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**PUBLISHER:** William S. Blair  
**CONTROLLER:** Louis A. Isidora  
**CIRCULATION MANAGER:** Elizabeth Jacobsen  
**PRODUCTION MANAGER:** Louis Seeger  

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R. Buckminster Fuller is a rarity in this age of science—a practicing natural philosopher. A self-described comprehensivist, he has been urging us for decades to realize that human societies, like biological species, court extinction when they become overspecialized. In Fuller’s view, the disease of specialization has progressed unchecked in this century; the recurring symptom is short-sightedness, revealed in our repeated failure to recognize and respond to the fact that life on earth is made up of a series of closed, interdependent systems arranged with all the delicate balance of a pyramid of pool balls.

Fuller’s counsel is that we must enlarge our vision and learn to think and operate in terms of Whole Systems. He would have us think of the earth as a spaceship, admirably and efficiently equipped for a journey of indeterminate length if we but understand the interconnectedness of things and use technology to enhance rather than violate natural balances. The alternative scenarios are dramatically simple: utopia or oblivion.

Fuller’s fundamental optimism runs counter to many of the intellectual currents of the twentieth century. He believes that the universe is understandable; that life is more than a random element in the universe, more than a bit of luck; and that man has a distinctive and important place in the ultimate order. These convictions are developed and explored at length—at times at an Einsteinian level of generalization—in his new book, Intuition, selections from which follow.

Fuller’s poetic style has been described as having the orderly impenetrability of nature itself. His suitcase sentences are essentially attempts to deliver thoughts whole, to give all the elements simultaneity, allowing the reader to unpack them bit by bit and adjust them to the dimensions of his own experience.

Evolution is apparently intent
That life in Universe
Must survive.
Biological life
Is syntropic
Because it sorts and selects
Unique chemical elements
From out of their randomly received
Time and locality of reception
As celestial imports;
Or from out of their random occurrence
As terrestrial resources—fresh or waste—
Anywhere around our Earth’s biosphere,
And reassociates those elements
In orderly molecular structures
Or as orderly organs
Of ever-increasing magnitude,
Thus effectively reversing
The entropic behaviors
Of purely physical phenomena
Which give off energy
In ever more random,
Expansive, and disorderly ways.
For human life contains the weightless,
Omnipowerful, omninknowing
Metaphysical intellect
Which alone can comprehend,
Sort out, select,
Integrate, coordinate, and cohere.

Little humans
Preoccupied with the immediate needs
Of their physical regeneration
Have locked their zoom-lens focusing mechanism
On the close-ups only
Leaving it exclusively to their intuition
To remind them
Once and again in a surprised while
Of the vast long-distance focusing
Of evolutionary events.

II
I feel it immediately important
To distinguish between mind and brain—
For that unique difference
Also differentiates most incisively
Between human beings
And all the other living creatures.
For instance, it was mind alone that discerned
That physical experiment disclosed and confirmed
That local physical systems
Are always exporting energy
In one manner or another, such as by friction,
And it was mind alone that determined to identify
‘semantically’
The exporting of energy
By inventing the abstract name entropy.
And mind went on to discern
That physical experiences disclosed and confirmed
That all living tissue
During cell multiplication
Must import more energy
Than it exports,
Else it could neither grow
Nor even sustain healthy balance.
And mind also witnessed
That crystalline structures
Also can import energy
But not as much as they export;
And mind identified
Energy importing by the name syntropy.

The sum total consequence of entropy is
An omnienveloping physical Universe
And an only apparently increasing disorderliness.
This does not mean absolute disorder;
It means the momentarily superficial appearance
Of less order than symmetry.
And the disorder is only relative
To the majority of individual cases,
For each system
And its particular entropic exportings
Is orderly within itself.
And the detection of disorder is mistakenly assumed
As the result of exclusively myopic
And too short-termed observing.

I am convinced therefore
That there is a great deal of difference
Between absolute disorder, i.e., chaos,
And the only one-sidedly considered,
Relative asymmetry, whose pulsative balancing
At a later time with other systems was not awaited
By the too hasty and biased observer.
On the contrary, I am convinced
By comprehensively considered experience
That a total integrity of order prevails
And am inspired to explore that order
In hope of discovering humanity’s function
In the evolutionary scenario
Of omniself-regenerative Universe.

