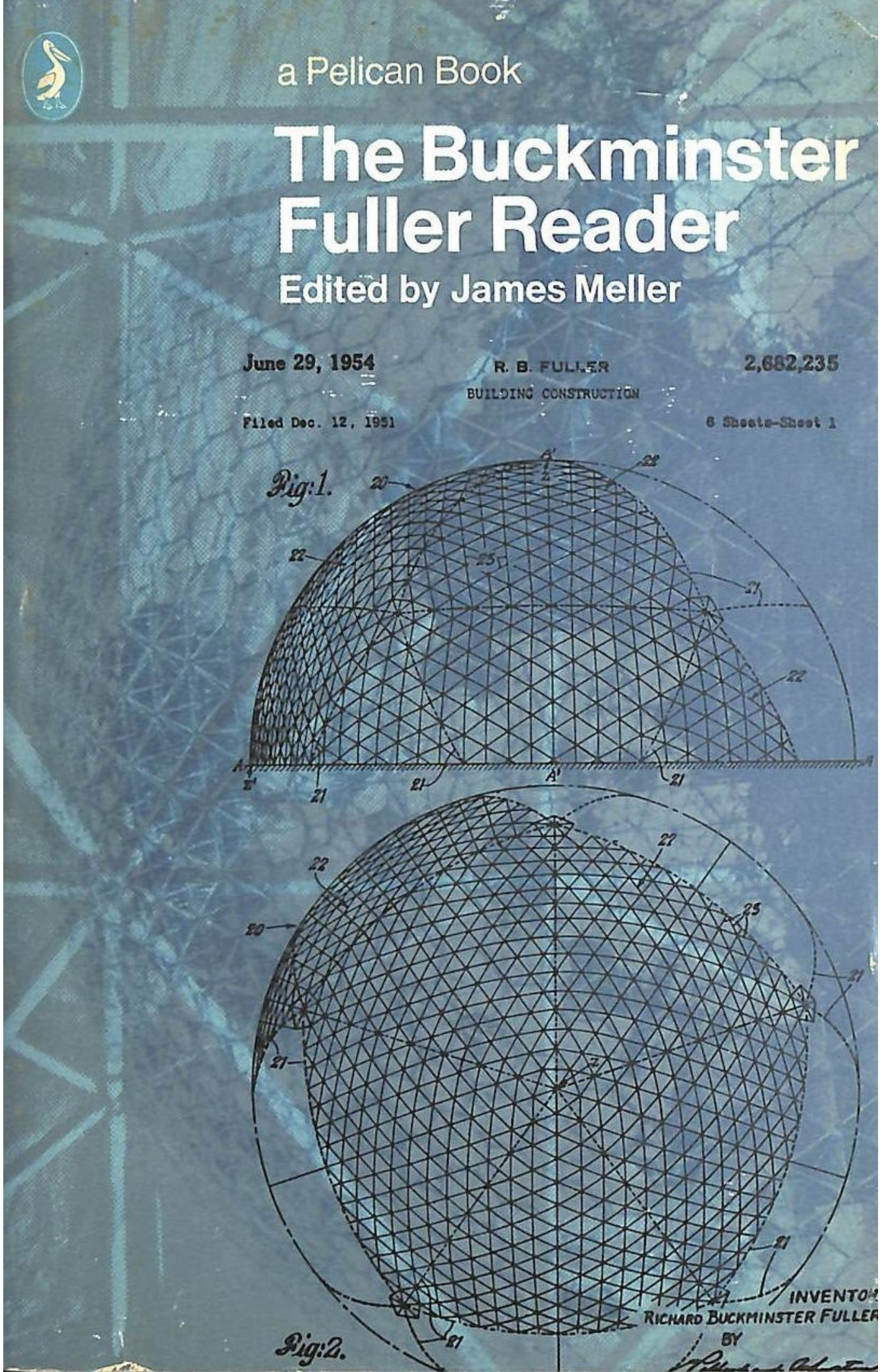

a Pelican Book

The Buckminster Fuller Reader

Edited by James Meller

June 29, 1954 R. B. FULLER 2,682,235

BUILDING CONSTRUCTION

Filed Dec. 12, 1951 6 Sheets-Sheet 1

Fig. 1.

Fig. 2.

INVENTOR
RICHARD BUCKMINSTER FULLER
BY

The Buckminster Fuller Reader

The Buckminster Fuller Reader
Making sure it all works

James Meller (Editor)

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Contents

Pelican Books

The Buckminster Fuller Reader

R. Buckminster Fuller, who was born in Milton, Mass., in 1895 and educated at the U.S. Naval Academy and Harvard, is currently Research Professor in the Department of Design at Southern Illinois University. Although he has no formal academic qualifications, he has been awarded honorary doctorates in design, art, science and the humanities from the Universities of Carolina, Michigan, Washington and Southern Illinois and from Rollins College. He has been visiting professor, lecturer and critic at over a hundred universities and colleges in the United States, and has lectured throughout the world. In this country, he has lectured at the Royal Institute of British Architects, the Royal College of Art, the Universities of Cambridge and Liverpool and the Institute of Contemporary Arts. Among the many international honours he has received is the R.I.B.A.'s Gold Medal for Architecture, presented to him in 1968.

Buckminster Fuller is the inventor of the Dymaxion House, the Dymaxion Car, the Dymaxion Bathroom and the Dymaxion World Map, as well as being the inventor-discoverer of energetic-synergetic geometry, geodesic structures and Tensegrity structures. Buckminster Fuller's first book, *Nine Chains to the Moon,* was published in 1938, and subsequent works have included *No More Second-Hand God* and *Education Automation.*

The Buckminster Fuller Reader

Edited and introduced by James Meller

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Contents

List of Illustrations

I know that I am not a category, a hybrid specialization,
I am not a thing — a noun.
I seem to be a verb —
an evolutionary process —
an integral function of the universe,
and so are you.
—R.B.F.

1 Introductory Note

In 1968 Buckminster Fuller was awarded the Royal Gold Medal for Architecture, yet he is not an architect nor, contrary to a widely held view, a geodesic dome salesman. In the last forty years he has been making news as an aviator, inventor, engineer, cartographer, scientist, mathematician, poet and philosopher. When asked to define his activity Fuller replies: 'I've been engaged in what I call comprehensive anticipatory design science.' His friend, author Christopher Morley, described him as 'a scientific idealist, whose innovations proceed not just from technical dexterity but from an organic vision of life'.

This volume of his writings begins with a chronological inventory and a number of autobiographical items and is followed by a chronological sequence selected from his writing between 1942 and 1963. This case history of a man on 'Spaceship Earth' in the twentieth century concentrates on the development of the concepts and strategies that are 'reduced to practice' in his structures and inventions.

The items in this volume drawn from a twenty-year period vary both in vocabulary and style; in many cases, ideas in the early essays are developed further in those which were written later. The items were chosen both to explore this development and to exploit the concept of 'useful redundancy'.

In his writings on education, strongly influenced by A. N. Whitehead, Fuller has constantly drawn attention to the dangers of over-specialization: the situation in which specialists are unable to communicate with each other and the task of integrating their work is left largely to their intellectual inferiors. In the present crisis in education Fuller's own strategy of constantly monitoring the relationship between the particular and the whole deserves close examination.

The reader, hampered by his own experiences in an over-specialized system of education, may find the wide-ranging inter-disciplinary explorations disconcerting. However, he is urged to persist, for Fuller's world-around lecture tours, the source of much of the material in this volume, are extraordinary demonstrations of his ability to overcome, in a few hours, the barriers between cultures, between generations and between specialists.

July 1969

JAMES MELLER

2 Buckminster Fuller Chronofile

[1]

An extended biography published under the title ‘Bucky’ in ‘Explorations’, 1967. Editor Marshall McLuhan.

Beginning in 1917, I determined to make myself the guinea pig in a lifelong research project; i.e.—documenting *the life of an individual born in the ‘Gay’ Nineties {1895), the year automobiles were introduced, the wireless telegraph and the automatic screw machine were invented and X-rays were discovered; having his boyhood in the ‘Turn of the century’; and maturing during humanity’s epochal graduation from the inert, materialistic nineteenth into the dynamic, abstract twentieth century.*

Had I perceptivity at that time equal in magnitude to the scale of my intuitive prospecting of forward events, this case history’s era might have been more accurately identified as that which terminated Sir Isaac Newton’s normally ‘At Rest’ and myriadly isolated hybrid world cultures, to which change was anathema, on the one hand; and, on the other, opened Einstein’s normally ‘dynamic’ omniintegrating world culture to which change has come to seem essential and popularly acceptable.

Though I lived within seven miles of Boston’s centre, so new and rare an object was the automobile that I was seven years old when I first saw one. I first drove one when I was twelve. When I was nine years old the aeroplane was invented but I did not see one flying until I was fourteen and I did not fly one until I was twenty-three.

1

Along with millions of other boys, I had been trying to invent that aeroplane, first with paper dart models and then with box-kite-like multi-planed gliders. Despite our elders' doubts and engineering's down-to-earth negatives, imminent invention of the 'aeroplane' was everywhere present in the mind-wind of my pre-Wright Brothers knee-breeches years. It is interesting that our latest supersonic and 2,000-mile-per-hour planes are beginning to take on the over-all shape perfection of those early paper darts. Children's intuitions are keen.

My extraordinary experiences with the U.S. Navy's World War I galaxy of new tools—oil-burning turbo-electric ships, aircraft, diesel- engined submarines, radios, automatic rangekeepers, etc., convinced me that the experience pattern of my generation was not to be just one more duplicate generation, in a succession of millions of generations of humanity, with an approximately imperceptible degree of environmental change, as compared to the immediately previous generation.

I was convinced that, unannounced by any authority, a much greater environmental and ecological change was just beginning to take place in my generation's unfolding experience than had occurred between my father's and grandfather's or between that of my great-grandfather's and my great great-grandfather's successive generations. I had (and as yet have) their diaries, expense accounts or letters containing descriptions of their lives in their successive undergraduate days at Harvard. They all told of day-long trips walking or driving from Cambridge to Boston via Watertown Bridge. I realized intuitively that the subway, which opened to connect Cambridge and Boston in seven minutes in 1913 during my freshman year at Harvard, was a harbinger of an entirely new space-time relationship of the individual and his environment.

It was clearly the environment that was changing, and though the environment changes might not alter man's genes, changes in his external conditions might permit man to realize many more of his innate capabilities. Dwellings are environment-modifying machines. So are automobiles. Automobiles are little part-time dwellings on wheels. Both autos and dwellings are complex tools. Both autos and dwellings are component tools within the far vaster tool complex of world-embracing industrialization. Life continually alters the environment and the altered environment in turn alters the potentials and realities of life. Environment embraces a complex of non-

simultaneously occurring but omni-integrating, or inter-stimulating and therefore inter-regenerating mutations of man's integral, internal, metabolic regeneration organisms on the one hand, and on the other of his external, invention realized metabolic regeneration organism which we think and speak of as industrialization.

Even though our Harvard freshman class of seven hundred members boasted only three automobile owners, one of whom was Ray Stanley, whose father had invented and produced the Stanley Steamer, it was even then at least wishfully clear that mankind in general might sometime acquire automobiles. Since that time I have owned successively fifty-six automobiles, three of which I invented and built, and have personally driven the fifty-six cars a total of one million and a quarter miles. I have lived long enough in various places to have had my cars registered in ten states. I have flown one million and a half miles, part of that distance in three of my own planes. I have owned many boats, travelled in many others, and have commanded several ships in the United States Navy.

My total travel, by land, sea and air, aggregates more than three million miles to date and I now find my work taking me annually around the world. This is in no wise a unique record. It is fairly average for millions of men who have responsibilities in the general frontiers of technology, business and statecraft of evoluting world man.

Three million is paltry mileage for any senior Pan American Airways pilot or for Pan American's founder-president, Juan Tripp, or for Howard Hughes, or the late John Foster Dulles.

Pre-1900 average world man covered only thirty thousand miles in his entire lifetime, which is only one per cent of my mileage to date. There is no longer valid dissent to the concept of an accelerating change in the affairs of man on earth. The average U.S.A, family now moves out of town every four years. My present official address for passport and taxation accommodation is in Carbondale in Southern Illinois. Illinois is the sixth state within which I have had successive voting privileges. Whether I am 'in residence' or not, my land, my house and I whirl constantly around the Earth's axis together at about eight hundred miles per hour as all the while our little spaceship Earth zooms around the sun at thirty thousand miles per hour while at the same time our solar system rotates in its nebular merry- go-round at hundreds of thousands of miles per hour.

In all reality I haven't 'left home' as it is usually said of me. My backyard has just grown progressively bigger until now the world is my backyard. 'Where do you live?' and 'What are you?' are progressively less sensible questions. 'At present I am a passenger on the spaceship, Earth,' and 'I don't know what I am. I know that I am not a category, a hybrid specialization, I am not a thing—a noun. You and I seem to be verbs—an evolutionary process. Are we not integral functions of the Universe?'

In 1917, in the U.S. Navy, I had intuited that an inter-multiplicative acceleration of technical events was beginning which would bring about a fundamental reorientation of human life in the universe. This concept of accelerating-acceleration which had been discovered by Galileo *circa* 1600 in respect to the first 'Laws of Motion' had not been conceived of, however, as accelerating our ecological evolution—up to the date of my intuiting and acting upon its arrival. Discussion of economic and ecologic evolution acceleration does not begin in the intellectual publications until more than a decade later. Nor did my 1922–7 discovery that ever-higher tool performance per units of pounds, time and energy as fallout from the weaponry industries into the domestic consumer economy—when erstwhile weaponry support contractors sought to exploit their advanced technological position after their war goods contracts were terminated by progressive obsolescence—was resulting sum-totally in doing ever more with ever less in the domestic economy. The domestic economy had theretofore thought only in terms of more security—only to be accomplished with more weight—the more the better. This reversal of affairs seemed to me to suggest that Malthus's dictum that only a few could survive successfully might be wrong. Conversely, it seemed that it could come to pass that all of humanity might become both physically and economically successful even within the foreseeable future. I identified this progressive doing-more-with-less as *ephemeralization.* Though *Fortune Magazine* published my 1922 concept of *ephemeralization* in 1940 in a prominent manner, and despite ephemeralization having subsequently wrought epochal advancements in the standard of living for two billion previously deprived humans, ephemeralization is a fact which is as yet—in 1966 - largely unknown to, or overlooked by the world's professional economists. Nonetheless the combination of accelerating-acceleration and ephemeralization have now brought forty per cent of humanity into the paradoxical state of bewildered, *ergo* apprehensive, physical and economic success.

