Designs on the computer
Annette LeCuyer
p. 26

Computers are now common currency among architects. Because the most widely used systems and software packages are those developed specifically for the profession, they consequently tend to serve architectural preconceptions about form-making, relegating computers to mere tools of production. However, some architects are transcending these limits by borrowing creatively from other disciplines, using widely divergent computer means and ends.

From the early days of studs and chain link – what Anthony Vidler calls 'bricolage populism' – the work of Frank Gehry has evolved into increasingly complex and monumental assemblages. Despite their plastic complexity, the schemes are still all conceived and developed manually through physical models. For conceptual work, Gehry firmly contends that models and drawings are much faster and more responsive than computers. However, it is the daunting task of building Gehry projects which has led the practice to embrace computers.

Gehry's office uses Catia software on IBM RISC 6000 computers. Originally developed by the French aerospace experts Dassault Systems for the design of fighter planes, this software is significant because it is based on surfaces in lieu of polygons. Since the system was released to the public 10 years ago, it has been adopted by industry with dramatic results. For example, Catia has been instrumental in enabling Chrysler Corporation to compete successfully with Japanese manufacturers by reducing the research and development period for new models from 72 to 36 months. Chrysler is currently working towards 24 months, an overall 67 per cent reduction of the R &D cycle.

Previously, Chrysler developed their designs for cars using artists' sketches, technical drawings, and clay models on plywood armatures laboriously made by teams of technicians. Neither aesthetics nor cost could be effectively evaluated until the physical models were complete, and changes were costly. Now, as designers sketch three-dimensional surfaces on the computer, Catia simultaneously translates all information into a geometric database which governs the milling machines which produce the clay model and controls the final manufacturing process. Chrysler has also developed full-size three-dimensional colour modelling with high speed animation, a system which is making physical models obsolete. Because aesthetic and cost judgements can be made using computer models, modifications can be entered readily in the database and evaluated virtually instantly. The benefits for a competitive product-based industry – the reduction in design and production time and therefore unit cost – are obvious.

Like Chrysler Corporation, Gehry's office is using Catia for surface modelling of non-polygonal forms. Their primary aim is not to reduce design time but rather to make their projects more buildable. Materials like the render of the Vitra museum (AR November 1989) and the sheet metal of the University of Toledo Centre for the Visual Arts (AR August 1993) have a built-in tolerance which is forgiving of Gehry's complex and fluid forms. However, producing the same forms in stone presents an enormous technical challenge.

The recently completed American Centre in Paris (AR August 1994) was designed and built without computers. Consequently, it was difficult to produce the complex surfaces to a level of accuracy sufficient to eliminate the 'pillow' effect of discontinuous curvature from stone to stone. In contrast, the stone cladding for the Disney Concert Hall in Los Angeles has been developed with computers, using Catia both for design and cost control. Using the thickness of the raw block of stone and cutting time as prime governors of cost, it is easy to understand that cost increases geometrically with the progression from flat surfaces through to single, double and complex curvature. Gehry's design – made by hand – was digitised, then rationalised by Catia to achieve repetition without sacrificing form. Using the database of the rationalised design, a physical model was computer milled, compared to the original cardboard model and adjusted where necessary.

The Catia database, which has also been used to generate construction documentation, has subsequently been passed on to the stone subcontractor. The stone cladding and cladding support package was tendered to 14 firms with three- and five-axe milling capability. As part of their submission, four shortlisted tenderers were required to build a 3 x 8 metre piece of wall using only numerically controlled computer milling. The selected subcontractor, Harmon Contract from Minnesota, is $500 000 under budget, or four per cent of the $11.5 million subcontract package.

This happy result is not unique to the Disney project. Gehry's Prague office building further explores complex curvature, contrasting precast concrete with steel and glass. Using the Catia database together with Pro-Engineer software on Sun computers, the architects have been able to model the glazed surfaces to ensure that every adjustment remains within agreed parameters. Pro-Engineer also identifies clearances and interferences. All mullions are complex curves and, while the glass is flat, no two pieces are the same shape. The initial budget for the glazing package was $200 per square foot. With the help of Catia models to detail fabrication and layout, Gehry has worked closely with the subcontractor, the Italian firm Permasteelisa, to reduce the cost by one-third to $135 per square foot.

While many architects are putting more and more design responsibility in the hands of others, Gehry's use of computers has led the office into closer relationships with contractors and direct relationships with suppliers and subcontractors. By generating the database to which everyone works, the practice increases its responsibility. The hope is that the accuracy of the information and the elimination of middlemen reduces everyone's cost and risk, and makes the schemes more buildable. However, notwithstanding the high degree of accuracy of computer generated construction documentation, the achievable tolerances for both fabrication and erection which are inherent in the materials used remain largely unchanged, and Gehry is conscious that this must be kept in mind continuously when working with computer models.

While Gehry has turned to the computer as a pragmatist, Peter Eisenman is using computers as the conceptual starting point for his most recent projects. Seeking to break free of Cartesian absolutes as a priori beautiful forms, Eisenman is using the computer to explore more dynamic, unpredictable systems of organisation. He is seeking to release architecture from the restriction of being object-oriented to become textual – that is, to convey the process of being conceived.

In his search for a design inventory which is free of human preconceptions, Eisenman has married Form Z Macintosh software to natural phenomena such as waves, quasi-crystals and slime moulds, all of which, in his terms, have no a priori knowledge or contingencies. The so-called contextual clue for the parti of his Haus Immendorff project in Düsseldorf is the 'turbulence' of a river inlet adjacent to the site. The starting point is a cube deformed by soliton waves, a dynamic system bordering on chaos. Solitary waves are physical phenomena that occur in seemingly random ways, but are caused by measurable physical factors such as abrupt changes in depth or subterranean seismic patterns in water. Doubling the solitary wave forms solitons, pulses of energy moving through solids, liquids or gases which form non-linear interactions. These non-linear interactions do not lead to chaos, but instead produce spontaneous self-organising emergent systems. For Eisenman, the soliton analogy for the deformation of the cube has produced outer and inner volumes whose surfaces intersect as they twist vertically, forming a vortex-like cone of space. The form could not have been foreseen but was discovered only through the computer. The recording of an emergent system is the objective of the design process. To build such a scheme – that is, to crystallise it as an object – may therefore be totally incompatible with its theoretical premise.

Eisenman's proposed Centre for the Performing Arts for Emory University in Atlanta is his first computer-generated scheme to bridge between theory and execution. The starting point is again Cartesian, made up of four programmatic typological boxes determined by the nature of the different performance spaces and, on a larger scale, the gridded masterplan of the university extended into nature like the Jeffersonian grid. These idealised forms are subjected to a series of deformations arising both from the

context of the site and from a non-material context that deals with the multiple layers of reality and meaning in the environment of the electronic information age of collapsing time and space.

A steep ravine on the site causes a deflection of the grid which Eisenman identifies as an impulse of energy registered as sine and cosine curves similar to sound waves. The multiple waves are built into a system of harmonics. Each wave is a product of the depth and the width of the ravine and is musically approximated in such a way that depth represents amplitude and width represents frequency.

Using these waves, the boxes are subjected to two deformations. The first Eisenman calls the small-scale fold which is contained entirely in a defined field of energy of harmonic lines; the second is the large-scale fold which spans two sets of harmonic lines. The resultant buildings are the intersection of the deformations, and the resulting forms are a product of always selecting the outermost envelope. The skin of the buildings is therefore composed of parts of both harmonic folds, and each harmonic fold is continuous beneath the skin. The results could not have been predetermined or designed but were entirely dependent on the manipulation of the computer. Using Autocad, Eisenman has translated the Form Z model of harmonic folds into construction documents which include both conventional drawings and a complex three-dimensional computer model and database for the buildings. The project is now ready to start on site.

Eisenman is the agent provocateur, using the computer not to save time or money but to challenge authority. He is looking for a means of transforming architecture into what he calls a 'condition of open writing' which is independent of brief and typology. It is a process which does not produce a 'guaranteed aura' for a building but which uses the computer to loosen the restrictions of architecture, provide absence instead of presence, and produce the unexpected.

Eisenman and Gehry represent extremes of American architectural discourse: cerebral East Coast and pragmatic West Coast. Eisenman's conceptual starting point is the computer; Gehry does not turn to the computer until well into design development. Eisenman's focus is on the interiority of collapsing time and space; Gehry, like Chrysler Corporation, is primarily concerned with surfaces. For Eisenman, who is engaged with the metaphor of design, buildings may not be the point; Gehry's objective is to transform an idea into physical reality. Through computers, Eisenman is looking for the unauthored process, while Gehry is producing the ultimate designer signature product.

Computer Animisms
Assemblage
p. 46

Something strange is happening right now in architecture but it's not what you think. It is not the formal strangeness of projects such as Greg Lynn's and Jesse Reiser/Nanako Umemoto's. Formal strangeness in architecture is now familiar. Instead, it is what one might call, crudely, the return of the sixties, of the geodesic dome (stretched) and of ecology. This event is happening in sophisticated competition entries (such as these) but also in the profession at large under the unfortunate rubric "sustainable architecture" adopted several years ago by the AIA. "Unfortunate" because architecture, unlike a forest, is not an ecosystem (although it leans on ecosystems). As with every cycle of history, however, there is a curious relationship between past and present. It is hard to return lightly to an epoch, take what you need, and get out cleanly.

The word ecology itself cannot be the same old ecology of the messy evangelical politics of the sixties green movement. It now must answer, at least in architecture, to its cultural "parts", its oikos (house) and its logos. We would like to suggest that the oikos and the logos of ecology in the 1990s is the computer and the theories and images of complexity it enables. The computer seems to be at its most powerful in the fields of biology and physics and, further, aspires itself to the condition of biomorphic intelligence. Computer discourse is replete with biospatial metaphors: pathways, networks, environments, structures, mutational systems, morphing, cyborg personas, prosthetic apparatuses, and so on. However, very little of this computer intelligence (technical and otherwise) has found its way into architecture. Form Z and Photoshop are now fairly widespread in architecture, as is AutoCad, but numerous technologies such as computer animation, virtual reality, stereo lithography, and other software/hardware applications are seldom used and, when they are, are frequently reductive and clumsy. So-called interactive computer technologies in architecture are mostly bad walkthroughs of the Parthenon. It is therefore of great interest to see these two projects by Lynn (working with Ed Keller) and Reiser/Umemoto.

All these architects are interested in the problem of the "supple". Reiser/Umemotos's theme is a version of the ornament/structure debate - the "structurally non-essential" and non-totalized condition of the geodesic building system. Lynn uses biological processes of growth and change to trope traditional architectural design assumptions. Reiser and Umemoto use the computer as a way of managing, and making real, complex curvilinear structures, much as Frank Gehry has done. Lynn and Keller use the computer as a generative instrument for systems of symmetrical and asymmetrical organization using theories of biological variation. Both projects use information from the Cardiff Bay Opera House competition site, in particular the Oval Basin, to govern and pressure design processes. Both projects believe in "vicissitudes" and "intuitions" and both could be described as biomorphic because both have jacked into computer programs that provide fluid permutational capabilities. "Fluid", in some oblique way, is a synonym for "body".