III
To date, we have gained vast inventories
Of trial-and-error experience
From all of which information we have developed
A family of generalized scientific principles
Which are weightless pattern concepts.
Being weightless they are metaphysical.
From the metaphysics
We have in turn designed
Rearrangements of the physical behavior constituents
Of our omnikinetik environment scenery.
We have rearranged the scenery
In the pattern of world-around occurring power-driven
tool networks
All of which telelogic process
Has produced an ever-increasing survival advantage
for humanity.

The human advantage is both physical and metaphysical,
As ever-increasing proportions of all Earthians
Become involved in the processes
Of massive production and distribution
Of both the necessities and desirables
Which implement humanity’s regenerative evolution
requirements.
And the degrees of increasing advantage
Are expressible in precise scientific terms
Of the number of centimeters, grams, and seconds of work
Humanity is able to accomplish
Out of each hour of investment
Of each and all of its individuals’
Potential lifetime hours,
Energies, materials, and know-how.

But we also discover that humanity
Does not yet realize its potentially imminent success
Despite the published statistics of death-deferring
Doubling and even tripling of life spans
Of a billion and a half humans
Rendered wealthy by industry
Within only the past seventy years
And despite the concurrent fractionalizing
Of the numbers of human hours
That must be individually invested
To produce the essentials and desirables.
And humanity’s enlightenment is delayed
Because the Earth planet is so large.
And man is so infinitely tiny
And so myopically preoccupied with personally avoiding
The erroneously assumed inevitability of poverty
for the many,
Which has slavishly and fearfully conditioned his reflexes.

Those not as yet included
In the high-living advantage, ever-multiplyingly produced
By power-driven tool networks,
Do not comprehend the swiftly accelerating rate
At which comprehensively increasing human advantage
Will include them and their children,
As well as the children of the already advantaged—
For they find themselves in a cultural environment
Whose customs, logic, and law
Were designed uniquely to cope only with the struggling
Of the preindustrial frequently failing agrarian era,
Which struggle is no longer essential to their
omniscient potential—
Intuiting which children find themselves brimming
With unanswered questions regarding
the significance of life.

Inspired by the beauty and appeal
Of their earnest questioning
And in continuance of our attempt
To differentiate the domains and functionings
Of brain and mind,
We eagerly explore
For experiential evidence
That human minds and brains
May be essentials
In the total design integrity
Of eternally self-regenerative
Scenario Universe.

From physics we learn that every fundamental behavior of
Universe
Always and only coexists with a nonmirror-imaged
complementary.
The nonsimultaneity and dissimilarity
Of the complementary interpatterning pulsations
Integrate to produce
The complex of events
We sensorially identify as reality.
Without the pulsative asymmetries and
asynchronous lags
The complementsations would cancel out one another
And centralize equilibribously,
And there would be no sensoriality,
Ergo, no self-awareness, no life.

For we have also learned from physics
That all the positive and negative weights
Of the fundamental components of matter
Balance out exactly as zero.
Life may well be a dream,
A comedy and tragedy
Of errors of conceptioning
Inherent in the dualistic
Imaginary assumption
Of a self differentiated
From all the complex otherness

Of reasonably conceivable Universe
For it must be remembered
That no human has ever seen directly
Outside himself.
What we call seeing
Is the interpretive imagining in the brain
Of the significance and meaning
Of the nervous system reports
Of an assumed outsideness of self
All of which organic design conception
May be that of a great intellect
Which is inventing Universe progressively
Evolving mathematically elegant
Integral equations
For each conceivable challenge
Including the invention
You and me.

At least our speculative excursion
Was relative to our attempt to differentiate
Between brain and mind
For the written record of two millenia
Discloses human minds forever rediscovering
The great dream concept
While the brains of the dogs
Sleeping at my feet
Have never given evidence
Of being concerned with such thoughts.
Either the brain tells them to go hunting
Because their bellies are hungry
Or they bark in reflex to a strange noise
Or they wag their tails in response
To brain-recalled propitious circumstances.