I decided in 1917 to contribute to the scientific documentation of the emergent realization of the *era of accelerating-acceleration of progressive ephemeralization.* I determined to do so by methodical and chronological inventorying of all the communications in which I was personally involved—i.e., all in-bound and out-bound correspondence and documentation concerning me transacted by others. I have kept this life-long file which I call the *Dymaxion Chronofile* and in 1960 presented it to Southern Illinois University's Morris Library, where it is now installed in a special room in their rare-documents archives.

The Chronofile consists, so far, of 250 volumes (half of them now bound in leather) containing *(circa)* eighty thousand letters, i.e. 300 and 400 pages per volume.

The first important regenerative effect upon me of keeping this active chronological record was that I learned to 'see myself' as others might see me. Secondly, it persuaded me ten years after its inception to start my life as nearly 'anew' as it is humanly possible to do. Thirdly.it persuaded me to dedicate my life to others instead of to myself, not on an altruistic basis but because the chronofiled first thirty-two years of my life clearly demonstrated that I was positively effective in producing wealth only when I was dedicated to others. Further chronofile observation then showed that the larger the number for whom I worked the more positively effective I became. Thus it became obvious through the chronofile that if I worked for all humanity I would be optimally effective.

In setting about to start life all over again I did not try to make myself a new or *different* man—another man. I sought only to allow myself to articulate my own innate motivational integrity instead of trying to accommodate everyone else's prefabricated credos, educational theories, romances and mores as had occurred in my 'first life'.

One basic tenet of my new volition was that whatever was to be accomplished for anyone must never be at the cost of another. Robin Hood, whose story my father read aloud to me when I was very young, and not long before my father died, became my most influential early years' mythical hero. This meant that in my 'first life' I had improvised methods in general to effect swift moral and romantic justice for those whom I found in trouble or danger. Foolishly self-confident in my 'first life' I had often rushed thoughtlessly to assume responsibilities beyond my physical or legal means. This rashness led me into complex dilemmas, for in attempting to keep my assumption of responsibilities legal I inadvertently involved my unwitting family, dragging them into preposterous financial sacrifices. In inaugurating my new life

I took away Robin Hood's longbow and staff and gave him only scientific textbooks, microscopes, calculating machines, transits and industrialization's network of tooling in general. I made him substitute new inanimate forms for animate reforms. I did not allow Robin any further public-relations professionals or managers or agents to 'promote' or 'sell' him. It seemed obvious that if the new tools which the 'new' Robin Hood developed could provide valid man-advantage increases they could inevitably be adopted by society in general as the inexorable emergencies which dictate the proper rate of regenerative gestations of evolution took place.

Along with the Dymaxion Chronofile, I have kept all the tear sheets of newspapers, magazines, and programmes, etc., in which my work was reported. I have never subscribed personally to a clipping service. Others have done so for brief periods. What clippings I have came into my hands by my own discovery or as a consequence of friends and acquaintances spontaneously sending clippings to me. This record now contains over three thousand five hundred unique items. It begins in 1917. Half of the three thousand five hundred unique items have occurred in the last eight and one half years.

I have drawn a curve showing the precise number of separate and individually written news items per annum from 1917 to date. As you will see, it is a curve of many peaks and valleys. Altogether it constitutes a wave pattern of ever-increasing magnitudes, with the valleys never going quite as low as previously and the peaks going ever higher. 'Smoothed-up', the record patterns into a ski-shape curve—an initially long, almost horizontal pattern with its nose finally rising ever more swiftly. It *is* an accelerating-acceleration curve. The successive peaks relate to my Navy days; my 1918 publication *olTransport Magazine',* my240stockade buildings of 1922–7; the 4-D monograph of 1927–8; the Dymaxion House; my publication of *Shelter Magazine',* the Dymaxion Car; the Dymaxion Bathroom; my book *Nine Chains to the Moon',* Industrial Man's Ecological Transformation Charts; Energetic/Synergetic Geometry; Dymaxion Air-ocean World Map; Fuller House in Wichita; University visiting; geodesic domes; my U.S.A. Pavilion for the 1967 Montreal World's Fair; the World Students Design Science Decade; Inventory of World Resources, Human Trends and Needs; my computerized game for Southern Illinois University's Centennial 'How to make the World Work' - known as the 'World Game'; The 'World Man Territory Trusteeship' inaugurated on Cyprus under joint auspices of Archbishop Makarios and World Academy of Art and Science, Caresse Crosby and myself; scientific publications by others identifying

New York Times	200	items
Architectural Forum	86	
New York Herald Tribune	62	
Time Magazine	56	
St Louis Post-Dispatch	38	
New Yorker	20	

Table 2.1: Items per Newspaper

my work with discoveries at various levels of the microcosmic structures of nature; and most latterly to a general admixture of editorial realizations that the separately experienced fundamental disclosures all relate to a total and unified philosophy which emerges as pertinent to the unfolding historical reality.

The preponderance of latest items published relates clearly to my general philosophy and to my world redesigning stratagems. There is a dawning awareness that I am saying something realistic when I say 'Reform the environment, don't try to reform man.' There is a dawning awareness that I may be right in saying we have been asking the politicians to do what only we can do ourselves by cooperative use of our intellects and our innate and politically transcendental integrity. Let automation take over the metabolics and let's go to work with our brains and wisdom.

All these published items are now in the Southern Illinois University Morris Library, and the Library has just finished microfilming them in their chronological entirety. Prints of the microfilm have gone to the New York Public Library, 42nd Street and Fifth Avenue-branch. Prints may be had by other libraries and institutions at cost from the S.I.U. Morris Library. All of the items have been indexed by dates, authors, titles and brief summaries. Typical examples are summaries of the one-third-century record of items that have appeared in the *New York Times, New York Herald Tribune, New Yorker, Time Magazine, Architectural Forum,* and the *St Louis Post-Dispatch* (to introduce a mid-American continent note into the record). I myself have been surprised by the shape of the results. For instance, I would have expected that the *Architectural Forum* would have had many more items than the *New York Times,* which surmise turned out to be wrong. The score is as follows:

Figure 2.1: Published references to R. Buckminster Fuller from 1917

I said that by my 1917 determination I undertook to treat myself as an historical-guinea pig and I assure any who may be interested that my files include as many unflattering as flattering items, such as notices from the sheriff, letters from those who thought me to be a crank, a crook, a charlatan, etc. I will say that these negative charges are fortunately infrequent, and to the best of my knowledge untrue, though the record discloses the ease with which items taken out of context could be negatively interrelated and interpreted.

Because the data constitutes a faithfully comprehensive record, I am now able to comment objectively upon my subjectively disclosed self, approximately as critically as though the subject were another man. As with any book when my subject is prospering, I am glad, and when he is unprosperous, I am sad. That is the extent of my prejudice.! think that the curves may be acceptable as: the realization of a scientifically disciplined marshalling of the case history, deliberately and methodically undertaken a half century ago. Incidentally, the *New York Times* was surprised to discover the 'earlier years' extent of my news pattern which they had not realized to be developing over so long a period. They have kept an active file on me only during the last five years.

The curve seems to document that my 1927 prognostication of the ensuing twenty-five-to-forty-two-year unfoldment of the evolutionary patternings in economics, technology, sociology and mathematics are not only proving valid but are also trending further to accredit my present prognosticating. My 1961 prognostication covering world developments to 1982 as contained in *Education Automation* [Ful62], as published by the Southern Illinois University Press (now in paperback) is tending to be far more spontaneously assimilated than was for instance my *4-D* monograph of 1928 [Ful28].

Possibly a more interesting trend is the acceleration in the curve of the rate at which books by others refer to my work (See 2.1). Books represent a half-century chronology of published items covering news events and unique concepts of R. Buckminster Fuller.

Curve shows number of news, magazine or book mentions of Buckminster Fuller for each year since 1917.

Though the frequency of items has some low points, in no year since 1928 has it gone to zero. The curves of High Points, Low Points and Median Trend are all constantly accelerating. In 1966–7 the frequency reached more than two items per day published about Fuller and his work somewhere around the world. The originals of all these items are on file in the archives of Southern Illinois University's Morris Library at Carbondale, Illinois. Strip microfilms are available from this Library.

1917 Marriage to Anne Hewlett

1918 U.S. Navy

1922 U.S. Naval Reserve Activities

1923 Early Flying Activities

1926 Stockade Building System

1927 Private Publication of B.F.'s book *4D* disclosing his philosophy—En/Syn Geometry...Chicago

1928 Dymaxion House - Art Exhibits, Lectures

1931 Greenwich Village, New York City - B.F. testing reaction to his philosophy of new form v. social reform

1932 *Shelter Magazine* (B.F. publisher-editor)

1933 Dymaxion Car, Bridgeport, Connecticut

1934 New York - Connecticut

1935 Washington - Chicago

1936 Phelps Dodge Research - B.F. history of world industrialization and economic charts, New York

1937 Dymaxion Bathroom

1938 *Nine Chains to the Moon*

1939 *Fortune Magazine* Economic Charts

1940 Dymaxion Deployment Unit - Butler Mfg, Kansas City - New York

1941 Board of Economic Warfare - Washington, D.c.

1942 Dymaxion Map - *Life Magazine* - New York - Washington

1944 Energetic Geometry - Industrial Brazil - Washington, D.C. - U.S.A.

1945 Fuller House - Beech Aircraft - Wichita, Kansas

1947 Fuller Research Foundation - Wichita, Kansas

1948 En/Syn Geometry Models - geodesic domes - Forest Hills

1949 Black Mountain College

1950 University Projects around the world

1951 University Projects around the world

1952 University Projects around the world

1953 Ford Motor Company - geodesic domes

1954 U.S.M.C. and Radomes

1955 U.S. World Around Trade Fairs - geodesic dome

1958 Visit to South Africa - around-world travelling begins - En/Syn Geometry - Nuclear Identity

1959 Moscow Fair - Mark's Book - Professor, Southern Illinois University

1960 University visits, domes, Japan Scientist Lectures

1961 International Union of Arch. Students' World Redesign inaugurated by B.F.

1962 En/Syn Geom. and Virus Identity, Harvard, Chas. Eliot Norton, Prof, of Poetry

1963 Five of B.F.'s books published: Economics, Philosophy, Math., Science-Gen. and Business Govt Consultation

1964 *Time* cover story - *Saturday Review Series*

1965 Arch. U.S. Pavilion 1967 Montreal World's Fair - *New Yorker,* Profile, *American Scholar* piece - 5 Delos Symposiums

1966 Keynoter to annual congresses of metallurgists, geographers, planners, medics and businessmen, mathematicians - N.A.S.A. Research - Cape Kennedy lecture

1967 50th Anniversary Harvard 1917–50th Wedding Anniversary *Saturday Review,* cover story, completion and realization of U.S. Pavilion Expo '67 -*New York Times*

certain amount of research filtering and retrospective processing. The curve of *books with reference to me, or my work,* is accelerating more swiftly than is the general publications curve.

I also keep a record of hearsay items published about my work and reported to me as having occurred over and above the items which I have actually received and entered into the record. There is a fairly constant percentage in the average of uncollected but reported items as ratioed to collected items. Reliable reports of the existence of uncollected items average twenty-five per cent of the number of items collected. The largest number of uncollected items occur outside the United States. There is less and less tendency of the uncollected items to get into my hands as my friends no longer look upon such published treatment of my work as *news* and therefore do not realize that it might be 'good news' for me to receive and therefore worth their taking the trouble to send to me. As it is, the curve of *collected* items about my work is now averaging better than one individually written news item or story each and every day of the year being published somewhere around the world.

All the while my long, sparse items curve had been developing there also occurred spectacular news eras of famous individuals and events that rocketed into saturation prominence. *Time Magazine* has made many studies of the *top* frequency items. Curves such as the Hitler curve represent tremendous rocket bursts which, when superimposed on my chart, render the peak magnitudes of my 'notices' invisible. What is interesting, however, is that my curve has been steadily growthful throughout all those spectacularly prominent yet relatively short-duration news explosions. It is at least

interesting that my kind of curve could go on and on without my ever approaching 'popularity' magnitude either as a positive or negative subject. I am well known in certain limited circles but my wife Anne agrees, with my surmise that we will never register in a motel in which the man at the desk will recognize either our 'name' or our 'face' when we sign the register nor connect my name with any of my work, even if he does vaguely remember that there was a U.S.A, golden 'Dome' in Moscow.

I have discovered that one of the important characteristics of most economic trends is that they are too slow in their motion to be visible to man. We cannot see the motion of the stars, or the atoms, or a whirling aeroplane propeller, or even of the hands of a clock. As with the electro-magnetic spectrum, most of the frequencies and motions of the universe are ultra or infra to man's apprehending tunability.

I think I am saying all this because I want to fortify any glimpses and impressions derived from it with some knowledge regarding the reliability of my prognostications, which may have more appropriateness than whether a sampling of people who know about my work shows that the people like or do not like it. I am firmly convinced that I can see clearly regarding a number of coming events and am therefore vitally eager that people should not be hurt by the coming of these events, particularly when I can see ways in which it would be possible not only for them to avoid hurt but even to prosper by and enjoy what now seems to me to be inevitable. Much that I see to be inevitable is unthinkingly opposed by various factions of society. Reflex-conditioned society, facing exclusively towards its past, backs up into its future, often bumping its rump painfully but uncomprehendingly against the wealth coffers of its future years' vastly multiplying capability to favourably control its own ecological evolution and the latter's *freedom-multiplying* devices.

The publishing world can play a great part in helping people to turn around, to comprehend and assimilate favourable aspects in what has up to now often been looked upon as unfavourable - though often to prove favourable later, but frequently too late to have avoided the (unnecessary) pains of fearful incomprehension which develop into active apprehension and evolutionary debilitation.

Chronological Inventory of Prominent Scientific, Technological Economic and Political Events -1895 to Date upon which has been superimposed the utterly personal chronology of Buckminster Fuller, his family, his discoveries and his inventions, both philosophic and technological.

