

## INTRODUCTION

# *Studies in the Evolution of Culture*

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The studies in this volume grew out of my eighteen-year collaboration with the chaos mathematician Ralph Abraham, so I would like to put this work on cultural history into the cultural history of my own work with my Lindisfarne Association colleagues in the period of the last two decades of the twentieth century.

In the 1980s, a group of video and electronic artists, computer scientists, mathematicians, and 'new edgy' sorts of thinkers was founded in Los Angeles by the late Andra Akers and called Synergy International. In the fall of 1985, I was in New York, conducting a symposium on the Gaia theory of Lovelock and Margulis<sup>1</sup> when Andra asked me to come to Los Angeles for the weekend to give an informal talk at the Los Angeles Film Institute in response to what I would see there in a conference cum performance of artists in the new electronic and computing media.<sup>2</sup> As part of this gathering, Andra arranged a party at her house in West Hollywood in which all the artists and scientists took part. One of the people I just had to meet, Andra insisted, was the mathematician and chaos theorist from the University of California at Santa Cruz, Ralph Abraham. Since I had recently read some articles about chaos theory in *The Scientific American*, I was quite interested, but also somewhat afraid, for like many people in the humanities, I suffer from a severe case of 'math anxiety'. Much to my surprise and delight, Ralph was inter-

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[1] This colloquium subsequently became the book *Gaia: A Way of Knowing* (Lindisfarne Press, Great Barrington, MA, 1987).

[2] International Synergy published the proceedings of this conference, *Is Journal* #1, 1986, ISSN 0887-946X, and this monograph became the pilot issue of a journal which carried on for about ten years.

ested in everything — art, religion, science, as well as mathematics — and was not at all interested in controlling experience with abstractions. Not at all like so many of the scientific reductionists I had met before, Ralph and his attraction to chaos theory seemed energized precisely because of an interest in the relationship between lively intellectual structures and living forms in nature. Looking more like a countercultural Jerry Garcia than an Olympian Albert Einstein, Ralph was not intimidating, so I began to open up to his way of thinking, one that seemed to fit in well with the complex planetary dynamics of the Gaia theory, and one also that seemed to offer a way out of the rigidity of ‘sacred geometry’ that in our Lindisfarne Summer School on Sacred Architecture under Keith Critchlow’s charismatic mastery had fast become an authoritarian platonic cult. I was looking for a way out of the closed, esoteric, and rigid geometry of containment in an unchanging eternity, and there in Ralph’s chaos theory, a door to another way of understanding the geometry of the phase portraits of complex systems seemed to open up.

At the time I had met Ralph, I had just published my science fiction novel, *Islands Out of Time*,<sup>3</sup> which expressed my allergic rejection of the organ transplant of European anti-democratic platonism to the Lindisfarne Summer Institute in Crestone, Colorado, but I was also at work on a shift from cultural history to cultural ecology.

The founder of the United Nations’ Environmental Program Maurice Strong had organized a conference in New York in February of 1983 in which he asked various environmental activists and thinkers from around the world to take part. Strong had organized the Stockholm Conference in 1972, and this had been responsible for the establishment of the United Nations new program on the environment; now Strong was continuing with the work that would lead to the Rio Summit on the Global Ecology in 1992. Strong had also donated the land for the establishment of Lindisfarne in Crestone, Colorado and had taken part in one of our Lindisfarne Fellows conferences on ecology, in which the Fellows and a group of about eighty people took part. Among them were Amory and Hunter Lovins, John and Nancy Todd, David Orr, Hazel Henderson, Wendell Berry, David Ehrenfeld, Wes and Dana Jackson, James Lovelock, Sim Van der Ryn, Paolo Soleri, and Gary Snyder. The Lin-

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[3] *Islands Out of Time: A Memoir of the Last Days of Atlantis* (Dial Press: New York, 1985).

disfarne Fellows presented an understanding of ecology and governance that was in advance of the Leftist position that Strong enjoyed in the world of national governments, NGOs, and multinational corporations. The UN conference he organized at the Waldorf Astoria in New York was a reflection on the global predicament seen ten years after Stockholm and ten years before the Rio Conference to come. In recognition of the Lindisfarne approach, I was invited to come to give a talk and to take part in a swanky black tie dinner for the global notables. I declined the invitation to the black tie dinner, as black ties and tuxedos give me cultural contact dermatitis, but I did agree to give a brief talk in which I offered another way of looking at Western Civilization as a movement through 'Four Cultural Ecologies'.

