Preamble with a Few Explanations

Since the death of R. Buckminster Fuller in 1983 at the age of eighty-seven, the record of his prodigal career as a writer, artist, designer, and philosopher continues to be widely recognized—and even celebrated—out of all proportion to the notable paucity of serious critical evaluation of his work.

It is not my purpose in this introduction to correct that imbalance. I have not acquired the academic credentials for such a task, and besides, as his longtime collaborator, I could not muster the necessary detachment.

So many of the discoveries of synergetics remain undiscovered by those very mathematical and scientific disciplines to which they would appear most relevant. But are they relevant? Will there ever be a synergetic accommodation with the psychologists and the particle physicists and the topologists? Can Fuller's claimed discoveries be reconciled with the latest accepted picture of reality as described by the various branches of physics? Maybe only the beginnings of answers will be found in this dictionary, but at least it exhaustively documents Fuller's proposal of a whole new field of study: a geometry of thinking and a geometry of physical reality.

This dictionary represents the first comprehensive documentation in one publication of all the major avenues of Fuller's thinking since they were first anticipated in his *Nine Chains to the Moon* of 1938. Here is the full array of the themes and concepts of his half-century of writing and lecturing—including many propositions that remain to be tested—always expressed in his own words but organized in a way to help the inquisitive reader pursue his own explorations. Hundreds of the entries herein are unpublished table talk and ephemera now in print for the first time, while roughly a third of the entries trace their way back to the primary source material of Fuller's dozen or so books published since 1938.

Though the systematic arrangement of the dictionary is inescapably analytic, it aims to be expository rather than critical. I organized it as an instrument to help the two of us write the *Synergetics* books. My hope is that it can serve as a tool for students and critics to make their own assessment of his work and thus reinforce the recognition of his achievements with the weight of discriminating examination.

At this point Fuller might tell us in his sometimes simpler words, "Every time man makes a new experiment he always learns more. He cannot learn less."[1]

This *Synergetics Dictionary* was developed primarily around Fuller's system of synergetic geometry as later incorporated in *Synergetics* and *Synergetics 2* (published by Macmillan in 1975 and 1979). But as a dictionary it goes well beyond the geometry to

cover the full range of his original strategies of economic accounting, tensegrity engineering, energy harvesting tactics, individual and group psychology, Dymaxion airocean world map, and world game patterns of industrialization, and their ultimate synthesis in one grand scheme that he termed *design science* (q.v.).

For Fuller it was all one gestalt book that never quite got published—one endless lecture with slides—a mosaic of his engineering blueprints, his allegorical lithographs, his lecture transcripts, his economic polemics, and his geometry. It was a frustration for him that his two *Synergetics* books were not fully comprehensive—particularly in the omission of his almost desperate lifelong commitment to the *geosocial revolution* (q.v.), his hallmark strategy of making the world work. The current Garland edition enables me to make public amends for the first time by placing his synergetic geometry in the context of the complete body of his work and his program. For Fuller mathematics is intensely relevant to the evolution of humanity.

The obituary of R. Buckminster Fuller that ran on page one and continued for six columns in the *New York Times* of 3 July 1983 made no mention of his magnum opus *Synergetics* although these two volumes are his chief literary accomplishment, his most original work, and constitute what I believe is his major legacy to posterity. *Synergetics* has gone through many printings and is available in both hardcover and paperback. It has a devoted following of readers young and old. But the *Times* failed to mention the work—with apparent impunity—because it has received a dearth of recognition from academic specialists in the fields it presumes to explore, and because of the peculiarity and difficulty of its language.

In fact it has been easy for many otherwise responsible people to absolve themselves from paying attention to Fuller's work solely on the grounds of the inaccessibility of its style. Perhaps I should not have expected others to share my intrigue with that mode of expression: I would prefer to collaborate with a difficult writer who might need more help than an easy writer, and Fuller could always be counted on to come up with drafts that were complex to the point of obscurity and devoid of the least risk of banality.

