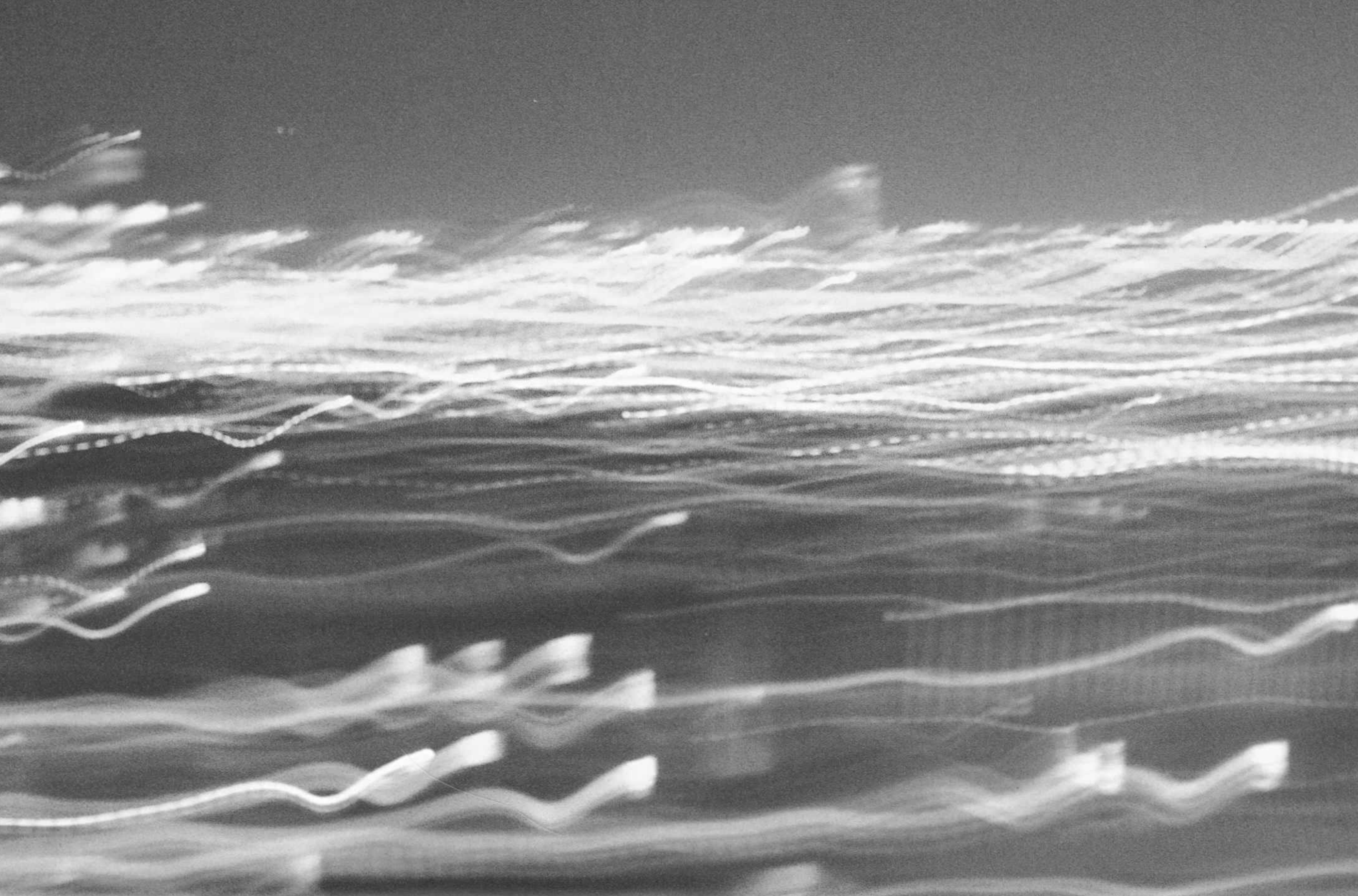
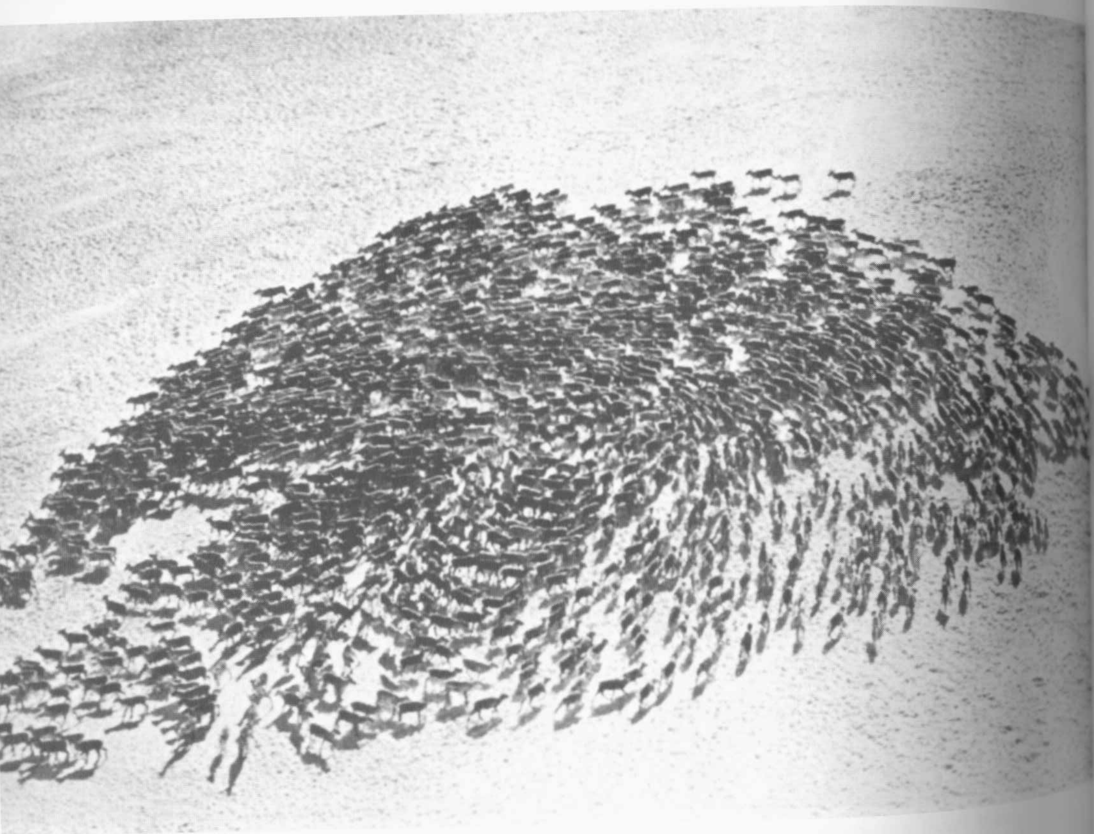
The Virtual Dimension