The "ecological" aspects of these projects (bioformal relations and infrastructural relations) are realized through "process studio" techniques tempered by non-automatic generative rules and critiques of the competition brief. Lynn begins with William Bateson's Rule that "when an asymmetrical lateral appendage [such as a right hand] is reduplicated [in a monstrous way], the resulting reduplicated limb will be bilaterally symmetrical, consisting of two parts each a mirror image of the other and so placed that a plane of symmetry could be imagined between them". The Rule was meant to "demonstrate regularity within the field of teratological variation". Gregory Bateson (William Bateson's son) brings to this rule another theoretical dimension, mainly cybernetics and information theory. Why, he asked in Steps to an Ecology of Mind, is the reduplicated appendage not asymmetrical like the corresponding appendages of normal organisms? His answer is that differentiation of one half from another is achieved by the reception of information from the outside (from neighbouring tissues and organs in the case of the appendage branch). Therefore, in a symmetrical condition, information has been left out or suppressed. Symmetry is thus not an underlying organizational principle but a "default" position. "Symmetry breaking" in architecture, Lynn concludes, is therefore not "a loss but an increase in organization within an open, flexible and adaptive system. Symmetry breaking from the exact to the anexact is the primary characteristic of supple systems".

Steps to an Ecology of Mind, which was published in 1972, is not so much about the science of teratology and the rules for the mutation of form as a search for "an ecology of ideas" that can help us understand the crisis of "man's relation to his environment" (an architectural problem if there ever was one). Bateson's thinking was important to cybernetics and is thus contemporary in a way that the phrase "ecology of ideas" is not.

Lynn's recovery of the formal principles of Bateson's project, without the utopian frame of an "ecology of ideas" - and, on the other hand, Reiser/Umemoto's use of the geodesics of Sir Barnes Wallis (the R-100 Airship and the Wellington Bomber) rather than, say, Buckminster Fuller (who was also a utopian thinker and who is currently back in vogue) - is important because the another utopia is in the process of construction in these two projects. That is, the now recognizably vague utopian projects of both Bateson and Fuller have been somewhat recouped by subjecting their "scientific" contributions to the diffuse utopia of the computer, a machine that can maintain and elaborate multiple relations (structural, social, genetic) ad infinitum. What is difficult

to see, at the moment, is the political and methodological content of these appropriations.

There is no question of proving that "internal directed indeterminacy and external viscissitudinous constraints" (Lynn) or the "flexible complexity" of geodesic models (Reiser/Umemoto) are the basis of a new supple architecture. The question is whether these modes of operation are persuasive in terms of the whole package: the design proposal, the text, the program, and so on. If the computer is to be of any use to architecture (beyond drafting, accounting, management), the graphic virtuosity enabled by the computer needs to be rendered in an extremely persuasive way to offset or forestall the inevitable (old) stuff about how real the project really is. But now the consequences of having refused to look at the projects in terms of their strangeness comes back to haunt us. Because the most amazing, and ultimately most persuasive, thing about these projects is that nothing has ever looked like this before. The projects have a "computer look" entirely different from AutoCad architecture. The metallic bulky pods (Lynn) and the crawling mass of geodesic structure (Reiser/Umemoto) seem to settle their own claim at the level of the look. But this is not entirely the case. Nothing looks different unless it is different and, further, it is virtually impossible to set out intentionally to find a "new look". One inevitably needs history and new-look machines and new-look theories and these immeasurably complicate the situation.

If, indeed, formal strategies (geodesics) and the connection of biology, structure, and site (ecology) have been resurrected from the sixties, infused with the nineties utopianism of the computer, and sent out into the playing field, we perhaps need only one more moment (the most leaden) to see if this is a new animal or an old one, the moment when someone calls up and says "here's some money, why don't you go build that thing". These projects are extremely provocative without that leaden moment, but at least some of the fragile criticality of this architecture lies in its own desire to be taken for built work, and this too belongs to the ethos of the computer.

The Renewed Novelty of Symmetry
Greg Lynn
p. 48

The competition brief for the Cardiff Bay Opera House was explicit about two expectations: first, that the project have a symmetrical horseshoe opera hall and, second, that the primary urban concern be a strong relationship to the historic Oval Basin. Initially, it seemed odd that in 1994, the authors of the competition would both ask for a new architecture and legislate formal symmetry. The dilemma inherent to these seemingly contradictory constraints became the catalyst for the project. After rejecting both the revolutionary potential of opposing these requests and the reactionary possibilities of supplicating to a predefined catalogue of Beaux-Arts partis, our design team decided to take a monstrously evolutionary position by incorporating both oval forms and symmetry so thoroughly that they could proliferate wildly in unexpected ways. Which is to say that the competition brief and its strange coupling of requests for newness and symmetry initiated the present discussions of novelty and symmetry.

The project became an experiment in the development of new concepts and techniques for contextualism. The competition organizers were emphatic in their desire for an institution that could be understood as absolutely continuous with its context while having a distinctly new identity. They hoped to reconfigure the defunct industrial waterfront as a cultural and recreational center while maintaining the urban fabric and atmosphere of the shipyards. We therefore attempted to evolve a new identity that could be understood as emerging from its urban, institutional, temporal, and cultural setting. To avoid the mere reproduction of the existing context, unification was approached through processes of differentiation rather than simplification, through mutation rather than duplication. We defined the new architecture as being "unattributably different yet continuous" - an architecture that cannot be localized within any previous context yet has been sponsored nonetheless by existing orders. Like a monstrosity that, despite its difference, can still be understood as inhabiting the familiar class of the normal, the project attempted to turn the indigenous information of its context into an alien novelty. In the design, the context was understood as a gradient field of generalized and unorganized information rather than as a repository of fixed values, rules, and codes. Our tactic was to treat the rusting technological husks of the ship-building industry, such as the Oval Basin, as the chrysalis for the incubation of a new urban structure. The maintenance of the Oval Basin and a compulsion for symmetry became the directives for differential growth. The progressive assimilation of differences within this system led to an emergent organization that was unpredictable at the outset and irreducible at its conclusion to either the external constraints of its context or the internal parameters of the competition program. This regime of dynamical organizations should be understood as neither neo-Platonist nor neo-Darwinist since it is not reducible to merely external or merely internal constraints. The resistance to both fixed types and random mutation makes flexible, adaptable, emergent, and generative systems provocative as a basis for contemporary techniques of organizations and explorations of dynamic architectural concepts of symmetry.[1]

After determining that the judges and authors of the project were very serious in their desires for symmetry, we specified a series of organizational guidelines for the project. The parameters of the project involved an adherence to rules of symmetry at all scales. Directed indeterminate growth became the motto for this approach, where a series of intuitions about abstract organizations (such as a predilection for oval basins and the symmetrical disposition of forms) were formulated as directives that would be triggered and guided by external constraints. We combined these intuited parameters with the contingencies of the unorganized context and began to study the generative fields that ensued as we organized the context. These generative fields emerged from the twofold constraints of internal directives and external vicissitudes.

During the design of the project, we became more interested in theories of symmetry and discontinuous variation developed by William Bateson in 1894.[2] What we found most striking about "Bateson's Rule" is the relationship between order and variation and homogeneity and heterogeneity. Bateson's insight, which has since been reaffirmed by his son Gregory, is that a loss of information is accompanied by an increase in symmetry. This seems plausible given that "iterative reduction through phenomenological variation" involves the elimination of difference (or more technically, what would be referred to as "alternations of deformation") toward a reduced "eidetic type". Here, the terms information and difference are almost interchangeable. Homogeneity is understood as sameness or lack of difference. And disorganization is associated with an absence of difference (information) and, therefore, symmetry. Thus are difference, information, and organization related. Gregory Bateson has gone so far as to define information as "the difference that makes the difference".[3]

William Bateson did not arrive at this theory of symmetry through classical reduction to types but rather by attempting to theorize processes of variation outside of their defective relationship to a norm.[4] His views on symmetry are explanatory rather than taxonomic. For Bateson, monstrosities and mutations are specific polymorphic expressions of growth and variation responding to particular temporal and environmental conditions. This theory, along with Francis Galton's "multiple positions of organic stability", is temporalized by Conrad Waddington's concept of the epigenetic landscape.[5] Against Darwin, Bateson postulated a theory of "essential diversity" rather than "random mutation" and organization through "discontinuous variation" rather than "gradualism". As a teratologist, he realized that even monstrosities adhere to recognizable forms of those classified as normal and they therefore might lead to a theory of order that does not treat the variant as merely contingent or extraneous. He argued that variant forms are as definite and well formed as typical forms. The variations of monstrosities led him to a twofold theory of diversity and differentiation. Like the earliest experimental morphology studies of Hydra and Planaria such as Abraham Trembley's, Bateson looked for typicality in the atypical.[6]

In his classic example of the two possible mutations of the thumb, Bateson demonstrated that the monstrosities display higher degrees of symmetry than do normal hands. On one hand, the normal asymmetry between four fingers and the thumb is replaced by two groups of four fingers reflected along a mirror axis. On another hand, nested within the normal asymmetry of the thumb and four fingers is a second level of mirror symmetry between the normal thumb

and an extra thumb. The existence of mutations that exhibit higher degrees of symmetry than the norm led to contradictory explanations. The taxonomic hypothesis locates extra information at the point of mutation in order to explain the increase in symmetry and the decrease in heterogeneity. Bateson proposed an alternative explanation whereby the decrease in asymmetry and the increase in homogeneity was a result of a loss of information. He argued that where information is lost or mutated, growth reverts to simple symmetry. Thus symmetry was not an underlying principle of the essential order of the whole organism, but was, instead, a default value used in cases of minimal information. Organisms are not attributable to any ideal reduced type or any single organization; rather, they are the result of dynamic nonlinear interactions of internal symmetries with the vicissitudes of a disorganized context. These contexts become "generative fields" once they are organized by flexible and adaptable systems that integrate their differences in the form of informational constraints.

For these types of morphological processes Bateson invented the term "genetics". Genes are not generators but modifiers or regulators that are intermittently applied during growth and regeneration. In the case of Bateson's Rule, information regulates simple mirror symmetries by introducing heterogeneity and difference as a form of organization. Gregory Bateson qualifies the idea of "information selecting asymmetry" as "information preventing symmetry". Genetic information excludes potential default positions of stability, like a governor or rheostat that excludes alternative possible states through feedback. Genes do not provide a blueprint in this theory, but rather, guide development at critical junctures by excluding simple default organizations. By differentiating in this manner, predetermined potentials are replaced with novel possibilities that are initiated by general external information and integrated within specific internal parameters.

The modifying information that generates heterogeneity was explained as a specific response to perturbations that could be either environmental or genetic. Symmetry breaking is therefore a sign of the incorporation of information into a system from the outside in order to unfold its own latent diversities. Contexts lack specific organization and the information that they provide tends to be general. In this regard, contexts might be understood as entropic in their homogeneity and the uniform distribution of differences. Adaptive catalysts configure this information by breaking their own internal symmetry and homogeneity in order to differentiate heterogeneously. Gregory Bateson gives the example of an unfertilized frog's egg that develops a plane of bilateral symmetry as an embryo depending on the point of entry of a spermatozoon. Bateson substituted this point of entry by pricking the egg's surface with a camel's hair, along which a plane of bilateral symmetry grew. In this example, the message from the context is relatively general, while the internal context into which this indefinite information is received must be exceedingly complex. While the external information is general, the response that it triggers is specific. The egg initially exhibits a high degree of simplicity and radial symmetry. As it unfolds in an open relationship with its environment, it breaks symmetry, differentiates, and becomes more complex and heterogeneous because of its feedback with exigencies and constraints outside of its control.

