JOHN F. KENNEDY-INSTITUT FÜR NORDAMERIKASTUDIEN

ABTEILUNG FÜR KULTUR

Working Paper No. 116/1999

ISSN 0948-9436

PAUL A. HARRIS

Emergence and Globalization: Ethologies of Synthetic Memory and Collective Imagination

English Department
Loyola Marymount University
Los Angeles, CA
U. S. A.

Emergence and Globalization: Ethologies of Synthetic Memory and Collective Imagination

Paul A. Harris
English Dept., Loyola Marymount U./Amerika Institut, U. of Munich

Something Is In The Air

Let me begin with two scenarios, serving perhaps as thought-experiments that introduce some of the issues I wish to raise today.

First scene:

It is late at night in Cambridge, Massachussetts some time in the mid 80's. Chris Langton, who will soon organize the first conference on Artificial Life, is playing with a cellular automata program called the Game of Life. Bored with waiting for a long configuration to run, Langton looks out the window at the twinkling lights on the Charles River. Then, he says, "'Suddenly I got the sense that I wasnt alone. A completely visceral feeling, hairs standing on the back of my neck.'" Langston says that his experience "went very deep"; it "'got caught up in the idea of information having a life of its own, a living logic. It's irrelevant whether you'd say it's alive, but it's a similar class of phenomena'" (Lewin 98-99). "'[I] had the feeling there was something very deep here in this little artificial universe and its evolution through time'" (Levy,95).

The other scenario unfolds in the mind of Joel de Rosnay, a biochemist and information scientist and administrator at la Cite des sciences et de l'industrie de la Villette in Paris. He begins his book *Le Cerveau Planetaire* with the proclamation that:

> We are the neurons of the earth: the cells of a brain in the process of forming on a planetary scale.... Today, satellite communication networks or those of personal

> computers figure among the first circuits of the nervous system of society. People who participate in the creation of these networks or who use them regularly, have the feeling of being the cells of new sensory organs with which the planet is endowed. (de Rosnay, 11-12)

These scenarios depict moments of what in contemporary parlance has come to be called "emergence." Emergence is a rather ubiquitous term: one speaks of the "emergence" of new literatures, political factions, diasporic cultures, virtual communities or viruses. The essential concept of emergence is relatively straightforward: the whole is more than the sum of its parts, or, a whole of some kind emerges from the interactions of parts, a whole that can maintain itself or reproduce or evolve. But these days a more functional, perhaps machinic description of emergence is favored: there is a system made up of certain components, which are connected in particular ways; they begin interacting in ways constrained by rules of exchange prescribed by the nature of components and the type of system. From these interactions a tangled web of connections among the components emerges. At some critical point, the system crosses a threshold where its interconnectedness overruns or supercedes the individual components, and the interconnectedness gives rise to an "emergent property" or constitutes an "emergent behavior" in itself. Often this threshold of emergence also marks the appearance of a self-sustaining or self-replicating system.

This model of "emergence" may be seen as holism in a different guise: the whole becomes, through the relations between its components and the resulting organizational morphology, more than the sum of its parts. Holism is nothing new--and neither, for that matter, is emergence, both notions playing prominent roles in Kantian organicism or Bergsonian vitalism, for example. But, largely through the influence of the technosciences, the contemporary form of emergence is distinguished from its predecessors by the materialist account it is given. In a philosophical sense,

this materialism stands opposed to essentialism; no a priori force such as elan vital is posited. In a, well, material sense, this materialism is quantitative and machinc; it is rooted in mathematics, and staged in and by the computer. Systemic properties emerge without a central processor or controlling agent. Local rules give rise to global coherence through "self-organization," a process intrinsic to "the dynamics of the system itself." Complexity theorist Stuart Kauffman sums up the contemporary mindset when he places self-organization and emergence in the service of an "unrepetant holism, born not of mysticism, but of mathematical necessity" (*Home*, 69).

Something is in the Air--Or Is It?

I begin with these scenes and descriptions of emergence because they seem to crystallize several aspects of a larger sense we all have--don't we?--that we are in the middle of some major bend in the evolutionary river. Emergence provides a trope for an encompassing transformation in the human: a potential crossing of an evolutionary threshold, an historical moment when the human species may be in the process of 'morphing.' Whether implicitly or explicitly, a sense of emergence--a feeling that something weird and new is emerging out of collisions and connections between known things--propels interest in areas ranging from postcolonial cultural identities and diasporic social formations to biotechnological production of new molecules and virtual communities in world-wide webs of communication. In all these domains, there is the sense that familiar boundaries and classifications are breaking down (life versus information), that previously relatively stable spatial and temporal patterns are undergoing radical reconfigurations (historical traditions and the seasons). The rules and rates of exchange in the world are becoming fluid and

speeding up, whether we think in economic terms (the Euro, global capital) or along cultural lines (the identity of the nation state becoming imbricated with diapsoric and virtual communities).

