

REMOVE ADVERT BY CLICKING ON “>>” →

[HOME PAGE](#) – [CONFERENCE PROGRAMME](#) – [ARCHIVE OF PAPERS](#) –
[REGISTRATION](#) – [ACCOMMODATION](#) – [WEBSITES](#)

NICK DYER-WITHEFORD

THE CIRCULATION OF THE COMMON

Nick Dyer-Witthford [University of Western Ontario]

Introduction

This paper makes theoretical propositions to assist conceive an emergent communism, a “coming community” that is neither capitalist, socialist nor anarchic, and the place within it of “immaterial labor.” [1] Its argument, in brief, is as follows.

Marx deemed the cellular form of capitalism to be the commodity, a good produced for exchange between private owners. His model of the circulation of capital traced the metamorphosis of the commodity into money, which commands the acquisition of further resources to be transformed into more commodities. The theorists of autonomist Marxism demonstrated how this circulation of capital is also a circulation of struggles, meeting resistances at every point. But although this concept proved important for understanding the multiplicity of contemporary anti-capital, it says very little about the kind of society towards which these struggles move, a point on which the autonomist tradition has mainly been mute. Today, new theorizations about multitude and biopolitics should to reconsider this silence.

I suggest that the cellular form of communism is *the common*, a good produced to be shared in association. The *circuit of the common* traces how shared resources generate forms of social cooperation – associations – that coordinate the conversion of further resources into expanded commons. On the basis of the circuit of capital, Marx identified different kinds of capital – mercantile, industrial and financial – unfolding at different historical moments yet together contributing to an overall

societal subsumption. By analogy, we should recognise differing moments in the circulation of the common. These include *terrestrial commons* (the customary sharing of natural resources in traditional societies); *planner commons* (for example, command socialism and the liberal democratic welfare state); and *networked commons* (the free associations open source software, peer-to-peer networks, grid computing and the numerous other socializations of technoscience). Capital today operates as a systemic unity of mercantile, industrial and financial moments, but the commanding point in its contemporary, neoliberal, phase is financial capital. A twenty-first century communism can, again by analogy, be envisioned as a *complex unity of terrestrial, state and networked commons*, but the strategic and enabling point in this ensemble is the networked commons. These must however, also be seen in their dependency on, and even potential contradiction, with the other commons sectors. The concept of a complex, composite communism based on the circulation between multiple but commons forms is opens possibilities for new combinations of convivial custom, planetary planning and autonomous association. What follows expand on these cryptic observations.

The Circulation of Capital

Marx famously described the commodity, a good produced for exchange between private owners, as the “cell-form” of capital, the primordial point from which grew all its more complex and composite manifestations.

“The wealth of societies in which the capitalist mode of production prevails appears as an ‘immense collection of commodities; the individual commodity appears as its elementary form. Our investigation therefore begins with the analysis of the commodity.’”[2]

The processes of this growth were however, not fully described until Volume Two of Capital, which outlines a model of the circulation of capital. This model traces the metamorphosis of the commodity into money and back again. This cycle is expressed in the classic formulae $M - C (LP/MP) \dots P \dots C' - M'$. Money (M) is used to purchase as commodities (C), including labor power (LP), and the machinery and raw materials that are the means of production (MP). These are thrown into production (P) to create new commodities (C') that are sold for more money (M'), part of which is retained as profit, part of which is used to purchase

more means of production to make more commodities. The money at the end of the process is greater than that at the beginning and the value of the commodity produced is greater than the value of the commodities used as inputs: repeat *ad infinitum*.

This circuit could, both in any specific instance or in general, fail. A C may not find its M if a seller does not meet a buyer, nor M tryst with C, if a buyer lacks a seller, and all may fall completely apart in the ugly abode of P. But if it surmounted these hazards, the circulation of capital becomes an auto-catalytic, self-generating, boot-strapping growth process, a “constantly revolving circle” in which every point is simultaneously a point of departure and a point of return.”[3]

This circuit is the dynamic process that converts the cell form of the commodity into what Marx termed more “complex and composite” forms, a process of organ-creation, forming an entire capitalist metabolism, that subsumes previous forms of the social body. It is, to use a different language, the path from capital’s molecular level to its molar manifestation.