Symmetry breaking is not a loss but an increase in organization within an open, flexible, and adaptive system. Symmetry breaking from the exact to the anexact is the primary characteristic of supple systems. These flexible economies index the incorporation of generalized external information through the specific unfolding of polymorphic, dynamic, flexible, and adaptive systems. Symmetry is not a sign of underlying order but an indication of a lack of order due to an absence of interaction with larger external forces and environments. Given this complex conceptualization of endogenous and exogenous forces, deep structure and typology are just what they seem to be: suspect, reductive, empty, and bankrupt. An alternative is an internal system of directed indeterminate growth that is differentiated by general and unpredictable external influences, producing emergent, unforeseen, unpredictable, dynamic, and novel organizations.

Notes:

1) The relationship between order (of which symmetry is perhaps a primary example) and variation has been criticized elsewhere. See my "New Variations on the Rowe Complex", ANY 7-8, Colin Rowe (1994): 38-43, and "Multiplicitous and Inorganic Bodies", Assemblage 19 (December 1992): 32-49.

2) William Bateson, Materials for the Study of Variation: Treated with Especial Regard to Discontinuity in the Origin of Species (1894; Baltimore: Johns Hopkins University Press, 1992).

3) Mark Rakatansky first brought to my attention the text "A Re-examination of Bateson's Rule", in Steps to An Ecology of Mind (New York: Chandler Publishing, 1972), 379-96, which pointed to the intellectual and filial connection between William Bateson and theories of feedback, cybernetics, negative entropy, and complexity.

4) "This much alone is clear, that the meaning of cases of complex repetition will not be found in the search for an ancestral form, which, itself presenting the same character, may be twisted into the representation of its supposed descendant. Such forms may be, but in finding them the real problem is not even resolved a single stage; for from whence was their repetition derived? The answer to this question can only come in a fuller understanding of the laws of growth and of variation which are as yet merely terms." (William Bateson, "The Ancestry of the Chordata", in The Scientific Papers of William Bateson, 2 vols. [Cambridge: Cambridge University Press, 1928], 1: 1-31).

5) See Gerry Webster, "William Bateson and the Science of Form", in Materials for the Study of Variation, xlvii.

6) See Sylvia Lenhoff and Howard Lenhoff, Hydra and the Birth of Experimental Biology - 1744: Abraham Trembley's Memoirs Concerning the Natural History of a Type of Freshwater Polyp with Arms Shaped Like Horns (Pacific Grove, Calif.: Boxwood Press, 1986).

Terminal Velocities: The Computer in the Design Studio

Stan Allen

p. 58

It seems that during the hot summer months in New York City cats begin to fall, or throw themselves, out of high windows. Nobody quite knows why, but researchers studying the phenomenon have uncovered a curious pattern. A cat falling from two or three stories has a relatively small chance of surviving, while a cat falling from four, five or even six stories is quite likely to survive. Researchers hypothesize that the extra airborne time allows a cat to twist around and land on its feet. Beyond six floors the chances of survival drop again. Too much time in the air, and the cats reach terminal velocity.

Speed is fundamental to the rhetoric of the computer. Bigger is better, but faster is best. In advanced imaging and animation programs, for example, it is processing speed and not disk space that is the limiting factor. High end personal computers already run at inconceivably fast speeds - xn calculations per second, and improving all the time. Mainframe supercomputers and parallel processing promise even greater speed. In part this is bound up with questions of marketing and efficiency. The immense capital expenditure for software development, and the large scale implementation of CAD systems in design and production would have been impossible without measurable gains in speed and productivity. The same Taylorizing impulse at work in early modernism - the elimination of obsolete and inefficient work methods - is still visible today.[1]

Along with efficiency, in the rhetorical fictions of the computer, speed brings something else: a quasi-utopian promise, not only of a technologically assisted future, but also a promise to recover what had been destroyed by modernity in the first place. Community, self, political space, precision craft and local identity will all be recuperated in the new space of the computer.[2] The breathless rhetoric of accessibility depends upon the capacity of the computer to simulate reality. And it is speed that guarantees the seamlessness (and hence the realism) of these new simulations. But between the promise of a digital future and the realities of the present there are complex questions to be answered. In Pure War, Paul Virilio has signaled his skepticism about the depletion of time as technologies of speed are everywhere put into place: "There again it's the same illusory ideology that when the world is reduced to nothing and we have everything at hand, we'll be infinitely happy. I believe its just the opposite - and this has already been proven - that we'll be infinitely unhappy because we will have lost the very place of freedom, which is expanse." Control and concentration are the inevitable counterparts of these new technocratic regimes: "The field of freedom shrinks with speed. And freedom needs a field. When there is no more field, our lives will be like a terminal, a machine with doors that open and close."[3]

Virilio distinguishes between metabolic speed - the speed of the living being, reaction time - and technological speed, the artificial speed of machines. But significantly,

what differentiates recent technologies from modernist machines (the aircraft, the telegraph or the automobile) is a blurring of the boundary between technological speed and metabolic speed. Computer speed is micro-speed, invisible in its working, visible only as affect. With the computer, technological speed approaches metabolic speed. Genetic algorithms can simulate hundreds of thousands of years of evolution in a few minutes; artificial life programs bring responsiveness and adaptivity to the technological environment. For Virilio, what distinguishes metabolic speed is its inconsistency: "What is living, present, conscious, here, is only so because there's an infinity of little deaths, little accidents, little breaks, little cuts..." It is through these interruptions that the field is reconstituted - not as seamless continuity, but through a shift in scale; a finer grained texture that allows local connection and continuity; an order that accepts discontinuity and difference without encoding it as catastrophic disjunction. Hence, as Sylvere Lotringer (Virilio's interlocutor in Pure War) notes: "All is not negative in the technology of speed. Speed, and that accident, that interruption which is the fall, have something to teach us on the nature of our bodies or the functioning of our consciousness."[4]

What is at stake for architecture in all this? The computer in the design studio provokes both extravagant claims and high levels of anxiety. As with the cats falling through the hot summer nights, is there a window of opportunity between an initial state of dismay or confusion, and the endgame of 'terminal' velocity? Questions of identity politics and the real effects of new technologies on the spaces of the city are issues that urgently need to be addressed. But before architects can do so, it will be necessary to look more closely at the paradigms and protocols at work in the use of the computer in the design studio.

A legitimate skepticism toward both the technocratic drive for efficient production as well as the vague promise of an utopian future is a start. But a positive program is required as well. This would begin with a speculative and open-ended investigation of the possibilities and potentials of these new technologies within the specific demands of the discipline of architecture. It is important not to lose sight of the instrumentality of the computer. The computer is not "just another" tool, but it is a tool nonetheless - a tool with very specific capabilities and constraints.[5] What are the specific opportunities for new modalities of geometrical descriptions, spatial modeling, simulation of program and use, generation of formal and organizational systems, rapid prototyping, etc.? A careful reassessment of the implications of these new tools in their theoretical and conceptual context could follow from this. By questioning the rhetoric of the new, it is possible to rethink both the new technology and architecture's own persistent paradigms of order, geometry and organization. The luddite option, for all of its rhetorical attractiveness, is untenable and finally, uninteresting. What is required is to become familiar enough with the technology so as to be able to strip away its mythological veneer. Don't count on "being digital" (as if it were a choice) but rather work on becoming digital. The interruption and the accident need to be cultivated; software systems must be used against the grain. Established protocols need to be tweaked.[6]

First Hypothesis: Digital Abstractions

One of the curious aspects of digital technology is the valorization of a new realism. From Hollywood special effects to architectural rendering, the success of the new technology is measured by its ability to seamlessly render the real. Even the promise of the so-called virtual reality is not so much to create alternative realities but to replicate those already existing. In architecture this is evident in "visualization" techniques. The promise here is that if computer technology can create more and more realistic simulations (renderings, "walk throughs" or "fly throughs") that design mistakes will be avoided. This is clearly market driven, answering a need to predict what the thing will look like before spending money to build it.[7] The fallacies of this position are almost too numerous to specify. For one it assumes that a very narrow range of perceptual mechanisms come into play in the experience of architecture: a tunnel-like camera vision, ignoring the fluidity of the eye and the intricacies of peripheral vision (not to mention the rest of the body's senses.)[8] But more significantly, it ignores what has traditionally given architectural representation its immense power of conceptualization - that is to say, its necessary degree of abstraction, the distance interposed between the thing and its representation.[9]

The story of Diboutades is often evoked as an account of the origins of drawing: The daughter of a Corinthian shepherd traces the shadow of the head of her departing lover as a momento. The drawing is a substitute, a partial record of the absent, desired thing. This story of origins is consistent with classical theories of mimesis, but problematic from the point of view of architecture. In architecture, the object does not precede its representation in drawing. Rather, the built reality is both imagined and constructed from accumulated partial representations. As codified in systems of mechanical drawing, the object is imagined inside a transparent box - the materialization of the Cartesian coordinate system. On the surfaces of the box are registered the traces of the lines of orthographic projection. Traditionally, the architect works on the two dimensional surfaces of this box, not on the object itself. The architectural project is a virtual construction, a whole created from abstract parts interpreted and combined according to shared conventions of projection and representation.

Now the computer simultaneously collapses and increases this distance. The vector of representation is reversed; the glass box is turned inside out. In computer modeling, the architect works directly on a three-dimensional representation of the object itself. In the virtual space of the computer, it is possible to go quickly back and forth (or even to work simultaneously) on the two-dimensional projection and the three-dimensional object. (Of course another system of projection/representation intervenes - that is to say the two-dimensional display of the screen itself - but the ease with which it is possible to move the object and to move around in that space provisionally suspends its presence as intermediary.) That object can be a series of projections or simply a collection of commands. Instead of a finite number of representations constructing an object (either in the mind or in the world) there is already an object (itself made up of a nearly infinite number of discreet elements) capable of generating an infinite number of representations of itself.

As a result of this reversal, the status of the drawing, and in turn the image of the architecture itself undergoes a transformation. A new feeling for abstraction emerges: abstraction not as final result of operations of idealization or reduction, but an abstraction of the indifferent order of bits. Interestingly enough, a sense of casualness, paradoxical lack of precision, is one result of this. Computer abstractions are radically provisional, open to infinite revision. If the power of the computer lies in its ability to handle large amounts of information, multiple variables and abstract codes, it is worthwhile to be attentive to an emerging sensibility for diagrammatics and loose organizational paradigms: an architecture of the contingent, a conditional abstraction. This might imply a shift away from the false certainties of "visualization" toward the generative capacities of the computer as an abstract machine. This is not expressed so much as a mandate but as a possibility. Abstraction today is no longer a categorical imperative, but one choice among many. But when working with the computer, it is a sensible choice in as much as it is something that the computer does well.

