

Short Note: This version of DeLanda's text is quite different than the one already posted to nettime in the fall.

Markets and Anti-Markets
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INTRODUCTORY REMARKS

Before I begin my reading this essay, I would like to introduce some background to you so you can see where I am coming from. Though I began my career as an artist and still make my living as a computer artist, I consider myself a philosopher. I have been publishing for fifteen or sixteen years, specializing in the Philosophy of Science. This is important because what I will read is a criticism of economic ideas. Since I am not an economist, you might wonder, "How does he dare to do this criticism?" The answer is that there exists a large branch of the Philosophy of Science, called the Philosophy of Economics, concerned with issues of methodology and conceptual structure of economic theories. It is a branch that has grown in the last two or three decades. And it is from the point of view of the Philosophy of Economics that I would like to speak today.

The Philosophy of Science up to the early 1960s was dominated by Positivism, beginning with the Vienna Circle which espoused a very idealistic vision of what science is. Scientists were pictured as these rational human beings who pursued truth at the expense of anything else: constantly engaging with one another in perfectly logical dialogues and basically elaborating on those theories that could be reduced to logic and logistic rationality. Then came the 1960s, and the 1960s overturned everything. The Philosophy of Science was not spared. You might have heard of Thomas Kuhn, or at least his famous phrase that has become familiar, "the paradigm shift," a shift in the world view that completely alters the way we perceive reality. Aside from Kuhn there were many others in the 1960s, and later in the 70's and 80's. It's has been an intense reaction against the Philosophy of Science, specifically by British sociologists in Edinburgh and Bath and now sustained by American and French sociologists and ethnomethodologists like Bruno Latour.

This reaction may be labeled the Anti Science Movement, and it possesses some important aspects. These sociologists and anthropologists were the first ones to actually go into a laboratory to study just what exactly happens there. Instead of giving us a totally abstract picture of rational beings confronting nature, they reported about the seamy, sleazy side of science in which there are, for example, negotiations between scientists over competitions for Nobel prizes and other prestige awards, to mention only the most obvious power struggles. And so it turns out that science is a completely social, human activity with all the friction and noise and messiness that every human activity has. There is something to be said for what the sociologists of science have done. They woke up philosophers to the idea that they cannot remain oblivious to real history, oblivious to the real details of how science has developed, and that science cannot be considered to be based on the Scientific Method that every single branch of science uses. Biologists, zoologists, economists, physicists, and chemists all use slightly different methods, and there is much to be learned from the details and distinctions. On the other hand, the rampant relativism with which the Anti-Science movement has replaced Positivism must also be rejected. To be coherent, we must criticize both the right and the left.

A similar point can be made of economic theories. After the collapse of the Soviet Union, the Wired Magazine type of people in the United States believe that free enterprise has won. Free enterprise in their sense involves a complete illusion about how the American economy (and the European economy, for that matter,) has worked over the last several hundred years. But their counterparts on the left (who speak in equally misleading ways about commodification and California Ideologies) must also be sharply criticized. More generally, what is important now is to take the economic knowledge that was developed (by the right and the left) and cut it down to size so to speak, to figure out exactly in what specific conditions these ideas apply. To make a comparison with physics: while for a long time we thought that Newton, Galileo, and our most preeminent scientists had discovered the laws of the universe, philosophers of science and sociologists of science now agree that Newton, Galileo and company only discovered some extremely simple regularities that apply only to extremely

simplified systems within a laboratory. In particular, most classical science is based on the exclusion of friction, noise, and all other kinds of complicating factors. Friction is very complicated because it interacts with other variables like velocity in a non-linear way, in a kind of feedback loop. An airplane, for example, will suffer more friction the faster it goes. When two such variables interact in a mathematical equation, the equation becomes essentially unsolvable by hand, and you need big computers to actually explore the behavior of that equation. Therefore, there is a practical reason why classical physicists excluded friction and noise from their theories. And we can justify this perfectly by saying, "Well, science would have never taken off, it would never have bootstrapped itself, if they had not done this." However, now we know that when you add friction and a driving force to counteract the friction to even a simple system such as a pendulum, the system becomes a non-linear pendulum with a multitude of dynamical behaviors that were undreamt of by the classics. Friction, far from being something we could add at the end once science figured all the irregularities out, is crucial to an understanding of reality. We understand that the friction, the noise, the messiness, and the heterogeneity of the real world actually have a much more complicated role to play in science than we ever admitted before. We are rediscovering extremely classical dynamical systems that we thought were completely exhausted.

A similar point applies to economics: many of the things that the classical economists, whether right wing or left wing, developed apply, much like Newtonian physics, to only extremely reduced portions of reality. Adam Smith's theory of the invisible hand in which demand and supply automatically cancel each other out preventing wasteful excesses and deficits only applies in very, very specific circumstances, for instance, in a small town market, that specific place in town where people come and gather every Saturday and then go home. As historian Fernand Braudel has argued, only in the old-fashioned sense of "market" is there enough transparency for prices to set themselves. The moment we begin using the word "market" to apply to a dispersed set of consumers, like the market for personal computers, the fact of the matter is that no one knows the dynamics behind price formation. Yes, there are some ideas to be taken from the classics, whether classical physics or classical economics, but we must find the specific circumstances where they work and not extrapolate carelessly. And you absolutely do not make the Wired Magazine mistake of believing that such a complex system as the United States economy--with all its large corporations that have nothing to do with market behavior--is a free enterprise or a free market. It's an illusion.

