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Abstract

Technology pervades modern life, from cars and computers to paper and clothing. Food might have organic origins but has been processed and transported using a variety of technologies. Even bodies have become technologically manipulated and transformed through hair coloring, glasses, prostheses and plastic surgery. Humans create technology and use it, so it is sensible to say that technology is political in the sense that it involves or embodies the exercise of power. This is an obvious opening for anarchist analysis. Anarchism can be said to involve a rejection of any form of domination, including by the state, capitalism, patriarchy and humans (over nature), and instead the promotion of non-hierarchical, collectively organized systems. How, then, should technology fit into anarchism?

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Technology pervades modern life, from cars and computers to paper and clothing. Food might have organic origins but has been processed and transported using a variety of technologies. Even bodies have become technologically manipulated and transformed through hair coloring, glasses, prostheses and plastic surgery.

Humans create technology and use it, so it is sensible to say that technology is political in the sense that it involves or embodies the exercise of power. This is an obvious opening for anarchist analysis. Anarchism can be said to involve a rejection of any form of domination, including by the state, capitalism, patriarchy and humans (over nature), and instead the promotion of non-hierarchical, collectively organized systems. How then should technology fit into anarchism?

Anarchists have approached technology in various ways, including challenges to particular types of technology (such as nuclear weapons), opposition to technological forms such as the factory and promotion of certain styles or modes of technology (such as "alternative technology"). Rather than canvass these sorts of approaches, here I start with some conventional frameworks for understanding technology from the field called science and technology studies (STS),^[1] and look at how they can be connected to anarchist orientations.

Most people think of technology as objects, such as toothbrushes and aircraft carriers. Scholars commonly refer to constructed objects as artifacts, using the term technology to refer to artifacts plus associated social relations, such as manufacturing processes. They use the expression technological ensemble to refer to collections of objects that operate together, such as a car that includes engine, wheels and so forth. On a wider scale, the road transport system is a technological ensemble.

A traditional approach to technology is to look at its impact on society; this remains a common perspective. For example, studies may look at the impact of factories on worker skills or satisfaction, the impact of the automobile on families, the impact of the contraceptive pill on sexual behavior or the impact of new weapons on war-

making. Impact studies can be informative, but they often are combined with the assumption that the way technologies develop is inevitable, beyond human control, being determined by the nature of artifacts (for example, the most efficient way to produce energy) and economics. This is called technological determinism[2] - and it can be disempowering.

If technological development is out of human control, there is no point campaigning. The Luddites, who smashed machines as part of their resistance to a changing mode of social control, have become symbols of irrational opposition to technological progress.[3] Early proponents of nuclear power said the technology was inevitable, and today the same is said or implied about various developments, such as global communication systems.

There are, though, plenty of examples of how technological development has been affected by human agency. Nuclear power is an example: compared to early projections, it has been slowed to a crawl. The supersonic transport aircraft, initially projected to be produced by the hundreds, was halted, with only a few Concorde and Tupolev-144s ever made.[4]

Looking at how some technologies have been slowed or stopped leads to a more general point, that societies influence the introduction, form and use of technologies. The most well-known theoretical framework for this process is called the social shaping of technology.[5] "Social shaping" includes economic, political and social processes. In one classic study, the military chain of command was a key factor in maintaining commitment to a less efficient weapons system.[6] This example illustrates that social shaping is not necessarily a democratic, participatory or rational process. It is linked to all the systems of power involved in the design and use of technology. Nevertheless, the idea of social shaping opens up the possibility of anarchist shaping of technology, namely influencing the development and use of technology in ways compatible with anarchist principles.

The two approaches to technology - impacts and social shaping - can be combined into an approach called the co-production of technology and society.[7] What this means is that technologies help to create and constrain options for society (technology "produces" society) and human agency and the organization of society influence the form and use of technology (society "produces" technology). To talk of the co-production of technology and society is shorthand for much more detailed processes involving individuals and groups. For example, a company might manufacture toothpicks that are sold through markets and end up being used for a variety of purposes, some never envisaged by the manufacturer. People's demand for certain types of toothpicks then influences manufacturing priorities, and so on. The key point is that toothpicks - and guitars, missiles and food processing - don't happen on their own. Every artifact is created by and embedded in a range of human processes, including motivations and goals.