Although Fuller declared that he was striving for a style expressing the most accurate and comprehensive observation of experience,[2] he ended up with a wholly new and unfamiliar and often polysyllabic vocabulary of his own invention. At their best his descriptions achieve a kind of poetic combination of feeling and abstraction—physical sensations merging into metaphysical patterns. Because it verges on a prose poem I describe *Synergetics* as a literary rather than a scientific work. In fact when we started to collaborate on the project in 1969 he had an impulse to write the whole book in blank verse—or at least with unjustified right margins. The manuscript as I discovered it after years of gestation had the first two chapters in verse form. Fuller agreed to my suggestion that these chapters had an integrity of their own, and with the invaluable guidance of Bill Whitehead at Doubleday I helped him prepare them for separate publication as *Intuition* in 1972.

Synergetics is a book without genre. It proposes no less than a *geometry* of thinking and a *geometry* of physics. It deals with questions of geometry and philosophy through an exposition which does not conform to the conventions of mathematicians and philosophers. Fuller's descriptions reintroduce those very subjective properties and sensory impulses that have been eliminated by classic science from formal descriptions in physics. He rejects the established disciplines of the universities by ignoring them; in their place he imposes his own self-discipline and his own way of thinking in a deliberate attempt—as artists do—to change his generation's perception of the world.

FULLER AND GERTRUDE STEIN

In his preface to *Synergetics*, Professor Arthur Loeb of Harvard compares Fuller's literary style to that of Gertrude Stein. They were both innovators in the metaphorical use of language. She made the English language "an artist's medium, a sort of prose imitation of the Cubist practice of portraying an object on all sides at once."[3] He made poetry a strategy for arriving at truth. For Fuller a poet is "a very general term for a person who puts things together in an era of great specialization . . . where most people are taking things apart."[4] By such a definition, "Einstein became and will probably remain history's greatest poet—for who could say so much so simply as did Einstein when he described physical universe as $E = Mc^2$."[5]

Fuller does not describe himself as a poet because the term is not really professable; it is a term which only society can bestow and then only retrospectively.[6] For Fuller, the essence of engineering is poetry:

Take out for yourself some engineering and science textbooks and break the words up into phrases . . . and prove it for yourself. Then try some non-engineering prose and it probably won't work. I would not be surprised if some day it were proven a law that the better the science the better the poetry.[7]

Fuller's language fuses the sensorial and the technological, as in ". . . the echoed voice of a poling raftsman to the forwardly informative radar manipulations of the stratojet-piloting airman." His speech abounds in physical allusions:

holding patterns of energy
corkscrew spiral traceries
impact extrusion
jet-stilting
pumping fraction factors
reach-miles
swivel-moored
girth-tensed bonds
fibrous crystalline units
invisible trampoline
vacuum-fulcrumed oars

Not so rich perhaps as Homer's rosy-fingered dawn and wine-dark sea, but what could convey more energy than Fuller's vacuum-fulcrumed oars?

FULLER AND EDGAR ALLAN POE

Perhaps the nearest thing to *Synergetics* in its cosmological range is the work of another American poet-philosopher, the *Eureka* of Edgar Allan Poe published in 1848. As Paul Valéry says of *Eureka*, "Cosmogony is one of the oldest of all literary forms. . . . As for the idea of a beginning—I mean an absolute beginning—it is necessarily a myth."[8] I am not suggesting that Poe had any influence on Fuller; he was only a casual reader of Poe and had never read *Eureka*. But both were amateurs and autodidacts venturing into heady speculations into the nature of physical reality. Since Fuller was not an accredited mathematician it was an act of presumption for him to dedicate *Synergetics* to a leading geometer of the day, Professor H. S. M. Coxeter of the University of Toronto. With comparable audacity Poe inscribed his work to Alexander von Humboldt. Poetic license indeed.

In an even greater extension of hubris Poe goes on to invoke the example of Johannes Kepler: "I care not whether my work be read now or by posterity. I can afford to wait a century for readers when God himself has waited six thousand years for an observer. I triumph. I have stolen the golden secret of the Egyptians. I will indulge my sacred fury."[9]

And *Synergetics* is an even more ambitious elaboration of the cosmological themes, both in the originality—the gritty intent—of its epistemological starting point and in the exquisiteness of its geometrical expositions. For Fuller the lodestar is what he calls *omnirationality*—the reciprocity of geometry and number.

What he shares with Poe is a fierce conviction in the inevitability of his description of the cosmos.