Having cut down to size of the contribution of the classics, let me begin with how we can apply these ideas to analyze some of the phenomena of the Internet.

INTRODUCTION

The explosive growth of computer networks in the last ten years, coupled with the recent development of electronic cash and cryptographic techniques for the secure transmission of credit card numbers and commercial documents has begun to open new possibilities for the flow of material and informational resources and for the conduct of financial and commercial transactions. Although these developments are, indeed, symptoms that the Internet is beginning to form a radically new economic space, the differences with other economic spaces and the degree to which the Internet represents a radical break with the past should not be exaggerated. Some economic characteristics of the Net are shared by many different kinds of networks: railroad and telephone networks, for instance. One such shared property is what economists call network externalities. An externality in classical economics is defined as a side effect of production or consumption in which people other than the direct producers or consumers are positively or negatively effected. An example of a positive externality is an owner of a house who paints the house and fixes the garden, increasing the property value of his or her house but also helping the other neighbors because the values go up in the neighborhood if it looks better. A negative externality would be, for instance, pollution by factories, in particular when it costs nothing for a factory to pollute a river. It is a negative externality because the side effect of production has an actual real cost for people down the river where the pollution ends up accumulating. An example of a network externality is the so-called fax effect. As the number of people using faxes increases, the use value of each individual fax machine increases, too. In other words, when there are only a few users, the fax machine is at most is an expensive gadget, but as the number of possible people one can reach via a fax increases, the machine becomes more useful and begins to change the routines and practices

of the users themselves until it becomes a necessity. As an economic space, the Internet is clearly subject to such network externalities, but so are non-computer networks. Thus it is important not to overemphasize the novel aspects of the information revolution, actually, to not even to use the term information revolution, for this gives us a false sense of its historical connections with other economic spaces. Many contemporary observers of the computer world, particularly of the Wired Magazine type, think we have entered a new age, the Information Age, characterized by the importance of knowledge instead of matter or energy or labor as factors of production. The problem with this view is that it forgets that at least a hundred years ago, the interaction of several technologies--electricity, the internal combustion engine, oil, steel, and plastics--had already made knowledge a key input to production processes. And it was the creation of the first industrial research laboratories early in this century such as the General Electric Laboratory that propelled knowledge to this key position. There were German precedents to the General Electric Laboratory, but at least for most of the nineteenth century, these labs did testing as opposed to research and development. The first paradigm of concentrated intellectual resources for research and development is the General Electric Laboratory. What the dramatic growth of computer networks has done is to intensify the flow of knowledge even more. And although this intensification will undoubtedly transform the nature of the economy in the next century, one should not forget that it is a development more or less continuous with the past. In other words, I do not believe we have reached a new age: we simply added a new set of technologies that are interacting with many historical trends that are at least one hundred, two hundred, or three hundred-years old depending on which one we are talking about.

Similar remarks can be made regarding the negative aspects of computer networks. Several software products readily available on the market allow the transformation of computers connected to a local area network into surveillance devices through which the management of a firm can monitor and discipline its workers: peek at an employees screen in real time, scan data files and e-mail, tabulate keystroke speed and accuracy (one way of controlling worker productivity, so to speak), override passwords, and seize control of a work station. Some of these software packages, by the way, don't even hide the fact that they are basically surveillance packages. One is called Peek-n-Hide, Peek-n-Spy, or something like that. Clearly network management software poses distinct dangers to privacy and individual control of work activity. But it would be wrong to blame computer technology for it. Computers are merely intensifying a process that is at least two hundred years old, a process in which workers were progressively deskilled as their daily activities were transformed into fixed routines and their skills were transferred to machines. Military institutions played a key role in the development of the disciplinary techniques and monitoring practices through which this routinization of the production process was achieved. I believe that an awareness of the historical origins of this process is a precondition to a successful understanding of the negative effects of routinization and surveillance and of the dangers that computer intensification poses for the future.

It follows that a discussion of the possible economic impact of the Internet needs to address many other issues besides those closely connected with the distribution and dissemination of information. In this essay I would like to address a few of these issues, some of which are concerned with the effects that network computing may have on our knowledge of economic dynamics, some regarding the effects of networks on the production of material and energetic products, and finally the more specific effects that the Internet may have on the production and distribution of information-based products and services.

EFFECTS OF NETWORK COMPUTING ON KNOWLEDGE Lets begin with a quick sketch of the potential use of computer networks in the production of knowledge about economic phenomena. Remember what I said before: "The only place where we know the dynamics through which prices form themselves, the only place in which exchange values are objective in the old-fashioned sense, is where people gather every Saturday at a particular spot in town." To understand the dynamics of a more dispersed economic system full of friction, full of noise, full of other dynamical phenomena, we need certain computer simulations that are only now becoming possible. It is not that we need computer simulations; it is just that the dynamics of more complicated economic spaces are much too complex for our old linear equations, for our old linear models, and we need all the help we can get in order to be able to develop intuitions within ourselves as to how these processes take place.