Second Hypothesis: Digital Fields

Analog technologies of reproduction work through imprints, traces, or transfers. The image may shift in scale or value (as in a negative), but its iconic form is maintained throughout. Internal hierarchies are preserved. A significant shift occurs when an image is converted to digital information. A notational schema intervenes. "Digital electronic technology atomizes and abstractly schematizes the analogic quality of the photographic and cinematic into discrete pixels and bits of information that are transmitted serially, each bit discontinuous, discontiguous, and absolute - each bit 'being in itself' even as it is part of a system."[10] A field of immaterial ciphers is substituted for the material traces of the object. Hierarchies are distributed; "value" is evened out. These ciphers differ one from the other only as placeholders in a code. At the beginning of this century, Viktor Shklovsky anticipated the radical leveling effect of the notational sign: "Playful or tragic, universal or particular works of art, the oppositions of one world to another or of a cat to a stone are all equal among themselves."[11]

This leveling of hierarchy has implications for the traditional concept of figure/field. In the digital image "background" information must be as densely coded as the foreground image. Blank space is not empty space; there is empty space throughout the field. If classical composition sought to maintain clear relations of figure on ground, which modernist composition perturbed by the introduction of a complicated play of

figure against figure, with digital technologies we now have to come to terms with the implications of a field/field relation. A shift of scale is involved, and a necessary revision of basic compositional parameters is implied.

By comparison with western classical architecture, it is possible to identify contrasting principles of combination: one algebraic, working with numerical units combined one after another, and the other geometric, working with figures (lines, planes, solids) organized in space to form larger wholes.[12] In algebraic combination, independent elements are combined additively to form an indeterminate whole. The local syntax is fixed, but there is no overarching geometric scaffolding. Parts are not fragments of wholes, but simply parts. (As Jasper Johns has remarked: "Why take the part for the whole; why not take the part for the part?") Unlike the idea of closed unity enforced in western classical architecture, algebraic combinations can be added onto without substantial morphological transformation.

A final point: it might be noted the universal Turing machine - the conceptual basis of the modern digital computer - performs complicated relational functions, (multiplication or division, for example) by means of serially repeated operations of addition. Paradoxically, it is only when the individual operations are simplified as far as possible that the incredible speed of the modern computer is achieved.

Third Hypothesis: The Logistics of Context

Even a very simple model of urban growth, ignoring large scale accidents of history or geography, but incorporating fine-grained difference in the form of multiple variables and nonlinear feedback, demonstrates how the interplay between laws and chance produces complex, but roughly predictable configurations of a non-hierarchical nature.[13] The whole of the city is never given at once. The city is a place of contingency, a provisional unity, not bounded and closed, but open to time and capable of permutation.

In the late 1980's, artificial life theorist Craig Reynolds created a computer program to simulate the flocking behavior of birds. Reynolds placed a large number of autonomous, birdlike agents into an on screen environment. The agents were programmed to follow three simple rules of behavior: First, to maintain a minimum distance from other objects in the environment (other agents, as well as obstacles); second, to match velocities with other agents in the neighbourhood; third, to move toward the perceived center of mass of agents in its neighbourhood. As Mitchel Waldrop notes: "What is striking about these rules is that none of them said 'Form a flock'...the rules were entirely local, referring only to what an individual agent could do and see in its own vicinity. If a flock was going to form at all, it would have to do from the bottom up, as an emergent phenomenon. And yet flocks did form, every time."[14]

The flock is clearly a field phenomenon, defined by precise and simple local conditions, and relatively indifferent to overall form and extent.[15] Because the rules are defined locally, obstructions are not catastrophic to the whole. Variations and obstacles in the environment are accommodated by fluid adjustment. A small flock and a large flock display fundamentally the same structure. Over many iterations, patterns emerge. Without repeating exactly, flock behavior tends toward roughly similar configurations, not as a fixed type, but as the cumulative result of localized behavior patterns.

One of modern architecture's most evident failings has been its inability to adequately address the complexities of urban context. Recent debates have alternated between an effort to cover over the difference between the old and the new (the contextualism of Leon Krier or the so called "New Urbanists") or a violent rejection of context (deconstruction, and related stylistic manifestations). The two examples suggested above - many more could be cited - dissolve the conventional opposition between order and randomness. They offer a way out of this polarized debate, acknowledging on the one hand the distinct capabilities of new construction, and at the same time recognizing a valid desire for diversity and coherence in the city. Logistics of context suggests the need to recognize the limits to architecture's ability to order the city, and at the same time, to learn from the complex self-regulating orders already present in the city. Attention is shifted to systems of service and supply, a logics of flow and vectors. This implies close attention to existing conditions, carefully defined rules for intensive linkages at the local scale, and a relatively indifferent attitude toward the overall configuration. Architecture needs to learn to manage this complexity, which, paradoxically, it can only do by giving up some measure of control.

Notes:

1) Questions of optimization and the continual replacement of obsolete technologies need to be re-thought. To give two simple examples: It is instructive to look at the development of high-speed trains in Europe and Japan. A 19th century technology, supposedly made obsolete long ago by air travel emerges as a logical alternative from an ecological and urbanistic point of view. More perversely, the incredible political power acquired by AM talk radio in this country (a technology supposedly made obsolete by television) was possible precisely because the possibilities of the medium were overlooked by corporate organizations bound by paradigms of technological optimization.

2) Many examples could be cited; see for example the collection edited by Michael Benedikt, Cyberspace: First Steps (MIT Press, Cambridge, 1991) as well as the more recent emergence of numerous academic and popular books on the subject. Scott Bukatman has coined the term 'cyberdrool' for this kind of terminal identity fiction; he cites Vivian Sobchak's observation of the "peculiar oxymoronic cosmology" linking "high technophilia, 'new age' animism, spiritualism, and hedonism, and Sixties counter-cultural 'guerrilla political consciousness." Scott Bukatman, Terminal Identity: The Virtual Subject in Post-Modern Science Fiction (Duke University Press, Durham, NC, 1993) p. 189

3) Paul Virilio/Sylvere Lotringer: Pure War (Semiotext(e), New York, 1983) p. 69

4) Virilio and Lotringer, p. 33

5) It is tempting to paraphrase Jean-Luc Godard here: "Not just a tool - just a tool."

6) Brian Eno has proposed a simple formula: "If you want to make computers that really work, create a design team composed only of healthy, active women with lots else to do in their lives and give them carte blanche. Do not under any circumstances consult anyone who a) is fascinated by computer games b) tends to describe silly things as "totally cool" c) has nothing better to do except fiddle with those damn things night after night." Brian Eno, interviewed by Kevin Kelly in Wired, May 1995 (San Francisco) p. 150

7) This is to ignore for a moment those who think that architecture will simply disappear in a 'virtual' future. As they have never been really interested in architecture anyway, there's no great loss.

8) "I ask myself, What is pissing me off about this thing? What's pissing me off is that it uses so little of my body. You're just sitting there, and its quite boring. You've got this stupid little mouse that requires one hand, and your eyes. That's it." Brian Eno, Wired Interview, p.149

9) See Robin Evans, "Translations from Drawing to Building" AA Files 12 (London) 1986

10) Vivian Sobchak, "The Scene of the Screen: Towards a Phenomenology of Cinematic and Electronic Presence" in Post-Script 10 (1990) p. 56, cited in Bukatman, p. 108

11) Cited by Manfredo Tafuri in "The Dialectics of the Avant-garde: Piranesi and Eisenstein" Oppositions 11, Winter 1977 (Cambridge, MIT Press) p.79

12) The term "Algebra" derives from the Arabic al-jebr "the reunion of broken parts", and is defined as "the branch of mathematics that uses the positive and negative numbers, letters, and other systematized symbols to express and analyze the relationship between concepts of quantity in terms of formulas, equations, etc.; generalized arithmetic." "Geometry" on the other hand is a word of Greek origin, and is defined as "the branch of mathematics that deals with points, lines, planes, and solids, and examines their properties, measurement, and mutual relations in space." Word origins and definitions from Webster's New World Dictionary (Cleveland, World Publishing, 1966)

13) Discussion of the Christaller model, taken from: Ilya Prigogine and Isabelle Stengers: Order out of Chaos Man's New Dialogue with Nature (New York, Bantam Books, 1984) p. 197ff

14) M. Mitchel Waldrop in Complexity: The Emerging Science at the Edge of Order and Chaos (New York, Simon and Schuster, 1992) p. 240-241

15) "One of the essential characteristics of the dream of multiplicity is that each element ceaselessly varies and alters its distance in relation to the others...These variable distances are not extensive quantities divisible by each other; rather, each is indivisible, or 'relatively indivisible', in other words, they are not divisible above or below a certain threshold, they cannot increase or diminish without changing their nature." Gilles Deleuze and Felix Guattari, A Thousand Plateaus (Minneapolis, University of Minnesota Press, 1988), p. 30-31

The Emergence of Ideological Smoothness
K. Michael Hays
p. 70

If for Marx – given his own experience of everyday life in the nineteenth century and the predominance of the economy in the structuring of the whole of that life – there was good reason to spend his time theorizing the economy, then for us – given our contemporary experience of the media, of complex interactive systems, of digitized information, and of mergers of seemingly incommensurable objects, images, and even thoughts as a cultural dominant – there is probably good reason a number of current architects and architecture theorists are spending their time trying to theorize the media, computer-generated forms, and biomorphic systems. I have in the front of my mind, just as an example, the recent theoretical and architectural projects of Greg Lynn, one of which is published here in ARCH+.[1] In the back of my mind, I have the genuine and serious worries of Sanford Kwinter regarding the irretrievable loss of certain ways of even thinking the possibility of resistance to technological modernization. In general, I have in mind the attempts to shift our thinking about forms and functions from of a model of contradiction, fragmentation, resistance, and disruption, to one of smooth relations between differentiated forms and multiple, changing uses, one that employs the metaphor of a computer network – coordinating multiple entities in a smooth, frictionless flow – to affirm a unity of techniques from architecture, physics, computation, and biology. One might characterize this shift as one from collage to assemblage, provided assemblage is understood as a radical coupling of not only forms but also of material and concepts from different disciplines. It is that theoretical shift that I will try to situate in the second part of this paper; it is the audience of that theory that I want to characterize in the third part of this paper. To get there, however, I will first have to review how these theoretical shift developed out of an earlier moment in the history of architecture theory.

1. Contemporary architecture theory "began" around twenty-five years ago, embedded in what I shall call an Althusserian moment. I am referring, of course, to Louis Althusser, his so-called structural Marxism, and his thorough and relentless critique of determinism in all its guises: economic determinism, humanism, historicism, positivism, and the like (versions of which have all had appearances in architecture as well). A key concept in Althusser's critique of determinism is the "semi-autonomy" of "levels" or "instances" within an ideological field – the economic, political, juridical, cultural, aesthetic levels, and so on – each "overdetermined" (a concept he borrowed from Freud) and held together by the "structural totality" of a social formation. Althusser insisted that no social entity (architecture, say) was ever determined by one or even one set of other social entities (the economy and technology, say); but neither was any entity or any level ever fully autonomous. Rather each entity was the product of the interaction of all the other levels at once. Here we have a non-causal model of the social structure understood as a set of insides and outsides that are reciprocally constituted – an enfolded interiority and exteriority which Althusser called the "structural totality." Each instance or level was the effect of all the other levels. At the same time, however, he argued that in any specific historical situation or ideological formation, one of the instances, though it would never be determinate, would typically be dominant, thus securing, through its ideological force, the unity of that formation.

