Danger! Metaphors at Work in Economics, Geophysiology, and the Internet

Sally Wyatt
University of Amsterdam

The author analyzes the types of metaphors that are used to describe the Internet in issues of Wired *magazine from before and after the dot-com collapse to understand the perceptions and expectations of some of the actors involved in the shaping of the Internet. In addition, the metaphors deployed in economics and geophysiology are used to demonstrate how metaphors can influence public debate, policy, and theory. The author argues that metaphors do not simply have a descriptive function but that they also carry normative connotations. Language, alongside social practices and material objects, is an important tool in attempts to construct the future. Six overlapping metaphorical themes are identified: revolution, evolution, salvation, progress, universalism, and the "American dream." A critical analysis of these metaphors, informed by a critique of the metaphors used in economics and geophysiology, leads the author to challenge the universalist claims made by some Internet enthusiasts for the inclusive potential of the Internet.*

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As Hiro [the protagonist] approaches the Street, he sees two young couples, probably using their parents' computers for a double date in the Metaverse, climbing down out of Port Zero, which is the local port of entry and monorail stop.

He is not seeing real people, of course. This is all part of the moving illustration drawn by his computer according to specifications coming down the fibre-

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> optic cable. The people are pieces of software called avatars. They are the audiovisual bodies that people use to communicate with each other in the Metaverse. . . .
>
> Your avatar can look any way you want it to, up to the limitations of your equipment. If you're ugly, you can make your avatar look beautiful. If you've just gotten out of bed, your avatar can still be wearing beautiful clothes and professionally applied makeup. You can look like a gorilla or a dragon or a giant talking penis in the Metaverse. Spend five minutes walking down the Street and you will see all of these.
>
> Hiro's avatar just looks like Hiro, with the difference that no matter what Hiro is wearing in Reality, his avatar always wears a black leather kimono. Most hacker types don't go in for garish avatars, because they know that it takes a lot more sophistication to render a realistic human face than a talking penis. Kind of the way people who really know clothing can appreciate the fine details that separate a cheap gray wool suit from an expensive hand-tailored gray wool suit.
>
> You can't just materialize anywhere in the Metaverse, like Captain Kirk beaming down from on high. This would be confusing and irritating to the people around you. It would break the metaphor.
>
> Neal Stephenson (1992, 33-34)

This quotation is from Neal Stephenson's 1992 science fiction/cyberpunk novel *Snow Crash*. Early in the novel, Stephenson provides an introduction to the norms and codes of his "metaverse," the combined chat room and role-play game featured in the novel. The extract above captures many issues important to the contemporary Internet, including the rules and norms governing behavior with this new medium, technical skill, and access to hardware. It also foreshadows the development of software agents. Adolescent fantasies are evoked as the first paragraph recalls the association between new technology and sexual desire, and those readers old enough to remember the early episodes are reminded of *Star Trek*. Most significantly, this extract uses the metaphor of the street: an urban space of difference, a metaverse of plurality. This is very different from both the engineering constructions such as highways favored by politicians and the peculiar metaphorical world of r/evolutionary change inhabited by some Internet enthusiasts, including contributors to *Wired*. Both types of metaphor are discussed below.

In this article, I examine some of the metaphors[1] that are used to describe the Internet in order to understand the perceptions and expectations of some of the actors involved in its shaping. Despite the enormous expansion of the Internet since the development of the World Wide Web in 1993, the technology and the services available continue to change. There remains a great deal of interpretative flexibility regarding what it is, what problems it can solve, and what problems it may create. Tensions between commercial and non-commercial use and between producers and users; uncertainty over payment

systems, privacy, domain names, charging mechanisms; and the emergence of new interfaces via mobile telephony or interactive television all contribute to difficulties in understanding its future form and role (Thomas and Wyatt 1999). Because of this instability and uncertainty, policy makers, industry spokespeople, journalists, and academic commentators often deploy metaphors in order to convey their image of what the Internet is or might be. The future has to be discussed in terms of the imaginary, in terms of metaphors, but sometimes today's imaginary becomes tomorrow's lived reality. It is therefore important to think about metaphors of the Internet not only because they reveal what different actors think it is but also because they tell us something about what they want it to become. For example, those who use metaphors of consumption generally and shopping malls in particular will devote resources to developing secure exchange mechanisms. Broadcasting metaphors carry with them assumptions about the nature of interaction between audiences and content providers that are more passive than those suggested by interactive role-play game metaphors and applications. Hackers draw on metaphors that convey the importance of transparency and the pleasures of puzzle solving, whereas computer security experts deploy metaphors that invoke fear, anxiety, and apocalyptic threat.