Anarchist principles

To tackle the topic of anarchist shaping of technology, it is useful to spell out some key principles of anarchism, not an easy task given the range of perspectives that exist and the fierce debates that sometimes occur. For the purposes here, a general

characterization of anarchism is not needed, but only some principles that are relevant to technology. I propose three.

- Self-management: people collectively organize their own lives.
- Non-domination: no individuals or groups are exploited or subordinated on the basis of class, ethnicity, sex or other categories; this can be extended to non-human animals and to nature.
- Empowerment: individuals are given maximum support to develop their capacities.

These three principles can be considered goals that anarchists try to achieve, knowing that practice quite commonly falls short. As with other political philosophies, principles provide guides to action and benchmarks for degrees of success.

Self-management is the traditional defining feature of anarchism.[\[8\]](#) It implies the absence of states, corporations, militaries and other hierarchical social institutions. Instead, people collectively organize systems of production, communication, housing and the like.

Non-domination has been gradually added to anarchism with each new wave of liberation movements. Self-management implies a certain level of non-domination, especially if people can voluntarily leave groups. In practice, anarchists have supported movements for equality.

Empowerment is a positive element: it involves active efforts to assist each person reach their capacities. A person with a disability, for example, might join in decision-making processes and not be discriminated against, but something more may be needed to enable this person to live life to the fullest. Empowerment as a principle serves to ensure that self-management as a process is attuned to positive outcomes for all.

The next step is to apply each of these principles to technology and to suggest how it can be shaped in anarchist directions. I do this using three case studies: energy, software and weapons.

Energy

Energy on its own is not a human need, but rather a means to satisfying needs and desires such as warmth, movement and producing music. Extraction, transformation and use of energy sources has become one of the world's largest enterprises, with governments and massive companies acquiring, processing and selling coal, oil and natural gas, commonly called fossil fuels.

Fossil fuels are, for the most part, found in discrete locations, unequally distributed. This makes them highly susceptible to centralized control[\[9\]](#); it is not surprising that access to cheap fuel supplies has been a key factor in wars.

The principle of self-management could be used as a basis for obtaining and distributing fossil fuels: collectives might decide which oil fields should be developed

and how oil resources should be allocated locally and worldwide. However, the world as presently organized is very far from this ideal: the extraction, processing and sale of fossil fuels have mostly been controlled by companies and governments. An unequally distributed resource is more difficult to self-manage. Although in principle self-management could be used to deal with fossil fuels, a more promising strategy is to promote energy systems that rely on them less.

Nuclear power is another option, with even less desirable characteristics from the point of view of self-management. Because of the risk of nuclear accidents, the proliferation of nuclear weapons and terrorist uses of nuclear materials, nuclear power brings with it a great increase in state power. Anarchists have opposed nuclear power for this and other reasons.

A different approach to energy is to rely on energy efficiency and on renewable sources such as solar and wind power. Renewable energy is more equally distributed and thus more amenable to local control. However, this depends on the way renewable sources are used. One proposal is to have an orbiting satellite that captures solar energy and beams it to earth. This way of using solar energy is just as centralized and potentially risky as fossil fuels. The conclusion is that renewable energy sources are not inherently linked to self-management, but need to be assessed on a case-by-case basis.

Next imagine a community with a well-functioning democratic decision-making process that decides to develop nuclear power, with safeguards such as building the plant underground to minimize hazards from accidents.^[10] A nuclear power plant built under these conditions would be able to satisfy the principle of self-management. However, the principle of non-domination would still be an obstacle. Nuclear power introduces the possibility of producing nuclear weapons, and the risk of criminal or terrorist uses must be protected against. These possibilities increase the risk of domination, in this case the use of nuclear weapons or an increase in power by someone - call them authorities - to protect nuclear materials from illicit use.

Collective, participatory decision-making is desirable, but it does not guarantee the best outcomes. Therefore self-management needs to be supplemented by other principles to ensure that decision-making is oriented in an appropriate direction. A principle of non-domination is one possibility, but what does this mean in practice - how is the principle to be operationalized, namely built into social practices? This is a central question for anarchist political practice.

For the purposes here, it is sufficient to note that non-domination is likely to rule out centralized energy sources, especially those with serious potential risks, such as nuclear power. By the same token, decentralized renewable energy is far harder to use to dominate others and thus is a better basis for an energy system.