Later I am going to suggest that, if in an earlier historical moment it was the economy that was dominant "in the last instance", as Althusser says, then now, in our present social formation, it is a very particular cultural-aesthetic region and set of aesthetic practices that spread their weight and their influence over all other levels. For now, however, I'll just make one last important preliminary point: that if, like all Marxisms, Althusser's insists on the relation between social, cultural, aesthetic, and political regions – which it does and which is its primary thrust – it relates these regions by way of their ultimate structural difference and distance from one another rather than their ultimate identity. Difference itself is a relational concept rather than a mere inventory of instances. This understanding of the structural totality enables us to ask what I think is the crucial question in architecture theory: Is the architecture a free-floating object or is it embedded in some context; and if the latter is true, does the architecture simply replicate the context ideologically, or does it possess some degree of autonomy in which architecture itself could be seen in constructive terms as producing compensations, repressions, negations, or affirmations of that context? (...)

For architecture theory's most recent recommendation to move toward computerized, media technology and toward complex systems the delicate dialectic between semi-autonomy and structural totality proved too complex or problematic to sustain. The Marxism inherent in the Althusserian moment suffered from the conservative turn in the 1980s and the essentially social and political thrust of that earlier theoretical work began to wither. But there were internal dissolutions as well. On the one hand, semi-autonomy began to collapse into an argument for the absolute autonomy of form and architectural discourse. Yet, on the other hand (and somewhat paradoxically), different regions of discourse, it was felt, could be crossed freely, almost without the transcoding mechanisms previously that Althusserianism requires. The necessary and correct interpenetration of different regions or different discourses was radicalized in the fruitful but problematic concept of "intertextuality." And henceforth architecture theory would draw its material from the most wildly distant disciplines and its intertextual references would become almost random – an ad hoc constellation that necessarily commented on other theoretical texts inside and outside architecture, that depended on a heterogeneous body of texts that could be glossed, interconnected, and rewritten. Attempts were made to match a certain reading of this text with a reading that building and architecture theory became radically occasional.

2. By the middle of the 1980s intertextuality had been converted from a strategy of reading into strategies for design production, including those that came to be called "mapping" and "grafting," in which two or more morphological or textual systems are transcoded and combined, resulting in a new system of continuous and articulate contingencies, both morphological and conceptual. If the theory of the 1970s yielded an aesthetics of collage, the new theory pushed away from the fragmentation and contradiction of architectural parts toward a suture that is not only a formal smoothing but also a seaming across media, involving film and video along with graphic design, computer imaging, mathematics, and biology. I will call this suture of form and media "ideological smoothness" and mention just three of its aspects.

First is a renunciation of the efficacy of contemporary architectural practices of negation and resistance. Negation, to these younger architects and theorists, came to be understood historically, as part of the old modernist legacy that was now thought to be anachronistic; Tafuri's pessimism but also materialism's phantom hope for resistance in contemporary practice was jettisoned. Second, the development of "linguistic" procedures for the production of meaning came to be regarded as a matter of fixing the otherwise inexhaustible and unstoppable processes of signification was therefore rendered suspect. And third, the whole program of self-referentiality began to be displaced by a call for multiple and smooth affiliations of architecture with other visual modes in ways analogous to the new "languages" of electronics, DNA, chaos, catastrophe, not to mention the semiotics of mass culture itself, all of which seemed to escape any notion of semi-autonomy and especially any notion of structural totality.

In some of the projects generated out of this moment, architectural codes were almost completely displaced by others, the vertical surfaces of the buildings conceived no longer architectonically but as blank screens for information. The hope of the new theory is that architecture's surfaces, as much as its spaces, will produce unexpected and spontaneous affects, that the surfaces will engender virtual intensities whose manifestations as actual information or as programmatic activities emerge as a kind of après-coup. The building surface is to be read as a diagram of potentials for activity, a dispositif or distribution apparatus for differential forms, functions, contents, and expressions from incommensurable registers now pressed together into a single tissue. One notes, however, that the attributes of this paradigm are not formal only. Rather this new system of relations and affiliations finds its social correspondents in practices as seemingly diverse as "channel surfing" and "malling" and gene splicing. But is there not something else at work? Feeling increasing pressure from theories of complex systems as well as from the technologies of information and communication, architecture seems to react by trying to become just those things – information and media. For the generation of theorists writing in the

1970s, it seemed healthy (even politically progressive) for the architectural sign to display its own degree of autonomy equally along with its arbitrariness, to unmask or de-conceal its own signifying apparatus. The suspect signifier was one that erased or suppresses the semiotic labor that had produced it. Now even if we agree that these earlier strategies are no longer adequate, and even if we agree on certain merits in theory's recent turn toward cross-cultural smoothness, I have some reservations. In rejecting this earlier theory of difference in favor of affiliations from diverse registers now pressed together into a single tissue, ideological smoothness runs a supreme risk: The process by which ideology creates as tight a fit as possible different regions and between itself and social reality – thereby closing the gaps of semi-autonomous instances, the gaps in which any critique gain purchase – that process is what we used to call "doxa" (Pierre Bourdieu) or "naturalization" (Roland Barthes) and it has the effect of occulting the reality that in fact generated the ideology. What is missing here, I suggest, is just the idea that a social formation is composed of different regions or levels, some of which exert more significant determinacy than others. The notion that it is now the region of aesthetics and instances of media that are now dominant is what I want to suggest by turning to the question of audience.

3. For if the recent ideological smoothness abandons the Althusserian experiment with which contemporary theory began, it nevertheless does construct something like a consensual meaning. My final question is, who is the audience of this new consensus? The appeal of the architecture and theory produced by this new ideology to the two generations of architects and theorists after 1968 and their appetitive response to this research is already a kind of answer ("For they are the contemporaries of the new entrepreneurs and they are themselves wonderful media animals"[2]). Ideological smoothness seems to achieve the expressive form of my own generation of baby-boomers and our just-younger siblings who, through historical circumstance and class alliance, have developed a very specific pattern of cultural production and consumption, one in which modes of cultural expression (what I earlier called the semi-autonomy of different levels) have been blurred, in which high and low, hip and nerd, left and right, have all but lost their distinctions, in which, like Jorge Borges's map, the mapping of the real becomes indistinguishable from the real itself. What is more, the loss of "reality" that comes with that indistinguishability is something some of us have learned to like. This, I suggest, is the audience ideological smoothness is made for.[3]

Now, many of us in America during the 1980s came to think of any consensual meaning as synonymous with officially designated meaning, as a conciliatory "don't worry, be happy" kind of culture that Reaganism had brought. It appeared to us as bathos at best, at worst a scam. But in the mean time, we were training ourselves in a paradoxical sensibility that amounted, nevertheless, to consensus and which I can describe only by example. It was the disintegration of individuality in Laurie Anderson's performance, Big Science, and the deoedipalization in David Lynch's television program, Twin Peaks, both of which represented for us profound psycho-intellectual transformations and cross-media developments; it was the cultural credit cards that allowed us to consume, not only with the same ease but with the same means, music video and Robert Wilson's plays, Paul Simon's presumedly "low" appropriations of South African music and those of the high-end quartet, Kronos; it was the ludic deconstructions of the commedian Andy Kaufman; it was the residual commitment to the liberating power of popular culture coupled with knowing better. It was too much education and too disproportionate a control, through our sheer demographics, over the distribution of cultural commodities. It was the smoothness with which uncertainty, estrangement, and self-liquidation were converted into an affirmative project – a blending of bleakness with euphoria, extreme competence with resignation, and almost manic swings between exhilaration and contempt for the absolute ease with which the signifier could be loosened from its signified and endlessly redistributed. It was on these very specific paradoxes that we built up our reading habits and it is this training that one must have in order to understand and appreciate the recent turn in architectural theory.

We, all of us, have been at one time or another guilty of hymning the virtues of schizophrenia and media addiction, the ecstasy of self-liquidation, and the utter loss of boundaries. But have we lost sight of the dialectical fact that intextuality, ambiguity, and indeterminacy often enough lie on the side of dominant ideological discourses themselves? If the scabrous, difficult surface of conflict and resistance is politically anachronistic, what are the politics of this newer, smoother surface? Is our only choice between an architecture clinched into an extreme and isolated self-involvement – that is, an architecture of absolute autonomy – or an architecture that relinquishes all its autonomy only to reassert itself as the total fusion of these dominating forces, coordinating them into a smooth experience of space and surface that dissolves the differences between a wall and a video screen, a column and a pixel, an object and its image? The developments of which ideological smoothness is a part, it seems to me, are too often attempts at this last – a total fusion of media, in terms of both form and content – where the most basic architectural drives enter into collaboration with the superego of socialized representations.

An audience nurtured on irony and paradox, with some remaining memory of the faith in an engaged resistance yet who can still be titillated by the ecstatic surrender of the architectural subject to the very forces than threaten its demise – an audience with a continuity of experience within which the punctual pleasure of disintegration can still be felt – this is the audience that the recent theoretical turn solicits. And the historical fate of this brilliant but vulnerable compromise-formation may well be decided not by virtue of its inherent value but by the intellectual and cultural use we put this memory to.

Notes:
1) See also, Greg Lynn, "Architectural Curvilinearity. The Folded, the Pliant and the Supple", in Folding in Architecture. Architectural Design Profile 102, ed. Greg Lynn (London: Academy Editions, 1993).
2) Jean Baudrillard, Cool Memories, trans. Chris Turner (London: Verso, 1990), 223.
3) Fred Pfeil has made a similar point about postmodern music and performance art in "'Makin' Flippy-Floppy": Postmodernism and the Baby-Boom PMC, in Another Tale to Tell. Politic and Narrative in Postmodern Culture (London: Verso, 1990).

Virtual City, or The Wiring and Waning of the World
Sanford Kwinter
p. 73

I would like to declare at the outset, that what I will say in the following pages, and what I would have liked to say, must remain separate things, because what I would have wished to have been able to say, for all practical purposes, is no longer truly expressible at all – not at least, in our modern, public language of ethical and philosophical debate. The problem here lies in the unavoidable use of the very concept of "modern". For this familiar term, which has expressed the hopeful essence of our specific type of civilization for almost five centuries, does not, as common parlance suggests, mean simply "new", but more precisely "emancipated"; emancipated on the one hand, from the episodic whims and prejudices of "mere" tradition and belief (those affects typically said to characterize the premodern universe), and on the other, emancipated from the indifferent, adverse and wild unfoldings of the natural world. The essence of the modern "type" of human that corresponds to this worldview is in turn expressed – to itself and in its own vision – as a creative freedom struggling in and with an indifferent world to shape itself as it wills. That human will and human freedom should today be bound together in this way to assemble the new, modern human type (and I use this term in the strictly Nietzschean sense), in fact already determines much of what it is today possible to say and what it is possible to know. For example, one would not expect to find many in the west today – let alone in the microcosm of our own profession – who sincerely believed that the mastery of nature, or of chance in general, was not the best means for improving the plight of the human species on the planet. Our culture's seemingly unassailable belief in freedom, and our faith in mastery are in fact twin and inseparable aspects of western modernity, and together they form the almost theological basis and certainly the economic engine driving our technological civilization. In so far as we are modern – and in this we simply have no choice – technique and its culture is not a thing external to us that might be fixed, isolated and examined; it is what we are.