ARCHITECTURE, REPRESENTATION, AND CRASH CULTURE

edited by John Beckmann





Terminal Velocities:

The Computer in the Design Studio

STAN ALLEN

Oh but it's not the fall

that hurts him at all—

It's that sudden stop.[1]

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. While a cat falling one or two stories has some chance of landing safely, a cat falling from three to six stories is unlikely to survive. Surprisingly, a cat falling from more than six stories is quite likely to survive. Apparently, by twisting into proper position and completely relaxing, the cats develop enough resiliency to survive the impact. Beyond fifteen floors the chances of survival drop again. Too much time in the air, and the cats reach terminal velocity—in the most literal sense.

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—x^n 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 computer aided design (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.[2]

But in the rhetorical fictions of the computer, speed brings something else: a future not only more fully integrated with technology, but a promise to recover precisely that which had been destroyed by modernity in the first place. Claims are made for the recuperation of community, self, political space, precision craft, and local identity.[3] The rhetoric of accessibility in turn depends upon the capacity of the computer to simulate reality. And it is speed that guarantees the seamlessness (and thereby 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 it's 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."[4]

Virilio distinguishes between metabolic speed—the speed of the living being, reaction time—and technological speed—the artificial speed of machines. 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 microspeed, 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..."[5] It is through these interruptions that the field is reconstituted—not as seamless continuity, but, through a shift in scale, as 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."[6]

What is at stake for architecture in all this? The computer in the design studio provokes both extravagant claims and high levels of anxiety. Is there, as with the cats falling through the hot summer air, 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 this is possible, it will be necessary to look more closely at the paradigms and protocols at work in the use of the computer as a design tool.