Finally there is the principle of empowerment. What sort of energy system gives the greatest prospects for individuals to develop their skills and understanding? At one level, it might be said that having a reliable energy supply enables people to do the things that make life worthwhile. Energy enables technologies for mobility for people who cannot walk or cycle; it enables communication at distances; and so forth.

There is another dimension to empowerment: development of expertise concerning energy technologies themselves. Building a nuclear power plants requires advanced skills in nuclear engineering, which can be empowering for nuclear engineers; building solar hot water systems requires a different set of skills. An anarchist direction in skill-development might be to promote energy technologies that allow more people to develop skills or enjoy satisfying work, or that allow non-experts to understand technologies. This is a challenging expectation, because even the most basic energy technologies become more and more sophisticated, with advanced materials manufacturing to produce solar electric systems and elaborate calculations to design wind generators. Empowerment at the design and production stage is unlikely to involve more than a small percentage of the population, at least if present-day technologies are used.

In summary, anarchist shaping of energy systems involves participatory decision-making, ensuring that no groups are subordinated through technologies, and with an eye to choosing and adapting technologies that facilitate acquisition and exercise of people's skills.

Communication technologies

The driving forces behind innovation in communication technologies have been governments and corporations. Despite their interest in control and profit, many new communication technologies are useful for participatory politics.

The traditional mass media - newspapers, radio and television - are based on a small number of people, especially owners and editors, controlling production and distribution to masses, a one-to-many process. Media studies scholars emphasise that audiences are active, so messages cannot be fully controlled, but with the mass media they still remain audiences, not producers.

The mass media have long been challenged by networked media that are more interactive, including alternative print media and community radio and television.[\[11\]](#) The rise of social media is shifting the balance of power from the traditional media to network media.

An anarchist approach to communication technology involves selecting media according to their service to participatory decision-making: participation is a key criterion in both the selection process and the goal of the selection. Non-domination implies that choices made, namely communication technologies developed and used, should not easily enable groups of the population to be excluded or exploited. Empowerment means that the capacities of groups should be fostered.

A prime example of an information and communication technology that fits several anarchist criteria is free software, more widely known today as open source software.[\[12\]](#) Free software is developed using voluntary contributions: its development is participatory. It is open for scrutiny and freely available for modification and distribution, which means it is difficult to monopolize: this is precisely the sense in which it is free. This means it is difficult to use for domination. Finally, it enables ongoing improvement, modification and adaptation, and thus has the capacity to foster programming skills in developers. Much of the free software

actually developed is designed to be accessible and flexible. It thus seems to satisfy the criterion of empowerment. This should not be surprising, given that many of those involved in the free software movement have anarchist sentiments, being opposed to proprietary software.

One aspect of the development of free software does not, at first glance, quite fit the model of participatory development: usually the key decisions about the software, such as which suggested modifications should be incorporated, are made by a few core experts. This raises the question of the role of expertise in relation to anarchism. In any society, some people will develop greater skills than others, simply by practicing and improving those skills to a greater extent. This is potentially a threat to egalitarian social dynamics if the expertise can be used to leverage power over others.[\[13\]](#) So far, though, few figures in the free software movement seem to have acquired large amounts of money or power. Instead, their primary reward for their efforts is satisfaction for doing useful work and, in some cases, considerable status and influence among peers. Because code is available for inspection, free software developers can never rest on their authority as experts. Instead, their productions are always open for scrutiny; indeed, others can replicate their entire enterprises.

Software can be and has been developed to serve people's development, for example to recognize voices (for people who cannot write), to speak text (for people who cannot see), to provide graduated intellectual challenges (for people with learning difficulties) and a host of others. Software development guided by the principle of empowerment will be attentive to the needs of those who most need assistance, especially those who cannot easily express their own needs. This is an example of applying the principle of empowerment to software development.

If decisions about priorities for software development are made participatively following the principle of self-management, then it might seem that empowerment will automatically follow, because people can voice their needs in decision-making forums. However, this assumes that voicing of needs follows directly from the needs themselves, which is not the case with some people with disabilities (those who cannot communicate), non-human animals and inanimate nature.