On the opening page of *Synergetics* Fuller exhorts the reader, "Dare to be naive." Similarly in speaking he tended to address professors as if they were nine-year-olds and nine-year-olds as if they were professors. This is a strategy that was anticipated by William Blake who "liked to think that his works were perfectly comprehensible to the innocent, to minds not blunted by education and fashion, especially children."[10]

MATHEMATICS DERIVED FROM EXPERIENCE

Fuller's alternate term to describe "synergetics" is "experimentally founded mathematics—EFM." This explains why mathematicians can ignore Fuller's conjectures with impunity: partly because the Cartesian XYZ coordinates and the centimeter-gram-second system of coordination work so well that there is no particular incentive to adopt the synergetic model, and partly because any mathematician will tell you that, whatever it is he does, it has nothing to do with physical experience. In fact, one of the glories of pure mathematics, to its practitioners, is its essential irrelevance to all but psychic or esthetic considerations. It is a discipline devoid of empirical content. Indeed, the branch of mathematics that is most remote from practical applications (except perhaps in codes and ciphers) is number theory, whose purity has gained it the description "the queen of mathematics." (That is, the basis of the mathematician's work is in pure logic, and the application of his work to the physical world is left to others.)

Fuller had no intention of reforming conventional mathematics; he merely wanted to introduce the world of science and physics to popular understanding. He had no quarrel with the deductive reasonableness of mathematics, only with its axiomatic assumptions of hypothetical points, lines, and planes based on grounds of strict logic. Fuller proposes a new philosophical foundation for a mathematics based on observation and experience, deriving from the physical reality of the energetic behavior of atoms, molecules, and gravity. His strategy is designed to cope with the information available directly from our senses as well as "the information progressively harvested through microscopes, telescopes, and electronic probings of the non-sensorially-tunable ranges of the electromagnetic spectrum."[11]

Fuller says that "even the development of sets derives from experience because mathematics is generalization—and generalization itself is sequitur to experience. The mathematicians talk of 'purely imaginary numbers' on the false assumption that mathematics could be a priori to experience."[12]

The world of mathematics is not about to give up its axioms to accommodate the world of physical experience—much less the picture of reality presented by today's physicists. The mathematicians have no imperative to confront or judge Fuller—they are doing quite different things—as long as they do not object to his application of mathematical strategies to his experiential picture of the world.

GETTING NATURE INTO A CORNER

In its simplest terms synergetic geometry aims to substitute triangular and tetrahedral mensuration for the rectangular and cubical XYZ coordinates of Cartesian accounting and calculus. It describes energetic phenomena in terms of angle and frequency and rejects what Fuller considered the vulgar quest for the ultimate "building blocks" of matter that has become the

theme of so much journalistic description of science. Synergetics generates its modularities from the operation of a few limit-case geometrical phenomena: the closest packing of unit-radius spheres, the foldability and triangulation of great circles, and the fractionation of the regular tetrahedron.

A tetrahedron may be thought of as a pyramid with a triangular base: a four-sided polyhedron with three angular corners at each vertex. Tetrahedra are the basic modules of Fuller's philosophic system. In his most elegant formulation he says, "Substituting the word *tetrahedron* for the number two completes my long attempt to convert all the previously unidentifiable integers of topology into geometrical conceptuality."[13] Understanding that sentence is the key to understanding synergetic geometry, where tetrahedron is unity and unity is two. Here is his integral pattern for the coordination of thinking with physical action, incorporating the energy quantum of physics into a rational metaphysical system: this is what he means by "getting nature into a corner."[14]

DICTIONARY AS AN ANALOGUE OF UNIVERSE

Knowledge organizes itself geometrically. There is a pattern in the very process of dismissing irrelevancies. ("The dismissing of irrelevancies" [q.v.] is Fuller's description of the process of thinking.) This dictionary should be thought of as systematic rather than linear. Though the dictionary contains the heart of *Synergetics*, it is organized for shorter spans of attention.