The circulation process that begins with money and ends with more money is a never ending process, but it can be punctuated in different ways. We could look at it beginning and ending with the act of production or with capital in a commodity state, or in its money state. As David Harvey puts it, “We can create three separate windows to look in on the overall characteristics of the circulation of capital. From each window we can see something different. . . .In the end, of course, we are interested in the circulation of capital as a whole, but we cannot understand this . . . without first examining the differentiations within it.”[4] So, for example, the transformation of commodities into money (C-M) is the role of mercantile capital; that of the production of commodities by means of commodities (P) is mediated by industrial capital, and the conversion of money capital into productive capital is the ostensible task of financial capital (M-C). While all have an interest in the expansion of surplus value, they do not necessarily always agree about how to divide it up.

These different sectors are both synchronic and diachronic aspect. That is to say, while they are simultaneously necessary for the fully actualised operations of capitalist society, each has assumed preeminence at different times. So, for example, the growth of mercantile capital from 16th to 18th century is often seen as the precondition for the emergence of industrial

capital in the 19th century, which in turn has generated an increasing preeminence to financial capital in the late 20th century. None of these different subsets of capital replace each other, but at specific historical moments one or other sounds a keynote or takes the lead for the entire ensemble.

The ramifying elaborations arising from these circuits have been depicted by theorists who have developed Marx's model into intricate diagrams showing our current deep entanglement in the commodity-form. If we think of a rotating sphere not only accelerating in velocity around its circumference but expanding in diameter as it fills more and more space we have the image of global capital, aka "empire."

The Circulation of Struggles

It was the great rediscovery of autonomist theory that the circulation of capital was also a circulation of struggles. Each node in the circuit of capital is a potential site of conflict where the productive subjectivities capital requires may contest its imperatives. If not all, at least many of the breakdowns in capital's circulation occur because LP (labor-power) refuses to remain LP: it resists and re-appropriates.

Although this insight was given many expressions, perhaps the most complete English language version is the essay by Peter Bell and Harry Cleaver, "Marx's Theory of Crisis as a Theory of Class Struggle." [5] This proceeds systematically around the circuit of capital showing the range of insurgent interruptions possible at each phase. Thus the attempt to purchase the commodity labor, M-C (LP), could be interrupted by struggles over dispossession of populations necessary to create a proletarian workforce, or the maintenance of that workforce in a suitable condition of precarity. The purchase of raw materials, M-C (MP), might be frustrated by eco-struggles. The moment of production (P) was the site of classic work place resistances to exploitation, from strikes, occupations and sabotage. The sale of commodities, C-M, was menaced by dangers from theft to boycotts to public reappropriation.

Furthermore, each of these flashpoints might ignite others. This knock-on effect might happen as it were unconsciously – if, for example, capitalists exposed to heightened costs for raw materials caused by "resource wars" responded by intensifying the rate of exploitation in production, thereby precipitating strikes, or responds to strikes by technological innovations that then overproduce so much that goods cannot be sold,

generating recessions, unemployment and militant movements of the immiserated. But the connection could also be a conscious process, as subjects contesting capital at different points linked or allied one with another. The concept of the circulation of struggles underlies much of the richest thought about the use of means of communication, old and new, to link together these variegated agencies into new combinations, a line of analysis running from Romano Alquati's reflections on "radiating the operational information of struggle" to Cleaver's concept of the "electronic fabric of struggle." [6]

In its intention, Bell and Cleaver's analysis of the circulation of struggle was an attack on objectivist Marxism that saw capital proceeding to crisis according to teleological laws: what they showed was that most of these "laws" were the outcome of colliding vectors of struggles waged by collective subjects. But ultimately, the concept of the circulation of struggles had even wider implications. In its various autonomist articulations it decentered traditional Marxist concerns with conflict at the immediate point of production. A focus on factory resistance became displaced to a multiplicitous view of contestation throughout a circuitously interconnected social factory. Marx's singular old mole of the proletariat digging through the factory floor became the "tribe of moles", burrowing a network of tunnels through schools, households, and welfare offices. [7] This view of a widening circulation of struggles, occurring at different nodes all along the circuit of capital, all potentially interlinked, is part of the genealogy of transversal politics and of the multitude, concepts which have become part of the theoretical lexicon of the contemporary movement of movements.