Weapons technology

Weapons with the capacity for causing death and destruction, ranging from rifles to nuclear weapons, are a prime example of how technology has been shaped to serve purposes detrimental to human well-being. Militaries and police are the ultimate protector of the state against challengers; their weapons are key tools of state domination. The usual rationale for weapons is that they are needed for defense against aggression, but in practice sophisticated weaponry has frequently been used to impose the will of the powerful over others. Military races have no winners. In many countries, the main danger is not from external aggressors but from the country's own military forces, via coups and dictatorships.

Weapons development has become a highly managed process, with scientists coming up with new ideas for deadly weapons, engineers designing them and militaries developing systems to operationalize them through doctrines, training and bureaucratic management. An armed uprising by "the people" who have little or no

training in weapons has no chance against even a small team of well-armed and well-trained soldiers. A few hundred years ago, when rifles were not very reliable and cannon were not precise, it was conceivable for a mass revolt to confront armed troops with some prospect of success. With the invention of the machine gun, grenades, aircraft, missiles and other deadly weapons, the prospects for armed liberation have become ever more remote, at least when direct armed combat is involved.[\[14\]](#) This is because weapons development has been shaped by the interests of militaries and states, not the wider public.

Nuclear weapons are the ultimate in a state-oriented weapons system.[\[15\]](#) The sophisticated apparatus of design, production, training, security and so forth is completely implausible as a technological ensemble created and operated using self-management. Nuclear weapons also contradict principles of non-domination and empowerment: they are tools for domination and cannot be allowed to be available for general use.

The concept of anarchist weapons development can be taken in several possible directions. One option is non-offensive military defense, namely development of weapons systems like fortresses and short-range missiles, useful for defense but not for offense.[\[16\]](#) The problem is that the skills and technical processes useful for defense are so easily turned to offence. For example, being prepared to defend against biological weapons often provides the basis - in skills, equipment and biological agents - for offensive use.

Another option is arming the people, as in Switzerland today, with small-scale weapons like rifles.[\[17\]](#) This reduces the risk of misuse, namely use of weapons for domination. However, as soon as there is an arms industry, there can be pressures to expand the capacities of weapons, as in the United States: arming the people with automatic guns does not necessarily promote equality.

A completely different option is development of technologies to support struggle using methods such as strikes, boycotts and sit-ins.[\[18\]](#) Evidence from struggles against repressive governments suggests that nonviolent campaigns are more likely to be successful than campaigns involving armed struggle.[\[19\]](#) There are several ways that technologies can be used to improve nonviolent campaigns, especially by providing network communication systems that cannot easily be disrupted by groups attempting to dominate. For example, one-to-many media systems such as television are ideal for rulers: radio and television stations are often the first targets in military coups.[\[20\]](#) Networked systems like telephones and email are far more resilient in the face of attack.

Nonviolent action, to be effective, relies on participation by a significant proportion of the population. Therefore, technologies for nonviolent struggle should enable widespread participation in using them. Social media satisfy this criterion; nuclear weapons do not.

The Internet today is the site of a massive struggle between supporters of free communication on the one hand and governments and militaries on the other aiming to own, regulate or monitor popular communication while preventing scrutiny of their own. For example, supporters of free communication promote unbreakable encryption whereas governments seek ways to break codes.

Another area of technology relevant to nonviolent struggle is self-reliance.[\[21\]](#) A small town can be mostly self-sufficient in food, transport and housing, or heavily depend on outside inputs. In the face of a blockade - a type of aggression used against, for example, Palestine and Cuba - technology for self-reliance offers a greater capacity for resistance.

Technologies for nonviolent struggle are much more likely to be compatible with the principle of non-domination than technologies involving violence. Being self-reliant in food and housing is no threat to others. The principle of empowerment is also sustained more easily, because self-reliance requires more local development and fostering of skills. If aggressors try to subordinate a population by imprisoning or killing key experts, widespread understanding of and ability to use and adapt technological systems provides greater capacity for resistance - so preparing for such resistance is bound to involve more people gaining skills.

An examination of technology useful for nonviolent struggle reveals connections to software. The sorts of software most compatible with anarchist principles are also those most useful for nonviolent resistance to aggression. Likewise, the energy systems most compatible with anarchist principles - decentralized, small scale, enabling self-reliance - are the ones most useful for nonviolent resistance.