One such tool could be a certain breed of computer simulations. This is, indeed, a crucial point. Since our evaluation of effects of networks on real economies clearly depends on our conceptions of what economies are, our dominant theories, whether Neo-Classical or Marxian economics, are very close to conceptual bankruptcy, and radically new theories will require development to replace them. One direction which new economic theory will have to follow may be illustrated from examples from non-linear science and theories of self-organization. Non-linear science and theories of self-organization are giving us a new view of what matter energy is. For a long time we followed the idea, which I believe was discovered by Aristotle but may have other older origins, that matter is just an inert receptacle for forms that come from the outside: either from the brain of a creator, from the brain of God, or from essences that exist in some Platonic haven. But matter-- pregnant with morphogenic capabilities and able to give form from within as opposed to receiving form from the outside--is a very important development of these new theories, and it will form the basis for a new Materialism divorced from the dogmas of the past. Basically, these theories of self- organization may be used to explain the emergence of wholes that are more than the sum of their parts. Real markets, in the sense of small town markets, are, in a sense, such synergistic wholes since they emerge as the result of the unintended consequence of many independent decision makers. In other words, every buyer and seller that goes to the market has intentions, beliefs, wants, and needs, but the structure of the market, what makes prices set themselves, is a collective consequence that is unintended. These specific markets are in self- organizing wholes that are more than the mere sum of decision makers that contribute to it. (On the other hand, no small town market can operate without some intervention by hierarchical structures, bureaucracies, guilds etc, so that any real economic space will always be a complex mixture of centralized and decentralized decision-making). The Internet, itself, at least before MCI and Sprint began carving their big niches after 1990, was also such a self-organizing entity despite its origins in the hands of military planners. In other words, markets, ecosystems--another example of a self-organizing whole in which many different interacting species come together without any plan or teleology--and decentralized networks all have in common synergistic properties that emerge spontaneously out of the interactions of a variety of elements: plants and animals, in the case of ecosystems; sellers and buyers, in the case of markets; computer servers and clients in the case of the Internet. To understand the processes that lead to such emergent synergistic wholes, we need to create new ways of modelling reality. We need new modelling technology. In particular, instead of the models of the past which began at the top assuming systematicity, assuming a totality of form and having certain properties, instead of starting at the top and proceeding analytically down to the smaller elements, we need to proceed in the opposite direction, to begin at the bottom and move up. For example, instead of creating a computer model of a market, an ecosystem, or a computer network by using a small set of mathematical functions that capture the behavior of an idealised whole, we need to create virtual environments in which we can unleash a population of virtual animals and plants, virtual buyers and sellers, or virtual clients and servers; let these creatures interact; and allow the self-organized whole to emerge spontaneously within this virtual environment. In this way the bottom up modelling strategy compensates for the weakness of the top down strategy. Emergent properties are the properties of the complex interactions between heterogeneous elements, but top down analysis dissects and separates these elements, and, therefore, breaks up the interactions and tries to add them back together. But, of course, when you break up the interaction and add them back together, all you are going to get is the properties that are the sum of the individual parts. What we want to get is something that is more than the sum of the individual parts, that is the synergetic surplus. The operation of dissecting necessarily misses any property that is more than the sum of the parts, hence analysis needs to be complemented with synthesis as is done today in the discipline of Artificial Life (AL) and in those branches of Artificial Intelligence (AI) known as connectionism and animats. AL has not succeeded in creating incredibly complex ecosystems within the computer. It would be a different talk to address the specific weaknesses of the modelling technology that these people have produced. We are at the beginning of realizing the limitations that the classical models imposed on us. Of course, AI and AL have been so covered by hype, with completely extravagant and exaggerated claims for what they are going to accomplish that in a couple of years, when the whole hype collapses, we might actually lose faith about what AI and AL had to offer. Therefore, it is important for philosophers to locate those nuggets of true contribution that modelling techniques can and will offer. Forget about the hype. Incorporate these golden nuggets into a philosophical system that is more sophisticated than what the people

themselves, for example, the Santa Fe Institute people, have developed.

This switch in modelling strategy would have a significant impact on the shape that a new paradigm for economics would take. Instead of postulating a whole, say the capitalist system, and attempting to capture its basic dynamics in some mathematical formulas, we would unleash within a virtual environment a population of institutions including virtual markets, corporations, bureaucratic agencies, unions, etc., as has been done in some MIT systems analysis models. We are to feel justified to talk about an overall system only if we can manage to "tease out" from the interactions of these virtual creatures, virtual institutions, and so on, something that is actually an overall whole. But if in trying the simulations we realize that, indeed, society forms more a collage of different institutions, that it never really quite forms a perfect system where everything has its function, then we would not feel epistemologically justified in postulating an entity like that. My guess is that there is no such an overall homogenous system. It was a simplification that the Classics had to make in order to bootstrap classical economics, much as Newton and Galileo had to eliminate friction to bootstrap classical physics, and so it is justified historically.