Metaphors not only help to make science and technology comprehensible to nonspecialists, they can also guide scientific work. Arthur Miller (1996) presents a realist account of the role of metaphor in scientific creativity, especially in physics. He argues that metaphors are an essential part of scientific creativity because they assist scientists to move from descriptions of the unknown to literal descriptions, namely scientific theories, of the world around us.

Metaphors are thus not only descriptive; they may provide clues to the design intentions of those who use them and, as such, they may help to shape the cognitive framework within which such actors operate.[2] When deployed by social actors, metaphors are not always merely descriptive. Their use is not simply an innocent attempt by commentators or politicians to demonstrate their own imaginative capacities or to appeal to the imaginations of their audiences. Metaphors also have a normative dimension; they can be used to help the imaginary become real or true. Friedrich Nietzsche described truth as a

> movable host of metaphors, metonymies, and anthropomorphisms: in short, a sum of human relations which have been poetically and rhetorically intensified, transferred, and embellished, and which, after long usage, seem to a people to be fixed, canonical, and binding. Truths . . . are metaphors that have become worn out and have been drained of sensuous force. (cited in Breazeale 1979, 84)

Different social groups use different metaphors to capture and promote their own interests and desires for the future. Highways, railroads, webs, tidal waves, matrices, libraries, shopping malls, village squares, and town halls have all appeared in discussions of the Internet. "Windows" and "menus" have been imposed onto Microsoft users, with their misleading connotations of choice, transparency, and openness. Not all metaphors are equal: those deployed by Microsoft have more immediate and widespread impact than those chosen by analysts of socio-technical change. George Lakoff and Mark Johnson go further than Nietzsche and observe that "new metaphors . . . can have the power to define reality. . . . [W]hether in national politics or everyday interaction, people in power get to impose their metaphors" (1980, 157). Thus, there are both cognitive and normative dimensions of metaphors that need to be considered. Metaphors may convey something about the future functions and technological configurations of the Internet, and they may also reveal the political assumptions and aspirations of those who deploy them.

Metaphors need to be handled carefully. They can help people to comprehend the new, the unseen, the unknown; but they can also mislead, sometimes deliberately, because the kinds of experience they purport to connect may be incommensurate. Terry Eagleton makes this point eloquently: "both history and nature are matters of process, to be sure; but to over-emphasise this is to risk eliding the distinctions between them in positivist or idealist style. A river does not flow as a sonnet does, nor does time fly like a goose" (1997, 22). The danger of elision is not sufficient reason to eschew either the creation of new metaphors or the analysis of existing metaphors at work in our world. Instead, it means we need to recall McCloskey's (1986) advice concerning metaphors in social science: "Self-consciousness about metaphor would be an improvement on many counts. Most obviously, unexamined metaphor is a substitute for thinking—which is a recommendation to examine the metaphors, not to attempt the impossible by banishing them" (cited in Joerges 1989, 48).

Stability and Change

To demonstrate the ways in which metaphors are used as normative and cognitive structuring devices, I examine two areas where metaphors have been deployed to unrecognized or unforeseen effect. The first example discussed below concerns the role of metaphors drawn from the natural sciences as used in economic thought. The second concerns Gaia theory, or, as its adherents within the scientific community now prefer, *geophysiology*. By examining economic theory and Gaia theory, I illustrate the cognitive and

normative implications of using metaphors to guide and structure both social and natural sciences. This serves as a reminder of the necessity to remain vigilant in the use of metaphor. The discussion of economic theory has another purpose because of the prevalence of market metaphors in discussions of the Internet, to which I then turn. Metaphors about the Internet found in *Wired* magazine, both before and after the dot-com collapse, are analyzed in relation to what they suggest about the normative order of the future.

Metaphors in Economics

Within classical economics, the dominant metaphors derive from the mechanical world view of Newtonian physics. Adam Smith's "invisible hand" and David Ricardo's image of the economic order as a gravitation process are examples of remote forces operating at a distance to maintain a system. Karl Marx used biological metaphors in his discussions of socioeconomic transitions in general and technological change in particular. On the whole, however, he rejected Darwinian theories of evolution because of their gradualism and emphasis on struggles for existence. Darwinism was not consistent with his vision of the class struggle, characterized by rupture and dialectical change. Joseph Schumpeter (1934) also deployed biological metaphors, for example, in his use of mutation as a descriptor of change. He too rejected the Darwinian "postulate that a nation, a civilisation, or even the whole of mankind (sic) must show some kind of uniform, unilinear development" (cited in Clark and Juma 1988, 212).[3]