These connections between anarchist-compatible technologies provide a useful way to assess ways of achieving goals. Having established the sorts of energy systems and software most compatible with anarchist principles, it is possible then to look at defense options - such as conventional military forces, defensive military defense, an armed population and nonviolent struggle - and assess their alignment with these energy and software options. The conclusion here is that, in the realm of technology, nonviolent struggle has most to gain from technologies for energy and software that fit anarchist principles.

Conclusion

To assess technology from an anarchist perspective, three relevant anarchist principles are self-management, non-domination, and empowerment. Technologies have social impacts, so anarchists should promote technologies compatible with these principles. Looking at social impacts highlights uses of technology but can overshadow the processes of technological choice and the production of technology, so it is valuable to focus on the anarchist shaping of technology, namely the application of anarchist principles to selection and production of technology, as well as ongoing adaptation through use. In other words, anarchist shaping applies to the process (of selecting technologies), the product (artifacts created) and use. In turn, these shaped technologies have an ongoing impact on humans and nature.

The dominant forces that shape technology include governments, large corporations and militaries. These influences often push technological development in ways that are incompatible with anarchist principles. For example, large and potentially dangerous energy systems, like nuclear power, are not readily amenable to participatory management, are easily used for domination, and do not encourage widespread development of human capacities.

However, technological development does not automatically or necessarily serve the interests of powerful groups, because there are other influences, of which one of the most important is user demand. Corporations prefer technologies they can use to control markets and reliably extract profit, but customers often have other ideas. Software development is an arena where these tensions are quite apparent. The forerunner of today's Internet was originally developed for military-related purposes,[\[22\]](#) but the attractiveness of other uses has meant its construction has shifted to accommodate the interests of small businesses, citizen groups and activists.

Companies like Microsoft try to control the uses of software, with the assistance of governments via intellectual property laws. However, corporate control has been challenged by the developers and advocates of free software. This has led to an ongoing struggle over the preferred form of software development and use.

Anarchists, and those with anarchist sentiments, have joined many struggles over technology. In this, their concerns overlap with activists and citizens with different but related agendas. For example, environmentalists have campaigned against nuclear power, raising concerns about reactor accidents and long-lived radioactive waste, among other issues. This happens to be largely compatible with concerns, linked with anarchist principles, about nuclear power being unsuitable for self-management, being a prime tool for domination and having limited opportunities for empowerment. Nuclear power thus is a prime instance in which anarchist-inspired agendas and campaigning easily mesh with agendas and campaigning of environmentalists.

A similar compatibility is found in struggles against military technologies, many of which are the antithesis of anarchist principles. Peace campaigners also oppose many military technologies, for example nuclear weapons and land mines, because of their human and environmental impacts.

Looking at technologies as human constructions that are shaped by different influences helps in seeing what anarchists can contribute to campaigning around technologies. Each of the three anarchist principles provides an orientation, mode of analysis, or goal that can be used in assessing priorities for designing, adopting, modifying or challenging technologies.

A common pattern is that dominant groups develop technologies - like nuclear power, genetic engineering or nanotechnology - and activists respond, often by opposing them, or in some cases by promoting them, as with renewable energy and free software. However, citizens are seldom involved in the research and design stages for new technologies. How to promote this is a difficult challenge that has been addressed by some advocates of public participation.[\[23\]](#) Anarchist principles support the involvement of citizens in research and design processes, something that is ultimately a part of the wider process of self-management. In addition, the criteria of non-domination and empowerment provide guidance for the sorts of technologies to investigate and promote.

Anarchism, by its nature, is not a body of doctrine to be applied in a mechanical way. The process of self-management allows a continual examination of its own methods: people who work together cooperatively to achieve goals may decide to modify the

methods they use to work together. Likewise, the processes of cooperative development and use of technology are inevitably a work in progress, to be modified as a result of people's experiences, which will include encounters with new technologies and the conundrums they pose. In this sense, an anarchist approach to technology is more bottom-up, experiential and empirical than usual government policy processes.

I have used three anarchist principles - self-management, non-domination and empowerment - to discuss approaches to technology. Others may prefer a different set of principles, or use some other approach not involving principles at all. In any case, there is considerable opportunity for further development of an anarchist approach to technology. It can draw on bodies of research and practice, but will contribute its own distinctive dimensions and directions.

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Notes

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