Returning to our hard and soft
Experiential realities
We seek to discover whether there exists
A major phase of universal behavior
Which complements but does not mirror
The omninexpansive, increasing asymmetry
And progressive entropy diffusion of physical systems,
And matches the latter
With an increasingly orderly and symmetrical
Omnicontracting and compacting syntropic phase.

IV
Our discovery and confirmation
Of man’s having a unique and essential
Role in Universe
Will depend upon our developing a clear understanding
Not only of the difference
Between brain and mind functioning
But also of their respectively unique characteristics.

Starting a new line of attack we first note
That at the present moment in history
Humanity has not differentiated lucidly
Between the meanings of the words
Brain and mind:
They are often used synonymously.
The pragmatist tends to discard
The word mind as embracing
What seems to him "unteachable mysticism";
While the realist feels
That the word brain
Is adequate to all his needs.

Sum totally to date
The scientists have learned
That the human brain
Is a vast communication system
Able to record and retrieve information
At varying rates of lag.

The brain is a special case
Concept-communicating system
Very much like a television set.
It's not just a telegraph wire,
Not just a telephone,
It is sensorially conceptual as well.
It deals with our optical receipts
As well as with our hearing,
Our smelling,
And our touching.
In effect we have a telesense station
Wherein we receive the live news
And make it into a video-taped documentary.
In our brain studio we have made a myriad of such videoed recordings
Of the once live news,
All of which we hold in swiftly retrievable storage.

You are the TV studio's
Production director—
Surrounded by many repeater
Cathode-ray tube sets—
You say, "What is going on here?"
As you view—hear, smell, feel—the news;
"Can I recognize this scenario?"
"Have I seen it before—
Or anything like it?"

Your phone-headed assistants
Search the files
And plug in any relevant documentaries.
In any television station studio
The director intuitively sorts and selects
Resource sequences
From out of the myriad of
Relevant scenarios, live or replayed;
Now putting the subject
At long range,
In full-environmental perspective,
And now at close range,
Scrutinizing some detail.
He has other cameramen
With their lenses aimed
At static photographs,
Others feeding angles
Of a host of yesterday's
Documentary footage.
He also has available
Imaginarily invented footage
As well as yesterday's experience clues

Which may be appropriately considered
At various stages for mixing in with the news.

Out of all this comparative viewing
The director then selects
What he conceives of
As an appropriate scenario
Of action to be taken now
In view of both the news challenges
And the documentary reminiscences.

Because the brain's TV prime resource
Consists of images,
We may call the total brain activity
Image-in-ation.

All we have ever seen
Is and always will be
In the scopes of our brain's TV station.
All that humanity has ever seen
And will ever see
Is his own image-ination;
Some of it is faithfully reported new,
Some of it is invented fiction or make-believe,
Some of it is doggedly retained "want to believe."

The physiologists and neurologists
Probing the brain
Say it is easier to explain
All the data they have
Concerning the general phenomena
Operative at the top of the spine
If they assume two prime variables always to be operative:
They give one of them the name “mind,”
The other they call “brain.”
The neurologists and physiologists say
It is easier to explain all the data they have
If they assume
The mind as well as the brain to be co-operative,
Than it is to explain all the data
If they assume only brain to be operative.

And why is that?
It is because it is found that there are conversations
Going on over this communication system—
Using its information retrieving and storing system—
Whose conversational contents
Are in no way explicable
As being produced by feedback of the system itself.

V
Universe is the aggregate
Of all of humanity’s
Consciously apprehended
And communicated experiences,
Which aggregate
Of only partially overlapping events
Is sum-totally a lot of yesterdays
Plus an awareness of now.

Yesterdays and now
Are neither simultaneous
Nor mirror-imaged;
But through them run themes
As over and overlapping woven threads,
Which though multiply and individualized
Sum-totally comprise a scenario.

No single frame either explains
Or foretells the whole continuity—
The picture of the caterpillar
Does not foretell the butterfly,
Nor does one picture of a butterfly
Show that a butterfly flies.
I cannot think simultaneously
About all the special-case events that I have experienced,
But I can think of one special set
Of closely associated events
At any one now.