A predominant trope for thinking about these changes is globalization, but I am wary of this rhetorical template because, like softwares that provide ready-made letters of recommendation, it seems to produce a few immediately recognizable personae. One familiar take on globalization comes from the techno-utopic Hacker, reader of Cyberzines like *Mondo 2000* and *Wired*. He (for this is a young, single white male-dominated group) really believes that as more and more people get ever cheaper, smaller, faster machines, we will witness the unleashing of a Dionysian cultural wave, a frenzied rush of visionary libidinal, entrepeneurial and political creativity. He maintains this belief despite the fact that he works in the very high-tech industry that transforms access and information into commodities and capital investments in a corporate-run market. A different take is heard from the safely situated academic cultural critic, who reduces "globalization" to a euphemism for capitalist imperialism, and equates economic hegemony with cultural homogeneization. When the inquiry into human transformations is framed by the roles that technology and science play in cultural change, using "globalization" as a byword is all the more like to elicit these polarized responses. But if we want to think about a kind of species-wide emergence without the discourse of globalization, then what theoretical tools should we use, and what sites might we visit on our world tour?

Machinic Thinking / Thinking Machines

"There is no biosphere or noosphere, but everywhere the same Mechanosphere" (Deleuze-Guattari 69).

A style of thought consistent with the emergence at work in the world could be called, sampling freely from Deleuze-Guattari, machinic. An organizing or methodological principle for such thought is suggested by Deleuze: an "ethology" that investigates "the relations of speed and slowness, of the capacities for affecting and being affected that characterize each thing." Objects of study--organisms, minds, bodies, machines--are defined by their relational velocities and affective capacities, as well as the manner in which they "select ... what moves it or is moved by it" (Deleuze, 125). Things or systems are termed "assemblages" in order to foreground functional principles over phenomenological behavior. Thus the Deleuzian method shares with the materialist account of emergence a machinic and systemic mode of description, a non-reductionist emphasis on the interactions within a system as well as its capacities for interacting with other systems. Ethology ultimately works on and through systems that are agglomerations, assemblages loosely assembled. Keith Ansell Pearson thus sees Deleuzian ethology referring to "the synthesis of heterogeneities," that is, "the demonstration of how the most varied components ... are able to crystallize in assemblages that do not respect the distinctions between orders" (Pearson, 190-191). The power of ethology as a theoretical tool is that it can do work in many fields; the danger is that its academic usage often lapses into a parrotting/parodying of Deleuze/Deleuze-Guattari rhetorical indulgences. Thus no talk here of the "Body without Organs," *undsoweiter*.

An ethology of "emergence" interested in a possible cultural transformation could take the "mind" as its first assemblage to study, since mind in a wide sense would seem a necessary component in any metamorphosis of the human. The boundaries of what constitutes mind are in question: what defines "intelligence"? what differentiates human intelligence from machinic or (other) animal intelligences? how do we define and distinguish mind and brain?

So, what are the relational velocities and affective capacities of the mind? And what are some of the "heterogeneous syntheses" in which it is involved? A compelling way to consider such questions is provided by evolutionary psychologist Merlin Donald, who, in his book *The Origins of the Modern Mind* outlines a "cognitive ethology of human culture." For Donald, "cognitive architecture" does not mean human brains, but involves the interplay of minds and cultural representational systems; his theory is marked by "its incorporation of biological and technological factors into a single evolutionary spectrum." Donald's essential contention is that "We act in cognitive collectivities, in symbiosis with external memory systems. As we develop new external symbolic configurations and modalities, we reconfigure our own mental architecture in nontrivial ways" (Donald, 382). Or, Brian Rotman succinctly summarizes Donald's idea: "the ways we technologize our environment . . . become the channels by which we install bodily regimes and re-configure, i.e., rewire, our brain; establishing mappings between our neuro-physiology -- the insides of our heads -- and the technological milieu . . . in which those heads operate" (Rotman, 6).

Donald's book probes the "origins" of the mind, but of interest here is his idea that two major cultural transitions brought about by changes in human biological hardware were followed by a third ushered in through technological hardware. This third transition--dating from the development of writing about 6,000 years ago and the phonetic alphabet around 4,000 years ago--occurs through "graphic invention, external memory, and theory construction" (Donald, 272). In essence, cognitive architecture crosses over a recursive fold: the speedier, more flexible internal biological memory that arose from the first transitions then enabled the mind to project and extend into external technological memory systems like writing and scientific theory. And ever since, Donald argues, "the growth of the external memory system has so far outpaced biological memory

that it is no exaggeration to say that we are permanently wedded to our great invention, in a cognitive symbiosis unique in nature" (Donald, 356). Donald's metaphor of "symbiosis" merits marking here, for symbiosis entails a fluid exchange between entities to the point of a breakdown of boundaries between them and the--surely you saw it coming--emergence of something else. In evolution, for instance, bacterial symbiosis generated new genes; in contemporary technoscience, biotechnologically induced symbiosis produces new molecules and machines. If we consider the human mind in terms of a "cognitive symbiosis" with external memory systems, then what new assemblages do we see emerging? What new minds are evolving? Is Bayerisher Rundfunk's Space Night not already some mutant form of techno-ecological awareness with a ghostly digital satellite I/eye in the sky and the earth for a body? Suddenly, de Rosnay's scenario of a planetary network brain begins to sound at least a little less like the *donnee* of a science-fiction screenplay.

Mind as Mimetic Morphing Memory

A necessary contributing factor to the notion of "cognitive symbiosis" between human minds and external memory systems is a change in the predominant idea of the mind/brain itself. In essence, we find in cognitive science, neurology, and philosophy of mind a trend toward a materialist emergent position: the "mind"--consciousness, memory, a sense of personal identity--is increasingly seen as an emergent property of processes that range from atomic and molecular behavior to the transmission of nerve impulses through neurons. The brain, in other words, becomes an assemblage, whose capacity for emergence is predicated precisely on its relational velocity and the capacity for its components to affect and be affected by others.