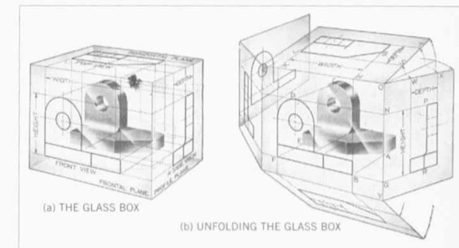
A legitimate skepticism toward both the technocratic drive for efficient production as well as the vague promise of a utopian future is a start. But a positive program is required as well. This would begin with a speculative and open-ended investigation of the possibilities and potentialities of these 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. What are the specific opportunities for new modalities of geometrical description, spatial modeling, simulation of program and use, generation of formal and organizational systems, or rapid prototyping? A careful reassessment of the implications of these new tools in their theoretical and conceptual context is warranted. 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"; 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.[7]

FIRST HYPOTHESIS: DIGITAL ABSTRACTIONS

One of the curious aspects of digital technology is the valorization of a new realism.[8] From Hollywood special effects to architectural rendering, the success of the new technology is measured by its ability to seamlessly render the real. Even so-called virtual reality has not so much been used 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, design mistakes will be avoided. This too is clearly market driven, answering a need to predict what something will look like before spending the money to build it.[9] 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.[10] But more significantly, it ignores what has traditionally given architectural representation its particular power of conceptualization—that is to say, its necessary degree of abstraction, the distance interposed between the thing and its representation.[11]

1. P. Devlamnyyk, *The Invention of Drawing*, after a painting by Joseph Suvée, 1791

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 memento (FIG. 1). 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 proceed 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 (FIG. 2). 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.



2. *The Glass Box*, from *Technical Drawing* by Giesecke, Mitchell, and Spencer, 1958

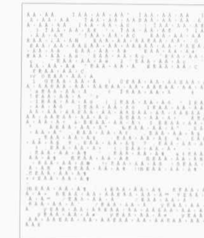
Now the computer simultaneously collapses and increases the distance between the architect's two-dimensional representations and the building's three-dimensional reality. That is to say, in as much as computer representations are more immaterial than conventional drawings, the distance is increased; in as much as it is possible to work directly in three dimensions, the distance is collapsed. 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—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 can provisionally suspend its presence as intermediary.) That object is a collection of commands as opposed to the result of a series of projections. 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 discrete elements) capable of generating an infinite number of representations of itself.

As a consequence of this, the effect of working on the computer is cumulative. Nothing is lost. Elements and details are continuously added, stored, and filed in perfect transparency. Instead of proceeding from the general to the specific, the designer moves from detail to ensemble and back again, potentially inverting traditional design hierarchies.

The status of the drawing, and in turn the process of design itself, undergoes a transformation. A new kind of abstraction emerges: abstraction not as final result of operations of idealization or reduction, but of the indifferent order of bits. Interestingly enough, a sense of casualness, a 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 diagrammatic and loose organizational paradigms: a contingent, "conditional" abstraction. This in turn implies a shift away from the false certainties of visualization toward the generative capacities of the computer as an abstract machine. Today, this is expressed not so much as a mandate as a possibility. Abstraction is no longer a categorical imperative, but one choice among many. When working with the computer, however, it is a logical choice as it is something that the computer does well.