The integration of the prime world history events with those of one individual and his family at first exaggerates the infinitesimal stature of the individual in respect to humanity's integrated, news- processed and arbitrarily classified experience.

But this exaggerated relationship of the minute individual in respect to the whole is nonetheless the only possible common direct experience of each and every human being. All else is hearsay.

The inventions of the single individual at first seem irrelevant and preposterous as associated with the great legends of the publicly accredited historical accounting. Gradually, however, the relevancy of the philosophy of the individual to the comprehensive evolution may become visible and his inventions may gradually appear feasible, even logical if he persists and learns how to perfect them both by inclusions and refinements.

If the individual were not moved by the seeming significance of his undertakings as exaggeratingly disclosed in this *chronological juxtaposition of men and man,* he would not have an adequately sustaining drive to reduce his inventions to commonly inhibitable practice and possible common advantage.

Taken out of the context of scientific search for data apparently governing and motivating the individual inventor in the era of the massive corporation and the massive state and the latter's apparently staggering economic and political starting advantage over the prime design initiative of the individual, the following record could only be classified as egotistical. However, it was compiled and is submitted in scientific earnest, by its only possible *direct* observer.

Because the lag between the dates of invention and common public use averages twenty-two years, the dates of the inventions listed must be considered only as harbingers with their effective industrial realizations and public advantaging variously postponed.

1895. Automobile (first U.S.A, gasoline-engined) designed under Charles Duryea's U.S. patent; wireless telegraph; automatic screw machine invented; X-rays discovered. First diesel engine. R. Buckminster Fuller born, 12 July, Milton, Massachusetts, U.S.A.; Cleveland, President. At this time Flat Iron Building, 22nd St

and Broadway and 5th Ave, N.Y. City, was tallest occupied building in world and Eiffel Tower, built in 1889 and 1,056 feet high, was tallest man-made structure in world and remained tallest until Empire State Building of 1,250 feet erected in 1930.

1896. Steam turbine, disc plow; Anne Hewlett (B.F.'s future wife) born, 9 January, Columbia Heights, Brooklyn, New York, U.S.A.

1897. Electric trip hammer drill; William McKinley becomes President.

1898. Electron discovered; Spanish-American War begins.

1899. Flotation of ore (oil); B.F. enters kindergarten, makes octet-truss.

1900. Escalator; Caterpillar tractor; dirigible balloon (Zeppelin); electric steel-making; mercury lamp; Quantum theory by Max Planck; President Cleveland elected (second inauguration).

1901. Wright Brothers' glider; gas welding; Marconi's transatlantic radio telegram; yellow fever vanquished. B.F. enters elementary school. President McKinley assassinated.

1902. Radio telephone; photos by wire (both in lab. only). Mt Pelee erupted Martinique destroying 30,000 people, powerful impression B.F.

1903. Around-the-world telegram 12 minutes; Wright Brothers' gas engine-propelled aeroplane flight, Kitty Hawk, N.C.; aeroplane 'supercharging', turbo-generator; ultra microscope (arc light); oil-burning steamship. Ford Motor Company founded, beginning of mass-production automobiles.

1904. Theodore Roosevelt elected President; reinforced concrete; Russian-Japanese War; N.Y.C. Electric Rapid Transit 'Subway' opened 42nd to 14th Streets. (B.F.'s Uncle Waldo Fuller a chief engineer of project. Uncle Waldo Fuller, a Harvard football great of 1883, who had gone to Klondike in the gold rush, was Bucky Fuller's greatest living boyhood hero.) B.F. enters Milton Academy, lower school. His parents travel to Europe and South America. B.F. and family go to Penobscot Bay, Maine, buy Bear, Compass and Little Spruce Head Islands.

1905. Einstein's relativity. B.F.'s family occupy Bear Island, Maine, as summer home.

1906. Sperry Gyrocompass; radio vacuum tube; crystal radio detector. B.F. enters Milton Academy, upper school. San Francisco earthquake and fire.

1907. Ford's model 'T' automobile inaugurates major world mass production industry; demountable tyres; Bakelite (phenolic resin plastic); B.F.'s father has stroke, brain clot.

1908. East River (L.I.R.R.) and Hudson railroad tunnels; President Theodore Roosevelt re-elected. Fire destroys Chelsea, Mass., witnessed by B.F.

1909. Bleriot flies English Channel; North Pole discovered by Admiral Peary, 6 April; Typhus vaccine discovered.

1910. Salversan discovered; Albany to New York Curtis flying-boat flight; B.F.'s father dies.

1911. South Pole discovered by Amundsen, 14 December; atomic nucleus proton discovered; hydro-plane; pulmotor; gyrocompass servos (Sperry).

1912. President Taft elected; vitamins. (President Taft rode in a 'White' Steamer Automobile made in Cleveland, Ohio.) s.s. *Titanic* sunk in collision with iceberg; first S.O.S.; New Orleans music - 'Alexander's Ragtime Band', Turkey Trot, begins. U.S.A, new type music and dance, displacement of classical and European dances.

1913. Tungsten incandescent lamp; gasoline 'cracking' process; B.F. graduates from Milton Academy and enters Harvard University in class of 1917. U.S.A, internal monetary system goes off gold standard and establishes Federal Reserve system (as private bankers' gold becomes inadequate to implement new industrial massproduction magnitudes of trade). But Federal Reserve as yet in private banker management, as the Alexander Hamilton U.S. constitutional interpretation or the dogma persisted that U.S. government had no fundamental wealth initiative and must borrow all wealth from private bankers and repay them through collection of taxes, tariffs and excises. B.F.'s Milton home sold.

1914. Military tank; regenerative radio circuit; chrome-nickel-steel; Panama Canal; World War I begins. B.F. expelled then reinstated at Harvard College after intensive experience as a millwright in cotton mill at Sherbrooke, Quebec.

1915. Transcontinental telephone; gas warfare; radio telephone. B.F. expelled from Harvard second time. Employed in New York City by Armour and Co., worked in 28 branch houses throughout greater N.Y. City, working 3 a.m. to 5 p.m. daily. Woolworth Building, New York City, 792 feet high, 60 stories, succeeded Singer as world's tallest occupied building and remained tallest until exceeded by Empire State Building fifteen years later (1930).

1916. Stainless steel (secret World War I accomplishment) does not get into commercial use until 1928. Depth bomb; President Wilson elected, s.s. *Lusitania* sunk by German submarine. B.F. and A.H.F. engaged, B.F. corporal at U.S. military training camp, Plattsburg, New York.

1917. U.S. into World War I; Russian Revolution; U.S.S.R. born; Anne Hewlett and Buckminster Fuller married at Rock Hall - which was Hewlett family homestead at Lawrence, Long Island, New York, for one hundred and thirty years. Rock Hall built by Josiah Martin, British Governor of Antigua, and his son Josiah Martin, British Colonial Governor of North Carolina, as their joint summer mansion about 1750. Rock Hall used by English as Tory Headquarters in Battle of New York during American Revolution. Rock Hall now a public museum of Nassau County, New York, given by Hewletts to the public in 1946. B. Fuller enrolled March 1917, Ensign U.S.N.R., Ensign U.S.N., Lt (JG) U.S.N. B.F. to U.S. Naval Academy, Annapolis, Maryland, special course. Then to active war zone Atlantic troop transport duty as personal aide Admiral Gleaves, who commanded cruiser and transport forces U.S. Atlantic Fleet. Service in u.s.s. *Great Northern,* u.s.s. *Seattle.*

1918. World War I Armistice 11 Nov.; Buckminster and Anne Fuller's first child, Alexandra Willets Fuller, born 12 December. Electron employed and development of mass spectroscopy.

1919. U.S. Navy flying boat NC-4 flies Atlantic in three jumps, Newfoundland, Azores, Lisbon, Spain, 16–27 May; transatlantic two-way radio telephone conversation; u.s.s. *Geo. Washington* in Brest Harbour, France, to Arlington Tower, Washington, D.C.; u.s.s. *Geo. Washington* was transport which carried President Wilson to France for his Versailles Treaty and inauguration of League of Nations. B. Fuller assigned temporarily to u.s.s. *Geo. Washington* at this time; Alcock and Brown fly

Atlantic in aeroplane non-stop, Newfoundland to Ireland, 14–16 June; British dirigible R-34 crosses Atlantic, England-U.S.A., 2 July. 1 Nov. - B.F. resigns from U.S. Navy, as his admiral assigned as commander-in-chief Asiatic fleet and B.F.'s daughter Alexandra successively contracted infantile paralysis and spinal meningitis in N.Y.C. B.F. became assistant export manager of Armour & Co. in their N.Y.C. headquarters in new Equitable building at 120 Broadway. B.F., Anne and Alexandra live in house on Pearsal Place, Lawrence, Long Island, N.Y.

1920. Neutron discovered; commercial radio broadcast of voice; President Harding elected; League of Nations began, Geneva, Switzerland (minus U.S.A.).

1921. Alcoholic beverage prohibition begins in U.S.A. B.F. resigns from Armour & Co. to become National Acct Sales Manager of Kelley-Springfield Truck Co. with office in Equitable Bldg, N.Y.C.

1922. Practical automobile self-starter (Bendix); air-conditioning; insulin; radar; B.F. resigns Kelley-Springfield Truck Co. and starts career as independent enterpriser. Stockade Blocks invented by B. Fuller's father-in-law, J. M. Hewlett, and manufactured by Buckminster Fuller; Bucky and Anne's only child, Alexandra Willets Fuller, dies 14 November, just before her fourth birthday. A.H.F.'s mother dies, and her brother, Willets, killed in auto accident.

1923. House oil burners. B.F. and Anne live in apartment, East 95th St, N.Y.C.

1924. President Coolidge elected. First dynamic loudspeakers on radio sets, using Major Armstrong's regenerative circuits; first inter-city auto bus line's established - Chicago to Detroit. Fageol twin coach - Greyhound buses. B.F. and Anne have apartment East 94th St, N.Y.C.

1925. First commercial airline Detroit to Chicago; phototelegraphy.

1926. Transcontinental airmail carried by cloth-covered wing biplanes. Electric refrigerator; talking, moving pictures; Amundsen, Nobile fly,to North Pole in Italian Dirigible; Richard Byrd flies Norway to North Pole and return, 9 May, in aeroplane. B.F.'s five Stockade Building System companies have their blocks and building system employed in total of 240 homes and commercial buildings between 1922 and 1927. B.F. resigns as President of the Stockade Company.

1927. Television (laboratory only, not in popular use in U.S.A, until 1947); photo-electric cell; Lindbergh flies aeroplane, 'Spirit of St Louis', across Atlantic, N.Y. to Paris, non-stop, 20–21 May. Heisenberg's indeterminism; Holland Tunnel under Hudson River, New York to New Jersey; B.F.'s and A.H.F.'s second child, Al- legra Fuller, born 28 August, Chicago, Ill.; B.F. and family live on Belmont Ave, Chicago. B.F. writes book, *4D,* privately published; B.F. founds *'4D'* company for research, development and patent protection of his Dymaxion House and Car. Energetic/Synergetic geometry discovered by B.F.; Dymaxion House invented as part of his concept of air-deliverable, mass-producible world-around, new human life protecting and nurturing scientific dwelling service industry as means of transferring high scientific capability from a weaponry to livingry focus, thereby to render successful all world's people instead of only a few, on the premise that a comprehensive anticipatory design science could, through increased technical efficiency and upping of overall performance per pounds of world resources, bring about physical success for humanity - never to be obtained in political reform - thereby eliminating fundamental causes' of war, i.e. 'you or me to the death - on behalf of yours or mine for there is not enough to sustain both' a seemingly scientific fact established by Malthus in 1835 and classified as secret until the twentieth century.

1928. Teletype; President Hoover elected; dirigible 'Graf Zeppelin' flown across Atlantic by Dr Eckener; Amelia Earhart flies Atlantic, 17 June; Sir Charles Kingsford-Smith flies Pacific, Oakland, California, to Brisbane, Australia, in aeroplane 'Southern Cross'. May 31st. Both Amelia Earhart and Sir Charles Kingsford-Smith became warm friends of B.F. Ford Introduces Model A, with stainless-steel headlight trim.

1929. Aston's closest packing effect; B.F. and family move from Chicago to N.Y. World Stock Market crash, 'Great Depression' begins. Night airmail inaugurated out of Chicago in cloth-covered biplanes. B.F. and family take house Woodmere, Long Island, New York; Coaxial cables; rocket engine (Goddard).

1930. Cyclotron (atom smashers) and jet engine invented and neoprene rubber developed. *Fortune Magazine,* conceived in pre-1929 boom days to service the boom's millionaires and frustrated by the crash, comes inadvertently into being as protagonist of the (hopefully) emergent enterprise concept of a self-perpetuating industrial management capitalism, surprisingly escaped from Finance Capitalism's 1929 shipwreck and death, by 'drowning', of International Banking as the world's economic master. B.F. and family have house Johnson Place, Woodmere. B.F. also has apartment on the roof, Leehigh-Starret Building, N.Y.C. B.F. sells Navy life insurance policy to finance taking over *T-Square Mag.* in Phila. and renames it *Shelter Magazine.*

1931. Piccard's stratosphere balloon flight; Post and Gatty fly around world by aeroplane in succession of refuelling short hops; George Washington Bridge opens, 3,500-foot span; Ford Trimotor Stout aluminium aeroplane flown.

1932. Economic depression depth in U.S.A.; President F. D. Roosevelt elected; Boeing and Douglas DC-3 all-metal passenger aeroplane; inauguration of transcontinental U.S.A. airline service; 92nd isolation of a chemical element; X-ray diffraction. B.F. closes *Shelter Magazine* after Nov. election of F.D.R. and inauguration of New Deal, hoping that economic ills which *Shelter* cited might be corrected. *Fortune Magazine* publishes 'The Industry that Industry Missed', citing B.F. Dymaxion House as prototype of new mass-production house industry.