For this reason among others, it is far easier to form in our minds the image of what our technological society has made

possible for us, but far, far more difficult to remember that of which, in the wake of its successful and relentless onslaught, we have been deprived. A further, and perhaps more important, reason for this imbalance, is that the affective economies and systems of meaning against which such significant absences, deletions and reconfigurations might yet be legible to us as historical aberrations, are the very ones that had been targeted, broken up and swept aside during the formation of the "modern" systematic mind. Mastery, at least our (Western technological) type, was achieved through techniques of quantification and numericalization, the reduction of shifting, variable fields of sensuous and material values to precise and fixable measurements. The full, if apparently crueler and more episodic world of pullulating qualities, of uncontrollable mixtures and the ecstatic values that both relate to and derive from embodied senses, once gave rise to different ecologies of both spiritual and social order, different grades of subjectivity of which today we are able, no longer to summon even the faintest intimation. True, modern society may be free of many older, systematic forms of political subjugation, much senseless religious and superstitious barbarism and the random brutalities of chance, and it may be good to witness and celebrate the passing of these archaic forms into irretrievability, but that does not change the fact that every day and all around us, something is being lost.[1]

Among the assertions I would like to put forward, is the following one: That because, in a society such as our own, we are unable to separate discourses of emancipation from discourses of mastery, unable to dissociate the will to freedom from the application of technique, and because the historical fusion of these two modalities constitutes the birth and hallmark of our modernity, the very existence of a language of resistance to modernization may itself belong to the systematic but largely invisible series of deprivals and exclusions upon which our technological civilization is built.

In other words, because the concept of abstract freedom is both the highest and most unchallengeable value in our modern world, having replaced virtually every other system of meaning both past and possible, secular and not, and because this concept of freedom is always already embedded within the boundless expanse of our belief in technological overcoming, no systematic critique of technological civilization is possible today in a language that would be intelligible to it.[2]

Is it possible, one might ask, that we suffer from a largely imperceptible, technologically-induced collective type of historical amnesia, one that is entirely structural to our civilization, and that the peculiar distortions that such concepts as freedom, identity and sexuality have taken on within our largely urban western modernity, have arisen expressly to hide from us this fact?

This is, of course, hardly a fair question at this point, but I pose it here in order to make the following point: That among the most important developments occurring today, beyond the indisputable (and probably inevitable) media-technological revolutions that are reconfiguring our cities, homes and workplaces, is one that may have to do, not simply with the encroaching soft tyrannies and surreptitious deprivals that are an intimate and necessary compliment to the so-called advances being prepared for us, but indeed with the withering away, of even the language, with which such continuing deprivals and subtle tyrannies might still be couched or expressed.

Though the threat once rhetorically posed to architecture by "the book" (in Victor Hugo's classic novel The Hunchback of Notre Dame) was in time revealed to be baseless, there does appear to be a challenge arising in our midst today that is at once far more systematic and comprehensive in its reformulation of classical notions of space and place, and far more spectacular in its capacity to invent architectural and environmental propositions for the structuring of life, labor and communicative interaction. This boundaryless new medium or "virtual" reality is however, not a simulated environment as many are still claiming, but a new space altogether – indeed a new type of total environment – and I borrow the adjective "total" from sociologist Erving Goffman, replete with ominous overtones lent by its association with prisons, mental hospitals, factories and schools – a new total institution, though one made possible now not by confining walls and political, social and medical decrees, but by the seemingly "natural" evolutionary convergence of telephones, data banks, computers and televisions. It is understandable then that at least some of the hype around the virtual world suggests that there is in fact nothing threateningly new about it, that it is a full-fledged form of social life, only richer, more egalitarian, vaster and more free; and that its domain – cyberspace – is not unlike that of a modern city, only infinitely more capacious, complex, and delirious.

Cyberspace, of course, as the now classic adage goes, "is where we are when we are talking on the telephone." It is, in other words, neither in a here nor a there, but is a continual articulation process, relentlessly boring through us. In more precise terms however, it is not where "we" are at all, but where our attention is within a promiscuous, multidimensional electromagnetic matrix, even when our bodies (for which there seems to be, yet again, no limit of protestant-capitalist contempt) are hopelessly fixed in viscous Euclidean "real" space.

But attention, let us not forget, it is at once effort and action; it is the application and distribution of energy on a disorganized material, a ceaseless feedback system that penetrates and arranges this material at a distance to produce a discernable pattern of distinctions and differences, it is a process that transforms raw time into history, giving it defineable qualities, storable elements.

In a word it is work, in both the thermodynamic sense and, alas, in the purely economic one as well. In fact, more than anything else, the virtual world may represent a landmark innovation in economic, as well as urban, architectural history – a new ergonomic interface in which the world becomes a huge, totally integrated factory/workplace, where the multiplicity of human being is once again forcibly reconfigured to isolate and affirm only those features of life and body that can be rendered productive – in this case, the magically complex and unreproduceable states of its nervous system. With the help of any interactive platform device – video and audio headsets, gloves, wired bodysuits or, more likely today, a simple computer terminal – one "inhabits" a virtual environment almost entirely through a stepped up form of the same mental or nervous vigilance used in navigating the flux of the real world. Only now, this type of vigilance, which controls – no matter how pleasurably – the interactions of vast arrays of sensual elements and relations, has become potential productive energy, and in doing so opens up vast new colonies for the production of surplus value. Listen to the virtual apologists incanting slickly "Cyberspace is where your money is", thrilled that so much historical process can be compressed into so few familiar words, and nearly giddy at the thought that human affect and substance too, might finally be reduced to the same double-entry accounting practices as money itself. Indeed, the recent "realization" of the virtual domain does not simply introduce a new set of tools, or a new way of using tools, but may be heralding the advent of a new social regime in which all value and experience can be created and made intelligible only in and through a reality throughly saturated by tools.

Ought we not be concerned with the apparent docility with which these intrusive and disruptive social, political and industrial developments are today being welcomed open-armed into the most intimate reaches of our domestic foyers and nervous systems? Is it alarmist to be troubled by the seemingly consensual chorus of enthrallment and slavish exuberance that has swept through our newsmedia, our corporate and governmental boardrooms and our college campuses whenever the promise – or specter, depending how one sees it – of a future "wired" universe is raised before one? I for one have no difficulty remembering a time when these three very different social institutions constituted distinct and, to say the very least, vigorously opposed mindsets and interests, nor have I forgotten the sting of disappointment and helplessness on witnessing their slow but inexorable migration toward and into one another during the Reagan '80s, but it is no less shocking for that to behold the manner in which – in the midst of both the new "beige" Democratic mood of the early Clinton era and the crude pseudo-Jeffersonian libertarianism that has today displaced it – how both student and corporate executive, as well as politicians, professional purveyors of "truth" and culturati have come to share, almost without nuance, the same blandness of outlook and corporate habit of mind: Life in a machine.

And who could possibly have remained indifferent (at least in America) to the recent television news coverage of the Gingrich team's overhaul of ex-Speaker Foley's old office: I refer here to the unrestrained expression of derision on the part of the news-

casters as they panned, first over what was presented as the Democrats' cumbersome and "outdated" electronic equipment, then over the typical rows and stacks of real books that in any other time or context might have appeared reassuring, stately, refined, yet here, alongside all the other hard and real paraphernalia that visibly reflected the years and toil of governing, was now dismissively displayed as the relics of a passé "paper administration" that had long since lost touch with the times. On the other side of the office – waiting – were the clean, neat columns of the Gingrich team's factory-sealed, logo-stamped boxes of brand new computer equipment, scurrying teams of telephone repair people installing high-speed modem lines, and then, a closeup of the lone Republican bookshelf (three board feet!) with Gingrich's personal, streamlined, no-nonsense library comprised of no more than a half dozen learned tomes – by the likes of Tom Peters, Peter Drucker and Alvin Toffler. If anyone still managed to harbor any doubt of the type of barbarism that is being prepared for us, this single scene would have dispelled it definitively. When soon after, Gingrich, with the help of the right wing Progress and Freedom Foundation, issued his fraudulent "Magna Carta for the Information Age" the golden – if deeply naive – era of cyberspace frontiership probably came to a close. In other words, the new gold rush had begun (the call for universal deregulation and the repeal of so-called "Second Wave" legislation and rights), and along with it, the corresponding vision of a profoundly segregated new society (outlined in the video "Renewing American Civilization"). At the present time, exactly twice as many internet users in America identify themselves with Republicans (48%) than with Democrats (24%).

Now clearly, the idea of a fully synthetic, infinitely reprogrammable world where even our own identities may continually be shifted and transformed, offers unbounded possiblilities to the speculative, even political imagination. But do virtual reality, multimedia and interactive telecommunications really represent just an extraordinary new space of limitless play, social intimacy and invention, or is the logic behind its imminent emergence more systematic, more historical, more nefarious and overdetermined than its apologists let on?

To peruse the travel brochures for the new information highways – or the "infobahns" as they are ominously often called[3] – is to be led by exclamations of the following type: "The Digital Revolution is whipping through our lives like a Bengali typhoon [provoking] changes so profound their only parallel is probably the discovery of fire", this from Wired magazine, the English world's hippest con, and marketer of the new corporate-youth ethic. It is to be led to believe that we are on the threshold of one of the great political notions of the Ages, one endowed with the capacity to foreclose existing dialectics, to bring the great chain of being to its full expression and final resting place, to reconcile within acceptable parameters outstanding differences – political, ethical, sexual and economic – between humans. To survey the political literature on cyberspace is to be led to believe that the medium's gravest outstanding problems concern only those of regulation and control, never the simple, brute fact of what is arguably an unbridled invasion and siezure of power of the public sphere, of the modalities of the human perceptual apparatus, of human energy, and of the interdependant historical ecologies that together these three entail.

It is probably true that since the early 19th century urban transformation has been driven much less by building innovations and architectural schemas than by the cruder, uglier but nonetheless irresistible forces composed and unleashed by the evolution of machines. Yet already in the early renaissance flexible, rational technologies of dissociation, such as the clock, the printed book, movable painting panels, navigational instruments and modern accounting practices had initiated what could later only become a massive wave of "deterritorialization", that is, the disentanglement and analytical isolation of previously embedded values and flows. The techniques that issued from these early modern technologies more than anything else permitted the rise and growth of the first "artificial" cities, for the simple reason that abstract economies based on trade and ledger sheets could for the first time be cultivated entirely independent of constraints of space and real, local productive capacity.

By the nineteenth century the development of lithographic techniques allowed images to follow text into the public domain of mass reproduceability and mass circulation, while the emergence of the literary form of the novel, as well as the newspaper and later of magazines not only generalized literacy through the emerging merchant middle classes, but invested the city proper with a whole new informational superstratum or network, complete with the system of exploitable class structures and exclusions that such informational economies invariably entail: access to books and newspapers after all, was never meant to furnish access to literacy, rather the reverse.

The new printing techniques gave rise to a whole new capitalist culture of romance consumables, and in turn, new economic megastructures such as the department store, thanks to the advent of advertising culture and its consequent recoding of urban social space as a marketplace both continuous (in space) and in perpetuity (time). The manufactory, the railway station and undoubtedly, from a more distant background, the inhuman mines, fill out the schema of the nineteenth century urban landscape, each environment in its own direct or indirect way driven, and made possible, by combustion energy and the steam engine.