For Fuller the dictionary is an analogue of the universe itself. He defines universe as an aggregate of humanity's communicated nonsimultaneous and only partially overlapping experiences. Dictionary is likewise a collective concept, integral but ipso facto nonsimultaneously recollectable. Thinking, remembering, and looking something up all require time. Though the set of all the words in the dictionary cannot be simultaneously considered, their overlapping sequence is progressively revealing. In the same way the universe encompasses too many simultaneous events for any man to have a comprehensive understanding of them at any one time.

So much for a glimpse through the magic casements—a foray into salvation by mathematics. Now let's get to the files.

RATIONALE FOR THE DICTIONARY

On 9 February 1970 Buckminster Fuller addressed a memorandum to one of his office assistants at Southern Illinois University saying, "Please arrange . . . to have an exhaustively cross-referenced, alphabetically coded, first-word indexing of my topical concept files . . . to package up all the concepts . . . and save me from repetitive discourse and writing."[15] As a result of that initiative, Fuller's office in Carbondale sent me (at my home and office in Washington, D.C.) over a period of many months copies of all books and articles by Fuller and relating to his geometry, including lecture transcripts, untranscribed tape recordings, manuscripts, letters, and unpublished papers, and two trunkfuls of the original files of his synergetics notes dating from the 1940s, together with notebooks, drawings, blueprints, and collateral clippings. Here was plenty of grist for the mill to keep me busy excerpting and indexing when Fuller was not visiting with me in Washington over the ten-year period of collaboration in which the two *Synergetics* volumes were completed.

Neither Bucky nor I realized it at

the time, but as all those files were compiled they seemed to manifest a sort of self-organizing character, and we ended up creating something approaching a new art form.

In preparation for collaborating with Fuller on the work that was to become *Synergetics*, I had, beginning in 1969, accumulated on 5 x 8–inch cards in alphabetical sequence by topic the best net statements I could get my hands on from everything he had said or written about almost everything. I typed all these entries myself on an old Underwood standard typewriter. (The few corrections to these entries made especially for this Garland edition of the dictionary may be identified by their new IBM typeface.) Eventually, there came to be twelve file boxes arrayed around my desk like the manual of an organ so that I could reach any of the 22,000 excerpts from where I sat while typing the successive drafts of *Synergetics*. (See photograph.) The current edition is designed to provide the reader with comparable easy access. (In 1976 Princeton Datafilm Inc. published the dictionary in a format of 250 microfiche.)

The first title entry of the dictionary reads

Catalog of a Mind

The second title entry of the dictionary is replete with antique initial capitals:

A SYNERGETICS DICTIONARY

Being a Systematic, Nonlinear, Variorum Selection
and Self–branching Arrangement of the Concepts, Definitions
and Generalized Principles Discovered or Formulated by

R. BUCKMINSTER FULLER

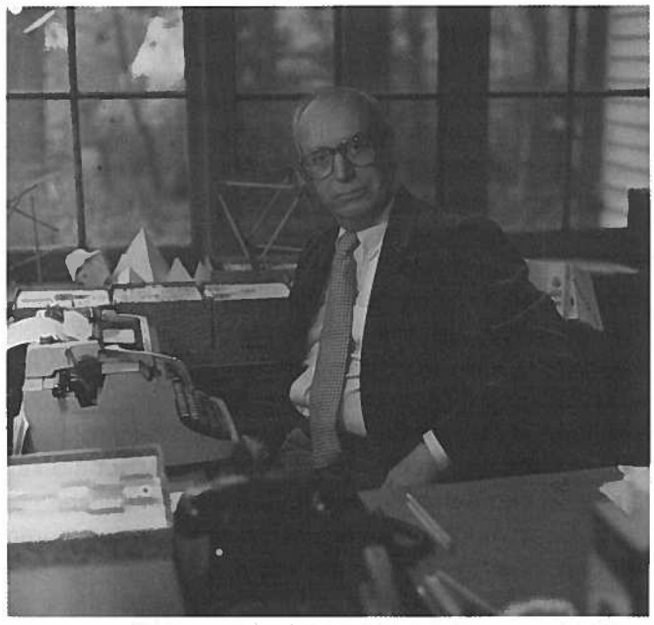
Embracing the whole Body of his Writings, Letters,
Lectures, Table Talk and Marginalia on the Subject of
Synergetic Geometry and Philosophy presented
exclusively in the Author's own Words
as an Index and Adjunct to
His major Work:

SYNERGETICS

Expressed in Model, Sequence, Metaphor, and Aphorism as
Recorded, Compiled, Arranged, and Cross–Referenced
for easy access by

E. J. APPLEWHITE

Fuller had a penchant for putting things together, I for taking things apart. We both wanted to write a book as accessible as possible to the common reader, and wherever his peculiar and invented terms were unavoidable we wanted to be sure that they were exhaustively defined. Like many great teachers, Fuller's communications mode of choice was oral discourse. The transcripts of his many—always extemporaneous—lectures recorded the sound without the sight with unavoidable loss of the gestures and body language that always helped him juggle several themes at once in a tapestry of interwoven exposition. Sometimes a Fullerian metaphor will run on for minutes and pages at a time, strung together by gesture and intonation despite illuminating asides and digressions, but making for a certain complexity of syntax and some strain on the auditor's span of attention. As the architectural critic Reyner Banham once put it in describing Fuller's creative thinking, "Problems are simultaneously bulldozed frontally, undermined termitically, and outflanked by relative



E. J. Applewhite and the *Dictionary* (Photo by Steve Flores, New York)

clauses lasting up to six weeks."[16]

Even on the occasions when Fuller is terse and aphoristic, his statements can benefit from being read in context. Thus the problem of the dictionary as I saw it was to index it in such a way that it could afford the reader (including Fuller himself) both the short focus of the net statement as well as the full context from which the phrase was abstracted. At the price of redundance, the dictionary provides both. For example, take his arresting statement "Time is an invention." In these files that observation is indexed for comparison with Fuller's other notions of inventions and cross-referenced to passages where the phrase appears in its full philosophic context.

The method is tomographic, like a succession of medical X-rays in which details on one plane of a tissue appear clear and sharp while adjoining planes are blurred: by varying the focal length we can concentrate on different objects of consideration.

For instance, take a short paragraph from Fuller's essay "Total Thinking":

Mathematical concepts of group phenomena may be acquired in principle by the willingness (subjectively *initiated) of the* individual *to be governed by the integrity of progressive conceptioning principle—the* objective synchronizations *are implicit and unavoidable competence and comprehensive, realizable design will result. Let us pursue further the conceptioning in specifics of* group principle.[17]

That unusually difficult passage initiates an uninterrupted narrative of exposition requiring thirteen successive file card entries subsumed under the caption *Periodic Experience* (1)–(13). That particular paragraph is abstracted under *Subjective & Objective* and cross-referenced to *Individual & Group Principle*.

DEFINITIONS AND SEQUENCES

Fuller's vocabulary may be unconventional but it is rigorously consistent—there would be no point in a dictionary if it weren't—both in its employment of invented words and in its use of familiar words in a special way.

The dictionary is organized to serve as a bridge between the peculiar concepts and terminology of Buckminster Fuller and the more common terms of our everyday discourse. Thus for convenience some common terms that he

simply never uses, such as "psychology" and "mortality," are listed in the dictionary to provide cross-references to the invented phrases that he uses in their place. (For some examples see "Enter With Your Word: Exit With Fuller's" on page xxxviii.)

When appropriate, both the most concise and the most all-embracing definitions are presented—always in the author's own words. In cases where there has been a significant evolution in the development of a concept, successive citations are presented in chronological order. Sometimes the chronological sequences are not only of interest in themselves as an illustration of Fuller's modus operandi, but also of possible clinical interest as an exercise in cognitive science.

There are two main classes of entries (intermingled by alphabetical order). They are *Definitions* and *Sequences: Metaphors*; the former tend to be topical in form while the latter tend to be narrative.

Definitions: Explicit statements of what the author means by each word he uses. Some words are limited to the most graphic and definitive examples; for example, there could easily have been a hundred different entries for the term *Regenerative* (a word Fuller works into almost every paragraph) while in fact there are seven. In a few cases the dictionary attempts to be exhaustive, as with philosophical concepts like *Limit, Set,* and *Metaphysical & Physical*. In other cases, like *Environment* and *Universe*, there appears an exhaustive record of the chronological evolution of the author's progressively poetic refinements of phrase.