1933. Dymaxion Car (invented in 1927) built and successfully demonstrated by B.F. in old plant of Locomobile Co. at Bridgeport, Conn., as first stage experimental vehicle leading to eventual omni-medium wingless transport-propelled and manoeuvrably controlled by twin, orientable, rocket and jet-stilts. Alcoholic beverage prohibition ends in U.S.A.; Adolf Hitler becomes chancellor of Germany, 30 Jan.; U.S. banks failing at rate 5,000 per day; Bank moratorium declared by President of U.S.A., 6 Mar.; 9 Mar. Congress gave President power to control money; law upheld by U.S. Supreme Court, 18 February, 1935. Approximately all of world's monetary gold paid over to U.S. Government and put back into Kentucky Mountain vaults. World completely off gold standard of exchange. B.F., Anne and Allegra live in house, Darien, Conn.

1934. N.R.A. (U.S. National Relief Administration); W.P.A. (U.S. Work Progress Administration); R.F.C. (U.S. Reconstruction Finance Corp., world's largest capital); R.E.A. (U.S. Rural Electric Adm.); T.V.A. (U.S. Tennessee Valley Authority); S.E.C. (U.S. Security and Exchange Commission); and H.O.L.C. (U.S. Home Owners Loan Corp.) B.F.'s mother dies. Sulfanilamide discovered.

1935. B.F. completes Dymaxion Transport - Displayed at Chicago World's Fair.

1936. Cortisone; first trans-Pacific aeroplane passenger service. Pan Am. flying boats. B.F. joins Phelps Dodge Corporation, Research Department. B.F., Anne and Allegra have apartment East 87th Street, N.Y.C. B. Fuller as guest performer of Gilbert Seldes - Director of frequent experimental broadcasts of C.B.S. television from Grand Central Station office building studio to 100 experimental sets of C.B.S. executives. Television broadcasts in England.

1937. Atomic fission theoretically envisaged Hahn and Stressman in Germany. Nylon produced. B.F., Anne and Allegra move to apartment 105 East 88th St, N.Y.C.

1938. R. Buckminster Fuller's book, *Nine Chains to the Moon,* [Ful38] published. B.F. joins *Fortune Magazine* as technology consultant. Munich. Hitler.

1939. World War H begins. Sikorsky helicopter invented.

1940. Plutonium fission. Meningitis vanquished. B.F. leaves *Fortune Magazine.* Inaugurates Dymaxion Deployment Unit of Butler

    Mfg, Kansas City. Used as first radar shacks and as air-conditioned dormitories of U.S. flyers and mechanics making fly-away delivery of war planes to Russians at head of Persian Gulf.

1941. Penicillin; pneumonia vanquished; Japanese attack Pearl Harbor, U.S.A, enters World War II. Commercial TV inaugurated in U.S.A, but held up until war's end.

1942. B.F. joins U.S.A. Bd of Economic Warfare, Washington, D.C. Uranium fission. B.F., Anne and Allegra move to 2222 Decatur place, N.W., Washington, D.C.

1943. Sikorsky helicopter successfully flown; R. Buckminster Fuller's Dymaxion projection Airocean World Map published *Life Mag.,* 1 March.

1944. First jet aeroplane (fighter), English; real prototype Dymaxion House manufactured by aircraft industry, Wichita, Kans., under joint auspices AFL-CIO Labour, War Production Board, War Manpower Commission, Aircraft Industry Production Board, Beech Aircraft's Executive Administration; B.F. as Chief Des. Eng. B.F., Anne and Allegra move to 6 Burns St, Forest Hills, N.Y.C. apartment, but B.F. goes to live Wichita, Kans., '44, '45, '46.

1945. Franklin Delano Roosevelt dies. President Truman succeeds; Mussolini executed 28 April; Hitler commits suicide 29 April; United Nations meets 25 April, chartered 26 June; first atomic bomb, Alamogordo (secret), New Mexico, 16 July - Hiroshima, 6 August - Nagasaki, 9 Aug. Streptomycin developed.

1946. Regular transatlantic aeroplane passenger service begins with prop-driven Douglas DC-4 trans-oceanic 'Work Horse' of World War II; League of Nations dissolved.

1947. Geodesic domes invented by R. Buckminster Fuller. Commercial television broadcasting gets under way in U.S.A. BJF. Black Mt College.

1948. President Truman re-elected. Aureomycin developed. B.F. to

Mass. Inst. Tech. -

1949. Giant electronic computers introduced to implement complex stockpiling and anticipatory arming and preparation for 3rd world war under title 'Cold War'; general industrial automation emerging.

1950. DC-6 aeroplane passenger service inaugurated. Brink's robbery of million dollars - Boston, Mass. B.F. in heavy university visiting.

1951. Korean War begins. DC-7 propeller-driven aeroplane introduced. B.F. and A.H.F.'s daughter Allegra Fuller marries Robert Snyder.

1952. President Eisenhower elected. Ford Motor Co. River Rouge Geodesic Dome project started - 26 Dec.

1953. Mt Everest climbed; Ford Motor Company's 50th Anniversary, Dearborn, Michigan, 93' diameter geodesic Rotunda dome installed as first successful industrial acceptance of R. B. Fuller's concepts quarter century after his 1927 prediction that first realization would be in 1952. Alexandra Fuller Snyder born 1 Nov. (Bucky and Anne Fuller's first grandchild). Polio vaccine (Salk).

1954. First atomic-powered submarine (U.S.A.) launched; U.S. Marine Corps' family-house-size geodesic dome helicopter airlifted and delivery at 60 knots; geodesic domes adopted by U.S. Marines for all advanced base enclosures.

1955. D.E.W. Line geodesic radomes installed in Arctic; Salk polio vaccine effective; Jaime Lawrence Snyder, born 28 April (Buckminster and Anne Fuller's first grandson).

1956. Transistor discovered and developed. First transcontinental helicopter flight, 37 hours; first transatlantic telephone cable; U.S.A. International Trade Fairs adopt geodesic domes as main pavilions. First geodesic 100' diameter trade fair dome flown to Kabul, Afghanistan, in one DC-4. Dome erected by Kabulians led by one U.S. Engineer in 48 hours. Eisenhower and Khrushchev meet at Geneva with their atomic scientists, followed by U.N. Food and Ag. Org. at which time it became publicly known that scientists conceded that Malthus was wrong and there could be enough of everything for one hundred per cent of humanity to live at highly successful standard of living *but* for time being obviously frustrated from realization by world political sovereignties. B.F. first appointment as visiting lecturer Southern Illinois University.

1957. European Economic Community established; first civilian nuclear power station; history's largest clear span structural enclosure, 384' diameter geodesic dome, Baton Rouge, La.; *First Russian sputnick orbits earth every hours,*

1958. Laser discovered. Geodesic domes go to Arctic and Antarctic and all around earth; first U.S. satellite orbits earth; English inaugurate first transatlantic jet-propelled aeroplane passenger service; first U.S.A, domestic jet airline service inaugurated; U.S. nuclear submarine *'Nautilus,* Commander William R. Anderson, crosses Arctic Ocean and North Pole from Pacific Ocean to Atlantic Ocean submerged below ice cap; R. B. Fuller's Energetic/Synergetic Geometry discov-

ered by nuclear physicists and molecular-biologists to mathematically explain nature's fundamental structuring at the atomic nucleus and virus levels. (See John Grebe, N.Y. Academy Sciences and Dr. Klug, Birkbeck Col. London U.) B. Fuller makes first of his subsequently multi-annual circuits of Earth in course of fulfilling his regular university appointments in S. Africa, India, Japan, England, etc.

1959. Russian un-manned rocket crash-landed on moon; Sputnik II circled moon and radioed photos of 'far side' back to earth; world-around air jet passenger service network established; first nuclear-powered commercial motor ship launched; Lunik I, Russian Rocket into orbit around sun as first man-made planet; 200' diameter Fuller-Kaiser gold anodized aluminum geodesic dome as U.S.A.'s International Exhibit Pavilion, Moscow, Russia acclaimed by Khrushchev and after fair purchased (full cost) by Russia from U.S.A. Dome now permanent structure in Moscow's Sokolniki Park. B.F. appointed by State Dept to visit Russia as representative of Engineering in protocol exchange. Russians, in giving dinner for him, stated they had been following his work for 29 years. St Lawrence Seaway opens; U.S.A.F. Major Rogers flies aeroplane 2,455 m.p.h. B.F. appointed as University Professor (Research) at Southern Illinois University. B.F. and Anne erect geodesic dome home 407 So. Forest, Carbondale, Illinois, and move to new home from Forest Hills, N.Y.

1960. President Kennedy elected; 114' diameter 10,000 sq. ft. floor space geodesic dome of Ford Motor Co. delivered by helicopter fully erected; Bathescape navigates one mile inward to bottom Pacific; U.S. Nuclear submarine *Triton* circumnavigates Earth submerged whole way, in 84 days.

1961. Russian Gagarin orbits Earth as first human space man. Men (Russian) orbit Earth in hourly cycles in co-rocketing vehicles; 2,000 geodesic domes produced by over 100 industrial corporations, licensees of R. Buckminster Fuller, primarily air-delivered and speed-installed in 40 countries around Earth and in North and South Polar zones between 1951 and 1961. B. Fuller proposes to 2,000 architects of International Union of Architects at 5th World Congress at London, England, to officially initiate Phase I of Design Science Decade 1965–75 which will put world on notice that making world work is an invention initiative and not a political

responsibility and is only solvable by a world design revolution which is the only revolution universally tolerable to diverse political interests of the world; and that the design revolution must be conducted by world-around students under university auspices and supported by professional degree accrediting boards and visiting committees of all the architectural, engineering and scientist professions and officially underwritten by their professional societies.

1962. B.F. appointed by Harvard University as Charles Eliot Norton Professor of Poetry - a one-year appointment. 1962 year of transition of comprehensive technology going from dry land into sea and into sky, from visible to invisible because more-with-lessing, through transistors, *et al.,* transfers all basic controls to invisible ranges. One Telstar weighing only one-quarter ton displaces transatlantic cables weighing seventy-five thousand tons. B.F. establishes 'Inventory of World Resources, Human Trends, and Needs' at Southern Illinois University with John McHale as executive director.

1963. World Congress of Virologists Meeting, Cold Spring Harbor, Long Island, New York, announced comprehensive discovery of protein shells of viruses as anticipated by B. Fuller's mathematical formula of frequency to second power times 10+2. Limited Atomic Test Ban Treaty U.S.S.R. and U.S.A. President John F. Kennedy assassinated 22 Nov. Lyndon Johnson becomes President of U.S.A. B. Fuller member of Doxiadis Delos Symposium #1. B.F. delivers world student discourse on Design Science Decade as International Union of Architects convene their Sixth World Congress in Mexico City. Seven-million-dollar railway train robbery Cheddington, England. Telstar communications satellite put into orbit around Earth. Syncom communications satellite put into 24-hour orbit holding flight position over one point of spinning Earth. B. Fuller made consultant to advanced structures phase of Advanced Research Programme of NASA (National Aeronautical and Space Administration). B. Fuller subject of 5 half-hour television broadcasts on National Educational Television Network on national hook-up.

1964. 8 Jan. - B. Fuller 'cover story' *Time Magazine.* U.S. Civil Rights Act, 2 July; Khrushchev ousted. Lyndon Johnson elected President of U.S.A. B.F. subject of B.B.C.'s first science programme on their new wide-range Channel Two network on recommendation scientists at Cavendish Laboratory of Cambridge University because TV is visual and B. Fuller had discovered the conceptual model bridging between science and the humanities. B. Fuller's serial articles, 'Prospects of Humanity' appears in *Saturday Review Magazine.* Anti-Poverty Programmes. B. Fuller commissioned as the architect of U.S.A. Pavilion for Montreal's 1967 World's Fair, 'Expo '67'. B. Fuller member of U.S.A, team in Dartmouth-Leningrad meeting of 'Leading Citizens of U.S.S.R.-U.S.A.' assembled by U.S.S.R.'s Academy of Sciences with U.S.A.'s Norman Cousins, Arthur Larson, etc., to discuss all known points of contention between U.S.S.R. and U.S.A. B.F. on Delos Symposium #2. Four volumes of Design decade and World Inventory of Resources, Human Trends and Needs published by Southern Illinois University.

1965. World's longest tunnel, 7-| miles, completed through Mt Blanc, Switzerland. Churchill dies. First commercial satellite put in orbit to relay intercontinental electro-magnetic wave programmes as telephone; television, etc. First space walking by both Russians and U.S.A, astronauts. U.S.A. satellite photos Mars from 7,000-mile passing distance and sends pictures back to Earth. Japanese put geodesic radome on top of crater's edge at summit of Mt Fuji and issue memorial stamp of 'Pearl in the Crown of Fuji-San'. B.F. member of Delos Symposium #3.

1966. Jan. - Russians make first successful instrument-package soft landing on moon followed few months later by U.S.A, successful duplication of feat as both radio pictures of moon's terrain back to Earth. July - B.F. persuades Archibishop Makarios to cede token land of 200 acres from Cyprus sovereignty to *World Man* under 50-year trusteeship of World Academy of Art and Science, a supranational organization. B.F. member of Delos Symposium #4. 4 Jan. B. Fuller 19-page profile in *New Yorker Magazine.* Nov. - B.F.'s U.S.A. Pavilion, a 250' diameter geodesic sphere, completed at Montreal - to open in April 1967. Plasma-propulsion and ion-propulsion engines for space travel and ultra high speed first flown by Russians. B.F. inaugurates computer game at Southern Illinois University called 'World Game', how to make world work in such manner all of humanity become physical and economic success and all humanity can enjoy all of Earth without

one interfering with the other and without any one advantaged at expense of other. B.F. asked to give lecture to scientists, engineers, contractors at Cape Kennedy which explained that fallout from space technology into domestic economy would bring first scientific house in history to world man on Earth which would catalyse physical success on Earth for all humanity.

R. BUCKMINSTER FULLER
Professor, Southern Illinois University

3 Margaret Fuller's Prophecy

Published by Buckminster Fuller in his *Shelter Magazine* in November 1932, and issued four days before the presidential election at which Franklin D. Roosevelt was first elected President and instituted the 'New Deal'.