Yet if the theory of the circulation of struggle both subverted objectivist Marxist accounts of crisis, and de-centered the classic Marxian focus on the immediate point of production, it also, in a very classically Marxian way, has little to say about the long term outcome of these struggles. Yes, sufficient proliferation of such struggles will bring capital to breakdown. Yes, in the struggles subjects self-valorise, reappropriating use-values from the sphere of exchange, winning back time and life. Bell and Cleaver's wonderful essay ends by remarking that what "defines a revolutionary subject" is "not only the negative power to abolish capital but the positive power to increasingly define its own needs, to carve out an expanding sphere of its own movement and to create a new world in place of capitalism." [8] But the organizational or institutional

forms this “expanding sphere” might take are unnamed. If today the concept of circulation of struggles speaks well to the multiple voices declaring “another world is possible,” to the begging question “but which world?” –or even, if one wishes to emphasise a potential diversity of arrangements, “which worlds?” – it does not answer.

The Circulation of the Common

Because the practical struggles of a multiplicitous movement, and the theoretical reflections that arise in tandem with them, have over the last decade and a half reached quite a high level, we might now be able to take another step. Having gone from the circulation of capital to the circulation of struggles, we can proceed from the circulation of struggles to the circulation of the common.

The common, and the commons, are terms that have amongst activists recently become, well, *common*. The usual point of reference is the lands collectively used for subsistence purposes by pre-capitalist agricultural communities and destroyed by enclosure in the process of primitive accumulation.[9] Although enclosure was resisted by overt and clandestine insurrections whose full dimensions were only recently disclosed by Peter Linebaugh and Maurice Rediker’s account of a “hydra-headed” rebellion, these struggles were lost.[10] But interest in the commons has been revived by opponents of global capital seeking a vantage from which to criticise the “new enclosures” privatizing of natural and social resources across the planet.[11] Some accounts romanticise the historical commons as a pre-capitalist utopia, rather than a marginal supplement to a hierarchic feudal order. Others invoke the commons only the better to plan their commercialization. But the concept remain an important lever for rethinking issues of collective production and ownership, and it is to this end, and with a profound debt to theorists such as John McMurtry and Massimo de Angelis who have already thought along these lines, that it is deployed here.[12]

If the cellular form of capitalism is the commodity, the cellular form of communism is *the common*. A commodity is a good produced for exchange. A common is a good produced for shared use. Capital is an immense heap of commodities. Communism is a multiplication of commons.

The commodity, a good produced for exchange, presupposes private owners between whom such exchange occurs. The common presupposes collectivities within which sharing

occurs, collectivities that coordinate, organise and plan this sharing. I will call these collectivities Associations.

We can thus postulate a *circulation of the common*. This traces how associations of various types, from tribal assemblies to socialist cooperatives or open source networks organise shared resources into productive ensembles that create more shared resources which in turn provide the basis for the formation of new associations. If C here represents not a Commodity but Commons, and A stands for Association the basic formulae is therefore: $A - C - A'$. This can then be elaborated as:

$A - C \dots P \dots C' - A'$; repeat *ad infinitum*.

Two notes on this formulae. First: we are dealing not only with Commons instead of Commodities, but with Associations instead of Money. The implication is that collective organization, not market exchange, governs the distribution of Commons, whether through mutual aid, public planning or gift economies. We will discuss this later. Second: in this formulation, the resources organised by Association into Commons production cannot be described as Labor Power and Means of Production, because these terms imply precisely the reductive abstraction and alienation that is inherent to commodity accumulation. To indicate that human creativity and ecological riches become something other than just factors of production when organized through Association, they are labeled here as GI, General Intellect and NM, Natural Metabolism. These may be the wrong terms, but we won't discuss this further, because it is the topic for another paper.

If an agricultural Association (A) on the basis of its successful cultivation of a Common banana plantation (C) joins together with other such Associations, first to place more lands under cultivation, and then to form a industrial packing plant which then provides the nucleus for further cooperatively conducted activities, we have a circulation of commons. If the Associative organization of a publicly funded education system researches collectively created software that provides the basis for open source associations (A') we have a circulation of commons. And if these open source software is then made freely available to our initial agricultural cooperative to enable its planning activities, we have a further circulation. The circulation of the common is thus a dynamic in which commons grow, elaborate, proliferate and diversify in a movement of counter-subsumption against capital, generating the "complex and composite" forms of communism.

We can describe this composite complexity by analogy with Marx's differentiation of specific sub-circuits within the circulation of capital. Similarly we can differentiate specific moments in the circuit of the common, moments which give varied priorities in the basic relation of Associations and Commons, and which also have, at varying historical moments had a different weight or importance. So, we might speak of:

Primitive communism (so called), based on a *terrestrial commons* that involves the sharing of natural resources, such as land, game, firewood and water, on the basis of associations shaped by custom. In so as these associations take as their foundation the apparently given quality of natural resources, we can say they proceed from Commons to Association (C-A).