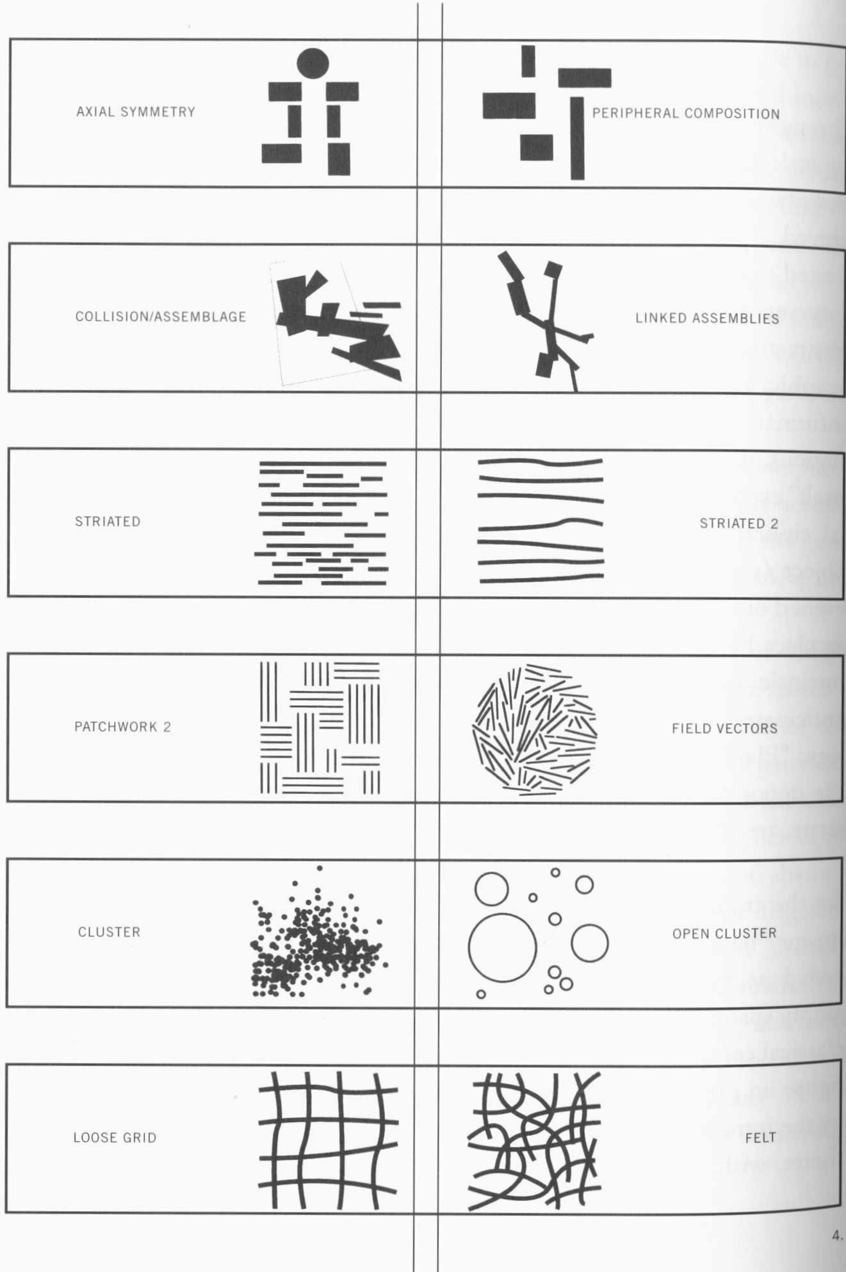
SECOND HYPOTHESIS: DIGITAL FIELDS

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."[12] A field of immaterial ciphers is substituted for the material traces of the object (FIG. 3). Hierarchies are distributed; "value" is evened out. These ciphers differ one from the other only as place holders in a code. They have no materiality, no intrinsic value. Already in 1921, Viktor Shklovsky had anticipated the radical leveling effect of the notational sign: "Playful, 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."[13]



3. Digital code: text file print out of image file

This evening out of value has implications for the traditional concept of figure/field. In the digital image "background" information must be as densely coded as foreground information. 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 modern composition perturbed by the introduction of a complicated play of figure against figure, with digital technologies we now have to come

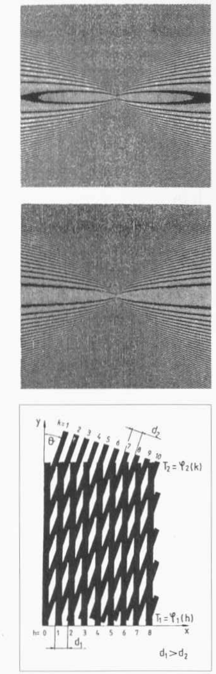


4.

to terms with the implications of a field/field relation (FIG. 4). A shift of scale is involved, and a necessary revision of basic compositional parameters is implied.

A moiré, for example, is a figural effect produced by the superposition of two regular fields (FIG. 5). Unexpected effects, exhibiting complex and apparently irregular behaviors, result from the combination of elements that are in and of themselves repetitive and regular. But moiré effects are not random. They shift abruptly in scale, and repeat according to complex mathematical rules. Moiré effects are often used to measure hidden stresses in continuous fields, or to map complex figural forms. In these cases, figure and field can never be separated as distinct entities, producing an uncanny coexistence of a regular field and emergent figure.