By the turn of the present century there emerged the modernist city, reshaped and considerably cleaned up in accordance with the new reigning principles of bureaucratic organization; this is a civilization built increasingly on the concept of files and their administration, a culture of records and micro-information, of rationalized management, of hygiene and scientific production. Urbanization increasingly begins now to follow the lines of managed density and increasingly subtle, enriched forms of mass dissemination that include the first electromagnetic technologies such as the cinema, the telephone, the wireless radio as well as incandescent light, automobiles, and the eruption of a third, vertical urban dimension thanks to the elevator, airships and airplanes.

From the early 19th century till the second World War remarkable urban visions came and went – Dickens and Engels in London and Manchester, Haussmann in Paris, Leonidov in Moscow, Ferris in New York, Sant'Elia in Milan – but the ever-transforming informational economies of cities did not win definitive success in breaking the morphological barrier of the classical capitalist city until the second world war. Suddenly at that time, the automobile, combined now with television – and only in such synergistic combination – induced a new type of urbanization: scientific in the extreme and with a total reliance on wartime engineering structures and practices, the city explodes spatially but only as a quilted interlock of increasingly confined and abstract synthetic environments. The chilling presence of engineering could be discerned virtually everywhere, controlling not only the spaces but even their syntax of use: from the freeways, to the office buildings, to the suburbs. Munitions factories and the full-employment war economy of which they were a part are now also turned inside out: the women who labored in them are now the subject of the most intensive technological re-engineering putsch of all time as the new workplace concept of rational, or numerical, ergonomics is projected onto the domestic household and backed up by a hard-sold panoply of so-called "labor-saving" domestic appliances. Reality is increasingly carved up, processed and filtered, then repackaged and delivered in controlled envelopes of remarkable persuasiveness, primarily because there is no longer anything more real (less engineered) against which such synthetic constructs can be checked. Clearly television here also played a determining role, not only by replacing contact with the real multispectral information fluxes of the true city that had been traded off for the pseudo-pastorality of the suburb, but because the reality it delivered was itself totally engineered, oriented to merchandising and thereby to extending the ethos of the mastered environment to ever finer levels. In many ways all other social and economic developments concerned mere logistics and matériel, but television arguably comprised the veritable nervous system of the post-second World War world; its role was not just to compensate (for the quick of the city and the marketplace that was lost) and to deliver (entertainment, information, goods), but in effect, to retrain.

The first – but most difficult – thing to understand about television is that it does not represent an isolated object in a landscape with a circumscribed field of effects,

but in fact comprises a full-fledged environment of its own. Though today we in the west receive far more information than at any other point in human history, we certainly receive far less than ever before in an unfiltered, raw, or unmediated form, in what might be called its "whole" state, that is, naturally embedded in a sensuous complex array and apprehended directly by actual experience. Indeed information and experience, and their difficult relationship (they are, in effect, for the most part, opposed to one another), together comprise the new battlefronts to be seized and occupied by technologization, capitalization, and of power, though in a way decisively different from earlier historical regimes of subjection. This is because the passage from the management and coercion of physical relations and of bodies, to the imposition of precise patterns and habits onto the fluid, labile continuum of human nervous response, represents a movement from the crudely empirical and visible to the subtle and invisible. Our modern, designed environments, including an ever-increasing proportion of the still real wilderness that makes up our most vital cities, is already a restricted, filtered, managed reality where the predigestion and selection of data flow is both the very reason of their existence and their main, and most proud, claim to efficiency. All background noise, and all free, non-channeled flows, are eliminated in the name of creating frictionless, "dedicated" or task-directed environments. Such environments work primarily either because they are designed expressly for the efficient deployment of other, smaller, similarily reduced, machines (imagine anything here from a freeway with its automobile machines, to a laundromat with its washer and dryer machines), or else, with a view to effectively channel human attention, to control it, manage it and direct it into productive but limited "activity pathways" in an increasingly optimized way (any "well-designed" modern office or factory).[4] And yet, it may be said that no inert spatial environment can successfully engage the mobility and fluidity of human attention as fully and assuredly as a dynamically active electromagnetic one.

Our nervous systems, evolved over millions of years in predator/prey environments that necessarily favored massively intertwined experiential modalities over discrete, abstract, informational ones, naturally read movement and temporal processes more readily and with more acute and intense engagement than fixed, purely spatial ones. In other words,"This (television)", may well already "have killed that (architecture)", to reinvoke Hugo's famous prediction. Herein lies the specific beauty and insidiousness of television: it easily lures attention with its flow – it lures attention easily because it lures it initially along its pathway of least work or resistance – then, once captured, confines and tunnels it into rigid, disconnected pathways of predigested, continually – but only infinitesimally – varying monotony. One would be hardpressed today to imagine any advanced, designed environment to which this latter description does not apply just as accurately as it does to TV.

Consider for example our ubiquitous modern shopping malls built since the 1960s. Mall engineers long ago identified a type of environmentally induced anomie or vertigo – a kind of queasiness and disorientation identical to that experienced by many TV watchers – that became known to the planning industry as the Gruen transfer. This term refers to a threshold, the moment when a shopper's purposive behaviour and directed, coherent bodily movements break down under the barrage of excessive, narrow-spectrum stimulation and continual interruption of attention. The unconsciously bewildered shopper, rendered docile, cannot help but drift into the prepared pathways and patterns of externally induced consumer activity, unfocused but exquisitely suggestible to gentle but firm environmental cues. It is estimated that as much as 90 percent of shopping mall transactions concern goods that the shopper had not planned in advance to buy, yet did so after the Gruen transfer took hold.

This, then, brings us back to the problem of retraining. The human organism is unarguably a marvelously flexible entity with enormous range and capacity to integrate even extremely subtle changes of features in the environment. However, as the milieus in which we live become more and more channeled, rationalized, efficiency-oriented and engineered, human capacities – both to affect and to be affected by the world – become filtered, narrowed or truncated. Every "rational" environment is in fact a machinic environment oriented to the efficient use, or flow, of energy and material resources and their conversion into value, if not explicitly into goods. Early synthetic environments such as the factories of the Industrial Age were not only sites of concentration of capital and production, they were also sites where the actual discipline of labour was first forcibly imposed on the human organism in such a way that the nuanced, almost infinite multiplicity of the human motor-nervous response could come literally to be subsumed by the primitive, sterile, repetitive modalities of industrial machinery. These factories, or "labor locales" were, quite simply, training grounds, that is, in addition to serving as sites for production of surplus value, they operated as sites for the production and formation of an altogether new "type" of human being. Yet, as the human relationship to machines became ever more intimate and scientific, for example, in the hyper-rationalized Taylorist and Fordist factories of the early 20th century, it could be said that the muscle-work of the pre-industrial age, had almost completely given way to the new, more refined and invasive reality of nerve-work.

It is in this period, and in the decades that followed, that the concept of "management" becomes the organizing concept in the science of work. Management principally targets and extolls integration, the integration now of a whole group of submodalities that indiscriminately includes machines, markets, labor and goods. With the emergence of this new, soft mega-entity, the human "unit," as it is now called, is analytically broken down, so that "routines" may be individually extracted from it and selectively integrated into this or that point in the production process; the human becomes a kind of universal servo-mechanism essentially monitoring and controlling – by means of its unique capacities of attention – an infinitely entailed cyclical process that seems otherwise to run on its own. Our machines may now well have their own independent personal and social lives and perhaps their own motive force, but they are, in relation to the massively complex evolutionarily interwoven systems of the natural world, still remarkably crude algorithmic assemblages, and so they must, at almost each stage of their operation, parasitically tap the human nervous system to keep themselves up and running and smoothly coordinated. What humans do nowadays – for a living, as it were – is essentially watch, discern, correct and respond, and it is these sets of nervous processes, and others closely related to them, that our labor and management theorists call "work" and that our credulous techno-enthusiasts call "communication."

It is hardly a surprise therefore that between May '93 and '94 the big news in white-collar civilization was that telephone companies had started buying cable TV companies, who in turn were buying movie companies who were buying computer companies who were themselves buying telephone companies – and yet, in point of fact, it was not companies at all, but rather entire industries that had begun to converge in a rapacious territory-grabbing dance around the domestic TV set, spawning the largest corporate mergers in history. What emerged in fact after the dealmaking frenzy last October – and despite the ultimate failure of certain well-publicized mega-mergers – was an information industry oligopoly of unprecedented scale and scope, where so much control over so much of what we will in the future call "culture", had been concentrated in the hands of so few people, that the sudden proliferation of hubristic phrases such as "the digiverse", "the telecosm", and the future "communicopia", could no longer really provoke laughter at all, but only a slowly escalating anxiety.

The new Virtual Society, and the cyberspatial, multimedia systems which form its infrastructure, are largely being sold to us as visionary, romantic and hyperbolic expressions of many fascinating but apparently less spectacular technical developments, either already in process, or just around the corner: universal digitalization and integration, intelligent systems, flexible specialization in the manufacturing sector, piezoelectric and microprocessor controlled materials and architectures, and the multiple revolutions in man-machine interfaces that more than anything else will destroy any precon-

ceived notion of what these two coupled words – man and machine – individually once meant.

What's more, this is clearly no garden-variety, vicious corporate assault in the classical sense: the campaign of persuasion-coercion has come to permeate us from all sides. The slickest approach perhaps comes from credentialed countercultural frontiersmen (they are almost uniformly men) who present public poses as committed hacker/crackers and liberators of privatized information (a position which is supposed not to be vitiated by their stockholdings and membership on Boards of Trustees for many hard- and software startup corporations). The technical infrastructure of the new virtual communities they argue – despite its well-known origins in geo-strategic, military and industrial applications – will create decentralized, highly intimate environments of human collectivity and free communication, and especially, will dismantle the informational autocracies erected during the 70s and 80s during the computer and information revolutions (these latter, of course, have now suddenly become dismissably paleolithic). So gung-ho are these cowboys on empowering "the people", that it does not seem ever to have occurred to them, despite the historical, demographic and intellectual developments of the last two decades, that "people" might also mean workers, women, and those economically, and perhaps permanently, disenfranchised through race, culture or geographical region.

In fact there are many obfuscations here. Perhaps the most basic is the very concept that information is even pleasing, let alone "liberating". Isn't information in fact really among the ugliest, most debilitating and distracting nuisances in our lives? Here is the voice of one of the big playing sellers – Arno Penzias, Nobellist and vice-president of research at Bell Labs:

"People are frightened at the thought of getting too much information, which just shows we're not in the Age of Information Transparency yet. Are you frightened by the thought of getting too much money? Too much happiness?. . . And when will you know you're in the Age of Information Transparency? I will tell you. If somebody says I can get you 10 times as much information as you have now, if that makes you feel good, you're in the Age of Information Transparency. And until then we're in the Age of Paper Work."