But society is a much more heterogeneous collection of processes. Historian Fernand Braudel, who many of you may know and is perhaps the most important economic historian of this century, has called attention to the striking differences between markets in the specific sense that I have been using here, where decentralized decision making is the rule, and the world of large corporations, in which centralization dominates and in which commands replace prices as the main mechanism of coordination of human activity. Many economists had already noticed this essential difference. Adam Smith noticed the effect that joint stock companies had on his invisible hand theory. But at least until recently, they had mistakenly attributed this non-market state of the economy, to our century, a kind of late stage of the capitalist economy. The 19th century had been very competitive while the 20th century became monopolistic or oligopolistic. But what Braudel has shown is that the difference between markets--that is institutions in which prices govern the behavior of the system--and large businesses--wholesalers, traders of luxury items and big financial institutions such as banks--can be traced to the 13th or 14th centuries, e.g., 14th century Florentine banks, 14th century Venetian wholesalers, etc., not to mention the companies of India that were so important to the Dutch, French, Spanish, and British in order to economically colonize the rest of the world. These institutions were already hierarchical institutions in which centralized decision making was the rule, governed by commands involving the manipulation of market forces, rather than being governed by supply and demand, and, hence, properly called markets. A wholesaler can dump large amounts of corn into the market in order to artificially drive down the price or, vice versa, withdraw large amounts of corn from the market to artificially drive up the price and then sell what it has in the warehouse. Very specific mechanisms govern these activities, and Braudel suggests that we should call them "antimarkets". To me this is a very important point because it is not just terminological; it is not a matter of coming up with a cute new concept. It is rather that, for instance, Newt Gingrich and right wing politicians of the United States, today, with very specific connections to Wired Magazine via direct and indirect links, pretend that the United States is a market economy. But if you make a census of the population of organizations in the United States, according to John Kenneth Galbraith, at least fifty percent would turn out to be antimarket institutions, having nothing to do whatsoever with demand and supply except indirectly. The new word antimarket does mark a very important distinction that I want to make. And, of course, it goes back to conceiving of societies as more heterogeneous, as more complex, as more noisy and messy systems in which many different institutions coexist and interact with one another. When the Soviet Union collapsed in conjunction with parts of Central Europe and supposedly began to change to a market economy, the word "market" was wrongly applied. Indeed, what they were doing was a transition to an economy governed by large factories and large firms with a managerial hierarchy in which commands are the rule not prices. In other words, they were actually trying to effect a transition to an antimarket economy, though we all go about happily talking about how Poland is changing to a market economy. Braudel, being the gentleman that I am sure he was, never suggested dumping the word "capitalism" and adopt a view involving more heterogeneous assemblages of institutions. I am not a gentleman, so I will say let's just dump the word. It is getting in the way. Recognizing this heterogeneity is crucial not only when thinking about network economics but more generally when analysing the oppressive aspects of today's economic system.

The problem with the new modelling strategy that I am proposing, the bottom up strategy in which wholes are generated as emergent ones as opposed to postulated a priori, is that it is extremely expensive to rent a supercomputer or a parallel computer where we can run these models. None of us here have the resources to do such a thing. What is the use? A possible solution to this problem would be convert the Internet into a parallel computer. Indeed, the Internet is already a distributed parallel system on which many computers are connected at the same time. It is just that there is no software available except perhaps Tom Ray's AL idea. It would be a relatively simple thing. You would just need software in both servers and clients that would allow the users of the Internet to leave their computers connected all day to the Internet and sell to whoever wants to buy it the two most important resources that are in the Net: memory and CPU time, computer processing time. Now most of the time when we are using the computer we are clicking or reading or waiting for something to happen, and a lot of memory is being wasted, a lot of CPU cycles are being wasted. If we had the correct software so someone could buy CPU cycles across the world and make them cohere, then we would indeed have access to cheap parallel computers. We would be able to run our simulations all over the Internet using it as a parallel computer. This is just a possibility on how to use networks as epistemological devices on how to use networks as the infrastructure to support new modelling strategies and, therefore, new ways of thinking about economics.

Recognizing the heterogeneity of real economies may be crucial when thinking not only of network economics per se, but more generally when analyzing the oppressive aspects of today's economic system, especially those aspects that we would want to change in order to make economic institutions more fair and less exploitative. We need to think of economic institutions as part of a larger institutional ecology, an ecology that must include, for example, military institutions. When I use the word ecology, I do not mean to imply anything about Mother Nature, ecosystems as Gaia, or anything like that. As I said in the beginning, ecosystems are simply one example of heterogeneous elements cohering without homogenization or hierarchy, but there are many other examples from human culture and institutions. We are not talking about naturalizing or legitimizing something by appeals to what Mother Nature says. Ecosystems are only one example of assemblages of heterogeneous elements that actually cohere via functional complementarities, such as predators and prey, parasites and hosts. Our institutional ecology, the heterogeneous assemblage that we need in order to replace the idea of a capitalist system, must include military institutions. Only in this way will we be able to locate the specific sources of certain forms of economic power, sources which would remain invisible if we simply thought of every aspect of our current situation as derived from capitalism. Many of the most oppressive aspects of industrial discipline, in particular, the use of machines to control workers in assembly line factories, were not originated by capitalists but by military engineers in 18th century French and 19th century American arsenals and armories. Without exaggeration, these and other military institutions created many of the techniques used to withdraw control of the production process from workers and then exported these techniques to civilian enterprises, typically antimarket organizations via a variety of processes in the United States, specifically via the contract system. The military would only give contracts to producers of, for example, weapon parts to companies using its own system of routinization and standardization in which workers were made into cogs in a larger machine. The reason why military institutions created standardized production was to create weapons with interchangeable parts, for as long as individual artists created an entire weapon, each weapon had its idiosyncrasies. It fit together and it worked, but it could not be taken apart and put back together with the parts from another artisan's weapon. Therefore, it was a big logistical problem for the military to supply battlefields with spare parts as they would not fit. Every weapon was an entity in itself. In order to create weapons with perfectly interchangeable parts, a model weapon was created that every artisan had to copy exactly, reinforced by special gauges that measured the tolerances of every new part created by every artisan and metallic fixtures that guided the cutting devices. Early on the military realized that to impose standardization in weapon production implied not only the disciplining of the materials, making them more homogenous and uniform, but the disciplining of human beings; for the moment you withdraw individual control of the production and put it in the hands of management, constant monitoring and constant discipline were necessary to ensure the proper flow within the factory. Hence, not including in our economic models the processes occurring within this wider institutional ecology potentially obfuscates the source of the

very structures we must change in order to create a fairer society and, hence, diminishes our chances of ever dismantling those oppressive structures. Virtual environments and the bottom up models they allow us to build may be the right tools to study these institutional ecologies without reducing their heterogeneity. [see //computer].