How are these characteristics measured? Most books about the brain begin by calling it "the most complex object in the universe," because of the unimaginable speed and number of signals being sent simultaneously. The cerebral cortex alone has around ten billion neurons that are interconnected by about 100 million billion synaptic connections. Speed and capacity for being affected are more than astronomical: If you could count one connection per second, it would take 32 million years; if you stuck a match in someone's brain and counted the connections on the head--the match's head, that is--you'd find about a billion of them (Edelman, 6).

Neurologist Gerald Edelman provides a machinic description of the brain that accounts for the emergence of thought under the name of "neural Darwinism." In Edelman's account, the genetic program of DNA provides groundrules for the division and interconnections of a relatively undifferentiated mass of trillions of cells, and how neural pathways and groups then begin to form as the organism interacts with the environment; these connections get strengthened by repetition. Deploying neuronal groups -- brain cell clusters randomly wired together, each in a different way--the brain uses a kind of selection process to mold itself to the contours of the outside world. When an unfamiliar stimulus enters the brain through the senses, many groups of neurons respond, but some happen to be configured in a way that makes them respond more strongly than the others, because they fit the stimulus better. This resonance between signal and circuit sets off a biochemical reaction which strengthens the synaptic links between neurons. Consequently, this group of neurons will react to the stimulus more strongly in the future.

The key "emergentist" element of Edelman's theory is that this process underlies the dynamics of the brain across several levels: different neuronal groups and topographical regions of the brain are linked up in recursive loops of connections; these connections are "mappings" that

enable systemic properties to evolve out of the interacting groups and regions. These neural configurations and behaviors are how the brain's recursive dynamics generates new categorical capabilities or modes of thought. This mode of learning is a form of "memory," since it functions through 'recognition.' Edelman defines memory as "a system property": in bare, functional terms, memory means that "previous changes alter successive changes in specified and special ways" (29). This system property functions on several levels, from hereditary memory at the genetic level or the 'memory' of antibodies on the level of the immune system. The brain is therefore a dynamic assemblage, always engaged in what Edelman terms "recursive synthesis," a kind of ceaseless selection process where impressions, thoughts and ideas emerge out of the tangled play of bottom-up interactions.

I must confess that I became interested in all this partly because the machinic language of the brain is simply magnificent, and the accompanying diagrams always compelling: "thought" is propogated from one cell to another by nerve impulses received through synaptic contacts on dendritic trees; neurotransmitters send these signals hurtling across synaptic clefts on their way through axons to the axonal trees; and oh, by the way, "the vesicles are floating in the bouton" (Scott, 67). Is it any wonder that Deleuzians celebrate "the rhizomatic plasiticity of neuronal development" (cite)? The brain-assemblage is quite, well, rhizomatic, or reticular, if you are particular--the brain functions by retiulation, it forms up into networks.

Now back to the larger point, in case you can't see the forest for all these trillions of trees. The idea at hand is that a symbiosis between human biological wetware and technological hardware becomes imaginable when, let us say, human memory becomes "a system property" that can be given a functional description and thus links up easily to "external memory systems." The human

cerebral assemblage, in other words, appears as a sort of communication network itself. This marks a shift from a traditional cognitive science and early artificial intelligence paradigm where the brain was metaphorically understood as manipulator of symbols, a processor of information. Now, the brain is a network wherein "symbols" and "meaning" correspond to global properties of local interactions and connections. Once the brain is conceived of as a communications network in itself, it becomes precisely the type of assemblage that would encourage us--or de Rosnay at least--to entertain the idea of the brain as a node in a world wide web brain-network. De Rosnay, extrapolating a model he draws from Jean-Pierre Changeux's book *Neuronal Man*, unfolds the analogy this way:

> Placed in a nurturing environment, neurons in a culture divide themselves, forming extensions and filaments which permit them to be connected with one another.... The entire history of communication on earth expresses itself along similar lines: the formation of networks, physical or immaterial, by direct contact, through chemical signals, the circulation of electrons, of sounds or images; between molecules in cells, between cells in the organism, between individuals in animal or human societies. (de Rosnay, 11-12; my translation).

The chief enabling feature of the cerebral assemblage that this scenario presumes is the suppleness a materialist emergentist account attributes to human minds and memory. In this avatar of philosophy of mind, human brains are defined not by a capacity for language or analytic or imaginative thought, but by a flexibility in internal organization and morphology, an adaptive openness to new linkages with the outside. The cerebral assemblage as "recursive synthesis of heterogeneities." When this description of the brain is linked back to Donald's thesis, the provocative implication is that the inside of our heads are increasingly susceptible to being rewired by using and learning from external memory systems. If this is so, then as we become more and

more logged onto or jacked into these external memory systems, won't the speed of external memory machines then speed up the process of rewiring the human brain? And if memory is indeed understood not as an internal psychological function but as a system property of the brain, then won't the human-machine relation evolve to the point where we live amid a sense of prosthetic memory? Is memory the way we will morph in the 21st century?