The satellite perspective of history that I offered was so lofty that the talk had as much impact on the audience as a passing cloud, and I remember being followed by a more conventional presentation by David Lilienthal, a founding father of the Atomic Energy Commission, and he spoke of the need for more economic growth and the construction of more nuclear reactors. I retreated to my customary solitude in Bern, Switzerland, and the talk was subsequently published in the Green activist journal *Resurgence*<sup>4</sup> — which is certainly a case of 'preaching to the choir'.

In spite of the lack of interest in this new approach, I was quite taken with the shift from intellectual history to cultural ecology and continued to work on expanding the brief talk into a more fully developed essay. I was in the middle of this work in Bern when I received Ralph's paper, 'Mathematics and Evolution', which he sent me as a follow-up to our meeting in Los Angeles. The essay was very brief — a kind of intellectual telegram which is often Ralph's favoured mode of expression — and was just about as fast and schematic as my talk in New York had been; but it had enormous impact on me, for suddenly I saw that the four cultural-ecologies that I was describing had not only four associated literary forms of narrative but four greater mentalities in which mathematical exposition and literary narrative were inseparably united in a historical world-view. Everything fell into place in one of those 'Eureka' kinds of peak experiences that give the intellectual life its unique joy. I rewrote my essay, working in this new theory of literary-mathematical mentalities that are embedded in cultural ecolo-

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[4] See *Resurgence*, November-December, 1983, No. 101, 16-17.

gies, and sent off the revised version just in time for it to make it into my new book, *Pacific Shift*, as the chapter entitled 'The Four Cultural-Ecologies of the West'.

Intellectual peak experiences are, I guess, by their nature rather isolated and isolating ones, for this book, much like the talk I gave in New York, had absolutely no impact and it went out of print within a year or two of its publication and never made it into paperback, except for two small and very obscure editions in German and Japanese. But Ralph and I carried on with our dialogue and I arranged a meeting of the Lindisfarne Fellows at Esalen in Big Sur, California in which Mary Catherine Bateson, James Lovelock and Francisco Varela interacted with Ralph. As these interactions continued to develop, they became expressed in my next book, *Imaginary Landscape: Making Worlds of Myth and Science*.

Our next collaborative project was to be an effort to unite mathematics and art in a performance at the high altar of the Cathedral of St. John the Divine in New York of what I called Electronic Stained Glass. Through the use of an enormous screen, a video projector, a superfast computer, and performances by three mathematicians using a modified stringed instrument and two piano keyboards, invisible micro structures of time were presented as visual geometries of the phase-portrait of their behavior in our world of slower, human time. As part of the evening's presentation, I did one riff with the band in which I read a poem combined with footage of spirochetes taken from the microscope filmings at Lynn Margulis's lab that I had edited and made into a music video, and that Ralph then set to theme and computerized variation. With an audience of about 300 people, we presented our scientifically avant garde experiment in the vault of that enormous Gothic cathedral. This performance of 'MIMI and the Illuminati' was intended to be more a moment of *Wissenskunst* than *Wissenschaft*. It was enormous fun and though certainly too experimental to be yet great art — more like a child's kaleidoscope than a rose window from Chartres — it was, nevertheless, an event unlike anything any of those present had seen before.

This expression of a form of presentation that was not simply mathematics and not simply art set Ralph and me to thinking about the whole relationship between mathematics and art, and in conversations at the Cathedral with the architect Santiago Calatrava, and other Lindisfarne Fellows — the atmospheric chemist James Lovelock, the biologist John Todd, and the botanists Paul and Julie Mankiewicz — we worked on the design of a bioshelter for the roof

of the Cathedral in which Lovelock would design electron capture devices that would read the atmosphere interacting with the exhalations of the visitors and Ralph would create the Visual Math software and hardware to transform that gaseous interaction into an interactive video art form in a more permanent installation of 'electronic stained glass'. Some of the videos were to be mimetic, some interactive, and some composed in advance by musicians and video artists. But the project was never to be, for the 'Green Dean' of the Cathedral, the Very Reverend James Morton, was blocked and then retired by the very prosaic Episcopal Bishop Grein. He objected to having trees and a bioshelter set on high in a cathedral, and so he worked hard to replace Dean Morton with a new Dean, one who was more conventionally Episcopal and less imaginatively ecological. The project was too utopian and its costs far too celestial for a city suffering from the more immediate crises of AIDS and crack. But practicality has its costs as well and the Cathedral of St. John the Divine has now become a very large, empty, and stone-cold space.