Not to drift from the main subject, let's consider examples from the industries that created the infrastructure of the Net, itself, that is computers.

The question of the manufacture of computer hardware and software has many different interesting angles, not to mention a very close association with military institutions which I have written about elsewhere. Even though the computer was created by Alan Turing as a completely abstract device to solve some very abstract problems in meta mathematics, it took World War II, problems in cryptology, breaking the Nazi's ENIGMA code, calculating artillery trajectories, and problems of fluid dynamics in the atomic bomb Manhattan Project for von Neumann and Turing on both sides of the Atlantic to realize how hard it was going to take this virtual machine that Turing had created in the 1930s and actually incarnate it into a real piece of hardware. For example, the memory of the original Turing Machine was an infinite paper tape. Now, of course, you cannot build computers in reality with infinite paper tapes. The question of how to implement an actual computer memory was a big obstacle for the creation of universal machines in the late 1940s and early 1950s. The Internet, itself, has military origins as everybody knows, and its packet-switched structure of circulation of information exists not because the military wanted it that way but because it was the only way of creating a network that could survive a nuclear attack. The military bit the bullet and accepted it as a reality imposed on them by the necessities of war.

But, today, I would like to discuss a different issue, one related to our bottom up modelling of heterogeneous institutional ecologies. And, also, it is an issue that connects with why it is important to stop thinking of societies as forming a homogeneous system, like the capitalist system, because only then can we begin to take seriously certain differences in economic performance, differences in which various industrial regions even within the same country operate, differences that become much less interesting if we use the term capitalist system. Capitalist system makes them all seem the same: they all use money, they all use workers in a subordinate position, etc. However, when you begin realizing that the Classics were wrong, that friction needs to be included, that heterogeneity needs to be included, and not only as an afterthought, "Oh, let's make it even more accurate," but as an essential piece of what the system is, then the differences between different industrial hinterlands become interesting.

Let me just discuss two industrial hinterlands in the United States, very briefly, that produce the hardware on which the Internet is based: Silicon Valley and Route 128 in Boston. Both are industrial hinterlands involving the production of hardware and software. Both are animated by intense flows of knowledge and information, partly due to their association with large technical universities, Stanford and MIT respectively. The two ecologies, however, are very different. And this has made a difference in their performance. Silicon Valley has much more heterogeneous collection of enterprises within it but that does not mean that there are not large, routinized, militarized factories in Silicon Valley. There certainly are, Intel or Xerox, for example. There are plenty of antimarkets in Silicon Valley. We are not talking about pure cases. In reality all we get is messy mixtures of things. But what does matter is what dominates the mixture. Do prices and real market dynamics dominate it or is it dominated by commands? I quote here from a study by Annalee Saxenian:

"Silicon Valley has a decentralized industrial system that is organized around regional networks. Like firms in Japan and parts of Germany and Italy, Silicon Valley companies tend to draw on local knowledge and relationships to create new markets, products, and applications. These specialist firms compete intensely while at the same time learning from one another about changing markets and technologies. The region's dense social networks and open labor markets encourage experimentation and entrepreneurship. The boundaries within firms are porous, that is not rigid and separating, as are those between firms themselves and between firms and local institutions such as trade associations and universities."

The growth of this region owes very little to large financial flows from governmental and military institutions. It was not directly connected to

the military-industrial complex as Route 128 was. Silicon Valley did not develop so much by the economies of scale typical of antimarkets as from the benefits derived from an agglomeration of visionary engineers, specialist consultants, and financial entrepreneurs. Engineers in Silicon Valley moved often from one firm to another. The typical length of their stay in one firm is about three years, developing loyalties to the craft and the region's networks not to the corporations. This constant migration plus an unusual practice of knowledge sharing meant that innovations can diffuse quickly through the region. This does not mean that there are not large routinized firms in Silicon Valley. I am not trying to romanticize Silicon Valley as a model for the future. As a matter of fact, the kind of regional dynamics in Silicon Valley today are very old. That is the way Venice in the 11th century broke away from being a supply zone of Constantinople; that is the way in which London and Antwerp stopped being a supply zone, sellers of raw materials, to Venice; that is the way New York, Pennsylvania, and Boston, selling cheap products to one another, stopped being a supply zone of England. There is historical precedent for the existence of these interactive networks of small producers. The key word here is small because only when there are many small producers do we have a decentralized decision making system in which prices more or less set themselves. But it does not mean that large firms do not exist in Silicon Valley. There are very oppressive antimarket institutions just as everywhere else. Only they do not dominate the mix. This is all that matters for my point.

Route 128, on the other hand, houses a completely different mixture of markets and antimarkets. I quote again from Saxenian:

"While Silicon Valley producers of the 1970s were imbedded in and inseparable from intricate social and technical networks, the Route 128 region came to be dominated by a small number of highly self sufficient corporations. Consonant with New England's two century-old manufacturing tradition, [a tradition which was, by the way, born in those arsenals and armories that I mention in the beginning of the paper,] Route 128 firms sought to preserve their independence by internalizing a wide range of activities. [Internalizing means that a large corporation buys a small firm. For instance, while Apple Computer was growing up, it bought all its hard disks, floppy disk drivers, memory, etc., and came up with an open architecture so everybody could write software for it, therefore initiating a chain reaction in which many, many small producers, could get involved. Eventually, some became big antimarkets like the creators of Lotus 123 and other large software companies. The Route 128 firms like DEC or Digital were always self-contained, or they had enough economic power and resources to simply buy a firm that manufactured the hard disk parts or buy a firm that manufactures software, etc. They thought this exercise of economic power was actually benefiting them, but as it turned out it did not.] Route 128 firms sought to preserve their independence via vertical or horizontal integration of a wide range of activities. As a result, secrecy and corporate loyalty governed relations between firms and their customers, suppliers, and competitors, reinforcing the original culture of stability and self-reliance as opposed to risk taking and innovation. Corporate hierarchies ensured that authority remains centralized and information flows vertically. The boundaries between and within firms and between firms and local institutions thus remained far more distant."