In contrast, various forms of *planner commons* emerged as radical project for the public ownership and state management in the factories and urban conurbations of the industrial revolution. Insofar as these centered on the marshalling of new industrial capacities of production into forms of collectivity, they proceeded from Production to Commons (P-C). The main examples are the command economies of authoritarian socialism and the welfare state of liberal capitalism, but there are also the important minoritarian traditions of the cooperative and self-management movements.

Finally, a *networked commons* proceeds on the basis of social communicative capacities, from language on up, that enable Associative practices to occur. So the movement here is from A-C. Today we are seeing an explosion of new developments in this sub-circuit, including open source software, peer-to-peer networks, grid computing and other socializations of labor intrinsic to high technoscience, which we will discuss further in the next section.

Like the different types of capital, these different forms of commons have blossomed or blazed at distinct historical epochs. Indeed, the varying forms of capital and commons should be seen as each summoning each other, or provoking one another into being. Thus terrestrial commons were attacked by the forces of mercantile capital, which in doing so lay the basis for the industrial capitalism to which the planner commons was a response. The temporary success of these largely state based commons was then undermined by the fluid mobility of finance capital, whose appearance is however, inextricably tied up with the development of a means of communication – the Internet – which provided the basis for

the mergence of networked commons. The concept of the cycle of struggles can be re-written as the story of this antagonistic spiral, between the circulation of capital and the circulation of the commons.

Because to date capital has mainly retained the initiative in this contest, many forms of commons have been partially destroyed. Although terrestrial commons persist, however imperiled, in some peasant and indigenous communities, we have only a fragmentary understanding of how they worked in their heyday. To a great extent planner commons have been conceived under conditions guaranteeing great malformation, and then yet further attacked and degraded. We are dealing often with an archeology of the commons, a set of ruins. But these ruins can also be, to use Fredric Jameson's fine phrase, an "archaeology of the future." [13]

Complex Communism

A twenty-first century communism can be envisioned as a *complex unity of terrestrial, planner and networked commons*, in which each reinforces and enables the other. As capital today operates as a systemic but differentiated unity of the mercantile, industrial and financial moments of its circuit, so a contemporary communism would form from the cellular forms of the common grow complex, composite forms that combine the logic of mutual aid customs, governmental planning and free and open-source peer to peer networks.

The terrestrial commons today reappear today as the requirement for a set of ecological arrangements preserving the biosphere from exhaustion. The imperative of new habits and norms and daily practices in regard to production and consumption is the great message of the green movement. But the need for a commons biopolitics extends beyond environmental questions to issues of climate control, epidemiology, and administering the biotechnologies which are in effect producing a common global social body. The generation of new customs in common adequate to the reality of this shared corporeality, on everything from safe sex to recycling to emissions and cloning, is *the* issue of the production of subjectivity today.

Such customs can neither be implanted, germinate nor flourish without new forms of planning. Despite all libertarian objections, it seems to me impossible to envisage address of global poverty, disease, or climate change without the restoration of an ethic of public ownership and coordinated

resource allocation, and at all levels, municipal, national, and global. And at this last level, it will have to be on a scale that would in fact make some of the efforts of the planner states of the past look quit modest and circumspect. One basis of twenty-first century communism is the return, possibly too late, of the plan, to redress the ruination of the planet from phantasmagoria of neoliberalism laissez-faire.

That such planning could, however, be a nightmare is all too apparent from a legacy of catastrophic socialist experiments. The only way such planetary co-ordinations can take a radical-democratic, rather than a despotic-technocratic one, is through a mobilizing the capacities of the networked commons to open forms of collective ownership and planning participation. It is in this context that we can locate the issue of immaterial labor, which I loosely interpret as those forms of communicational and affective production associated, not exclusively but strongly, with digital networks. Here I make three propositions.

First, such immaterial labor is bringing into being a post-scarcity software economy whose commons logic troubles the commodity form. Free and open source” and “peer to peer networks” are the twenty first century’s way of saying what Marx in 1844 called “free association.”[14] Such experiments are not immune to commercial capture, but in their non-rivalrous plenitude and instantaneous circulation of goods they create acute problems private ownership and market rationing. *Contra* the “tragedy of the commons” hypothesis favored by market advocates, foretelling the inevitable degeneration of resources outside individual ownership, such immaterial practices explore the possibilities of a “cornucopia of the commons” in which collaborative creation and shared use generate most robust and abundant goods. [15] In this sense, then, the construction of a network commons has already been raised to a very high level.