It is but a short step from these kinds of questions to fantasies of a total symbiosis between humans and machines where human memory runs on technological hardware. This is the dream of what Hans Moravec calls "digital immortality," a state achieved by downloading one's mind into a computer and thereby living forever (see Moravec 1988). Of course, this idea presumes that identity is a virtual or emergent aspect of the biological human, a dimension that can be encoded and therefore transferred to a different machine--one not so susceptible to rotting as flesh. Another machinic projection of the self toward extended life is the increasingly popular practice of cryonics: the moment you die--or as soon afterwards as possible--you are frozen and stored someplace, until such time and place that some machinery will thaw you into a new life form. Other sites could be enumerated, but clearly, a human symbiosis with "external memory systems" is beginning to assume new meanings.

(Question: cryonics offers the options of having your whole body frozen or just your head. So, which would you choose? A true litmus test of personality.)

WERBUNG--A Two-Minute Spot for TV

But now let's leave this little shop of technoscientific horrors in order to consider briefly the implications of this cognitive ethology in the more immediate cultural context. What do we do with

the idea that human memory seems ever more able to reconfigure itself and is more and more densely linked to external memory systems, when the dominant "external memory system" today is not the WWW or the PC but the TV, that machine of collective amnesia? It's a tired riff, I know, but on TV collective cultural memory is reduced to and transformed into a storehouse of images that can be recombined in any way called for by the context of consumption. Jameson cogently diagnosed this process as a "loss of historicity" brought on by postmodern techniques such as collage and pastiche, and media critics like Neil Postman have done detailed work on how this process plays out in specific contexts.

But more is involved here than a forgetting or vacuity, a loss of some genuine history in a flurry of imagistically induced temporal and cognitive confusion. Now we see something like the virtual synthesis of history and personal as well as cultural memory: as the consumer media train our perceptual apparatuses, as the speed of image-flow entrains our capacity to be affected, external media memory becomes injected into our own personal sense of memory, and we feel it as it were our own. This rather overly-Baudrillardian sounding vision can be grounded in a simple example: the fact that many ads are designed to induce in the viewer a nostalgia for something they have never experienced except as image--such as the American TV ads aimed at the 17-25 year olds that splice together images of Beat writers like Kerouac or feature William Burroughs. Such viewers feel an intense connection with a literary/cultural rebellion, even though they live it only by vicarious consumption. These ads create what cultural anthropologist Arjun Appadurai calls an "imagined nostalgia"--a simulated desire for something that feels as if it were experienced and lost, when it is actually only created as an ephemeral illusion to induce a fleeting longing or fondness. In effect, this imagined nostalgia redistributes the attractors of our emotions and memories, ultimately

reconfiguring the internal sense people have of their lives in subtle ways, and altering the links they feel to preceding generations.

In this type of consumption-based repetition of the past, then, much more is at play than a merely passive absorbtion of recycled images. Creating various images of the past also reconstitutes the very concept of the past or history or time. As Appadurai writes, consumer media repetition of images "is not based simply on the functioning of simulacra in time, but also on the simulacra of time. That is, consumption not only creates time, through its periodicities, but the workings of ersatz nostalgia create the simulacra of periods that constitute the flow of time, conceived as lost, absent or distant" (78). In other words, consumer media reattune us to time from the bottom-up: the rhythms of their presentation enact temporal patterns and cultural histories that we internalize on many levels. These media, tuning our neurons to neurotic speeds, "naturalize" life in consumer culture--they are part of a larger set of information flows that make up the rhythms of life at the turn of the millenium.

Complexity Goes Global

This line of thought would feed nicely into a neo-Heideggerian critique of technology predicated on a distinction between an existential time into which we are thrown and a technological time that sort of artificially inseminates itself into our lives. But the limitation of this line on technology is that--in its American avatars at least--it posits a mimetic model where life imitates technology. This not only runs the risk of granting technology some kind of given status and autonomous agency--but it is also all too soon a reductive and--if I may say so--simply boring way to conceptualize technology in the first place. Both the seductive promise and real danger

posed by technologies today grow out of what we might call the productivity of machines. Technologies do not only compute answers to prescribed problems or impose attitudes on us from some ideological command center; technology has become a means of experimentation, of assembling new assemblages, of synthesizing emergence in virtual forms. We are approaching a point where, to the degree that technologies and machines become more 'vital,' humans become increasingly peripheral.

This transformation in the machinic domain is viscerally visible in the contemporary "sciences of complexity" and related practices such as "artificial life." What began in chaos theory with running simulations to describe the behavior of complex nonlinear systems has crossed a threshold and become the writing of algorithms that persist as information strings in a computational ecosystem. As Artificial Life guru Chris Langton puts it, "A different approach to the study of nonlinear systems involves the inverse of analysis: *synthesis*. Rather than start with the behavior of interest and attempt to analyze it into its constituent parts, we start with the constituent parts and put them together in the attempt to *synthesize* the behavior of interest" (Langton 1989: 41). In the sciences of complexity, the "behavior of interest" is "complexity" itself. Complexity is defined as an emergent systemic behavior that is orderly but flexible, that has a degree of stability at the level of the whole but can accomodate and adapt to new local events. Complexity is thus said to reside "at the edge of chaos": i.e., between the extremes of order and chaos. In an "ordered regime" or configuration, a system's components evolve into a fixed configuration that is closed to new input, while in a chaotic regime any small perturbation sets off cascades of effects. Order means frozen intransigence; chaos means constant turmoil. Complexity means discernible structure and supple order. Scientists do not analyze complexity but get it to emerge in networks by

tweaking and tuning the algorithms and rules that govern the interactions of components interact. In networks that display complexity, the computer ecosystem falls onto attractors, regions or patterns of relative stability. What these attractors mean depends on the field of "application": in ecology, attractors could represent foodwebs; in theoretical biology, they might signify morphogenesis; in sociobiology, insect colonies, and so on.