Metaphors: Sequences: These narrative sequences that recur time and again in Fuller's lectures and writings have been assigned descriptive phrases or clauses to permit their systematic recapitulation. An alphabetical list of these major metaphors—in fact 668 of them—may be found under the file indicator *Sequences*. Sometimes as many as a half-dozen different versions are presented when there are significant variations, particularly over a period of time. For examples, see:

Bubbles in the Wake of a Ship Sequence
Divide & Conquer Sequence
Lever: Fallen Tree As a Lever
Rich Man Drowning in Shipwreck
Wave Pattern of a Stone Dropped in Liquid

Miscellaneous entries: Some of the "table talk" items in the dictionary are not filed strictly as definitions but under the name of the person or object considered. Fuller always said that conversation was the most generous of the arts. Even when not lecturing, he was a prodigal talker—not at all as an indulgence but as what he considered an act of responsibility. Although he loved people and funny stories he had no small talk. One could not inquire about his health or the journey or the weather without risking a response of disconcerting gravity.

I gathered these informal and impromptu observations from his casual discourse at such unpromising occasions as breakfasts with sophomores or long waits at airports—not to mention his marginalia on the back of envelopes, tickets and menus. As an example of his free-form conversation see the entry for *Aiken: Conrad*, 14 Feb '72; it may not tell you much about Aiken but it's quite a glimpse into the mind of RBF and his views on the social function of literature.

For detailed instructions on all the nuances of tracing and searching available from the various types of cross-references, see "How to Use the *Synergetics Dictionary*," beginning on page xxxiii.

An incidental result—Fuller might have said a synergetic result—of the process of compiling the dictionary was its use as a device and stimulus for furthering the creative process itself. For Bucky there was never a final draft and seldom a time when he could be confronted with a file card of one of his earlier statements on some topic without wanting to amplify it (al-

most never to delete or erase). Some holographic examples of this procedure are included among the initial cards in "Sample Entries Edited by Fuller."

A PERSONAL NOTE

People often ask me why I don't give a course or write a book that will really explain synergetics. One of the reasons I don't is that I see a basic incompatibility between the passive role of an editor and the active role of a teacher. A collaborator should not be an explicator. I have tried to write synergetics in the voice of one person—Fuller's. I never want the reader to have to worry about whether this is something RBF is saying or is it EJA who is talking; in these two books and in this dictionary the reader need have no doubt: the voice is always that of Fuller.

As for teaching synergetics I can come up with no better curricula than those I have already devised. They are the ninety-page index at the end of *Synergetics 2* and the comprehensive introduction to Fuller's work that this dictionary constitutes. I have nothing more to add.

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January 1986

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NOTES

[1] See entry in dictionary captioned *Learning: You Can't Learn Less*, dated Dec '72.

[2] *Synergetics*, sec. 203.06.

[3] James Atlas, review of *Everybody Who Was Anybody*, by Janet Hobhouse, *New York Times Book Review*, 11 April 1976.

[4] See dictionary entry captioned *Poet*, 22 Apr '61.

[5] See dictionary entry captioned *Poetry*, 13 Nov '69.

[6] E. J. Applewhite, *Cosmic Fishing* (New York: Macmillan, 1977), p. 57.

[7] See dictionary entry captioned *Poetry*, 1962.

[8] *Variety* (New York: Harcourt, Brace, 1944), pp. 137, 141.

[9] *Eureka* (New York: Mclellan Book Co., 1908), p. 190.

[10] Mark Shorer, *William Blake: The Politics of Vision* (New York: Henry Holt and Company, 1946), pp. 13–14.

[11] See dictionary entry captioned *Mathematics*, 13 Mar '71.

[12] See dictionary entry captioned *Mathematics*, 22 Apr '71.

[13] From "Omnidirectional Halo" in *No More Secondhand God* (Carbondale: Southern Illinois University Press, 1963), p. 156. Also found at *Geometrical Conceptuality*, 11 Nov '73 in this dictionary.

[14] See *Synergetics 2*, sec. *261.01*—which is excerpted among the five citations to *Nature in a Corner* in this dictionary.

[15] RBF memorandum to Dale Klaus, 9 Feb '70.

[16] *Arts Magazine*, London, October 1963.

[17] Chapter 12 of *Ideas and Integrities* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 237.