Alfred Marshall (1997), one of the first neoclassical economists, also adopted some evolutionary metaphors for understanding the selection mechanisms at play in the growth and survival of firms. His views about equilibrium, however, owe more to the laws of thermodynamics than to either Newtonian physics or Darwinian biology. Mainstream economic theory remains committed to the neoclassical model that emphasizes short-term, static equilibrium states. In this model, economic systems are understood as units of production (firms) and units of consumption (households) that exchange goods and services (including labor) in markets at prices that reflect the forces of supply and demand. Because of competition among both buyers and sellers, the price mechanism ensures that markets tend to equilibrium. This model of perfect competition requires that all economic actors have full information and respond rationally to changes in the prices of inputs. Neoclassical economics draws upon two metaphors central to capitalism: *time is money* and *labor is a resource*. Both of these reinforce the importance of time- and labor-saving technological change and contribute to people's alienation from their own labor. Time and labor can be made to fit equilib-

rium models of supply and demand that are regulated by price changes. Imperialism and globalization have profound political and economic consequences, but our understanding of these processes could be enriched by consideration of the imposition of metaphors developed in industrialized capitalist societies in other parts of the world.[4]

Why does neoclassical economics, dominant within the economics profession, continue to adhere to models of equilibrium and stasis, especially when physics itself has largely abandoned them? The first possible answer is ideological or normative. Individual greed, sanctioned by Smith's "invisible hand" serves the status quo very well. The second reason is cognitive. Newtonian physics and thermodynamics validate a view of nature (and by metaphorical extension of the economy and society) in which discrete entities are linked together by different forces that are capable of self-regulation. This view works well for describing the behavior of large, inert systems; it does not, however, work very well for explaining living systems of any size or complexity (Clark and Juma 1988, 214). There is a third reason that links these two. Perfect competition is the idealized system against which economic systems are judged. Even though economists know that reality is characterized by numerous market imperfections (such as monopoly, uncertainty, and imperfect information), they continue to promote policies that might move economic activities closer to the normative standard of perfect competition. Equilibrium models continue to set the metaphorical pace, in orientational and ontological terms, to the detriment of economic theory, policy, and the lives of millions of people.

Metaphors in Geophysiology

Metaphors of equilibrium and stasis have proved remarkably durable within economics. I now turn to an example of a metaphor in science that was abandoned by its originators relatively quickly. "Gaia theory" is associated primarily with the work of James Lovelock (1991; 1995). He analyzes the Earth as a single system in which the evolution of organisms is tightly coupled to the evolution of their environments. Self-regulation of the climate and its chemical components are emergent properties of the system. Gaia is simply the Greek word for planet Earth, although Lovelock appears to think Gaia is the name the ancient Greeks gave to the Earth Goddess (1995, 3). Gaia is used to capture the essence of this theory in which the Earth is a single physiological system. Lovelock and his adherents deployed Gaia (and other metaphors, including Earth as a patient in need of planetary medicine and Gaia as a control system like the thermostat of an oven) to draw attention to the unified, self-regulating, interdependency of the Earth's systems. Lovelock

regards the Earth as alive, not in the way a sentient goddess is alive in possessing purpose and foresight but more in the way a tree is alive. For him, the "use of the term 'alive' is like that of an engineer who calls a mechanical system alive" (1991, 6). In a passage that is wonderfully evocative of actor-network theory, Lovelock uses the metaphor of a political or trade union to analyze what is happening on Earth:

> Our vision represents the bacteria, the fungi, and the slime moulds as well as the nouveau riche fish, birds, and animals and the landed establishment of noble trees and their lesser plants. Indeed all living things are members of our union and they are angry at the diabolical liberties taken with their planet and their lives by people. (1991, 186)

Lovelock is fully aware of what is at stake in using this ontological metaphor. In the preface to the second edition of *The Ages of Gaia* (1995), he discusses the reception of the Gaia metaphor by the scientific community. He reports that during the discussion following a lecture in which he had used the Gaia metaphor with the intention of making his lecture more comprehensible, fellow scientists expressed their shock at his choice of metaphor. He writes, "shocked they may have been but nowhere near as shocked as I was by their response. I was shocked most of all that they were more interested in my choice of words than in the content of my talk" (1995, xiv). The use of "Gaia" left Lovelock and his colleagues vulnerable to attack from the so-called mono-scientists and to co-option from the so-called new-age wing of the environmental movement. More dangerous is the self-interested adoption of the concept by politicians and industrialists to justify their inaction in reducing pollution on the grounds that Gaia will regulate herself. Indeed, the Earth may well re-regulate itself but quite possibly in a way that leaves humans out of the union. Because of the confusion and misappropriation of the Gaian metaphor and as Gaia theory itself takes on more of the features of Kuhnian normal science, its proponents are seeking to shed these potentially damaging metaphorical associations and are establishing what appears to be a more literal name to describe their work—geophysiology. They are behaving in line with what Miller (1996) suggests, as mentioned in the opening section, in that they are attempting to move from metaphorical to literal description. Lovelock bemoans the linguistic straitjacket imposed by "scientific correctness" but accepts that the adoption of "geophysiology" has helped "to unite scientists in the common cause of a rational environmentalism" (1995, xv). Lovelock and other geophysiologists do not appear to recognize the ontological metaphor implied by the term *geophysiology* itself: physiology is normally used to describe the processes of life in animals or plants.