The wider cultural significance of the sciences of complexity though lies in the ways in which scientific theories are "applied" to a range of problems in areas such as economics and globalization. In an interesting recursive interplay, humans synthesize emergent behaviors in computer ecosystems, and then extrapolate from them the solutions to knotty problems in the world around them. In this vein I would like to discuss the work of Stuart Kauffman, a charismatic figure in complexity science and original member of the Santa Fe Institute. The SFI functions as a think tank/research facility where experts from many different fields gather to adduce a common theoretical framework for studying complex systems. In recent years, the Institute has diversified, one might say, and branched out into corporation consulting. Kauffman's field is theoretical biology; in 1993, he published a widely read and praised technical book, *The Origins of Order*; followed two years later by a popularized version of his ideas in *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. Within an ethology of emergence in the context of globalization, *At Home in the Universe* is an important text, for it tells a compelling story of emergence as a machinic property of life, while also deploying synthesized models of emergence as templates for strategies and policies of globalization.

As even a quick look through *At Home in the Universe* shows, its governing trope is capital. Kauffman's language purposively depicts ecological, economic and planetary problems and

processes as isomorphic systems of exchange: "We are all trading our stuff to one another. We all must make our living. Might general laws govern all this activity?" (Kauffman 1995: 16). Kauffman searches for such general laws by using networks based on Boolean logic to create "computational ecosystems" that simulate "fitness landscapes," model environments that provide insight into "niche creation and combinatorial optimization" (Kauffman 1995: 282). Kauffman's work seemingly revises the Darwinian/Spencerian image of socio-economic relations with a strikingly beneficient rhetoric: the ecology as a system of economic exchange is seen not in terms of competition, mutual destruction and consumption, but as a system where "self-organization arises naturally," spontaneously creating orderly patterns that maximize efficiency in the system. Kauffman's trademark phrase for this scenario is "order for free," a credo whose metaphoric registers include economics, energy and politics.

One could say that *At Home in the Universe* is itself an assemblage that synthesizes these heterogeneous domains into a rhetorical network. Thus emergence in computational ecosystems provides a political-economic blueprint for globalization: Kauffman proclaims that "the edge of chaos may even provide a deep new understanding of the logic of democracy": indeed, "democracy may be far and away the best process to solve the complex problems of a complex evolving society, to find the peaks on the coevolutionary landscape where, on average, all have a chance to prosper" (Kauffman 1995: 28). The idea is problematic on many accounts--if Kauffman bases a politcal preference for democracy on the basis of economic prosperity, then how would the success of Indonesia fit into his model? Moreover, democracy as "far and away the best process" for finding maximal economic efficiency turns less democratic at times--a somewhat Spencerian-sounding virus infects Kauffman's rhetorical software in the chapter "In Search of Excellence," where his fitness

landscape simulations uphold a 'survival of the fittest' ethos. The technical inference from the model is that "In conflict-laden problems, the best solutions may be found if, in some way, different subsets of the constraint are ignored at different moments" (1995: 269); when translated into specific economic practices through SFI's corporate consulting, the scientific model's demonstration that "the best solutions" involve ignoring "different subsets of the constraint" essentially justifies massive corporate downsizing. This synthesis of neutral machinic description and real world analogues is Kauffman's rhetorical trademark: describing the behavior of his virtual systems, Kauffman says "Diversity begets diversity, driving the growth of complexity. Such ideas might eventually have policy implications. If diversity matters, then helping Third World countries might be better accomplished by fostering cottage industries that create a local web that is mutually reinforcing and can take root and grow, rather than creating the Aswan Dam" (1995: 297).

Here it seems apt to interject Rob Wilson and Wimal Dissanayake's injunction that "in this era of uneven globalization and the two-tier information highway, [many discourses] can sound like a way of making the world safe and user-friendly for global capital and the culture of the commodity form" (Wilson and Dissanayake 1996: 2). Certainly, Kauffman's gushingly enthusiastic extrapolations could be made with a more prescient eye to the consequences of the flows of capital that his simulations would entail. The hope that First World capital would nurture cottage industries in the Third World sounds rather naive; the primary form of transaction has come through the multi-national corporation's expansion into new sites of production that cut costs while opening new markets: "Transnationalization of corporate identity . . . implies a process of *global localization*: crossing borders and segmenting markets via flexible production" (Wilson and Dissanayake 1996: 5). Perhaps the biological model that best describes the economic relations

between "developed" and "developing" nations is not Kauffman's "order for free" but Whitehead's pithy riff, "life is robbery" (Whitehead 1978: 105).