Each one of these thinkable sets
Is what I call a system.
A system is a subdivision of Universe.
A system subdivides Universe
Into all of the Universe events
Which are irrelevant to the considered set
Because (a) they are outside the system,
Too macrocosmically too infrequent
Either to fit into
Or to alter
The considered set;
Or irrelevant because (b) occurring
Too microcosmically remote

Within the system
And of too-high frequency
And of too-short duration
To be tunable with
Or to alter significantly
The considered think-set.

After dismissing momentarily
Both the macro and micro irrelevancies
There remain
The few clearly relevant sets of associated events
Which constitute the system.
We find that all the systems which subdivide Universe
Into insideness and outsidersness
Are concave on the inside
And convex on the outside.

We next observe that
The concave and the convex
Always and only coexist.
A rubber glove on my left hand
Has an external part which is convex
And an inside which is concave.
If I strip the rubber glove from my left hand,
It now fits my right hand.
What had been the concave
Becomes the convex
And the convex becomes the concave.

So we find these always and only coexisting
Complementaries are behaviorally interchangeable—
The tension could be the compression
And the compression could become the tension.
Because in one case the girth
Went into tension
And in the other it
Went into compression.

Experimental demonstration
Of a plurality of special-case instances
Of always and only co-occurring phenomena
Is prerequisite to generalizing
The brain-mind differentiation.

I will give another example
Of always and only co-occurring phenomena.
Physicists today observe
That the proton and neutron
Always and only co-occur.
While they are not “mirror” images of one another
And have different weights,
They are transformable
One into the other,
And are thus complexedly complementary,
As are isosceles and scalene triangles.
None of the angles and edges of either needs be the same
To produce triangles of equal area.
And the sums of the three angles of each
Will always be one hundred and eighty degrees.

The mathematical balancing or complementation
Of the proton and neutron are analogously balanced,
Each one having two small energy teammates.
The proton has its electron and its antineutrino,
And the neutron has its positron and its neutrino,
And each of these little three-member teams
Constitutes what the physicist calls *half-spin* or a *half-quantum*.
They complement one another
And altogether comprise one unit of quantum.

We have now discovered experientially
An always and only coexisting tension and compression;
An always and only coexisting concave and convex;
And an always and only coexisting proton and neutron.
We next consider the Theory of Functions,
Which embraces all of these terms.

X and Y are the always and only co-occurring Covariables of the Theory of Functions.
We can have X stand abstractly for *tension*
Or for convex or for proton.
And we can then have Y stand abstractly
For compression, concave, or neutron, respectively.
In each of our foregoing *always and only co-occurring*
Experiential observations of interessential relationships.

We can go further still:
We have the word *relativity*.
We cannot have relativity
Without at least two phenomena
To be differentially related.
There is also the word *complementarity*.
We cannot have one phenomenon complemented
By less than one other phenomenon.
The words *complementarity* and *relativity*
Do not identify identical physical phenomena.
We need to discover
Whether there exists a generalized concept
Which embraces both phenomena,
And we find that the ponderable physical energy Universe,
That is, *physical universe*,
In contradistinction to the Universe’s Weightless, metaphysical aspects,
Does embrace both *complementarity* and *relativity*.

I started our brain-mind differentiation
By saying, “I take a piece of rope.”
I’ve done this before many audiences,
And no audience has ever said,

“You don’t have a piece of rope.”
But the fact is I didn’t have a piece of rope.
Nor has anybody ever said,
“Is it nylon, manila, or cotton?”
Or, “What is its diameter?”

My statement was a “first-degree scientific generalization.”
In literature the word *generalization* means
Covering too much territory
Too thinly to be convincing.
However, we have in science a term “generalization”
Which does not have the literary connotation.
A *generalization* in science refers to
A principle discovered by experiment
To be operative in every special case.
If we find any exception,
We no longer have a scientific generalization.

It is a second-degree generalization
To find an additional generalized principle
Operating within the generalized piece of rope;
Such as the always and only
Coexisting tension and compression.
It is also a second-degree generalization
To find the concave and convex within generalized systems.

It’s a third-degree generalization,
Or a generalization of a group of generalizations,
To develop the Theory of Functions
Wherein the X and Y could stand
For any one second-degree coexistence generalizations.

It is a fourth-degree generalization
To develop the word *relativity*.

And it’s a fifth-degree generalization
To employ the word *Universe*
To embrace both the relativity and complementarity.
The degrees are then progressive omnibus stages
Of generalizations of generalizations.