These very brief accounts of economic theory and geophysiology illustrate four important features of the use of metaphor. First, metaphors can assist scientists to think about new phenomena and new problems, as in the case of Gaia theory. Second, metaphors can become solidified, as in the case of neoclassical economic theory, and inhibit thought about new phenomena and new problems. Third, a successful metaphor can alter our understanding of the world, quite literally in the case of Gaia. Finally, metaphors are contestable, and there are real political and cognitive issues at stake, as continuing debates about theories and policies for the economy, environment (Hajer 1995), and biotechnology (Hellsten 2002) demonstrate.

Metaphors of the Internet

In this section, I analyze some of the metaphors found in *Wired*, the monthly journal for evangelical Internet enthusiasts. I focus on the January 1998 issue, which marked the fifth anniversary of *Wired*, and the January 2002 issue, produced after the collapse of dot-com mania.

The list of contributing editors and writers is an impressive selection of the digerati, the cybercultural elite, including Kevin Kelly, Po Bronson, William Gibson, Neal Stephenson, John Perry Barlow, Bruce Sterling, Esther Dyson, Douglas Coupland, and Nicholas Negroponte. The colophon listed Marshall McLuhan as its patron saint and always included a quote from him until early 2002. *Wired* is known for its libertarian views, disparagingly referred to as "Californian ideology" by Richard Barbrook (1996). *Wired* contributors identify lack of government control and competition of ideas and products as crucial factors in the success of the Internet, although, as Borsook (2000) and Hudson (1997) point out, they often overlook the public sector character of the early Internet and the continued openness of nonproprietary Internet protocols and standards.

This article opened with a long quotation from Neal Stephenson's *Snow Crash* (1992). Below, there is a shorter extract from William Gibson's 1984 cyberpunk classic, *Neuromancer*. Roger Burrows (1997) endorses Mike Davis's (1990) suggestion that Gibson should be read as "prefigurative social theory." This is perhaps going too far as literature has its own norms, standards, and objectives, not all of which are shared with social science. Nonetheless, I agree with Burrows's conclusion that we should (re)read cyberpunk novels, not as social and political theory as he suggests, but as sources of metaphor upon which social actors can and do draw. As the list of *Wired* contributors illustrates, there is considerable movement between both medium and genre by the journalists and novelists of cyberspace.

Gibson is usually credited with first introducing the term *cyberspace* in *Neuromancer*, in which the following description of a children's television program appears:

> "The matrix has its roots in primitive arcade games," said the voice-over, "in early graphics programs and military experimentation with cranial jacks." On the Sony, a two-dimensional space war faded behind a forest of mathematically generated ferns, demonstrating the spacial possibilities of logarithmic spirals; cold blue military footage burned through, lab animals wired into test systems, helmets feeding into fire control circuits of tanks and war planes. "Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding." (1993, 67)

Twenty years after its initial publication, this remains one of the best definitions of cyberspace: a consensual hallucination where we keep our money, talk on the telephone, play games, buy books, and search for a huge variety of useful, mundane, obscure, or titillating material and information. Gibson's description reminds us of the military origins and the popular application of the techniques to games, contributing to the emergence of the so-called military-entertainment complex. Although Gibson wrote this before what we now call the Internet had spread much beyond the military, the academy and very big business, it is a description that still resonates. Gibsonian cyberspace simultaneously deploys the orderly metaphor of a matrix with the chaotic image of the city. Like Stephenson, Gibson allows for multiple interpretations and uses.

Wired, *January 1998*[5]

Metaphors found in *Wired* in 1998 did not allow for the same ambiguity that Gibson and Stephenson suggest is characteristic of cyberspace. In the lead editorial, Louis Rossetto, the editor, reflects on what motivated the launch of *Wired* in 1993:

> What we were dreaming about was profound global transformation. We wanted to tell the story of the companies, the ideas, and especially the people making the Digital Revolution . . .
>
> After a century of war, oppression, and ecological degradation, we've entered a period of peace, increasing prosperity, an improving environment, and greater freedom for a growing proportion of the planet. (1998, 20)

Contributors to *Wired* recognize the importance of metaphors. Virginia Postrel (1998) attacks the engineering metaphors of highways and bridges used by politicians, suggesting they carry with them the entailments of government funding, teams of experts, and large bureaucracy.