We all went our separate ways, and my way took me to San Francisco to give a series of lectures on 'literature and the evolution of consciousness' at the California Institute of Integral Studies. The journey gave me more opportunities to go down to Santa Cruz to work with Ralph, and in presentations we gave at C.I.I.S. and Esalen, we continued to try to take the project a few steps further. As part of the work in preparing my lectures, I brought along a small figurine, a copy of the paleolithic statuette of Lespugue, that I had bought at the museum shop in the Louvre in Paris. As I studied the statue, it seemed to me that the head was a unit of measure, and that the most unrealistic rendering of the body seemed to divide up into sections that I thought possibly could express some canon of proportion — something like, length of head is to chest as chest is to thighs: a prehistoric version of the classical canon of Praxiteles. I suggested to Ralph that he scan the figure and then study it mathematically to see if there was anything interesting going on in the figure as icon. Ralph found the little statue to express a visual correlate to the heptatonic scale and his mathematical confirmation of my artistic hunch makes up the material of the first chapter of his new book, *Bolts from the Blue: Mathematics and Cultural Evolution*.

As Ralph and I continued to carry on our discussion by e-mail, from Zurich to Santa Cruz, concerning works of art and the progression of the historical mentalities — the Arithmetic, Geometric, Galilean Dynamical, and Chaotic — Ralph cautioned me and said, 'But

what about the algebraic?' I asked him what he saw as the essence of the algebraic mentality and he responded with a note about the entrancement with the purity of a transcendental notation. I asked for more time to think about it.

The next morning I e-mailed back to Ralph that the entrancement with code, with a substitution of the mental for the material, seemed to express itself at the time of the emergence of algebra in the art of calligraphy circa 800, in the beautiful Arabic Korans and Celtic Gospels. Indeed, the genius of Islam itself is expressed in the sublimation of concrete idols in favour of an invisible Allah registered on Earth by an angelic intermediary in a transcendental script of letters and Indian numerals. Coeval with this emergence of algebra was alchemy, and, in its Alexandrian origins, it was concerned with the subliming of base lead into ethereal gold, script into scripture. Certainly, medieval allegory expressed a mentality completely fascinated with the emblematic power of an esoteric code.

But the more I thought about the algebraic mentality, the more I thought that it had never really become as globally extensive as the geometrical, which externalized itself in the expressions of architecture all around the world, from Mesopotamia to Egypt, India, China, Mesoamerica, and medieval Europe. The geometer of the kind of civilization that expressed itself in classical and high medieval architecture was not simply a technician but more like a public health officer responsible for the harmony and just proportion of the polity; he was more of a Pythagoras or Confucius than a wild Gallois or a paranoid Gödel.

The thought of paranoid Gödel, who starved himself to death because he was afraid that people were trying to poison him, made me stop to reflect on the paranoid's fascination with secret code, with an entrancement for notation that held the sacred hieroglyphs of cosmic meaning. The substitution of code for concrete experience is a primary characteristic of the 'paranoid cosmic synthesis' in which everything is explained. I thought of all the paranoid conspiracy mail that I had received over the years: manuscripts without any margin, with a whole separate text circling around the central transcription, and with keywords like 'world order' or 'Rothschilds and Rockefellers' colored over with highlighting pens. The paranoid had a terror of empty spaces; no space could be left unfilled or uncolonized by his imperious obsession.