The generalized principles
Are all interaccommodative.
None contradicts another;
Nor do they contradict
Any combination
Of other scientific generalizations.
They have complete integrity.
One is associative with the other.

The a priori integrity of scientific generalizations
Is manifest in all the phases of Universe
As we explore it progressively.
Man does not create,
Man cannot create,
Creation is a priori,
Creation is the gamut
Of generalized principles
Which scientists can and do discover
And inventors can employ
In special-case uses.

Man can invent,
Which means "bring in,"
The special-case use
Of generalized principles
And of combinations of them.
But man cannot design
Or invent
A generalized anything.

We find that brains deal
Always and only with special cases.
We remember the special-case name—Tim Smith—
Which we may not need to recall
For thirty-five years,
Yet it occupies its own special
Physical brain's "after-image" locale—
Possibly its own neuron.
We find the brain always dealing with special cases
And the mind dealing with generalizations.
The generalizations have no weight;
Only special cases have weight
Or any other physical characteristic.
All scientific generalizations
Are pure metaphysics.
All metaphysics are weightless
And physically unlimited.
A triangle is a generalized principle
And a triangle persists conceptually
As a triangle,
Independently of size,
Color, weight, taste, texture, or time.

VI
Searching for a function of man in Universe
We found first
A phase of Universe
Which needed counterbalancing.
This was the entropic, expansive,
Increasingly disorderly, radiantly explosive Universe.
In answer we found Earth to be a sphere
Wherein Universe was collecting,
Sorting, concentrating, and storing energies
In mathematically orderly ways
Such as by refraction, crystal growth,
Photosynthesis, or molecular formations.
Then we found that all the biologicals
Were antientropic.

I found myself publishing in '49,
As did Norbert Weiner
In another book at the same time,
Unwitting of one another's coincidental
Perceptionings and simultaneous disclosures,
That all biological life is antientropic
And that the human mind
Is the most powerfully effective
Antientropy
Thus far evidenced.

It was only a few years ago
That it seemed logical
To cease speaking of the phenomena involved
As antientropy,
Entropy being disintegratively negative;
Antientropy was, in effect, a double negative
Used to express a positive.
So to render the concept positive
And to identify its kinship
To synergy, I started speaking of it as syntropy
As the positive complementary
Of the negative entropy.

Now I surmise
That the speculative thought
Of the human mind—
In contradistinction
To the physical-experience recalls
Of the physical brain—
Is physically nondemonstrable,
Ergo, metaphysical,
But its teleological activity,
Which subjectively evolves generalizations
From multiplicities of special-case experiences
(And thereafter employs the generalizations
Objectively in other special-case physical formulations)
Can be detected
Through man's intuitive recognition
Of the weightless pattern integrity per se,
Ever weightlessly, abstractly present in the original
Discovering and inventing events.
Scientific generalizations
Have no inherent beginning or ending.
In discovering them
Mind is discovering a phase of Universe
That is eternal.
The physical human and its physical brain
Unmonitored by mind
Are not only less effectively syntropic
Than other biological species,
They are often consciously
Far more entropic
Than other species
And are only subconsciously syntropic.

Human's average birth weight of seven pounds
Is multiplied sometimes as much as fiftyfold
By syntropic chemical combining of
Other protoplasmic cells
Taken in as food;
With gases and liquids
Taken in by breathing and drinking,  
But humanity's syntrope cell multiplication  
Is outperformed greatly by trees, whales, elephants,  
And other living organisms.

Remembering that antientropy, or syntropy,  
Means, on the one hand,  
Reversing the physical trending  
Toward greater disorder  
And, on the other hand, means  
Converting the relative disorder  
To increasingly orderly physical arrangements,

We found that the human's biological role is minor,  
But that his metaphysically sorting mind-role  
Is the paramount syntropy,  
For it reviews and sets in fundamental order  
The random, ergo disorderly,  
Physical-event experiences of the universal environment;  
And the magnitude of physical rearranging  
In progressively more orderly patterns  
Metaphysically conceived  
By the human mind  
Is overwhelmingly greater  
Than that produced by the  
Physiological organisms  
Of any other biological species.