Complexity Science: The Journey Home

This critique of Kauffman's take on globalization, however, only engages a small part of the story told in *At Home in the Universe*. For Kauffman, the stakes are even bigger than globalization: he sees complexity science as "a new way to think about origins, evolution, and the profound naturalness of life and its myriad patterns of unfolding"; ". . . through this new science," Kauffman hopes, "we may recover our sense of worth, our sense of the sacred" (Kauffman, 4-5). Thus from the outset Kauffman forges a link between the cutting edge techno-virtual and the spiritual-archaic. He relates how he learned the importance of recovering the sacred from Native American author N. Scott Momaday, and frames the narrative with meditations on the Santa Fe Institute's surroundings. After describing the New Mexico landscape outside his window, "home of the oldest civilization in North America," Kauffman recounts a conversation with Gunter Mahler--a theoretical physicist from Munich--where the two scientists agree that this terrain provides a fitting image of Eden. Perhaps, Kauffman and Mahler speculate, this spiritual resonance stems from the resemblance of the New Mexico plains to East Africa, where the earliest human remains have been found. They thus infer that "we might conceivably carry some genetic memory of our birthplace, our real Eden, our first home." Kauffman's narrative is, then, a voyage back to this lost origin; and it is science that should restore us to our "home in the universe," Kauffman tells us, because it was the rise of modern science that deprived us of our faith: Kauffman's aphorism

"Paradise was lost not to sin, but to science" could serve as the epigraph for the film version of the book, "Complexity Science: the Journey Home."

This phrase flashed into my mind when I was looking at the \cover of *At Home in the Universe*, which plays off of and into several registers of cinematic and science-fiction association. The jacket's background is a color image of the universe generated by the National Air and Space Museum. Placed next to the bold, white capital letters of the title "AT HOME IN THE UNIVERSE" is a computer-generated image of a footprint; a red dashed line links the footprint inset to a yellow-circled spot in an image of the earth generated by NASA; another red dashed line connects the earth inset to a yellow circle that presumably designates the earth's location in the universe. There is a kind of stunning, cosmic anthropomorphism at work here: like a spruced up rendering of the T-shirts that have an image of the universe on the front with an arrow pointing to an encircled dot that bears the legend "you are here," the book's cover in essence makes the footprint, signifier of human origins, the most significant point in the universe. The Copernican revolution that decentered humans and the earth from their privileged place in the universe is met by a counterrevolution: one small footprint of man, one big footstep for mankind. While the words "The search" next to a circle around a small planet in the universe usually refer to a search for alien intelligence, here, the adventure is a search for scientific "laws" that describe our integral place in the universe; the cosmic time-travel signalled by a search for alien life on a distant planet becomes an anthropological-evolutionary time-travel back to our origins. "What a long strange trip it's been."

We cannot judge this book by its cover, of course, since it discloses a substantial and specific scientific narrative. Kauffman's central idea is that evolution is driven not only by natural

selection and random variation or chance mutation, but also by self-organization. This marks a major revision of the Darwinian narrative of human origins, especially in its contemporary expression through molecular biology--Jacques Monod's famous aphorism being that evolution through natural selection was "chance caught on the wing." If, by contrast, the "laws of self-organization" play a central role in the origins of life, then the human species does not appear as just another "tinkered together contraption" of evolution, but the inevitable target of natural selection. Kauffman argues that the intricately ordered features of ontogeny in particular are hard to account for in terms of selection alone; he maintains that these features arise from the self-organized behavior of complex genetic regulatory systems, and self-organization is so integral a part of this behavior that "selection cannot avoid that order" (1993: xvii). Thus Kauffman's evolutionary credo: "Not we the accidental, but we the expected" (8)--spiritual succor for a lost species.

The question Kauffman must answer is, why would complexity or self-organization be a natural target of natural selection? Recapping the whole concept of "complexity as life at the edge of chaos," complex systems would be selected by natural selection because of their ability to maintain and replicate themselves in the face of perturbations from the environment. And what explains this ability? Self-organization. And what is the motive drive in self-organization--or, what is the "self" of self-organization? It is a parallel-processing internal structure that enables a system to "perform extremely complex computations" that allow for "more complicated dynamics involving the complex coordination of activities throughout a network" (Kauffman 1982, 82). Thus in a sense the information processing capability embodied by the dynamics of the network signifies the evolutionary fitness and stability of the natural entity. The larger implication is

succinctly summarized by Chris Langton: "the edge of chaos is where information gets its foot in the door in the physical world, where it gets the upper hand over energy" (Lewin 51).

Now, there seems to be a weird form of circularity at work here. In our narrative, we see a new form of machinic assemblage, the computer simulation, synthesizing emergence as a virtual behavior. In Kauffman's narrative, the machinic properties that enable this to occur, "complex computations," is read back into the evolutionary tale of origins. Or, more grandly put, technoscience at the end of the 20th century generates new graphic inventions housed in external memory machine that have the power of suggestion to make us recall how humans came to occupy an inevitable, and therefore sacred home on earth and in the universe. Evolutionary narratives are always inscribed in this kind of strange temporal loop, in that they retroactively construct a theory of how things 'evolved' into the state that they are now. But in Kauffman's narrative, where Boolean nets and computer simulations play a central performative or demonstrative role, it is as if the "external memory systems" remember how it is that humans came to be. Or, in Rich Doyle puts it, "who or what would have expected us, except a simulacrum?"