Comparing these field formations to the organizing principles of 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. 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.[14]



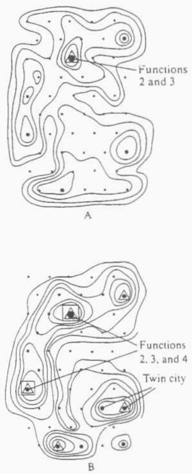
(a)

(b)

5. top: Moiré fringes formed by the superimposition of a circular grating and two linear gratings with period (a) larger than and (b) equal to the period of a circular grating

bottom: parametric description of moiré fringes formed by two linear binary amplitude gratings

THIRD HYPOTHESIS: THE LOGISTICS OF CONTEXT



6. Christaller diagrams

The diagrams produced by the Christaller model of urban growth (FIG. 6), which ignores large-scale accidents of history or geography but incorporates fine-grained difference in the form of multiple variables and nonlinear feedback, demonstrate how the interplay between laws and chance produces complex but roughly predictable configurations of a nonhierarchical nature. The whole of the city is never given at once. The city is a place of contingency, a whole that is not bounded and closed, but capable of permutation, open to time and only provisionally stable.

In the late 1980s, 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 (which he called "boids") 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 neighborhood; third, to move toward the perceived center of mass of agents in its neighborhood. As 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 boid could do and see in its own vicinity. If a flock was going to form at all, it would have to do so from the bottom up, as an emergent phenomenon. And yet flocks did form, every time."[15]

The flock is clearly a field phenomenon, defined by precise and simple local conditions, and relatively indifferent to overall form and extent.[16] 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). These two examples, the Christaller model of urban growth and Reynolds' simulations of flocking behavior (others could be cited as well), dissolve the traditional 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. And it should be pointed out that the computer is especially well suited to the mapping and simulation of these systems—registering the cumulative effects of incremental changes, recursive and reiterative strategies, these are all inherent to the logic of the processor. 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. Bobby Russell, "Sudden Stop," recorded by Percy Sledge, 1968.

2. Our tendency to privilege the new and the optimal, along with the popular idea that every new form of technology renders existing technologies obsolete, needs to be rethought. Two simple examples demonstrate why: the first is the development of high-speed trains in Europe and Japan. A nineteenth-century technology, railroads were supposedly made obsolete long ago by air travel, but they now emerge as a logical alternative from ecological and urbanistic points of view. Similarly, AM talk radio—a technology supposedly made obsolete by television—along with the Internet and other advanced forms of communication, has acquired extraordinary political power in the United States in recent years.

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

4. Paul Virilio and Sylvere Lotringer, *Pure War* (New York: Semiotext(e), 1983), 69.

5. Ibid., 33.

6. Ibid.

7. 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." Kevin Kelly, interview with Brian Eno, *Wired*, May 1995, 150.

8. The use of the computer in the design studio has facilitated two important shifts in design practice that have yet to be examined critically. First is a renewed use of perspectives, which once had to be laboriously drawn by hand but can now be generated effortlessly by clicking a button. Second is the use of color. Color in the computer is either extravagantly false or attempt to simulate photographic representations of reality through sophisticated rendering programs incorporating reflection, transparency, and texture mapping. In both cases, the ease of achieving seductive effects has as yet overwhelmed any impulse to question the relationship between the means of representation and the architectural intention.

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

10. "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." Kelly, interview with Brian Eno, 149.

11. See Robin Evans, "Translations from Drawing to Building" *AA Files* 12 (1986).

12. Vivian Sobchack, "The Scene of the Screen: Towards a Phenomenology of Cinematic and Electronic Presence," *Post-Script* 10 (1990): 56. Cited in Bukatman, *Terminal Identity*, 108.

13. Viktor Shklovsky, "Theory of Prose," (1921) cited by Manfredo Tafuri in "The Dialectics of the Avant-Garde: Piranesi and Eisenstein," *Oppositions* 11 (winter 1977): 79.

14. In this context it is interesting to note that the Turing machine—the hypothetical computing machine that is the conceptual basis of the modern digital computer—performs complicated relational functions, (multiplication or division, for example) by means of serially repeated binary operations. Paradoxically, it is only when the individual operations are simplified as far as possible that the incredible speed of the modern computer is achieved.

15. Ilya Prigogine and Isabelle Stengers, *Order out of Chaos Man's New Dialogue with Nature* (New York: Bantam Books, 1984), 197ff.

16. M. Mitchel Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon and Schuster, 1992), 240–1.

17. "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, MN: University of Minnesota Press, 1988), 30–1.