> Like an earlier Clinton/Gore plan to overlay the Net with a centrally planned and federally funded information superhighway, their bridge to the future isn't as neutral as it appears. It carries important ideas: The future must be brought under control, managed, and planned—preferably by "experts." It cannot simply evolve. The future must be predictable and uniform: We will go from point A to point B with no deviations. A bridge to the future is not an empty cliché. It represents technocracy, the rule of experts. (p. 52)

The engineering metaphor refers back to the metaphors of computing as utility, akin to electricity and transport. Such utility metaphors were more common in the 1970s (see Abbate 1994) and were used to help construct fast and reliable networks as well as to promote models of control and regulation common in "natural monopolies" at that time. Postrel (1998) argues that "dynamists [contributors to *Wired*, for example] typically are drawn toward organic metaphors, symbols of unpredictable growth and change" (p. 54). She later suggests that dynamists "see markets not as conspiracies, but as discovery processes, coordinating dispersed knowledge" (p. 56). Postrel is unaware of the contradiction inherent in holding both organic and market metaphors simultaneously. As the earlier discussion of economics indicated, metaphors drawn from neoclassical economics carry with them the stasis of eighteenth- and nineteenth-century physics.

Gore's metaphor of the superhighway guided the development and implementation of a range of policies around the national information infrastructure during the first Clinton administration. The metaphor has been significantly more successful than the policies, reflecting the promises of freedom and mobility delivered by the car earlier in the twentieth century.

Between the covers of *Wired*,[6] the following six overlapping metaphorical themes can be found: revolution, evolution, salvation, progress, universalism, and the "American dream." Revolutionary fervor is sometimes mixed with religious imagery. George Gilder (1998) reminds us of the book of Genesis: "In the beginning was the word—the code—and it is not reducible to anything else" (p. 42). Randall Rothenberg (1998) mixes religious imagery with highways to discuss markets: "The Net . . . is the highway leading marketers to their Holy Grail: single-sourcing technology that can definitively tie the information consumers perceive to the purchases they make" (p. 76). This marketing Holy Grail can only be reached because of the omniscient facilities of surveillance technologies.

Metaphors of revolution also appear frequently. Po Bronson (1998) describes what is happening in Silicon Valley.

> I explained how there used to be this ethos through Silicon Valley that everyone was on a mission to transform our society, not just with personal computers—the ultimate populist tool—but by creating decentralized models for the workplace and new religions based on self-enlightenment rather than church scriptures. We wanted to shake up the world. Ten, 15 years ago—people felt this call to arms. I told him about the skull-and-crossbones flag flown over Apple during the development of the Macintosh. (p. 112)

One of the people Bronson interviews designs telephony software. He exhibits some weariness with the constant change of the digital revolution: "I've got a friend who's 24, and he's at his fourth start-up. How many revolutions can you join? It's like Monty Python's *Life of Brian*: you can't keep straight the People's Front of Judea from the Judean People's Front" (Bronson 1998, 110). Such weariness is rarely found between the covers of *Wired*.

Evolutionary metaphors are the most common, and often also carry images of progress and salvation. Four short examples are given below:

> There is no global village . . . A village is stable; everyone knows his or her role. What's happened instead is that everything has become more fluid. . . . Corporations are transnational, merging and splitting like slime molds. (Lanier 1998, 62)
>
> The concept of evolution argues [sic] that—in the absence of an unimaginably huge alteration in the physical world, such as climate change or planet collision—humanity will continue to go forward. . . . We ride the greatest trend of all. (Simon 1998, 68)
>
> Like some kind of technological Godzilla, IP [Internet protocol] has gobbled up WANs [wide area networks] and LANs [local area networks], leaving behind a trail of dying equipment vendors. . . . And—whomp!—the IP snowball rolls on. (Steinberg 1998, 80)
>
> Eat or be eaten. Even the little guys, the very little guys who are doing something very cool and important—the four-guys-in-a-garage start-ups are playing the acquisition game. (Bronson 1998, 108)

Leaving aside the mixed metaphor of Godzilla and the snowball and the attribution of voice to the concept of evolution, the repeated invocations of evolutionary change, progress, and salvation require more careful scrutiny. Recall the caution with which Marx and Schumpeter treated evolutionary theory. They rejected what they perceived as its inevitability and universalism.[7] The contributors to *Wired* deploy evolutionary metaphors while they invoke images of revolution, of massive social change toward a society characterized by greater freedom and progress. What are the agents of this

revolution? It seems to be a mixture of the market and the technology. Yet, as we have seen, the market within capitalism is meant to operate in accordance with models of static equilibrium. The technology, as Gibson recognized, is not neutral. It is largely the product of military research applied to the lucrative markets of games and entertainment. The reasons for optimism about a dynamic and egalitarian future would seem to be misplaced. Presenting technology as the asocial mechanism for emancipation removes people from the historical process of change, which might occur in different ways in different places.