The different dynamics of these two institutional ecologies illustrate one of the potential benefits that computer networks can bring to an economy. Although the dynamics of Silicon Valley involve networks of different kinds--social, institutional, educational networks--that formed more or less spontaneously, networks like the Internet could help energize other industrial hinterlands around the world including the Third World by making possible the interconnection of many small businesses, thus allowing them to compete with large national and international corporations which enjoy economies of scale. I am not saying you can have a small business fighting a large multinational corporation. This is ridiculous in reference to what I just said. The multinational corporation can simply internalize a small business as it is happening with all the biotechnology companies in Boston. They were small businesses to begin with, and now they are part of large oil companies or large food producers that have them as one of their divisions. The point is to create entire regions in which the skills developed by learning by doing, by actually creating little pieces of hardware and software, stay in the region because no small little firm can move out from the region without ceasing to benefit from the economies of agglomeration that occur when you put a lot of these small firms together. All the small firms become undetachable from the region, therefore eliminating one of the main dangers of antimarket institutions: that when a

large corporation dominates the life of a town, the moment it moves to another town or country where labor is cheaper, it kills the town because the corporation internalized all the skills. All the skills are within the corporation in the research laboratory and move with the corporate entity. If a network crucially depends on these local dynamics, then it cannot move away. Even though it may still have other points that we may criticize, for instance, the treatment of workers, at least it will not kill a region by relocating.

To speak of these relative advantages is not romanticize markets versus antimarkets, precisely because markets as self-organized entities grow by drift. No one plans where they go, so they are inefficient and go through cycles of boom and bust. Sometimes we can benefit from this drift, and sometimes we cannot. It is not a matter of romanticizing these things but getting a better grip on the actual heterogeneity of the world. Silicon-Valley style dynamics have, for instance, occurred in certain European regions. In Italy there is a region mentioned by Braudel and several other writers where three huge textile corporations were broken down into much smaller but networked textile producers. I believe the region is between Bologna and Milan. This revived the region. These companies compete with one another but at the same time collaborate, for example, when a company cannot take another job because it is too busy doing something else, then it can pass it on to another company in the network even if it is a competitor. They benefit from each other, and they have enough clout to resist the large corporations that are their real enemy. We do not know very much how these networks evolve. But we have empirical data from history: Venice, London, and more recently 18th century Boston, New York, and Philadelphia. That historical research needs to be deepened in conjunction with the collection of more data coupled to bottom up computer simulations in order to understand how these networks actually work and how we may be able to intervene in reality to allow these networks to form, particularly in the Third World.

Now, finally, I would like to speak about the economic potential of the Internet, itself, its capacity to create a space on which to carry brand new commercial and industrial transactions. The Internet is rapidly evolving into such an economic space, and the development of electronic cash and crypto- technology to perform secure and anonymous transactions will accelerate this trend. Much of these traditional economic systems may be seen as a means of allocating or distributing resources that are scarce. Scarcity is one of the factors that determines the nature of Net economics, at least as we are theorizing about it now. The scarcity in question is not of computer power or memory, both of which are becoming cheaper and more plentiful every day, but a scarcity of bandwidth, i.e., the capacity to transport information through the conduits or channels that link computers together. Everybody that has to sit in front of a computer waiting for a web page to come in with a 14/4 modem like myself knows what I mean by bandwidth scarcity. A change from a world of scarce to one of plentiful bandwidth would have very important consequences for the Internet. Of the writers who have analysed the possible impact of such a change, no one has received so much attention, at least in the United States, than George Gilder. George Gilder was on the cover of Wired Magazine four or five months ago. He is an economic guru and advisor to Newt Gingrich, much like Alvin Toffler. We are talking about the American right wing. Gilder's technical analyses are, indeed, quite interesting, but their merits must be assessed against the context of my introductory remarks. Gilder has a strong ideological commitment to 18th century economic ideas, and he incorrectly identifies the dynamics of markets with those of antimarkets. In particular, Gilder is what we may call an extreme "invisible hander," i.e., a believer that the economy is guided to optimal performance by an invisible hand which mysteriously optimizes the match between supply and demand. However, Gilder's right wing ideology is so transparent that it is quite easy to separate it out from his concrete analysis of the technologies that could one day end bandwidth scarcity.

What would happen if bandwidth scarcity was to end all of a sudden? To begin with the current channels used by the Internet are owned by telephone companies, and the technology that runs those channels was designed to deal with bandwidth scarcity. When bandwidth is expensive much of the infrastructural investment is on the hardware switches that control the movement of analog or digital information through the conduits. Today, as Gilder argues, the telephone companies have replaced much of the old copper wire with optical fiber, vastly increasing the amounts of data that can flow through these channels. However, to take advantage of the huge bandwidth increase that optical fiber makes possible, we need to get rid of hardware switches, replacing them with control devices simulated by

software. But this move is resisted by the telephone companies since they are in the business of selling services based on switches. This is an example of a corporate culture that develops around a specific set of practices and the specific economic situation of bandwidth scarcity that then becomes so rigidified that it cannot change easily. The packet switching design of the Internet of military origin is in danger of being replaced by old-fashioned circuit switching, in the form of the new standard the TelCo.'s are trying to impose, ATM. ATM is supposed to replace IP, Internet Protocol. Because they are in the business of selling services based on switches, they cannot take advantage of this new world of bandwidth plenty.