I am including here a quotation from my great-aunt, Margaret Fuller. This quotation is important today, when considered in the light of C. P. Snow's book, *Two Cultures.* His two cultures are those of the scientists and the literary intellectuals, whose respective languages and interests in the last century and a half have pulled so far apart as to have created a chasm. Snow says that this is partially due to the fact that the intellectual writers of the early nineteenth century not only failed to comprehend the significance of industrialization but that its individual literary stars abhorred industrialization's every symptom. This occurred despite the fact that the Royal Society of Arts was formed in England in the 1750s by the literary intellectuals and learned scientists for the very purpose of anticipating and forestalling this dichotomy. Snow says that Emerson and Thoreau in America were typical of intellectuals with aversion to industrialization, and their popularity increased the academic divide between the literary and the scientific.

Margaret Fuller was co-founder with Emerson of *Dial* magazine, which she undertook as the first publishing medium to present the work of Emerson. She was also the first publisher of Thoreau's work and he, Emerson, and other *literati* of the time were her great friends. She alone seems not only to have been aware of the looming significance of industrialization, but also to have hailed and welcomed it as it came from England to impinge upon America.

In reading Margaret's essay, it should be remembered that two years before it was written she had spent the summer with the Indians outside Fort Dearborn, which had been established seven years earlier. She had reached that present site of Chicago via the sailing ships on the Great Lakes, and stage coaches. The telegraph had been

invented a few years earlier, and at the time Margaret wrote her essay in 1842, the only railroads in America were the short twenty-mile line between Schenectady and Albany and the forty- mile track between Baltimore and Washington. There was nothing in the scene of her time that obviously foretold her 'complete linking together of the great continent of America by the telegraph and railroad'. Very little of America was as yet within the 'United States'. Not only did Margaret envision the coming and the important significance of industrialization, but she stated also the realization that it would bring a great cross-breeding of man. She foresaw the necessity for the public to serve as sole patron of mass production and she predicted the public's ripening ability to appreciate its responsibility to the regenerative functioning of the individual artists.

Some may think it paradoxical that the work of Emerson, Thoreau, Hawthorne and Poe has been acclaimed by history (though these writers were antipathetic to the subsequently realized evolution of man), while Margaret Fuller's name has remained obscure. In fact, her work has remained so obscure that C. P. Snow and his audiences are unaware of the extraordinary vision and cordiality to industrialization in America she had more than a century ago. Margaret Fuller, however, is well known academically in America. Her life and work is one of the leading thesis subjects for graduate school candidates for Master's degrees in early American literature.

When Horace Greeley founded what is now the *New York Herald Tribune,* in April 1841, he asked Margaret Fuller to be his literary critic. Heywood Broun, one of her many successors as literary critic of the *Tribune,* said almost a century later, 'This was the first and last time a literary critic was regularly "front-paged".' Because Margaret was devastatingly critical of popular American writers and poets who produced what would be today classified as 'saccharine corn' imitations of English authors and pursued a far-sighted vision of an as-yet-gestating intellectual conceptioning for America's role in history, she lost her front-page battle to establish the primacy of the regenerative individual to industrialization and the fundamental economic responsibilities of an industrially instrumented society to its individual conceptual pioneers as the prime commonwealth initiators and augmentors. ' -

Margaret Fuller's 1842 Prediction

Some thinkers may object to this essay that we are about to write of that which has as yet no existence.

For it does not follow because many books are written by persons born in America that there exists an American literature. Books which imitate or represent the thoughts and life of Europe do not constitute an American literature. Before such can exist, an original idea must animate this nation and fresh currents of life must call into life fresh thoughts along its shores ...

That such a genius is to rise and work in this hemisphere we are confident; equally so that scarce the first faint streaks of that day's dawn are yet visible. It is sad for those that foresee, to know they may not live to share its glories, yet it is sweet, too, to know that every act and word, uttered in the light of that foresight, may tend to hasten or ennoble its fulfilment.

That day will not rise till the fusion of races among us is more complete. It will not rise till this nation shall attain sufficient moral and intellectual dignity to prize moral and intellectual no less highly than political freedom, nor till the physical resources of the country being explored, all its regions studded with towns, broken by the plough, netted together by railways and telegraph lines, and talent shall be left at leisure to turn its energies upon the higher department of man's existence. Nor then shall it be seen till from the leisurely and yearning soul of that riper time national ideas shall take birth, ideas craving to be clothed in a thousand fresh and original forms.

Without such ideas all attempts to construct a national literature must end in abortions like the monster of Frankenstein, things with forms, and the instincts of forms, but soulless, and therefore revolting. We cannot have expression till there is something to be expressed.

The symptoms of such a birth may be seen in a longing felt here and there for the sustenance of such ideas. At present, it shows itself, where felt, in sympathy with the prevalent tone of society, by attempts at external action, such as are classed under the head of social reform. But it needs to go deeper before we can have poets, needs to penetrate beneath the springs of action, to stir and remake the soil as by the action of fire.

Another symptom is the need felt by individuals of being even sternly sincere. This is the one great means by which alone progress can be essentially furthered. Truth is the nursing mother of genius. No man can be absolutely true to himself, eschewing cant, compromise, servile imitation, and complaisance, without becoming original, for there is in every creature a fountain of life which, if not choked back by stones and other dead rubbish, will create a fresh atmosphere, and bring to life fresh beauty. And it is the same with the nation as with the individual man.

The best work we do for the future is by such truth. By use of that, in whatever way, we harrow the soil and lay it open to the sun and air. The winds from all quarters of the globe bring seed enough, and there is nothing wanting but preparation of the soil, and freedom in the atmosphere, for ripening of a new and golden harvest.

We are sad that we cannot be present at the gathering in of this harvest. And yet we are joyous, too, when we think that, though our name may not be writ on the pillar of our country's fame, we can really do far more towards rearing it than those who come at a later period and to a seemingly fairer task. Now, the humblest effort, made -in a noble spirit, and with religious hope, cannot fail to be even infinitely useful. Whether we introduce some noble model from another time and clime, to encourage aspiration in our own, or cheer into blossom the simplest wood-flower that ever rose from the earth, moved by the genuine impulse to grow, independent of the lures of money or celebrity; whether we speak boldly when fear or doubt keep others silent, or refuse to swell the popular cry upon an unworthy occasion, the spirit of truth, purely worshipped, shall turn our acts and forbearances alike to profit, informing them with oracles which the latest time shall bless.

Under present circumstances the amount of talent and labour given to writing ought to surprise us. Literature is in this dim and struggling state, and its pecuniary results exceedingly pitiful. From many well-known causes it is impossible for ninety-nine out of the hundred, who wish to use the pen, to ransom, by its use, the time they need. This state of things will have to be changed in some way. No man of genius writes for money; but it is essential to the free use of his powers that he should be able to disembarrass his.life from care and perplexity. This is very difficult here; and the state of things gets

worse and worse, as less and less is offered in pecuniary meed for works demanding great devotion of time and labour (to say nothing of the ether engaged) and the publisher, obliged to regard the transaction as a matter of business, demands of the author to give him only what will find an immediate market, for he cannot afford to take anything else. This will not do! When an immortal poet was secure only of a few copyists to circulate his works, there were princes and nobles to patronize literature and the arts. Here is only the public, and *the public must learn how to cherish the nobler and rarer plants, and to plant the aloe, able to wait a hundred years for its bloom,* or its garden will contain, presently, nothing but potatoes and potherbs.

4 Influences on My Work

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> January 1955. The original is a letter from Fuller to John McHale in reply to questions about the influence of the Bauhaus on Fuller's work. First published in Architectural Design, July 1961. Editor John McHale.

Many people have asked if the Bauhaus ideas and techniques have had any formative influence on my work. I must answer vigorously that they have not. Such a blunt negative leaves a large vacuum and I would like to eliminate that vacuum by filling in with a positive statement of my initial teleologic preoccupations and their resultant proclivities.

By ‘teleologic’ I mean: the subjective-to-objective, intermittent, only-spontaneous, borderline-conscious, and within-self communicating system that distills equatable principles - characterizing relative behaviour patterns - from our pluralities of matching experiences; and reintegrates selections from those net generalized principles into unique experimental control patterns - physically detached from self - as instruments, tools, or other devices admitting to increased technical advantage of man over environmental circumstance, and consciously designed to permit his modification of forward experiences in preferred ways.

My teleologic stimulation first grew out of boyhood experiences on a small island eleven miles off the mainland, in Penobscot Bay of the state of Maine. There, floatable at will, in and out of nature’s tidal dry docks, with a fifteen-foot flood rise twice a day, boatbuilding was the parent technology, and the devices for its original design and fabrication, together with its subsequent sparring, rigging, beaching-out, wintering, cradling, rebuilding, launching, and upkeep in general were so broadly effective as to govern spontaneously almost any technical tasks to be effected on the land,

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whether this was building of dwellings, barns, well houses, or water-course controls (for water conservation on the island was as essential to survival as was our ability to pass successfully over the waters around the island, away to other islands, or to the mainland). Fishing was the primary local industry, and such tension systems as seines, trawls, weirs, scallop drags, lobster pot heads, and traps, together with all their respective drag and buoy gear, insured an ever-present abundance of stout cordage and light lines as well as experience in net- weaving, tying, splicing and serving. Here men 'passed a line' and 'took a turn' in deft tension techniques as spontaneous as those of spiders.

This boyhood experience on an island-farm included those first turn-of-the-century days of individual, or family, small-tonnage water transportation almost exclusively by sail or rowboat, leading to the experimental inclusion of the newly invented internal combustion engines. We had in our sloop one of the earliest auxiliary gasoline engines within many miles, and this induced a whole line of inventiveness, along with gallons of sweat, relevant to priming the engine, testing the spark, and rolling over a flywheel. But the rowboat had to serve its complementary tasks, and as I had to row each day on a four-mile round trip to another island for the mail, my first teleologic design invention was a mechanical 'jelly fish', or teepee-like, folding, web-and-spirit cone which was mounted like an inside- out umbrella on the submerged end of a pole. This pole could be hand-pulled through a ring over the stem, drawing the self-folding cone on the pole's water end through the water with little resistance. When pushed by the pole, the cone opened and gave inertial advantage, almost as though touching bottom, to push-pole the boat along far more swiftly and easily than by sculling or rowing.

These trips were frequently rowed in the fog and across strong tidal currents which involved complete dependence upon calculations and compass. The push-pole made it possible to see ahead, having been frustrated in back-towards-bow rowing.

Our island had a rich resource of beach-dried driftwood and standing timber, the use of which required permission of no one. With a pocket knife and a few other tools I designed and produced many crude, scale and full-size, experimental designs in planing boats, valuable houses, and rolling or soaring transport devices at Bear Island between 1904 and 1914. There were also a number of invented and produced furniture items. These also included a set of vertical Victrola record roll-in-and-pop-out storage cabinets which have been in use now for a half century. The first Victrola records of

1904 and 1905 stored in these cabinets are still in fairly good condition, due to their standing on edge rather than on face. These record storage units were tensionally partitioned, which made for great space economy. They were the prototype for the crop of welded wire devices which appeared on the market a quarter of a century later.

My next series of important design-influence experiences came at Milton Academy in Milton, Massachusetts. Here I received a good private school's theoretical education, coupled with enthusiastically broad experience in the historically differentiated family of controlled physical principles known as 'athletics'. Athletics greatly heightened what I call the 'intuitive dynamic sense' a *fundamental,* I am convinced, of competent anticipatory design formulations. This organized primary education brought me into Harvard with good marks in all but Latin. My first serious objective adolescent experience grew out of being fired from Harvard, officially for cutting my classes, but in fact for general irresponsibility.

Fortunately, I landed in Canada as an apprentice to a group of English (Lancashire) and German cotton mill machine fitters. Here I learned to assemble and erect cotton-mill machinery. I finally mastered on my own the assemblage and installation of each and every type of cotton-manufacturing machine. The installation included running of the pulley-shafting throughout the buildings and its overall alignment from the power house take-off through to each belted-in and aligned production machine. I stayed on to help put the mill into operation.

Starting with a bare new building in a new land and taking part in its mechanical installations and subsequent running I gained, at first hand, a dawning awareness of a major economic pattern factor - that of effective 'addition of value (or wealth) by manufacture', effected between raw and finished goods, and gained by the rich synergetic admixture of *technology and energy.* Both the latter, I could see, were fundamental assets that defied exhaustion in *apparent universe.* Technology was a basic resource that improved, or self-multiplied, with each repeated opportunity of its application. I could see from all this fundamental wealth augmentation - without resource depletion - that there was arising an important reorientation of mankind, from the role of an inherent 'failure', as erroneously reasoned by Malthus, and erroneously accepted by the bootstrap-anchored custodians of civilization's processes, to a new role for mankind, that of an inherent success.

But I could also see that this magnificent reorientation was occurring only through knowledgeful, and experience-rich competence in teleologic designs, integrating transcendentally man's conscious planning, but by virtue of physical laws, as an organic workable complex - *industrialization.*

Machines of the cotton mill in my 1913 to 1914 experience were as yet primarily *imported* by the Americas. The importations were mostly from England (Dobson and Barlow) but they were also brought in from France (Combers). The French machinery was of far better metallurgy and engineering refinement. The cotton-mill machinery was shipped from Europe to America in cases of completely disassembled parts. Frequently the English machine parts were damaged or broken in transit, and it became my special task to find ways of obtaining replacement parts in a hurry within the small industrial town of Sherbrooke, Quebec. This involved me in a self-tutored course of engineering exploration in rediscovering the original designer's strategy of determination of the respective functions and stresses of each of the parts, which in turn had occasioned their appropriate dimensioning, and metallurgical specifying.

I also had to rediscover the economic considerations and production strategies originally used in determining the forming procedures for final realization of the parts. This experience involved, too, the discovery of the whereabouts of local resources for reproducing such items. It was an all-important phase in my life, when I came to know shop foremen, moulders, machinists and their respective tools, and the beginnings of metallurgical procedures in general. Sometimes I succeeded in designing better parts.

The chief engineer of my company wisely persuaded me to keep an engineering note and sketch book of my experiences. So well did I enjoy and therefore carry out my new phase of learning that I was invited to return to Harvard and quickly accepted, only to be dismissed again for lack of sustained interest in the processes within the University.

Once more I resumed my real lessons, not without deep anguish and shame at having brought hurt to my family, but also with a sense of deep enjoyment in the opportunity to get into the live economic pattern. This time it was with one of the great packing-house industries - Armour and Company - where I worked successively in twenty-eight branches of that company in the New Jersey-New York City area.