Second, the consequence of this development are flowing back through other commons sectors – those of the terrestrial and planner commons. If the network effects was simply to stay in the realm of immaterial goods – music, films, games, intellectual production – it might be contained as an aberrant and ghettoised sub-sector of an otherwise un-impeached capital. But such containment is increasingly difficult. This is because the circulation of software is a “traffic in tools” that distributes, as code, instruments for production and planning. [16] This has profound implications for the reinvigoration of a planner commons of public ownership and governmental

coordination.

The creation of the personal computer was arguably a major step in the socialization of production. But this step is already being extended by the creation of microfabricators. low cost, programmable machine tools that can “print out” what were formerly thought of as large scale industrial artifacts, and also the tools to make even larger ones promises to bring manufacturing the same informational logic that pervades the cultural field.[17] If one starts to think of peer to peer networks of microfabricators running on open-source software one sees the possibility for a decentralised collective dispersion of industrial capacity to make the pioneers of workers’ cooperatives delirious.

Something of the same process is affecting even the politics of governmental planning projects. The electronic fabric of struggle is today made up not just by the circulation of e-alerts, communiqués, and guerilla news but equally importantly by a circulation of research instruments, cyber-geographical tools, search capacities, accountancy packages, data banks, knowledge aggregators, spreadsheets and simulators. This is effecting dissemination down to levels of molecular activism of administration, management and planning capacities that were once the possession of the great molar concatenations of governmental and corporate power. In this sense Lenin’s aphorism that “every cook should learn to govern the state”, so bitterly ironic after of a Soviet experiment where “the state governed every cook,” is being obliquely renewed. [18]

Some of the most dramatic implications of this networked socialization of production tools bear on the new terrestrial commons of eco- and bio-spherical concerns. Large scale research projects such as the search for extra-terrestrial intelligence, global warming and climate change prediction and epidemic control, requiring vast calculative capacities, are being realised through the myriad singular donations of unused computing cycles from individuals. Adopted on a very large scale, this would amount to voting with one screensaver as to which programs of research to support – a massive re-socialization of collective knowledge, an exercise of general intellect.

Let us take it as understood that the these radical potentials can be actualised, not according to any automatic technology determinist progression, but only via struggles about not just the ownership but the most basic design and architecture of

networks, struggles that have to be not only fought, but fought out in detail, with great particularity. With that understanding – and only with that understanding – there are grounds for suggesting that while a twenty-first century communism should be envisioned as a *complex unity of terrestrial, state and networked commons*, the strategic and enabling point in this ensemble is the networked commons of immaterial labor.

The third proposition is, however, more cautionary. While the expansion of networked commons created by immaterial labor can circulate through other commons sectors, the actualization of network potentials is also dependent on – perhaps sometimes even in contradiction with – transformations in these other sectors. Thus, whether or not the democratizing capacities of networked commons are realised will depend on planner commons in constructing free or cheap access communication infrastructures, from municipal wi-fi hotspots to mass distribution of ultra-cheap laptops; in building educational and literacy programs; in rolling back corporate IP regimes; and in establishing open source standards for public institutions. It is true also that digitally networked commons, dependent as they are electrical supplies, on resource intensive and computer fabrication, and on the generation of e-wastes places its own ecological load on the terrestrial commons. These types of interconnections, interdependencies, and possible contradictions between different sectors are, however, precisely what a model of the circulation of the commons highlights, and as an invitation to grounded utopianism.

Conclusion: Pre-Cogs

This long-sealed issue of left utopianism has in fact over the last decade been reopened from numerous directions. This resurgence has taken its impetus from both the streets of Berlin and the jungles of Chiapas – from the fall of command socialism, and the revival of anti-capitalist activism. It is, I suggest, an important move. In Milan, precarious entrants to the cognitariat or immaterial labor force have, using the metaphor of *Minority Report*, referred to themselves as “pre-cogs.” Taking that metaphor seriously, let us see into the future to perceive not just its dangers, but its hope. This paper has attempted such a glance, while avoiding the locked gaze of the abstract utopianism Marx so famously criticised. Just as the idea of a circulation of struggles arises, methodologically, from the concept of the circulation of capital, so the notion of a circulation of the commons arises that of the circulation of struggle. Fights for commons – terrestrial, planned and

networked – are happening, now. Complex communism is a forward projection of these aspirations.