A Re-emergence of Imagination

The ethologist turns away now from scientific narratives of emergence, and, nostalgic for the Lit Crit persona he has long since abandoned, looks around for alternative narratives, more creative morphologies of emergence. But the search is constrained by the Cultural Critic's stern admonishment that the lit game is played differently when the field expands and includes globalization. How can any creative, socially meaningful assemblages emerge in the techno-virtual domain? A theoretical answer may be formulated by linking Donald's thesis that humans act, think

and evolve in "cognitive collectivities in symbiosis with external memory systems" to Arjun Appadurai's take on globalization. Appadurai argues that the primary driving forces in globalization are widespread electronic mediation and mass migrations. Both of these forces, he argues, open up a revitalized function for a redefined idea of what he terms "the work of the imagination." Emergent diasporic cultural formations must invent themselves anew, combining disparate circumstances and traditions into new fultural forms. Electronic mediation provides some of the means by which such work is carried out.

From the ethologist's standpoint, Appadurai gives a machinic account of imagination as a form of emergence. More precisely, we could say that Appadurai gives a materialist account of the work of the imagination. Imagination, he says, is not an individual faculty; it is also not simply a mode of contemplation, fantasy or escape. In its properly collective sense, Appadurai theorizes imagination as "an organized field of social practices, a form of work (in the sense of both labor and culturally organized practice), and a form of negotiation between sites of agency (individuals) and globally defined fields of possibility.... The imagination is now central to all forms of agency, is itself a social fact, and is the key component of the new global order" (31). Translating collective imagination into a model of machinic emergence, we would say--this work occurs as several dispersed people begin to exchange words, forging connections that build in number and speed; soon, the justification or idea of why they are doing so emerges as a collective identity--a process comparable to what Benedict Anderson saw in "imagined communities." The emergent collective sense of what is being worked for or on is what then sustains the community's development.

Such an account frequently is met by the critique that collective work as carried out in virtual networks constitutes a flattening or loss of agency. In terms that reiterate Donald's notion

of "cognitive symbiosis," Judy Purdom acknowledges that "the PC revolution has brought communication between man and machine to a new complexity," to the point of "a real symbiosis between man and machine." But for Purdom, this symbiosis can be thought only as "the move towards a generalized regime of subjection which actually dissolves the notion of the individual as a distinctive agent; it make man an agent of inhumanization and the socius of a machinic production..." (124). Mediation thus produces a reduction of cultural differences, a cultural entropy that precludes emergence. Appadurai resists this idea: "there is growing evidence," he says, "that consumption of mass media throughout the world often provokes resistance, irony, selectivity and in general, agency" (7). As migration and mediation break down traditional boundaries, the cultural sphere becomes increasingly dynamic; Appadurai, while cognizant of the risks involved, asserts that this loss of traditional ground simultaneously makes it possible to rethink the "cultural," to move it from spheres of kinship or ethnicity into a permeable and changing space, a constantly shifting emergent work actively produced through imagination.

Sleepless in Seattle

I will end simply by invoking some work of collective imagination that is explicitly informed by a view that culture is something to be made, and that new media enable certain forms of such production to assume new morphologies. I am speaking of a writing collective called IN.S.OMNIA that originated in the Seattle area in 1983 as an electronic bulletin board where people carried on different "conversations" taking place in "rooms." Ever since, Insomniacs--so named because they lose sleep to their work--have continued to investigate the potential of new media to reappropriate the work of culture. In *Invisible Rendezvous: Connection and*

Collaboration in the New Landscape of Electronic Writing, a published manifesto of their work and ideas, IN.S.OMNIA announces that rather than "look[ing] for 'the next big thing' in literature," we should realize that perhaps "the next big thing already surrounds us, embedded in small gestures we perform every day[.] What if the next big thing is the realization that we have changed the way we use culture--remapping, rewiring, renetworking the same old pool of elements in new ways, adding to them furtive scribbles, seeking pleasures without naming them?" (8). Insomniacs thus think along the lines of Appadurai's definition of the work of imagination as a social practice and definition of the cultural as an ongoing project.

It is not a genre or type of writing Insomniacs are after, but "WRITING THAT DOES NOT KNOW WHAT IT IS." Thus Insomnia seeks something more like a narrative mode or habit of mind, one that "requires cunning, speed, and multilevelled thinking. Sophisticated techniques of irony, punning, and collage are used for their efficiency. Quick acts of selection and linkage are the name of the game" (6). IN.S.OMNIAc practices include using canonical classics to create hybrid texts, such as "Miss Scarlett's Letter," a crossbreeding of Hawthorne's Puritan New England with Margaret Mitchell's antebellum South. They invent practices that comprise scripted analogues to digital sampling or improvisational rapping: imagine, they say, literary cover versions of classics--Mailer's *Moby Dick* or Ashberry's *Don Juan*--and insomniac Strange Justice asks, "'Wouldn't you love to see *The Waste Land* remixed?" (89). (Of course, pound for pound, the "original" was already one of the better remixes in the history of the canon.)

The most sustained work of imagination undertaken by IN.S.OMNIA involved a project begun in the early 80's called Invisible Seattle. The idea was to create neither a "world apart" nor "a reflection or imitation" but an "alternate use" of something already persisting, "with which it

coexists and which it interpenetrates" (118). Examining the urban space, the "invisibles"--as they deemed themselves--asked, "'Who describes America now?'"--the developers, merchants, politicians, who mainly erase reality to erect a profitable substitute. At first, Invisible Seattle was a small group collaboration, a fictional reappropriation of the ostensibly 'real' Seattle, an imaginative act of revenge for all the subdivisions that get named for the geographical features they destroy. They drew up a map of Invisible Seattle, where Seattle landmarks are recast: the Kingdome becomes the Coliseum of Rome, dubbed the Dome of Kings; an office tower morphs into Breughel's Tower of Babel, which the legend names Bibioteca Jorge Borges; the Space Needle is restored to its quoted source, the Eiffel Tower. And Invisible Seattle can best be seen by riding the monorail, renamed "The Disorient Express."