I went to work in New York City's pre-World War I daily market routine of 3.00 a.m. to 5.00 p.m. My experiences included physical tricks of lugging beef quarters into export ships, gaining knowledge of the economics of abattoirs, refrigeration, by-product chemistry, and high-speed, cross-nation perishable tonnage movements impinging endlessly on sidewalk market-trading. I learned of distribution shrinkage, of comprehensive premechanical accounting and auditing methods, and, most importantly, of broad-scale, high-speed, behind-the-scenes human relations in the give and take provisioning of men's essential goods.

During the war I entered the Navy and took a course at the United States Naval Academy at Annapolis, which gave me an enthusiasm for scientific methodology, not only as witnessed in the large patterns of shipbuilding, but also as experienced in their handling and navigating, under a multitude of conditions. I found all of these ship complexes to be the most superior tools of their respective historical moments, providing standards of effectiveness undreamed of in my boyhood's island days. The new tools of the Navy experience were the more deeply appreciated by me because of my earlier, limited success with self-improvised tools, which so often were realized only through successive stages of spontaneous designs and inventions.

My second derivative Navy experience, in *conceptioning of patterns,* gave me an exquisite confidence in the superior effectiveness potential to the individual in the direction of competently apprehended, analysed and design-applied principles integrated to anticipate forward needs by physical translation of the associable principles into event-control mechanisms. Tools were consummately wedded *principles,* as function couples, as variably functioning couples, differentiated out of experience, abstracted (or generalized), in terms of ratios of advantage and ratios of anticipated stress proportionment - all objectively translated into the mathematically manageable but infra-sensorial principles governing synergetic chemical structures.

I learned the process of conscious self-attunement towards the understanding of principles and their subsequent teleologically translated anticipating effectiveness, as demonstrated in: navigation, ballistics, logistics, ship-squadron and fleet handling (at sea and in port), all of which attuned comprehension of principles invariably was reduced to generalized complex equation by a process of incisive and swift differentiating-out of the problems' complementary functions, *not only from one another*

but also from all of the entirely impertinent and unfavourable a priori *association factors.* Then came the effective reassociation of the selected and separated pertinent factors within a reciprocating, dynamic totality of now relevant but complex interactions which methodically processed the variables in respect to the constants.

I was fortunate in having Navy commands and very live experience in exercising comprehensive responsibility for the safety, comfort and organizational effectiveness of large numbers of men, as associated with, and advantaged by, a complex of exquisite tooling. This tooling, it was clear to see, had accrued only to the whole history of man's experiences and subsequent irrepressible teleologic reflexes towards further anticipatory design.

Thus I saw that the teleologic design process was ever *regenerative* - within the plurality of progressively harvested physical principles of experience which could be converted, through initiative, to articulatable advantages, thus in turn progressively modifying man's *a priori* physical environmental-hazard patterns, and thereby bettering his effective survival chances. The teleologic process was therefore regenerative because its new patterns created re-stimulus towards further teleologic conversions of subjective, *a priori* design experiences into objective design formulations - as man took on increasingly conscious functioning in the evolutionary processes.

My Navy experiences ranged all the way from those small commands to subsidiary functions within much larger command patterns. The assignments and commissions brought, for instance, incidental participation in the first development of ship-to-plane radiotelephony. They also brought subsequent participation in the conversion of radio-telephony from seventy-mile-range spark sets to long-distance, arc-type equipment. The first instance of the above electronic experiences occurred when a small ship I commanded was selected for the experimental work of Dr Lee de Forest. While aboard, he established the first successful voice communication ever heard between a ship and an aeroplane.

I was later fortunate to be Force Radio Officer for the Cruiser and Transport Force of the United States Atlantic Fleet, which carried and escorted the American troops across the Atlantic in World War I and, as personal aide for secret information to its commanding admiral, had intimate experience in large teamwork maintenance of colossal dynamic patterns: for instance, that of maintaining the high- velocity transatlantic turn-around of 130 major troop-carrying ships, together with their cruiser and destroyer escorts. Here was the pattern of secret high-speed exact communication

and the strategy of sea group formation, all logistically maintained by expertly scheduled supply and maintenance men at their inspired best, accomplishing the *impossible* under war-induced spontaneous cooperation. After the war I compiled the official Navy statistics of that operation. During the war I had been editor of its sea-printed publication *Transport,* which had monthly circulation in our fleet of 130,000 copies.

Immediately after the Armistice of World War I, the U.S.S. *George Washington,* one of our ships, was selected for President Wilson's trip to France to attend the Versailles conferences. In the *George Washington* we installed the first long-distance wireless arc telephony which dramatically graduated the ship-to-ship telephone from a seventy-mile-range spark set squawk to an effective two-way trans-oceanic voice communication. On President Wilson's second trip to France, the human voice was transmitted trans-oceanically for the first time in history, as man was heard through the receiving instrument in Arlington, Virginia, speaking over the transmitter in the radio shack atop the u.s.s. *George Washington* at anchor in Brest, France.

This Navy experience also involved a tour of duty with naval aviation and short assignments escorting underwater craft. In our first naval aviation training programme of 1917, seaplanes crashed daily, usually 'stubbing' their floats, tripping and capsizing as they hit the water. A seaplane rescue mast and boom which I design-invented and mounted on high-speed patrol craft for yanking the usually capsized crashed planes from the water, with the intent of saving the belted-in, stunned pilots from their usual fate of drowning, won me an appointment to the special course at the U.S. Naval Academy in 1917.

Such pattern-experience continually excited conceptioning in potential advantages accruable to new complex design integrations, and subsequent conceptual experimentation with forwardly conceived and theoretically designable entities. It made possible, for instance, a clear and reliable prevision of an entirely new type ship, and a well- developed prescience of handling that ship in action; but all, of course, prior to its actual experimental development, physical building and final sea trials, as proof of the original conceptioning's validity.

This coordinate predemonstration conceptioning and integration is a mental functioning which must for millenniums have been common to those men who have undertaken new phases of ship design and building techniques and who today also lead the accelerating-acceleration in design evolution now characterizing airocean craft, which is developing at an exponential rate of growth without precedent in, and unanticipated by, history.

In their teleologic treatment of omni-oceans architecture - operating within, upon and around the liquid and gaseous envelopes of earth-the clear prevision of comprehensive designers integrates, perforce by stark physical limiting factors, a synergetic reality so organically persuasive as to induce its spontaneous identification in the communicating minds of men by the vital pronoun 'she'. Such man-conceived dynamic 'shes' are parented by a whole inventory of newly evolving technical potentials, which individually break through barriers of yesterday's practicable limits, all married, by competent integration and intellect wrought with the whole history of acquired shipbuilding and handling experiences.

In this intuitive formulating the aesthetic perspicacity - sensorially tunable by man - is specifically trained to process those borderline nuances of dimensional ratios of the envisioned system's interacting sub-system component functions.

So *invisible* are the important teleologic initiation processes of the designer's intellect, yet so dramatically visible are the sequitur processes and systematic phases of translation into reality of such ship design-evolution envisioning, and so scientifically prosaic are that envisioning's ratioed criteria of required performance improvements per units of invested resources - over any previous results of undertakings within the respective categories - that it has been erroneously predicted throughout the original years of industrialization that the science, technology and industrial evolution must eventuate inherently in a vast stereotyped monotony.

In historical refutation of such inadequate surmise, it is now in startling evidence that no evolutionary era of biological mutations has ever proven so prolific in accelerated multiplication of species,, types and sub-variety nuances and regenerative by-product aesthetic stimulation as that which now accrues to omni-medium ship architectures.

I will here trace briefly a forty-year sequence of episodes which quite possibly were delay detonated from delighted watching in 1904 of the jet-propelled white jelly fish in the clear Maine water. This experience inspired my push-pole propulsion device probably by the innate ability of children to practise, without knowledge of the mathematics discovered in generalized patterns and formalized by maturer minds - the spontaneous teleological inversion - or transformation of relative action-and-reaction behaviours.

The sequence which I shall now briefly trace starts in 1917. This conceptioning development is in turn woven into the warp of contiguously overlapping conception-to-reality threads which I have also served throughout a half century. The fabric thus woven adequately demonstrates my major preoccupations - and consequent orientation - to the important exclusion of, and immunization to, secondary value influences of post-maturing life.

During 1917, in exploratory conversations with my commanding officer, Commander P. N. L. Bellinger, later a vice-admiral and one of the Navy's first four aircraft pilots, I started my theoretical conceptioning and development of a wingless, amphibious 'jet-stilts' elevatable aircraft which would plummet aeronautically in tetra-vector guidance. This aircraft would be powered by twin *combination plants,* consisting of gas turbines, jets and rocket assist thrusts, universally hinge-mounted, on both starboard and port sides, abreast the maximum beam section. Each thrust would be angularly orientable throughout a spherical-tetrant sector; vertically, outwardly, forwardly, backwardly, inwardly, with the geometrical degrees of freedom characterizing a wild duck's full manoeuvring range of wing-thrust angles. The gas turbines would also be clutchable with breast wheels, or paddle wheels, for original ground or water taxiing, or for take-off and alignment skittering.

This slowly gestating jet-stilts flying concept brought me to a paper and model-making design stage of a conceivably workable ship in 1927. It was, however, impossible to consider its full-scale realization in 1927 (even had I the necessary capital or technical accrediting, which I did not) because of then-prevailing metallurgical heat limits which, however, have since been advanced to permit practical realization by others of the principles involved, first as jet ships in 1943 and now as vertically orientable jet ships, 'flying bedsteads', etc.

I published the concept with a sketch in a two-hundred-copy, privately distributed monograph in 1928, and publicly in *Shelter Magazine* in November 1932. In December 1932 I was invited to show the models of the jet-stilt '4D transport' in the Grand Central Building windows of the Engineers' Book Shop in New York City. In January 1933 I demonstrated them in a feature booth throughout the National Automobile Show in New York City's Grand Central Palace.

However, in February of the same year I was so sure of the eventual successful jet and rocket power plant development that in anticipation of its imminent realization I built three full-scale experimental transports of appropriate aeronautical conformation, embodying strategic steerability controls in respect to eventual omni-directionable steerability, loadability and manoeuvring as these related to centres of balance, effort and stress. I hoped that these experiments would hasten man's practical realization and enjoyment of all-medium navigation by hoverable, yet swift, spotalighting and spot-take-off transportation, thus opening up vast new ranges of preferred earth-dwellability, when extension of chemistry of the metallurgical heat-level strength ratios appropriate to thrust- supported, plummeting, air-land-water craft should be realized.

I felt that the ground taxiing and cross-wind travel problems of such wingless 'fish' would be more difficult to solve than the aeronautical manoeuvring problems to be encountered. This proved a worthwhile assumption, for the ground contact manoeuvring problems proved to be many and difficult to overcome, as the land contacting problems of vessels of all types of either the sea or air have always been. Where there is plenty of sky room for the plane and sea room for the boat, time is afforded to re-establish controls when breaks in regular functioning occur. The liquid and gaseous mediums are chemically bonded in flexural freedoms, permitting energy-event contact stress distributions to innocuous magnitudes, but the crystalline state concentrates its energy effect. Crystalline-structured ships in liquid and gaseous mediums provide convergent- divergent systems in equilibrious balance, but crystalline ships and crystalline earth converge all their potential contact energies at point of contact. Pneumatic tyres are packaged sky oceans to insulate earth and ship and to distribute their potential energies of contact. I chose this landed phase of the

omni-transports experimental development, not only because the metallurgy was not quite ready, but because this was the hazard zone where lurked the preponderance of frustrations to be overcome on the way to important new freedoms of man, in exponential degrees of his present, first-dimensional linear crowding along streets.

My three experimental units of 1933, 1934, and 1935 were called the Dymaxion 4D transports. As a result of building and testing these three successive types of the 4D transport I learned of the primary cross-wind, cross-furrow, in-rut, on ice, in-traffic, in-parking, ground looping, cornering, high-speed accelerating and decelerating problems and answers and, to the best of my knowledge, am at present better prepared than others for initiating the successful prototyping phases of this new era transport.

Prior to the arrival of the opportunity to make such initiation of the jet-stilt transport, I had ready the conception-processed designs for application of the tetra-vector thrust support and plummet principle to twin miniature-combination, jet-rocket power plants of a few pounds, each mounted in 'crutch-like' assemblies, harnessable under and to the two arms of an appropriately clothed man, and providing practical means for the man's personal free hovering and swift flight, and bird-like landing and taking-off, independent of fuselage or skeletal frame.

We now jump a long way back from such thoughts to resume tracking of my design stimulus and its complex of conceptioning trends. These have integrated most comprehensively in a search and research preoccupation which I have named *synergetic* and *energetic geometry.*

My attunement to this preoccupation was spontaneous and of possibly native interest, for I can dimly recall a happy experience in kindergarten about 1899 or 1900 when I made a complex tetrahedron structure of toothpicks and semi-dried peas, whereupon the teacher called another teacher to look at it. Together they expressed either feigned or true surprise and pleasure. Whichever it was, I had made an impression on the ladies and the whole affair was vivid enough for me to remember.

I do know, however, that I began my systematic search in synergetic and energetic geometry in 1917 and the omni-directionally regenerative octahedron-tetrahedron complex, or vector-tensor- equilibrium, was first assumed as probable to Avogadro's Law of gases, and then glimpse-discovered as constructionally possible some time in the 1920s and proven in the 1930s.

My discovery of the 'Octet' truss was synergetic - intuitively avoiding special case tactics. I define 'synergy' as follows: Synergy is the unique behaviour of whole systems, unpredicted by behaviour of their respective sub-systems' events.

I was seeking in the whole of experience and knowledge, rather than in specialized isolations, for a comprehensive mathematical scheme of patterning.

My energetic and synergetic geometry exploration has since proven the 'Octet' complex to be a precessionally non-redundant, isotropic vector-tensor evolutionary relationship whose energy transformation accountings are comprehensively rational - radially and circumferentially - to all chemical, biological, electro-physical, thermodynamic, gravitational and radiational behaviours of nature. As such, the discovered synergetic system is probably nature's spontaneously employed coordinate system, for it accommodates all transformations by systematic, complementary symmetries of concentric, contractural, involutional, turbo-geared positive-to-negative-to-equilibrium-to-vice-versa coordinate displacements.