When I was living in Bern, I became acquainted with the psychotic art of Adolf Wölfli, for the Kunstmuseum in Bern holds his primary

collection. Wölfli is so great an artist that it seems unfair to pigeon-hole him in the category of psychotic art. Psychosis may have driven Wölfli and given him his 'horror vacui' and provided the content for his visions, but his uses of multiple spaces, his sense of design and structure, raise him to the level of art as art and not just psychotic art and clinical data. In Wölfli's 1904 work he was coeval with Cubism in breaking down linear perspective, and in his 'Samoaaden Brücke' he envisions the bridge from multiple and simultaneous perspectives. Rational, linear perspective is abandoned and space becomes curved as beings from multiple dimensions leak through the holes in space and time. Thinking of Ralph's comments about the 'entrancement with notation', I went back to give Wölfli another look, and much to my astonishment I found that Wölfli had written an 'Ode to Algebra', that he had filled in whole notebooks to algebra with his fascinations with cosmic calligraphy and esoteric notation.<sup>5</sup> Perhaps, I thought, Wölfli was the end of a process, the algebraic mentality carried to its extreme.

The coeval emergence of calligraphy and algebra represented a bifurcation, a fork in the road in which one line moved into entrancement with notation and the replacement of the concrete with code in a very introverted form of cosmic solitude, while the other line of descent moved in a more extroverted manner toward the Galilean Dynamical mentality with its movements of global capital and ballistic artillery that transformed the world in what became the shift from medievalism to modernism.<sup>6</sup> One path led into the solitude of cabalistic magisters who thought that they alone under-

[5] Adolf Wölfli: Schreiber, Dichter, Zeichner, Componist (Herausgegeben von der Adolf-Wölfli Stiftung Kunstmuseum Bern, Wiese Verlag, Basel, 1997). The Ode to Algebra is on p. 131.

[6] Alfred W. Crosby sees this shift as occurring before the Renaissance. 'Then, between 1250 and 1350, there came, not so much in theory as in actual application, a marked shift. We can probably pare that century down to fifty years, 1275 to 1325'. See his *The Measure of Reality: Quantification and Western Society 1250-1600* (Cambridge University Press: Cambridge and New York, 1997), p. 18. Since this is the time of Giotto and Dante, it makes some sense as to see the intellectual breakthrough occurring then, followed by the calamity of the Black Death, and then the economic and social reconstruction of Europe that we associate with Florentine capitalism and Renaissance art. Cultural historians as different as Alfred Crosby and Rudolf Steiner both see the thirteenth century as the time of the bifurcation in the evolution of consciousness, so perhaps it is more informed to push the Renaissance back, before the Black Death. The new mentality would then be seen to be expressed in Arabic music and poetry, inspiring Provencal poetry and Dante's *dulce stil nuovo*, as well as the new

stood the world, and the other to the military-industrial complex of those who sought to rule the world and not simply understand it in some esoteric notation. And not until the cabbalistic notation of a small band of mathematical physicists transformed the outer world with the atom bomb did these roads reconverge. Now in the new mathematical mentality of chaos Dynamics, it would seem as if all the historical mentalities are being synthesized in algebraic formulae in which the phase portraits of the geometry of behavior of complex dynamical systems are creating a new evolutionary niche for Artificial Life in which mathematical entities and mathematical domains have their own ontological uprising. Like the holes in space in which other ontological domains leak into ours in the paintings of Adolf Wölfli, other realities, Virtual, Virtuous, and perhaps Unvirtuous as well, are leaking into our conventional world.

Ralph Abraham and I have come to our contemporary cultural bifurcation from two different lines of cultural descent that touched us when we were young assistant professors at Princeton and MIT in the sixties, but we do imagine together that the art and science of this new emergent culture is not going to be an embodiment of the reductionism and eliminativism of the present, or the past five hundred years. Neither abstract nor concrete, this new way of knowing seems to us to be a kind of visual math that is also musical, and perhaps just that kind of music of Strings the Calabi-Yau topologies make as they pulse with the fabric of space-time in ways imaginable for heads that have the heart for it.<sup>7</sup> To get ready for this new planetary culture, we climb and turn on the spiral and blink our eyes in wonder and disbelief as we see a history we missed in the settled cities of the plain where the universities lie.

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mathematical sensibility. The Algebraic mentality could then be seen as a transition state between the Geometrical and the Galilean Dynamical to come.

[7] See Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate theory* (New York: W. W. Norton, 1999), pp. 207, 208.