But then the project, well, emerged--local connections and contingent events began to add up, until the project exfoliated into a more fully blown social event. The rallying cry became "Function Follows Fiction," meaning that the use of the tanglible city could be reclaimed by being reimagined and rewritten by its inhabitants, and the ultimate goal became to "tickle a city into writing a novel about itself." Literary workers in hardhats took to the streets, and flyers went up around the city inviting people to record events at specific locations, to rename buildings, to develop "three zones of INVISIBLE SEATTLE: the Ignored, the Imperceptible, and the Impossible" (35). To feed popular interest and play into the ludic, participatory spirit of the project, the Invisibles invented new writing tools. Sculptor Clair Colquitt assembled the "first of a new generation of literary computers," the Scheherezade II, later followed by the Insomnium, a writing station done in video game format providing "a genre of literary engagement limited only by time and spare change" (100). This all eventuated in the Invisible Seattle Novel Project being

installed in the city museum, where Seattle mayor Charles Royer stepped through Scheherezade II and "threw out the opening word," and for four days thousands of people came and read, wrote and edited a growing text. Finally, in 1987, the novel *Invisible Seattle* was published.

Mutant Professors

One can easily level any number of objections and critiques against this breezy picture of Insomnia and an optimistic trust in the work of collective imagination. The simple fact alone that the vast majority of conversation on the Internet shows absolutely no imagination precludes that Insomnia poses any kind of "solution" to the "problems" that such work must overcome. But the beauty of Insomnia's work lies precisely in its tenuous, local quality--the contingency of one project's success being confirmed by all the failed ventures and lame texts produced in the meantime. From within the safe and sage confines of academia, it is easier to sit back and watch the nasty tentacles of globalization spread than to jack into the dreck-filled information highway, more comforting to use PC's to describe the evils of technology than to learn how to play with them. But academia as a project, if it is survive in a sustainable form, must itself produce its proper forms of emergence. Perhaps the Insomniac ethos of ludic openness and lucid speed, textual excursions and ironic incursions, could be mobilized in the service of an intellectual commitment to collective works of imagination. In spite of our worst fears, culture cannot be homogeneized by machines as easily as milk can. We are no longer the sacred cows we once were, but then, maybe we can have more fun than we used to.

References

Appadurai, Arjun. *Modernity at Large: Cultural Dimensions of Globalization*. Minneapolis and London: University of Minnesota Press, 1996.

Deleuze, Gilles. *Spinoza: Practical Philosophy*. Trans. Robert Hurley. San Francisco: City Lights, 1988.

Deleuze, Gilles, and Felix Guattari. *A Thousand Plateaus: Capitalism and Schizophrenia*. Trans. Brian Massumi. Minneapolis: University of Minnesota Press, 1987.

De Rosnay, Joel. *Le Cerveau Planetaire*. Paris: Olivier Orban, 1986.

Donald, Merlin. The Origins of the Modern Mind: *Three Stages in the Evolution of Culure and Cognition*. Cambridge, MA: Harvard University Press, 1991.

Edelman, Gerald. *Bright Air, Brilliant Fire: on the Matter of the Mind*. New York: Basic Books, 1992.

Kauffman, Stuart. *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. New York: Oxford University Press, 1995.

_____. *The Origins of Order: Self-Organization and Selection in Evolution*. 1993.

_____. "Antichaos and Adaptation." *Scientific American*. August 1991 Vol. 265 (no.2): 78-84.

Langton, Christopher, ed. *Artificial Life VI*. Boston: MIT Press, 1989.

Levy, Steven. *Artificial Life*. New York: Vintage Books, 1992.

Lewin, Roger. *Complexity: Life at the Edge of Chaos*. New York: MacMillan, 1992.

Moravec, Hans. *Mind Children*. Cambridge, Mass.: Harvard University Press, 1988.

Purdom, Judy. "Postmodernity as a Spectre of the Future." In Keith Ansell Pearson, ed. *Deleuze and Philosophy: the difference engineer*. London and New York: Routledge, 1997: 115-29.

Scott, Alwyn. *Stairway to the Mind*. New York: Springer-Verlag, 1995.

Waldrop, M. Mitchell. *Complexity: The Emerging Science at the Edge of Chaos*. New York: Simon and Schuster, 1992.

Whitehead, Alfred.North. *Process and Reality*. Corrected Edition, ed. David Ray Griffin and Donald W. Sherburne. New York and London: The Free Press, 1978.

Wilson, Rob and Wimal Dissanayake. "Introduction: Tracking the Global/Local." In Wilson and Dissanayake, eds. *Global/Local: Cultural Production and the Transnational Imaginary*. Durham, NC: Duke University Press, 1996: 1-18.

Wittig, Rob (for IN.S.OMNIA). *Invisible Rendezvous: Connection and Collaboration in the New Landscape of Electronic Writing*. Hanover and London: Wesleyan University Press, 1994.