Subsequent to my Navy experience in World War I, I made re-entry into the world of commerce as an assistant export manager of Armour and Company in 1919. With that re-entry into commerce came a whole new pattern of experience which integrated not only my theoretical conceptioning, but also the whole previous navy transport experience in maintenance, supply, and coordination of swift *turnaround,* with my pre-Navy packing-house familiarity in high-speed continental distribution of essential and perishable goods, to all of which the factor of accelerating *turnover* seemed the key to success.

Thus came a dawning conception of an enormous over-all and world-around accelerating integration of those two land and sea processes - turnover and turnabout - turnover of the landed biological metabolic process cycles, and turnaround of the waterborne and later airborne vessels of distribution of the advancing process standards to the most people in the shortest time. The accelerations were obviously keys to the economics of wealth augmentation and its concomitant improvement of the over-all advantage of man. By acceleration more of the total energy relaying in universe may be shunted into a complex of earth-emerging patterns within a given time interval.

Towards the very last of the war my first daughter was born. She subsequently contracted each of the war-aggravated epidemics of influenza, spinal meningitis, and infantile paralysis. I was increasingly resentful that the effectiveness of teleologic processing of man's all-history experience came only to maximum projected design

effectiveness in turnover and turnaround exploitation patterns arbitrarily selected at sub-total experience magnitude. This sub- comprehensive undertaking invoked carelessly non-anticipated byproduct emergencies. The emergencies were resultant to irresponsibly neglected contiguous displacement accelerations inherent in the arbitrarily undertaken patterns. The contiguous displacements caused important economic gear strippings, which in turn induced economic and social impasse. Impasse meant war and inversion of the right-makes-might equation - consisting of exquisite teleologic processing of experience-into-design - inverted mathematically into might-makes-right and thereafter manifested through the teleologic processes only as an emergency rationalized, essential hitting power, with which to slug out the answer as to who should be held responsible for stripping the gears, which stripping could all the while have been avoided by an earlier and relatively small comprehensive investment of wealth advantage in the contiguous but disclaimed responsibilities for displacements.

However, it was clear that if those in responsible positions had been willing to underwrite contiguous displacement controls, even then such avoidance of evolutionary gear-stripping could have been effected only by an engineering-initiated and designed gradual transfer of the full load through progressively decommissioned apparatus synchronized with progressively commissioned new apparatus. This would be so only if the ramifications of individually assumed teleologic design responsibility were upped to include the looming mini- mum configuration of full world industrial network integration, on a realistic basis of omni-bountiful advantage acceleration, in turn to be gained only through total commonwealth regenerative cycling advantage, itself in turn accruing only to an adequate statement of the original design problems - a big order, but a fundamental and therefore conservative minimum.

It was visible to me that the death of our child on her fourth birthday, 1922, resulted from then-unheeded environmental process integrations of comprehensively unattended yet design-preventable factors. This premise has been adequately proven to be correct by the interim elimination of those epidemics from the ‘fatal’ list. Potential preventive success was visible to me as inherent in the advanced practical technology of the premium water and air-ocean tooling and their related ballistics and navigation sciences, in all of which I had experienced an intimate fore-imagining of their implied

land-life applicabilities. Because the possibility was visible to me, when the unattended factors impinged on the life for which we cared the most, there then occurred the important beginning of the negative stimulus or vacuum into which my increasing pressure of teleologically induced design increment tended to explode.

This pressure differential grew finally to a critical detonation point in the subsequent five years' experience within the most ignorant and most prodigious of men's fumbling activities - that sub-industry activity of men, in fortuitous agglomeration of sheltering and dwelling facilities. I learned how these were gleaned out of the industrial and defence left-overs, without benefit either of science or of advanced technology; how all building enterprise was exploited on a gross trial-and-error basis; how all building was beset with arbitrary rules designed to avoid political misfortune while promoting corrupt exploitation of economic monopolies staked out in the rubble-and- weed traffic; how building activity was nurtured with superstition, busybodiness, vain reflex patronage and, above all, fixed with the prior necessity to design ways to make money first, with which hopefully to buy living means afterwards, rather than making better living itself through directly applied design competence and unpatronized designer initiative, undertaken in exploration for an art and science of a generalized anticipatory design competence that would convert social cycling from an emergency-and-cure sequence to an antici- pating-and-laboratory experimenting, complex design, development sequence, akin to shipbuilding, which when appropriate introduces the new-proven advantages into the complex before emergency sets in, even as today we replace aircraft parts prior to probable failures through scientifically evolved scheduling.

The building world which I met with dismay in the 1920s was the paradoxical world in which the patient diagnoses his own ailments and by virtue of his dollar authority commands the retained and muted physician and surgeon to perform, with the doctor's feigned pleasure and admiration for the client's sagacity, operations designed by the patient's own limited, personal, traumatic conceptioning.

Between 1922 and 1927 I took part in the building of 240 structures in the expensive residential and small commercial buildings categories, buildings erected throughout those of the United States lying east of the Mississippi River. During this time I organized five regional factories and invented the machinery for the production of those bulk materials which I introduced into the 240. There I met with the chaos of the building and home-improvising world.

After five years of prodigious and informative wrestling within this arena of increasing inefficiency, my thoughts were suddenly brought into new focus by an independent event. A new daughter was born to us, and with her birth also suddenly was born my resolve to adopt a whole new strategy of thought and action predicated upon the assumption that if an as-yet-unattended but integral function of the industrial complex be adopted for responsible attention, and if design competence is demonstrated in the original statement and pursuit of that unattended problem, then even though the whole search and development was undertaken without any recognized public or private credit and economic authorization, its husbanding would induce spontaneous and unpredictable support by society.

My blind date with principle seemed the only way for me to serve those processes most potential of accelerating the overall technical advantage network towards realization for our new child and all new children of commonly gained participation in spontaneous, anticipatory, economic and technical pattern adoptions, by industry and by society, which would erase from probability the reoccurrence of the unattended environment-bred hazards fatal to our first child. I resolved to apply the rest of my life to converting my pattern sense, through teleologic principle into design and prototyping developments governing the pertinent but as yet unattended essential industrial network functions necessary to removal of such housing chaos by physically effective and lasting technology. As a corollary I resolved to eschew further acceptance of conventional recourse to political or moral reforms which, lacking physical energy effectiveness, must in the face of physical inadequacy adopt peaceful or forceful palliation through political action.

It seemed clear to me that only a transcendental engineering design and technical process pattern predicated upon a world- around dynamic town plan could here succeed. It would have to be a pattern of accelerating and anticipating design evolution to supplant by economic superiority the constantly innocuous design revolutions accruing at increasing expense through the substitution of new materials in the production of parts for old functions within an increasingly obsolete totality, *ergo,* by more expensive chemistry investment in less valid functions.

My envisioned transcendental world design plan would be inherently non-political, because it would be utterly independent of any need for authority beyond' that to-self-by-self for initiation of its study and development. It permitted, on the individual's own initiative, convening of all the appropriate, documented knowledge of man and

universe in integrated teleologic objectivity. It permitted priority of attention to designing the establishment of a whole new world industry concerned only with man's unavoidable needs and implementation of his inherent freedoms. Such an industry could well be the most important phase of application of the very phenomenon 'industry' itself. To wit: the first-hand application of all advancing facets of knowledge to the design of implements for direct support of the regenerative process 'man', within the known and economically realizable resource limits.

By industry I meant in 1927 and as yet mean the following: *''The integrated, teleologic objectivity of the full gamut of the exact sciences',* no more - no less.

Clearly it would be essential to such comprehensive performance that structural and mechanical complexes be design-adopted whose high performance, per units of invested resource, would render the total tonnage of world resources effectively distributable to the physical advantage of the total world population, in improving waves of standards of satisfaction. This could be brought about only by the synergetic (behaviour of the whole unpredicted by the behaviour of the parts) effectiveness accruing uniquely to the relatively large art of sea and air-ocean vessel-building. Keels and ribs, though independently inadequate to subsequent stress functions, gain adequate effectiveness only through means of assembly within jigs, or cradle, which locally and temporarily position the components until the complementary interactions and shortened modular bracings are completed, whereby the structural behaviour pattern of the respective single components is altered into coordinate action of associated vectors, interacting to exponentially augmented total advantage. Vessels, as a totality of differentiated and reintegrated functions, coactive as a complex of efficiently resolved functioning, may, when completed, be launched into a tolerable stress-distributive medium and brought thereby to an adequate plurality of appropriate work focuses within the great turnover-turnaround precessional gearings of total world patterning, thereby also to effect further augmentation of the world's tapped ratio of universally available energy - valuable only when valvable. - and when valvable, accountable as explicit 'wealth' increase.

The transcendental participation of the sheltering structures and dwelling mechanisms in the comprehensively gestating advantages of the industrial network of world design evolution could be effected through the teleologic designing processes of man which progressively convert his pattern participating from subjective to objective, i.e., from subconscious to conscious adoption. For the transcendental plan to be

consistent with lessons of most profitable synergetic and physical experiment it had to involve direct airborne deliveries of jet-stilt transports, coming as an eagle to firm poise at loci of progressive advantage, within the regenerative manpatterning of geography, while ever increasing man's concomitant degrees of freedom and prospective advantage.

To such a comprehensive transcendental dynamic design complex, the sub-system problems, governing local differentiations of design functioning are sequitur but not inferior to considerations of the design evolution of the surrounding plurality of energy-valving mechanisms of the total industrial process. This is to say ±at the dwelling devices are essential and attention-worthy and only subsidiary in schedule of priority-for-development consideration within the greater pattern of dynamic turnover and turnabout of the mechanism's tools-to-make-tools evolution. This 'tooling-up' evolution is emergent in intermittently progressive wave peak congruences historically detectable as uniquely visible eras of the perfecting efficacy of the total network service integration, as the integration impinges upon the conscious reflexes of man, as periodic frames of infocus-ness of objective men upon subjective economic man. But between such glimpsed frames men are prone to return to irresponsible preoccupation with minor, local aspects of the reciprocating mechanisms.

However, the subsidiary system's dwelling devices, resultant to comprehensive processing, are equivalent to electronic tubes which may be plugged into the greater regenerative circuits of the electronic communicating systems. 'House', in comprehensive designing, would be as incidental to the world-around network dwelling service as is the telephone transceiver instrument to the energy processing in communication systems, which are in turn within the larger systems of industry. Industry is subsidiary itself within the universal systems of macrocosmically and microcosmically pertinent evolution.

The Dymaxion technology and design formulations of 1927 were examples of such incidental design events within the frame of designing a new industry, a concept which I published in May 1928.

In 1929 in Chicago, student designers, excited by favourable results already visibly accruing to experimental tests of the economic efficacy of my non-geographical and generalized theories, informed me of a seeming revolution in European design activities in Sweden, France, Holland, Denmark, and in Germany at the Bauhaus. It was evident in the pictures they showed to me that the European architects were

beginning to experience with cogency those same vital stimulations, through privations persistent within the paradoxical environment of high potentials, which had come flooding upon me a few years earlier, as I came to maturity in the accelerating industrial frontier economy opening chapters of new magnitude upon the shores of the American continent.

The industrial frontier wave on the American continent had been regenerated from its former European and even earlier Asiatic beginnings. On its American rebirth the industrial equation was approximately disembarrassed of the progressively paralysing secondary credit-breaking devices which had been put upon European industrial facilities by cartelism's staticizing exploitation schemes. These sought, of course, to perpetuate security of income patterns, though those patterns were inherently incidental to passing phases of fundamental, universal, and evolutionary transformations.

The new cartel-shunning industrial wave, advantaging America's highly competitive early-twentieth-century economy, was also a trend within which I underwent my unforgotten experiences with broken parts of industrial tooling received from Europe. It put me on notice that there was much room for original design improvement, made increasingly reasonable and possible by the evolving inventory of potential design-resource growth within that part of the world in which it was my good fortune to be living.

It was also evident to me that the 1920–30 wave of architectural awareness regarding important design potentials, realizable as design simplifications and improvements, had been generated in Europe in the post-World War I decade by the European's 3,000-mile perspective-clarifying review of architecturally unencumbered, giant silos, warehouses, and factories in the cleanly emergent United States - structures which had been disembarrassed in unique degree, in the space-rich American scene, of economically unessential aesthetics. This American inspiration was well documented by the European- style protagonists whose original publications invariably fortified their arguments for design reform by photographic examples of American silos and factories as constituting sources of their European inspiration.

They still further fortified their argument with pictures of the generalized morphation in design complex, demonstrated by the nakedly functional superstructures of ships of the all-ocean all-sky categories.

For instance they built tiered, outstretched, cantilevered, conningbridge wings, developed a half-century earlier with the first iron torpedo boats and subsequent battleships (the 'bridge' having originated much earlier in gunwale-to-gunwale bridging super structure walkways over crowded decks). It was also amusingly clear that the European designers of the 1920s had glimpsed and comprehended the design paradox within the American continent. This was the aesthetically pure silos' and factories' coexistence with the aesthetically impure architectural nonsense beshrouding America's dwellings and patron-occupancy buildings, as the latter wallowed hypnotically and superstitiously within the European-originated architectural garmenture.

It was also evident that the going design blindness at the lay level in the United States afforded European designers an opportunity in Europe and America to exploit their far-view discernment of the more appealing simplicities of the industrial structures which had inadvertently earned their architectural freedom. This had been accomplished not by conscious aesthetical innovation, but through profit-inspired discard of economic irrelevancies in non-popular occupancy structures. This surprise discovery, the European designer well knew, could soon be made universally appealing as a fad, for had they not themselves been so faddishly inspired? The international style thus brought to America by the Bauhaus innovators demonstrated a fashion inoculation effected, without necessity of knowledge of the scientific fundamentals of structural mechanics and chemistry, whose upped performance abilities had brought about, through economic spontaneity of engineering cost limits, that new factory design revolution which had a quarter of a century later such superficial appeal to the European architects as a functional style formula.