It is a concept of emergence. Postulating the common as its cellular form, and the circular generation of common goods and associative organization as its dynamic of growth, it envisages a composite communism built from the aggregation and interlinking of such cells and cycles. Unlike the top down, seamless blueprints of some other current left utopias, it envisages a communism bubbling from below. We might think by analogy with shifts in artificial intelligence research. Here emphasis has over recent decades shifted from the programming of comprehensive and impeccable logic-models to the assembly of many small units of code that can in their interaction bootstrap themselves, albeit unpredictably, to higher levels of complexity. The motto of such research is “Fast, cheap and out of control.” [19] Commons may be fast or slow; even better than cheap is free; but out of control – out of the control of the society of control, out of control from global capital – that is indeed the aim. By moving from a cellular model of commons and association that is simple, even rudimentary, this paper has aimed to suggest a process that is scalable, thinkable at levels from the domestic to municipal to the planetary, and terms of the interconnections between these levels. And by speaking of a communism composed by a circulation of distinctive modalities – terrestrial, planner, networked – that nonetheless can be linked and reinforce on another it has tried to wake from the hallucination – dream-world or nightmare – of a uniform utopia, of which Soviet style socialism was the only the most notorious, in favor of a heterogeneous communism built from multiple forms of common logic, a communism of singularities. Under such conditions it may be possible once again to say: “Omnia sunt communia.”

NOTES

1. Giorgio Agamben, *The Coming Community*. Minneapolis: University of Minnesota; Michael Hardt and Antonio Negri, *Empire*, Harvard: Harvard University press, 2000.
2. Karl Marx. *Capital. Volume 1*. New York: Vintage, 1977, 125.
3. Karl Marx, *Capital Vol. II*. New York: Vintage, 1981, 180.
4. David Harvey, *The Limits to Capital*. Oxford: Blackwell, 1982. 69-71
5. Peter Bell, and Harry Cleaver. “Marx’s Theory of Crisis as a Theory of Class Struggle.” *Research in Political Economy* 5 (1982).

Available online *The Commoner: A Journal for Other Values* 5 (2002). <http://www.commoner.org.uk/cleaver05.pdf>

6. Romano Alquati, "The Network of Struggles in Italy," Unpublished Paper, 1974. Red Notes Archive: London.

7. Sergio Bologna, "The Tribe of Moles." In *Italy: Autonomia – Post-Political Politics*, ed. Sylvere Lotringer and Christian Marazzi. New York: Semiotext(e), 1980, 36-61.

8. Bell and Cleaver, 60.

9. See E.P. Thompson, *Customs in Common*. Merlin, London, 1991; Michael Perelman, *The Invention of Capitalism: Classical Political Economy and the Secret History of Primitive Accumulation*. Durham: Duke University Press, 1992.

10. Peter Linebaugh & Maurice Rediker, *The Many Headed Hydra: Sailors, Slaves, Commoners and the Hidden History of the Revolutionary Atlantic*. Beacon, Boston, 2000.

11. Midnight Notes Collective, *Midnight Oil: Work, Energy. War 1973-1992*. New York: Autonomedia, 1992.

12. John McMurtry, *Value Wars: The Global Market Versus the Life Economy*. London: Pluto, 2002; Massimo De Angelis, *The Beginning of History: Global Capital and Value Struggles*. London: Pluto. Forthcoming.

13. Fredric Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions*. London: Verso, 2005.

14. Karl Marx, *Economic and Philosophical Manuscripts*. New York: International Publishers, 1964.

15. Garrett Hardin, "The Tragedy of the Commons", *Science*. 162 (1965) pp. 1343- 48; Eric Raymond, *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*, O'Reilly Media, New York, 2001.

16. Peter Lunenfeld, *Snap to Grid: A User's Guide to Digital Arts, Media and Cultures*. Cambridge, MA: MIT Press, 2001.

17. Neil Gershenfeld, *Fab: The Coming Revolution on Your Desktop – from Personal Computers to Personal Fabrication*. New York: Basic 2005.

18. V.I. Lenin, *State and Revolution*; Spunk Library: An Anarchist Library and Archive, "The Bolsheviks and Workers Control 1921." Available on-line: <http://www.spunk.org/texts/places/russia/sp001861/1921.html>

19. Rodney Brooks and Anita Flynn, "Fast, Cheap and Out of Control: A Robot Invasion of the Solar System," *Journal of the British Interplanetary Society* 48 (1989), pp. 472-485.