One mind can design orderly machines,  
Such as the steamship Queen Mary,  
Or a continental highway system  
That dwarfs in physical magnitude  
Any biological undertaking,  
Even that of coral-reef building  
By minuscule coral creatures.

It must be remembered  
That syntropy also means  
To collect, concentrate, and store.  
When I speak to any audience,  
Saying, "Let us take a piece of rope..."  
To demonstrate the generalized rope concept—  
I am drawing on  
A multiplicity of special-case rope experiences  
As a brain-stored resource of that audience,  
Probably amounting to over a hundred experiences each:  
With different kinds of pieces of rope,  
Ergo—I am drawing upon a memory resource  
Of more than one hundred thousand experiences  
With as many different pieces of rope,  
When I speak to an audience of one thousand.

So my first-degree generalization  
Reduces our experience processing  
One hundred thousandfold.  
Our second-degree generalization  
Reduces the experiences multi-billionfold,  
And each further degree of generalization  
Multiplies the number of special experiences  
From which the generalization is extracted.

The third-degree generalization,  
Consisting of the Theory of Functions,

Embraced all the always-and-only co-occurring phenomena  
Of a plurality of second-degree generalizations.  
When we get to the fifth-degree generalization,  
Universe,  
We have increased our numbers-of-experiences base  
To all the experiences  
Ever known to and remembered by humanity,  
Including all the experiences  
With all the atoms and their nuclear components.

Thus, the human mind  
Has collected, combined, and refined  
All experiences of all humanity,  
In all-remembered time,  
Into one single concept,  
Universe,  
Which is, ipso facto,  
The ultimate generalization.

Clearly it is seen  
That man's metaphysical mind  
Demonstrates the most effective  
Syntropic capability evidenced in Universe  
Excepting that of the universal mind's  
Cosmic syntropy  
As manifest in the eternal design complex,  
Comprehensively and synergetically interaccommodative  
As eternally regenerative Universe,  
Which cosmic syntropy combines  
All the metaphysical integrities  
As well as all the physical patterns.
VII

Einstein,
As metaphysical, weightless, human intellect,
Took the measure of the weighable physical
And wrote
The most economically formulated equation
Mathematically possible,
For it put on one side of the equation
The physical universe, which is to be equated,
Represented as “E” —
Because all that is physical is energetic —
And on the other side of the equation
Einstein placed the two terms
Minimally necessary to disclose a relationship.
For these two terms he employed
“m” (for energy associated as matter) and
“c^2” (for energy disassociative as radiation),
Expressed as c^2 because
c is the speed of light
In any one linear direction;
But light goes omnioutwardly
In a spherical wave
Whose surface increases
As the second power
Of the linear speed of radiation.
Ergo: Einstein’s equation
Is E=mc^2.
And in it the velocity of c^2
Is the constant and known term
And the amount of energy
Compacted in any given mass
Can be determined
If the given E to be analyzed
Is measured.

Einstein’s equation
Was intuitively formulated
From the experimentally
Harvested data of others,
But proved to be correct
When the subsequent fission occurred.

Here we have the metaphysical intellect
Taking the measure of
And mastering the physical.
We have no experimental data
That in any way suggests
That this process is reversible
And that energy can or will
Take the measure of
And write the equation of intellect
Or the equation of the metaphysical.
This is an example of one
Of the great generalized principles
Operative in Scenario Universe,
Which is the principle
Of irreversibility

VIII

Though humans are born equipped
To participate
In the supreme function of Universe,
This does not guarantee
That they will do so.
Humans are born utterly helpless,
And must through trial and error,
By physical experiments,
Discover what the controlling family
Of generalized principles may be,
Which principles must be employed by humans
To fulfill their Universe function,
But in order to discover the latter
They first must discover the overwhelmingly superior efficacy
Of the mind, as compared to muscle.
And humans also must discover
That the physical,
Which they tend to prize
As seemingly vital
To their regenerative continuance,
Is utterly subordinate
To the omni-integrity of metaphysical laws,
Which are discoverable
Only by mind.

Only if man learns in time
To accredit the weightless thinking
Over the physical values,
In a realistic, economic, and philosophic accounting
Of all his affairs,
Will the particular team of humans
Now aboard planet Earth
Survive to perform their function——