all
Information communication technologies have made the world a smaller place

• 2 ways to define globalization: descriptive (flatteners) & normative (neoliberalism)

10 world flatteners: (only 4 needed for final)

Berlin wall falls in 1989	Capitalism "wins" vs communism, world is united again
Netscape goes public in 1995	Web browsing, searching the internet becomes possible, triggers dotcom bubble (overinvestment in undersea fiber optic cables)
outsourcing	Work is digitized & sent to be done cheaper for you elsewhere
offshoring	Moving entire factory to foreign country where labor is cheaper

Engineering Globalization
2 theories of engineering education

Instrumental view	• engr education about preparing students to get engr job, preserving status quo • education adjusted to what market needs • bad practice means education will be bad • not a good way to educate, old school & hardcore

Normative view	• engr education prepares students to get jobs in current socioeconomic context • engr education teaches critical thinking, how to reshape current practice • CEAB (Engineers Canada) defines engr curriculum • current accepted view

World war 3.0
Technology is on a global scale because of internet

• how will engineers reshape world w/ their participation?

Front	Order	Disorder
Sovereignty (freedom from interference)	• Internet must be controlled & regulated by national government	• Internet designed to bypass laws & regulations for communication & must remain as so
Piracy	• SOPA/PIPA: bills to prevent piracy • Criminalize hosters & make them responsible for unauthorized content uploaded on their site • Could shut down sites like Facebook & google because user uploads a picture	• No second hand liability • ex. Story of Vinnie & his van, selling stolen merchandise, you don't get arrested but need to forfeit the stolen merchandise
Privacy	• People should be tracked because internet is a public place	• Right to privacy should extend to the internet
Security	• either you have it or you don't	• should not shut down dark web

Lecture 11
Nye: Ch6

The Role of Technology in Sustainable Development
Need more than technological fixes

• Clean vs cleaning technology: reducing pollution vs not producing pollution (ex. solar)

Industrial Ecology: From Theory to Practice
Increasing efficiency, producing more, while using less & polluting less

Lecture 12

Framing Ethical Acceptability: A Problem with Nuclear Waste in Canada

Issues with Canada nuclear waste management organization (NWMO)

• Is nuclear viable alternative to fuel fossils? Many people think yes, hippies now agree with suits on this issue.

Code of conduct

Code of conduct is in form of questions	• Questions don't impose responsibility • No legal requirements • needs imperatives to have any value as code of conduct
Proxy/second hand consent	• potential victims of nuclear waste not born yet • uncertainty, cannot inform people or guarantee safety from accidents • proxy consent, wrong to give consent for future generations that might have different standards than us today
Problem statement framed in way that limits solutions	• implies Canada will be producing nuclear waste in future • could be framed as "where is Canada going to get energy", making nuclear only an option and not required

• NWMO implies nuclear is least bad option

• we cannot control consumption patterns & population growth

• therefore we must control & regulate energy production

The Ethics of Synthetic Biology: Guiding Principles for Emerging Technologies

Currently unregulated, heavily subsidized, promising tech

• GMO is modification, SB is creation

• how to deal with uncertainty?

• does public ignorance lead to lack of trust in science?

Science and Its Public: The Need for a Third Way

Legitimate non-tech critique of science

Deficit model (PUST)	• public don't trust because don't understand/lack knowledge, therefore must educate public • public actually understands, but doesn't trust regulators or their studies because they are too close to the industry • ex. Mad cow disease in UK that destroyed beef industry because people didn't have trust/faith in authorities
Improved Dialogue (PEST)	• public have misunderstanding & false beliefs about tech • public excluded from application of tech & decision-making policy, therefore don't trust tech • ex. GMOs & Monsanto applying seed tech and forcing people to use it
Empowerment of public	• people just need to be involved in in tech policy for them to accept it

Lecture 13
Final exam (quiz 2)