A similar point applies to other potential channels for data such as wireless transmission through the electromagnetic spectrum. Just like the switched based technology evolved in the world of bandwidth scarcity, so our current broadcast technology grew to take advantage of the limited, hence scarce, space in the radio portion of the spectrum. Today, the technology exists to use higher frequency portions of the spectrum, like microwaves, increasing bandwidth enormously, but the cellular telephone companies that should be rushing to take advantage of this are still caught in the scarcity-based paradigm. (However, this is not entirely true now, as low orbit satellite systems operating in this spectrum are being heavily invested in by communication corporations.) A system of optical fiber liberated from switches, a "fibersphere" as Guilder calls it, together with the use of the atmosphere at high frequencies, could result in a world that bandwidth is so plentiful as to be virtually free. So far so good. But when Guilder switches to an analysis of the economic consequences of these developments and even more to his advice to policy makers, Guilder's ideological baggage completely overrides his technological insights. There are two biases which any invisible hander will bring to an analysis. First, the most obvious one: any intervention by the government is by definition evil, since it interferes with the invisible hand, therefore one has to attack government regulations even if they serve to break up monopolies, thereby contributing to technological development, as was the case with the break up of AT&T in 1984. Guilder uses a slight of hand to accuse the government of creating the monopoly in 1913. This is ridiculous. AT&T ruthlessly eliminated all its small competitors prior to 1913 and only settled into its monopoly regulated form once it had already won via anti-competitive, antimarket tactics. Newt Gingrich and John Perry Barlow's speeches reflect this pro-corporate, anti-government perspective. If you read interviews with CEOs, the head honchos of large multinational corporations, from the early 1970s, the entire discourse of "Let's break the national government" and "governments are obsolete, etc." was already part of their own little theoretical contribution. It does not take a genius to say why. National governments, today, are one of their main obstacles to the global expansion of antimarkets. They would like no regulations, no labor protection, nothing that would stop them from converting the world into a global supermarket. It is quite ridiculous that today pseudo-populists ideologues in the United States are supposedly taking this banner of "Let's break the government" as a radical move.

The second bias is more dangerous because it is less obvious: one divides society into private and public sectors and then one applies the term market to all private organizations, regardless of their size, structure, or economic power. This ideological manoeuvre is performed through several operations. First one uses the word competition, as if it applied to both the anonymous competition between hundreds of buyers and sellers in a real market, the only one to which Adam Smith applied his invisible hand theory, as well as to the competition between oligopolies, for example, General Motors, Ford, and Chrysler. The problem is that these two forms of competition are completely different. In the competition between oligopolies--involving rivalry between opponents which must take each others responses into account when planning a strategy--oligopolies will set their own prices but will always avoid entering into a price war with one another. You might remember two years ago when Compaq started by dropping the prices of personal computers and forced the rest of the oligopolies producing personal computers into a price war, which, of course, was good for consumers but was bad for these large corporations. Large corporations have a variety of means to avoid price wars. One of them applies when they exist as a joint stock company: they have a management hierarchy, a lot of stock holders, and a board of directors which supposedly represent the stock holders. But in the board of directors they sit people from banks or large insurance companies that also sit on the board of directors of other corporations. Although they are not a monopoly conspiring to push prices up, these interlocking directorates, as institutional economists call this phenomenon, make it into a completely

different kind of entity. In other words, the competition between antimarkets should not be called competition, but rivalry. But if you want to keep the word, then a distinction should be made between market-theoretic competition and game-theoretic competition, involving rivalry and knowledge of the opponent that characterizes antimarket dynamics.

As economist John Kenneth Galbraith has shown, oligopolies are structures as hierarchical as any government bureaucracy with as much centralized planning and as little dependency on market dynamics. Unlike the small buyers and sellers in a real market who are price takers, oligopolies are price makers. They create prices by adding a mark-up to the cost of production, and they may manipulate that mark-up as much as they want. In short when one confuses these two different kinds of competition, one fails to distinguish between markets and antimarkets. The consequences of these two biases are very obvious: oligopolies with the power to absorb smaller competitors through horizontal and vertical integration are eliminated from the picture, and the landscape now contains only markets and the government, with monopolies like electric utilities being the only antimarket forces left but one that can be easily dismissed. (A very typical right wing ideological maneuver is to dismiss monopolies. Guilder agrees that there is such a thing as monopolies like those famous robber barons in the 19th century who created the railroad industry. But he dismisses Microsoft because the enormous profits that this monopoly generates is seen as transitory. Therefore, the menace they represent is dismissed as largely imaginary. Guilder actually says this. Microsoft is today playing a similar role as the robber barons, but, according to Guilder, its potential menace and any government action should be dismissed.) When Wired Magazine interviewed Newt Gingrich the only pointed question they asked him was, "What would you do about Microsoft. Would you pursue the antitrust case against it?" And Gingrich responded with something like, "No I wouldn't. In this I am influenced by Guilder, and the answer is "no" because Java will now become the operating system of the Net and that will end the domination of Windows 95." So, what if Bill Gates has a virtual monopoly on operating systems, a position of power that allows him to control the evolution of software that runs on top of those operating systems? "No problem," says Guilder, "In a world of bandwidth plenty the paradigm of operating systems will change to one of distributed software on the Internet, and this by itself will end Microsoft's domination." Dream on. This, of course, assumes that Microsoft, using its enormous leverage, cannot simply buy and internalize any company it needs in order to ensure its presence in a network economy.