And just what could Transparency mean? Who on earth would want to be so transparent that she or he would spend 10 times more of one's day in front of a CRT screen, 10 times more time searching data bases, 10 times more time reading vast, unedited expanses of shapeless prose, 10 times more time logging on, sending thanks, uploading, downloading, file transferring, scanning, etc. Of course Penzias is probably just referring to ten times more access, tantamount to, and about as useful as, for example, owning a really huge ranch that one could use, that is, if one didn't also already have houses in Paris, Aspen, Tokyo, New York and the Costa Amalfi. Given that our time on earth is finite, having access to a data base of 800 encyclopaedias rather than to a single good set, can at best improve our effectiveness only incrementally, though it will certainly degrade the overall signal-to-noise ratio emitted by our world to almost useless levels. And yet, if this is what the information revolution offers us, do not be surprised if what "they" stand to reap from our participation is of considerably greater value and interest. For we all know, or at least suspect, that while more information is terrible for life – it cannot not make an afternoon on a café terrace better, a smile sexier, or an idea more startling, in fact, it only impoverishes these by interrupting them – it is good for business, though primarily through the systematic invasion of public privacy by rendering all of our actions visible, trackable, systematizable and capitalizable.

Consider the implications of computer-based automation, for example, on real "smart" roadways, letting aside for the moment the far more comprehensive colonizations which would characterize the virtual electronic superhighways:

Imagine some future government, faced with paralysing traffic congestion in its urban centers and on its highways, declaring roadways to be private right-of-ways, and installing a program requiring motorists to pay fees for the privelege of using them. Since the idea is for motorists to pay more for a given road during peak congested hours, less during off-hours, but to pay in proportion to how much time is actually spent on them, and in relation to what designated zones were occupied – premium, subpremium or non-premium ones, a relatively intricate electronic tolling system is necessary. Such a system would also have the capability to weigh freight trucks electronically (without requiring them to stop and pull over onto a weighbridge), to check the weight against the truck's bill of lading, and then to debit the operator, all automatically. In addition, such a smart system could, and indeed might want, to monitor the speed of a particular Ferrari every 1000 yards (which is excellent business), while simultaneously keeping an accurate tally of each time a particular Toyota runs an orange light or parks illegally, even for only a few minutes.

Magnetic induction loops buried in the roadway would act as the system's sensors, and they could, in addition to everything else, time and coordinate traffic lights, count vehicles, monitor traffic speed, and feed all this information back – with rerouting advice when necessary – to the user-drivers via roadway billboards, or more directly, to small dashboard-mounted screens inside the vehicles. More advanced roadside or satellite sensors of the barcode-reading variety will obtain much more detailed information from a vehicle's electronic tag (Automated Vehicle ID or "AVI"), a technology borrowed from military aircraft "friend-or-foe identification" systems.[5] Drivers in turn would either carry their AVI tags in a conspicuous place, allowing roadside or airborne radios to identify the car and automatically to deduct the toll from the driver's AVI account, or perhaps better, they could purchase "smart cards" (like those inserted into telephones to direct billing to a home address) that could be swiped through a device inside of any vehicle, then, via the AVI tag, be billed personally for whatever tolls they racked up. An elegant system.

Now the first downside of this, as you have well guessed, is that the latter scenario was not drawn from a science fiction novel at all. Such road systems already exist, if in limited fashion, in Belgium, France, Japan, Germany, Sweden, Singapore, on America's I-95 interstate between Pennsylvania and Delaware, in London, Newcastle, Cambridge and Oslo – in fact they are poised to become more or less universal. But the second, and far more serious, downside is that such smart road systems will, once deployed, have the capacity to know precisely where a motorist is in the network at any given time, in fact, where they had been, when they were there, and for exactly how long. Indeed, such roads will almost certainly know far more than this, depending on which traffic-management and road-pricing schemes are ultimately implemented. This electronic tollbooth urbanism is in fact little more than one massive, automated traffic robo-cop nightmare in the making. Combined with both traditional and video cameras, image-processing computers and databanks, the system can easily be, indeed is already being, designed to nab drivers without cards or who simply have bad credit. The day will all too soon come to pass when we will need to ask "exactly how much are we willing to allow our roads to know about us?"

It hardly needs to be pointed out that things will only be worse – to the nth power – on the information superhighway, for the simple reason that far more intelligence is being built into the system, both at the terminals and in the networks themselves. In fact, bank, credit card and especially telephone use has always generated a frightening amount of information about our lives – try examining a friend's or lover's phone bill sometime – yet in the approaching era of the wireless "on-line" citizen dutifully (as if it were really their choice) toting a "personal digital assistant" on the wrist or in the back pocket, the integral "police-function" that Jeremy Bentham handed down to us in his efficient prison designs from the18th century, will have been permitted so thoroughly to suffuse our daily reality that an off-line jail cell may one day seem like a rare, limited space of pure freedom.

Add to this the increasing prevalence of Automatic Number Identification (ANI) systems and Caller ID, that are already sending not only our names, phone numbers and billing addresses but now also database files, credit information and consumer records to any business we call using an 800 or 900 number, and this even before our voice connection is even accepted, not to mention the compiling, analyzing and selling of this data to other marketing firms on the model of mailing lists. AT&T has already whorishly announced that it will switch exclusively to

using the U.S. Government's Clipper encryption chip on its networks, granting Federal eavesdroppers masterkey priveleges not only for wiretapping but for monitoring all telecomputer traffic at will.[6]

Yet, as I have already indicated, thanks to electronic footprinting, the networks themselves will know far more about us than any centralized government ever will or could. Naturally, hundreds of irresistible new services are being developed for cellular communications systems, most based on the necessary premise that we users will let the switching network know where we are. Most will use global positioning systems derived from maritime and military satellite-based devices. Marketeers will map our walking routes and displacement patterns in a city with comprehensive precision, and though this information will most likely be used benignly to locate sites for new Burger Kings and Federal Express outlets, on the other hand, maybe you just don't want someone else to know that you're always taking that trip at lunch.

Just as television technology in the 1980s ultimately came to be used for surveillance applications, it appears that the phone-based telecommunicational digiverse just may be on the verge of delivering the real, and terrifying, total Transparency that Arno Penzias is talking about.

Despite all this we continue to hear daily a chorus of what marvellous new freedoms and socialities await us on the nets: How we have the choice to be anyone we like, how we have the freedom to cross-dress, become plural, multiply ourselves, become old or young, talk dirty, act out any sociopathic experiment we like without hurting others too badly or humiliating ourselves. This may be true... for now. But as interfaces mature, the dream of mapping our bodily responses directly and seamlessly in to cyberspace will become increasingly seductive, and real. Current research and prototypes are based on ultrasound and magnetic resonance technologies, as well as interfaces derived directly from lie detector technologies; they monitor body temperature, blood pressure, heart rate, as well as micromotor responses in such a way as to generate massively detailed, personal body response profiles – indelible, unchangeable signatures – that clearly, no cross-dressing halloween masks will be able to cover.

Clearly emigration into these new environments is not only today being made quasi-mandatory through public intimidation programs about progress, global competitiveness, and how little Johnny and Sue will be left on the dole lines if they don't get wired by age 4, but it is certainly full of risks, impoverishments, and illusions. Access to the nets is not now, nor will it ever be, equally and democratically distributed throughout society (less than 45% of Americans today have access to their own phone lines, less than 1% of Chinese and Nigerians, and only about 1 in 10 people on earth). Elitist forms of urbanization are already standard fare with expensive "country club" environments and services in which the well-to-do connect and network efficiently among themselves. The entire Internet universe might itself be conceived as a kind of blueprint, belonging to the classic de-urbanization model of a wholesale secession of a unified social class from a public sphere to a protected enclave (the class referred to here would be one of the new informational classes such as "those who live or work in synthetic computer environments").

In fact the idea of unification and preselection may be one of the worst dangers shaping Internet sociality. Because the Internet is an entirely engineered space adjacent to, and entirely removed from, the concrete material world, the normal constraints of friction, viscosity, noise, and the general panoply of resistance and reactivity that characterize responses to gestures in the material world are nearly absent from it. For this reason, aggregation patterns, unlike those traditional ones unfolding in richly articulated, complex, material social spaces, here freefall, in the absence of cohesional counterforces, into micro-user groups of unbelievable, even shocking narrowness. And this narrowness is then in turn, extolled as some type of "revolution" that, among other things, will soon allow the preselected, predigested "narrowcasting" of personalized daily information in a neat package that will replace the daily newspaper with what MIT Media Lab founder Nicholas Negroponte smugly calls "The Daily Me". More social and intellectual atomization, just what is needed for today's fragmented, creolized, ghettoized world in crisis.

Clearly, one could go on forever. But what is most important of all, is that with the migration of tools from the older, peripheral spaces of human ecology to its center; and with their transformation from an external, objectifiable object into an environment and a set of modalities that are inhabited, human substance, and even the capacity to conceive of human freedom, are modified in the process.

Somehow, somewhere our democratic institutions will need to be reinvented, if only to lay down the rules and fix the limits within which economic rationality ought to be permitted to function and to run roughshod over our lives. The forces behind the coming virtual city are driven by savage economic imperatives, not delirious new possibilities for freedom, and we will need, at great challenge to the imagination, to find effective new ways of refusing them. We will need to create strong alternative cultures resistant to the sleazy short-term seductions of gadgetry, in the hopes of maintaining any semblance of longterm autonomy over our fates. "Jacking in" to a cyberspatial matrix, as the characters in William Gibson's foundational novel Neuromancer put it, is, after all, hardly a convincing idea of life reinvented beyond the tyranny of productivist ethics nor the most promising erotic vision of a world where the body's energies are partially freed to create new modalities of pleasure.

But in seeking to develop the new intensities, the alternative, off-line forms of culture and attention, we will almost surely have to free ourselves of certain prejudices that once served us well. Indeed the most difficult part of all I fear, is the possibility that for the first time in our history, and against all of the truisms of our education and our traditions of progress, it may well at last be necessary, while cautiously stepping forward across the ominous threshold into the future, to keep at least one eye hard trained on the past, on its objects, and on the parade of types that make up the humans that we once were. Somewhere in that pageantry a million little spores lie, each representing a pathway once primed but never taken, along which human consciousness might today still travel, and free itself from the precariously narrowing trajectory on which it is otherwise perilously embarked today.

1) I would like to acknowledge the direct debt that this section owes to the work of two philosophers of technology, George Grant and Jacques Ellul.
2) The so-called Islamic revolution of the last 15 years, to give just one example, is by no means simply the neo-archaic, arbitrarily anti-American belligerence that it is often made out to be, but represents a broader, more systematic – and for these very reasons, (to us) nearly inapprehensible – refusal of modernization, secularization and technologization.
3) The german Autobahnen were explicitly developed to facilitate the logistical and supply demands of the Nazi war machine during what would become the second World War.
4) Antonio Gramsci, the first philosopher to describe social relations in terms of muscular-nervous effort, argued that one could gauge the complexity of industrial societies by their capacity to produce machines with which to produce further machines, and that of technical civilizations by their capacity to produce not only scientific instruments but rather, to produce further, more refined instruments for testing the first ones. In this same sense, our own society moves to ever greater mathematical and perceptual abstraction as it engages itself in planning and engineering environments specifically for engineered – and no longer primarily natural or animal – objects and flows.
5) Used (with less than impeccable accuracy) in the recent Gulf War.
6) The National Security Agency (NSA) has reportedly monitored all international phone traffic in the U.S. for decades – all incoming and outgoing calls, as well as all those simply transiting through the country – based on machinic recognition of targeted keywords. The new keystroke-based communications and optical form- and character-recognition technologies now not only increase the detail and accuracy of these surveillance techniques but extend their domain of applicability by an exponential factor.