Langdon Winner (1986) raised similar concerns in "Mythinformation," published originally in 1984, during what was then more commonly called the "computer" or "microelectronics revolution."

> The same society now said to be undergoing a computer revolution has long since gotten used to "revolutions" in laundry detergents, underarm deodorants, floor waxes, and other consumer products. . . . Those who employ [revolution] to talk about computers and society, however, appear to be making much more serious claims. They offer a powerful metaphor, one that invites us to compare the kind of disruptions seen in political revolutions to the changes we see happening around computer information systems. (p. 99)

Winner invites the reader to consider the goals of the putative computer revolution and how they might contribute to greater social justice. One of the traditional claims of political revolutions concerns universal rights: to land, education, the democratic process, and the means of production. I now examine the claims to universal access and social justice implicit in the metaphors of the so-called information revolution.

Internet enthusiasts often claim that connection is a global process, albeit an uneven one. This is not unique to the Internet. Similar claims can be found in much literature and policy about industrialization and modernization more generally. Individuals, regions, nations will catch up; those who are not connected now will or should be soon. This is the real annihilation of space by time: the assumption that the entire globe shares a single time line of development, in which some groups are further ahead than others along this shared path.

John Perry Barlow, cofounder of the Electronic Frontier Foundation, is committed to the emancipatory potential of the Internet. He reports on his visit to Africa, where he went to test his optimism about its potential to "proceed directly from the agricultural epoch into an information economy" (1998, 143). He took with him fifteen pounds of solar panels, two 3400 Apple PowerBooks, a Newton 2000 MessagePad, a Jaz drive, five incompatible transformer bricks, and a large bag of power and telecom adapters. (The

archetypal U.S. tourist at the end of the twentieth century?) He remains optimistic, not least because of what he perceives to be the "overlap between the ability to make music—one of Africa's prowesses—and the ability to make code" (p. 158). "All this suddenly melds into a vision of a prosperous Africa of small towns and rural communities, networked to the global grid through a web of wires and hearts opened wider with estrogen" (p. 156). Women are central to his vision of the future, arising from what Barlow perceives to be women's greater capacities for work and lateral thinking. He observed that women effectively ran both the agricultural and information economies in the African countries he visited. His optimism is thus partly based on an essentialist view of the talents and capacities of black people and women. Barlow downplays the transient inconveniences some people will experience: "Will there be data sweatshops? Probably. But, just as the sweatshops of New York were a way station for families whose progeny are now on Long Island, so, too, will these pass" (p. 158).

Bronson (1998) is less certain than Barlow regarding the extent of the changes to come. He leaves open the extent to which the norms of the industry are transferable from Silicon Valley to other parts of the world.

> Am I looking at another "steel city" Pittsburgh, the ground zero of an industry that is supplying a valuable technology to the whole world? Or am I looking at the future of the world itself—as the rest of the world adopts the technology being created in the Valley, will the rest of the world also adopt the Valley's work habits and campus parks and organizing principles? (p. 112)

Like Barlow and the Electronic Frontier Foundation (not least in its choice of name—see Neice 2002), Bronson (1998) also uses metaphors associated with the "American dream." He extends the metaphor of the melting pot, the great U.S. assimilation metaphor, in his description of Silicon Valley.

> On the high heat of burning money everything and everyone in there [Silicon Valley] melts into one boiling, spattering frenetic stew. Boston is like a nicely arranged four-food-group meal on your Sunday china, and Seattle is a huge hunk of Microsoft barbecue with a few thawed peas rolling off the paper plate, but Silicon Valley, California, is not just a stew, it's a stew that never comes off the gas heat. The juices meld, and the histories intertwine, and it's spiced up with high achievers from every nook of the world. (p. 99)

Wired, *2002*

In 1997, Stephen Graham and Alessandro Aurigi suggested that "Much of the current hype and hyperbole surrounding the Internet and 'information

superhighway' rests on the utopian assertion that such networks will inevitably emerge to be equitable, democratic and dominated by a culture of public space, enrolling multiple identities into new types of collective, interactive discourse and 'electronic democracy'" (p. 20). Within the burgeoning literature about the Internet and cyberspace, two alternative visions can be found. The first vision focuses on the emancipatory potential of the Internet, a technology that allows individuals to transcend the limitations of space, time, and biology to forge new identities and communities with like-minded people across the globe. The second vision is the dystopian antithesis of the first. Instead of liberating individuals, the Internet becomes the focus of alienation, of people from their families and friends in their local environments and of information workers from their own labor and that of their colleagues. It is also the source of concerns about the proliferation of pornography and racism. In the preceding section, I focused on the first vision, on the utopianism that the contributors to *Wired* actively asserted in 1998, but it is important to attempt to move beyond this dualistic thinking (as do Jordan 1999; Crang, Crang, and May 1999; Wyatt et al. 2000).