In short, the core of Guilder's ideological maneuver is to lump together small producers and oligopolies in one category and to call that "the market" and to focus exclusively on government regulation as the only real enemy, dismissing monopolies as chimerical. Applied to his theory of the Internet, the theory works like this. A world of bandwidth scarcity like today's cable television favors the creation of large companies which acquire control of both the channel and the contents flowing through those channels and, therefore, gain monopoly rents. For example, TCI a cable giant in the United States, also owns content producing channels such as the Discovery Channel, Home Shopping Network, TNT, etc. With bandwidth scarcity gone, argues Guilder, the rationale for owning both conduit and data is gone, and this will benefit small producers of content. Here he seems to siding with real decentralized markets. But what are his policy recommendations to get to this decentralized world created by cheap bandwidth? Well, the fastest way to get there is to allow the optical fiber infrastructure of the telephone companies to be combined with the final connection to homes owned by cable companies and create a huge monopoly. His reasoning is totally absurd. Remember that according to Guilder this would all be a transitory monopoly, an evil thing that we must live with for a while but will go away. The government which, of course, opposes the merger between the TelCo.'s and the cable giants is the enemy of the people because its antitrust regulations are preventing us from enjoying the benefits of the world with cheap bandwidth.

I could go on adding detail to this criticism, one that Guilder, himself, makes easy by offering such an obvious target. But we would wrong to think that the only ones to be ideologically biased are rightwing invisible handers. Left wing commodifiers, i.e., intellectuals for whom the very entry of an object into a market involves commodification (which is seen as a bad thing), are equally simplistic in their assessments. I strongly believe that neither side of the political spectrum can be trusted anymore in their economic analysis, and a new economic theory, one that respects the lessons of economic history and that assimilates the insights from

nonlinear dynamics and complexity theory, should be created. The elements for this new theory are already here not only from institutional economists and materialist historians but from philosophers of economics that are now more than ever participating in dispelling the myths that have obscured our thought for so many centuries.

Q: (Andreas Broeckmann) The way you describe the non hierarchical economies, the market, its a very appealing model and there are problems that we are dealing with at the moment as content producers that resemble what you are describing. Is there any way of intervening and strategically acting within these really fluid environments. I guess that developing an economic theory for this is one way of doing this, but ...[tape] So the question is how much space is there for individual agency.

MDL: I obviously believe that there is plenty of space for individual agency, but again, it really depends on how we draw our distinctions. For instance, we tend to think of capitalist institutions being run by entrepreneurs, but of course that is not the case. As far back ,as I said, as the fourteenth and fifteenth centuries large economic institutions, ones that had economic power were run by managers. And the moment the joint stock corporation began, ownership and control were separated, and now indeed you had a completely hierachical structure. An entrepreneur is a completely different category, particularly if he is an entrepreneur of a small business. He is the owner and the force behind that particular business. Anything that we can do to create the conditions for entrepreneurs to flourish is something that would help the creation of decentralized decision making structures. In other words, there is individual agency in the form of entrepreneurship. There is also individual agency in the form of criticism of standards that go on in the Internet. For instance, (and I already talked about this in Madrid when you asked me a similar question) the payment structure in the Internet, standards for which are being developed now, should essentially include micro payments, that is 5 cents or even better 1 cent payments, and the possibility of doing that efficiently. If we set a lower limit of say, ten dollars, like credit cards sometimes have, by that very means we will be influencing who can actually be a producer on the Internet. Another thing that would immediately change the nature of the Net is if we switched to asymmetric technology, i.e., more bits coming to your computer than going out. The moment more bits come into your computer than go out, then you are becoming a consumer and a computer is becoming a vehicle for you to consume things. And you send a few bits of email to your relatives and friends. It is essential that we keep the hardware of the Internet perfectly symmetrical to allow small producers to produce. Those are some areas, some of criticism, some of direct intervention, that I can think of right now. As I said, we must proceed with a lot of caution here because the very first thing, and its the most important thing, we must do is to avoid creating a caricature of history in which the decentralized structures appear as the heroes and centralized structures as the villains. The reason for this is twofold. First of all, decentralized structures become centralized structures. Apple Computer started with \$1300 in a garage and two entrepreneurs but the moment they brought in a professional manager from Pepsi Cola and kicked out Steve Jobs, it was already an antimarket institution. So obviously, small businesses grow into big ones and become antimarkets. This is not a new phenomenon. The large fairs in the 13th and 14th centuries such as the Champagne Fairs were huge markets that were already hierarchical with a money market at the top, luxury items next, and then the humble goods that were exchanged in the marketplace. Markets give rise to hierarchies, hierarchies give rise to markets. We need to confront the complexity and never over simplify, just so we can give ourselves a role as the heroes of decentralization. Besides that, of course, we need to consider that many of the right wing, and particularly extreme right wing like the skinheads or the militia movement in the United States, are completely decentralized. Therefore, there is nothing intrinsically good or heroic about decentralization. If I am drawing these distinctions carefully right now, it is because I believe it is crucial for us to understand our economic history and therefore to be able to intervene in the present and the future, not because I am trying to romanticize decentralized decision making per se.

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