In spring 2000, the NASDAQ index was over 5,000 and the Dow Jones Industrial Average (DJIA) was over 12,000. Share prices in new-economy companies collapsed (described by Johnson in *Wired* as a "death spiral" [2002, 73]), and venture capital for them dried up at the end of 2000. A more widespread slowdown in the U.S. economy and the aftermath of the attacks on the World Trade Center, the Pentagon, and a field in Pennsylvania means they have not yet recovered. In summer 2002, NASDAQ hovers around 1,300 and the DJIA is around 8,700. *Wired*, the print magazine, was sold to Condé Nast in May 1999. Condé Nast publishes a range of luxury lifestyle magazines, including *Vogue*, *Glamour*, *Architectural Digest*, *Traveler*, *House & Garden*, *GQ*, and *Vanity Fair*. The *Wired* Web presence was sold to Lycos, the portal, later that year, accompanied by much acrimony between different classes of shareholder. The fortunes of *Wired* prefigured those of dot-com companies more generally as it became clear during the takeover negotiations that *Wired* was undercapitalized and overvalued[8] (Kelleher 1999).

Since the bursting of the dot-com bubble, the unbridled enthusiasm prevalent in the late 1990s has been tempered by greater caution about the social and economic transformative potential of the Internet and related technologies. Or has it? What has happened to *Wired* and its metaphors? On the cover of the January 2002 issue of *Wired*, the reader is informed this is a "special history issue." On the inside cover pages, together with small insets of images of Matthew Boulton (financial backer for James Watt's steam engine), a screw, a train, a cadaver, and a Chinese man exhaling gunpowder, the following three phrases appear:

> Freneticism and disappointment, excitement and fear.
> The history of technology is filled with bursts and busts.
> Looking backward is not to retreat into the past but to prepare for the future.

Forty pages of the January 2002 issue are devoted to examining important moments in the history of technology, including standardization of the Whitworth screw and the development of the Clipper ship. In addition to repeating the phrases above, the opening page also states that "the Internet is just part of a stream of economic, cultural, and industrial revolution that date back centuries. Each was amazing. Each was disruptive. All left glory and chaos in their wake" (2002, 76). The tropes of revolution and progress remain.

What also remains is the free market, libertarian commitment. In his article about standards, including discussion of screw threads in the nineteenth century as well as mobile telephony and software, James Surowiecki writes, "the market may seem messy, but it's actually much better at dealing with a situation of permanent revolution than official standards organizations are" (2002, 89). The libertarian commitment can also be seen in the choice of topics of the longer articles. Brent Hurtig (2002), in an article titled "Broadband Cowboy," writes about the development of wireless communication on reservations for native Americans. As well as providing communication and Internet access to a previously excluded social group, the explicit objective is to challenge the control of spectrum allocation by the Federal Communications Commission (FCC) as native Americans have sovereignty over the land granted to them. The test will be whether they also have sovereignty over the airspace. The use of "cowboy" in the title could be considered inappropriate given the setting of this article, but it plays on images of the settling of the United States identified in the 1998 issue. In another article, Julian Dibbell (2002) describes the reemergence of the gold standard online, with the development of e-gold and the e-dinar. The opening sentence is, "from gun-wielding libertarians to radical Muslims, an unlikely global cabal is plotting financial revolution" (p. 60). The choice of stories reflects a continued commitment to universal access and revolutionary social and economic change made possible by the operation of the free market.

There is some evidence of a more ironic reflexivity. The history section ends with a series of imagined covers of *Wired* from earlier epochs, with the following lead stories:

> Now it gets interesting. The wheel. Get ready for the death of distance. January 3500BC.
>
> Is the Y1K scare real? Being decimal. Why the zero means nothing and everything. May 967.

Samuel Morse's Secret Weapon. How the Telegraph Will Kill the Post Office. August 1844.
Evolution Revolution. Charles Darwin plays God. January 1859. (pp. 113-15)

Conclusion

In this article, through the examples of economics and Gaia theory, I have examined how metaphors can influence public debate, policy, and theory. In the case of economics, metaphors deriving from nineteenth-century physics have proved remarkably durable in guiding both theory and policy. In the case of Gaia theory, the metaphor was quickly abandoned as the study of the Earth's environment as a global, interconnected, self-regulating system took on the features of normal science. The discussion of metaphors in economic theory also demonstrated the contradictions inherent in the biological and market metaphors deployed by some Internet enthusiasts, such as contributors to *Wired* magazine. Closer examination of the metaphors deployed by *Wired* writers during and after the euphoria about the Internet revealed a number of overlapping themes, including revolution, evolution, salvation, progress, universalism, and the "American dream." I challenged the universalist claims made by those same enthusiasts for the inclusive potential of the Internet and questioned the desirability of the promotion of a single, globalizing technological development.

Even though the rate of growth of the Internet shows some signs of slowdown (Lenhart et al. 2003), it continues to expand in terms of almost every indicator: number and geographical location of users, number of hosts, amount of content. The extent and variety of services available is constantly emerging. New interface devices are becoming more widely available. As the technology becomes opaque, mysterious, and increasingly black-boxed for a growing proportion of its users and as the future retains its uncertainty, metaphors about the nature and the implications of the Internet continue to influence our views of its potentials. Much is at stake: the design, use, and control of a global communication infrastructure that has the capacity to transmit data, speech, sound, and images in a variety of configurations for many different purposes. Brown, Rappert, and Webster (2000) argue that manufacturing "the future" is no different from constructing "the past." The future of science and technology is actively created in the present through contested claims and counterclaims over its potential. Language is an important tool, alongside social practices and material objects, in attempts to construct the future. Metaphors not only help us to think about the future; they are a resource deployed by a variety of actors to shape the future. As metaphors

stabilize within discourses and as actors become less self-conscious in their choice of metaphors, it may seem that the metaphors themselves actively convey expectations about the future. Metaphors can mediate between structure and agency, but it is actors who choose to repeat old metaphors and introduce new ones. Thus, it is important to continue to monitor the metaphors at work to understand exactly what work it is that they are doing.

Notes

1. A metaphor is the description of one thing in terms of another to create a dramatic effect or because one cannot find another way. Lakoff and Johnson (1980) distinguish between the following three main types of metaphor: structural, spatial or orientational, and ontological. Stefik (1996) presents a variety of structural metaphors of the Internet, including library, post office, marketplace, and other worlds. Spatial metaphors are among the most pervasive as they draw upon fundamental physical experiences such as up-down, in-out, near-far. Our experience of ourselves and other entities provides the material for ontological metaphors. This is reflected in the habit of attributing human qualities, especially agency, to nonhumans and in the tendency to think of ourselves in terms of other entities. Thus, computers have resulted in the generation of many new metaphors, reflecting people's attempts to understand both the machines and their own role in relation to them.

2. See, for example, Mambrey and Tepper (1998), Turner (1999), and Neice (2002).

3. In their introduction to *Biology as Society, Society as Biology*, Maasen, Mendelsohn, and Weingart (1995) suggest that concern about the use of biological metaphors arises from their use by latter-day eugenicists or present-day racists.

4. Contemporary evolutionary and institutional economists, such as Christopher Freeman, Carlota Perez, Luc Soete, and others, have revived the more organic metaphors occasionally to be found in Marx and Schumpeter in order to develop economic theories that they argue are better able to explain the dynamics of both technological and economic change. This approach to economics also has roots in the Cambridge school, especially the work of John Maynard Keynes (1936), who focused on the problems of disequilibrium, in particular on the problems associated with the underemployment of resources, especially the underemployment of labor.

5. A more extended version of this subsection, and a more general discussion of the role of metaphors in future-oriented discourses, can be found in Wyatt (2000).

6. At a public lecture at the Royal Festival Hall, London on February 21, 1998, John Browning, European contributing editor of *Wired*, suggested that its designers wanted it to look, "as if it had dropped from the future." The fifth anniversary issue from 1998 is not atypical: it is Day-Glo orange with the aphorism "change is good" superimposed in another shade of Day-Glo orange. The January 2002 issue has a blue cover with pinky-orange lettering. To me, they look as if they have been unearthed from the 1960s. I am unsure whether this is more revealing of my age or of the age of the designers of *Wired*.

7. One of the anonymous reviewers of this article points out that Darwinism today conveys a sense of open-ended interaction between the Internet, for example, and the social, political, and technical environment within which it operates and thus might indeed be an appropriate metaphor. I am grateful for this clarification, although as the reviewer also says, this shift in the commonsense understanding of Darwinism since the nineteenth century reinforces my general argument that we need to be more self-conscious in our use of metaphors.

8. *Wired* filed its share prospectus with the U.S. Securities and Exchange Commission in May 1996. Almost immediately, questions began to be asked about how a company with revenues of $25 million could have a market value of $450 million (Kelleher 1999).

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Sally Wyatt is an associate professor at the Amsterdam School of Communications Research, University of Amsterdam. Her current research is about the ways in which people draw on multiple information sources to construct risk narratives about their health and possible treatments. She is president of the European Association for the Study of Science and Technology (EASST). e-mail: s.m.e-wyatt@uva.nl.