Paradoxically, the introduction of Bauhaus international to America was accompanied by a school routine of manual-sensitivity training, whereas the fundamental of the design revolution inherent in industrialization, whose superficial aspects had inspired the international stylism, were predicated upon graduation *from* manual crafts, and 'seat-of-the-pants' controls only within the sensorial sensitivity limits. The international style's simplification was then but superficial. It peeled off yesterday's exterior embellishment and put on instead formalized novelties of quasi-simplicity permitted by the same hidden structural elements of modern alloys which had permitted the discarded *beaux-arts* garmentation. It was still a European garmentation. The new international stylists hung 'stark motif walls' of vast supermeticulous brick assemblage, which had no tensible cohesiveness within its own bonds, but was in fact

locked up within hidden steel frames supported by steel without visible means of support. In many such illusory ways did the international style gain dramatic sensorial impingement upon society, as does a magician the attention of children. As with the magician, this new architecture and furnishings fad contrived semantic deception by using fake words to describe this design as being 'tensed' or 'suspended curtain' walls.

As the prestidigitator puts over his tricks by focusing attention of the audience's sensorial reflexes upon his decoy functions, in order to render the true functions invisible, so (despite the individual exploratory integrity of the artists themselves) were international-style architecture and the quasi-abstractions of modern art aesthetically propagandized and patronized by those whose larger pattern security seemed challenged by the science-initiated transcendental transformations of the industrializing world's unhaltable trend to constantly accelerating change. Paradoxically, the extreme left and the extreme right (with no fundamental sympathy for the artist-explorer) both, hopefully, promoted the attempt to detour America's dynamicfunction designed philosophy of evolutional acceleration into what they hoped might be an innocuous cul-de-sac; the extreme right because it hoped to keep the design change superficial in order to prolong the tooled-up pay-off, the extreme left with the hope of slowing down the industrial evolution within America and possibly even causing its breakdown through resulting common ignorance regarding fundamentals of the times camouflaged by the nonsense.

History shows that all those periods of faddish nonsense which promote 'getting into the know regarding naught' eventually bring about comprehensive vitiation of a whole society, as is related in the tale of the emperor's clothes. What was going on in a fundamental way in the second quarter of the twentieth century was that world- around economics were shifting from the static norm of classical science to the dynamic evolutionary acceleration norm of relativity's realistically reappraised physical experience. The present economic revolution that renders income from capital gains more universally attractive than income from dividends, and converts yesterday's foolhardy into this day's sagacious, demonstrates that negative strategy has been abandoned and the dynamic relativity of values espoused. The prospects of society are now propitious to a rewelcomed evolution in fundamental design, which in turn promises advance in world design of economic affairs.

However, in the meantime, the momentum of this superficial modern fad nonsense has inflated the American success category of suburban 'international-ranch' construction, from the $10,000 to the $50,000 range for equivalent cubage increments. This has heightened the emotional confusion of these dwellers in nonsensical structures who are already dizzied enough by the paradox of the augmented buying power of an industrially advantaged commonwealth, succeeding despite the commonly accredited Malthusian assurances of inevitable failure of the invention, 'man', within an alleged inherently hostile, man-destroying universe.

I had to conclude when confronted by it in 1928 that as far as the international style and its influence were concerned, we were in for new educational decades in which we must learn to do all the little wrong things first in order to learn by direct experience that we must take broad, comprehensive and incisive responsibility in the formulation of our over-all strategies, if we in America are to maintain our responsible growth-husbanding function in the history of man.

If we have not already scuttled our own historical ship in the process of learning how not to operate it, we may be able to bring it into port despite all the vigorous nonsense organized to redirect man's emergent competence into bypaths of vanity and self-inferiority coddling, which squander the potential advantage in superficial irrelevancies.

In speaking in such a directly critical and unfriendly way of the international style, I do not hold myself a paragon and am sure that there are many who feel that they can shoot more holes into my domed-over Gardens of Eden or mountain-top, moorable, skyhouseboat kind of philosophy and record than I can in theirs or others.

I have written in this blunt way to demonstrate the remoteness of Bauhaus concepts from those I hold. However, the simplest demonstration of the fundamental remoteness of our ways is the lack of schedules of ratio of invested resources per units of performance abilities concerning structures designed by Bauhaus international school architects. Do any of them publish what their structures weigh and what their original minimum performance requirements must be, and later prove to be, in respect to velocities of winds, heights of floods, severity of earthquakes, fires, pestilence, epidemics, etc., and what their shipping weights and volumes will be and what man hours of work are totally involved?

What convinced me that the Bauhaus international designing was of secondary rank and limited to interior furniture sculpture, fabrics, and bric-a-brac pattern variations and to exterior redecorating to reveal the structural facts that had been insinuated behind the old-time facades, was the fact that their designing consciously limited itself to formulated employment of the component items manufactured by the going old-line building materials world. The Bauhaus international school used standard plumbing fixtures and only ventured so far as to persuade the manufacturers to modify the surface of the valve handles and spigots and the colour, size, and arrangement of the tiles. The Bauhaus international school never went back of the wall surface to look at the plumbing, never dared to venture into printed circuits of manifoldly stamped plumbings. They never inquired into the over-all problem of sanitary functions themselves. They settled upon the real estaters' sewers like hens on glass eggs. They did not inquire into the economic patterns governing research, production, tooling, airframe and power plant, and distribution. In short, they only looked at problems of modification of the surface of end products, which end products were inherently subfunctions of a technically obsolete world. Finally the Bauhaus international undertook design only as commissioned by direct patronage and essentially for crafted production of limited-edition products claiming that because the craftsman used modem machine tools (designed to make mass-production tools, not end products) the design must be modem.

This direct patronage designing was in contrast to the kind of 'generalized case' designing effectiveness to which I subscribed. The generalized case designing had to assume complete lack of direct patronage in order to find through scientific competence the way in which ultimately to serve the general public in the manner most effective towards general man's improving survival and happiness. It was clear that the generalized case meant forswearing opportunism, and strict adherence to the programming indicated by the full gamut of laboratory-produced data covering the problem of effecting higher standards for all realizable from the full inventory of history's and geography's resources.

I could see as implicit in the generalized case that not until the comprehensive problem had been worked through in such a manner that the going resources could match the complex of required tasks and the economic criteria had been graduated from mystical hopefulness to demonstrable adequacy that the first presentation of the concept, in its entirety, could be made. When it could be made it must be so obviously

of general advantage that it could be and must be brought in through the front doors of civilization because it would be too big for the cellar-way or side porch. It was clear that the frontdoor introduction would be reachable only by the 'hard way avenue' of broad integrity, universal tolerance, education by experiment, and due (i.e. thoroughly integrated) process.

Now that I have finished stating all the hows and wherefores of my primary design-influence-environment, I must also say that I always hold in deep respect, oft-times with enthusiasm, and sometimes with great affection, all those of whom I am at times most argumentatively critical. It is they in particular who have taken the design initiative after the urgings of their heads and hearts. I warm to all such initiative. I find no men 'bad'. I am convinced by my own frequent stupidities that the hell's-fire-to-be-known by him who calleth his brother a fool is a hell-of-the-mind right here immediately upon earth. I am convinced of the utter integrity of the *total experience,* and of the indicated extensibleness of the comprehensive integrity-apparent universe - extensible further to man, as always, only through the congruent integrity of the individual. *Ergo,* I am convinced of the integrity of the infinitude of complementary functionings identifiable in principle.

In all our case histories are those unique cases where none may trespass and wherein all may profit through the increasing lucidity in the operative principles of the comprehensive integrity implicit of every self-error-revealed stumbling.

5 Later Development of My Work

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June 1958. The original was delivered by Fuller as the Annual Discourse to the Royal Institute of British Architects under the title 'Experimental Probing of Architectural Initiative'. It was subsequently published in the RIBA *Journal* in October 1958.

I have been concerned for a great many years with the potential functioning of the individual in the presence of swiftly integrating world affairs and the increasingly massive states and corporations, and their respective enormous capital advantage in respect to the accrediting of initiatives in any directions. I am sure I am but one of several millions who wonder how much the individual can actually affect the evolutionary processes of his day, while starting only upon his self-accrediting of his own initiative, enterprise and effective transformation capabilities.

In 1927 I decided to experiment and probe in this direction by gathering data on how much the contemporary individual might be able to effect. That year I had come to the end of some very vigorous experiences in the world of building activities. I had taken part in the building of 240 buildings between 1922 and 1927. I had had a very vigorous experience in the American scene regarding this kind of activity. And that building activity followed directly upon experiences in the Navy with its then new world of flying and of radio and other experiences in mechanical activities. My conclusions after five years in the building world were that it, through no fault of its own or of its choosing, did happen to be the last primary area of man's activity yet to come importantly under the effect of the industrial equation which had been coming over all other world technologies and economics for at least a hundred years.

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It was also very clear, I thought, that the superior capability of the industrial equation was approaching inexorably an embrace of all of mankind's productive techniques and therefore would in due course come into availability for direct solution of men's immediate living problems rather than as an aftermath diversion of war-born technologies. Industrialization had been applied at first on very high priority, due to its relative scarcity and enormous initial cost, only to great emergency problems of war and the annihilation of life. Because I had had high-priority industrial technology experiences in the mechanical, Navy and aircraft worlds and then subsequently non-industrialized experiences in the building arts, my experiences had taught me to see the differences between these industrial and non-industrial capabilities. Inasmuch as I saw those differences, there seemed to be some responsibility for personal taking of initiatives.

In 1927 I decided to peel off from conventional livelihood preoccupations and to enter into a period of research and development, the minimum limits of which turned out to be of many years' duration. In fact, the first prospecting into the ramifications of such a researching initiative pursued alone as an individual indicated that there was a minimum of twenty-five years of detached reconnaissance activity before the individual might be able to bring into industrially useful economic harvest any of the kinds of initiations that he might undertake within these vast new evolutionary premises. Feasibility studies I originally found myself making showed that there were many different kinds of unfamiliar gestation lags in respect to final birth patterning within the industrial equation. Whereas in the agricultural world we tended by historical experiences to think of crops coming in annually, we also tended to expect profits annually in respect to the industrial equation. However, I found that there were a variety of multi-year lags between the various industrial inventions and their respective active introduction into the industrial world as new tools, structures and processes. For instance, in the railroad arts, there was an average of fifteen years' lag between invention and the incorporation of that invention in the railroading arts.

The lag was much shorter in the radio world - only about two years - and in the aeroplane world about four. In the world of building I found an enormous lag - approximately forty-two years. Typical had been a building-arts invention at the time when mass production of steel by industrializing man began. Mass-production steel was very different from the previous making of steel by man, which had dribbled along for centuries as a fine art. Production steel ushered in the civil wars of the mid-nineteenth

century. In the mass production of steel Portland cement became a fundamental by-product of the complex steel-making activity. It was, however, forty-two years after the production of Portland cement as a by-product of the steel industry in America that anybody thought of putting a piece of steel into the cement to make reinforced concrete. This is very typical of lags in the building field - as well as of the latter's blindness.

Integrating all the different kinds of lags in the industrial equation ranging between forty-two and two years and weighting the total inventory of categories in the terms of their respective total dollar volumes in respect to the total annual activities, it appeared that there would be a twenty-five-year lag instead of a forty-two-year lag to be anticipated in relation to shifting 'building category' over into the industrial-equation columns and out of the craft arts columns.

I am going to examine the craft arts in contrast to the industrial equation in search of working definitions. There may be other definitions for *craft* v. *industry,* but when I use these words I mean the following:

Both craft and industry deal with extra-corporeal work capabilities greater than those that are integral to the human organism. Therefore, both deal with tools. The craft tools I define as that class of tools which can be spontaneously fashioned and adopted by any one individual starting nakedly in the wilderness - for instance, his picking up of a stone to do work at a distance greater than his arm's length; or his picking up of a stick, using the stick either as spear or as lever. Industrial tools I define as those which cannot be produced by any one man.

Those definitions seemed to me to provide a rather sharp differentiation. But adoption of the definitions brings surprise lines of cleavage. Let me take the case of the hammer: The man in the woods certainly would be prone, having thrown stones and probed with sticks, to take a crotched stick and lash a stone in it, making the hammer with which he could deal a blow greater than that accomplished with his fist. So we might say a hammer belongs categorically to craft. However, I looked at a modem carpenter's hammer and I found that this instrument, made out of forged alloy steel, does involve finding iron which would probably not be in the vicinity of the man in the woods. It involves a knowledge of how to mine the ore, to render and produce the iron, to find and render the manganese, nickel and molybdenum in faraway lands

and to bring them all together. Therefore, invention of ships is involved in the bringing together of many metals, and there is also requisite the invention of blast furnaces, forges and so forth. Obviously, the modem carpenter's hammer cannot be produced by one man, and is therefore industrial - so there are both craft and industrial hammers.

While hammers demand a little exploring, we can take other cases, such as a steamship like the *Queen Mary,* which obviously cannot be produced by one man, operated by one man, or used by one man. What I mean by the industrial tools are those which only relate to the integrated capabilities and initiatives of a plurality of men. With that basic distinction I then discover many other and very important differences between the crafts and industry, as, for instance, craft is inherently local - local in time and in the generations of man. It is local geographically in the small ecological roam-around of the individual; it is very local, then, in knowledge.

In contradistinction then to this local time and geography and knowledge aspect of craft, we find the industrial equation does represent an integration of all the knowledge of all human beings, as gained from their plurality of experiences, and as relayingly communicated by one man to another. Industrialization represents an employment of all the resources of the earth, wherever they may be. It is inherently comprehensive and universal, in contradistinction to local. This is the reason why I have adopted the word comprehensive as unique to my kind of exploration.

The industrial equation goes inherently, *ergo* inexorably, around the world to find the various excellences of unique behaviours of respective elemental resources, because tools are only adopted by men to help them to do greater or more incisive work than that to be accomplished only with their integral physical member capabilities. Out of men's integrated experiences there is regenerated an accelerating realization of ways in which they can improve a workable advantage over the progressively evolving physical environment.

In no time at all we begin to discover that not only in our own wanderings, but also in the reports of other men, there are unique materials elsewhere, which, if added to what we have locally, could give us greater performance capabilities, such as unique lightness combined with a unique new degree of hardness. We also begin to discover that by travel and commerce we might be able to bring together extraordinary new complex capabilities. Thus industrialization, as the total integrated complexity of advantage gains, grew slowly out of the progressively and regeneratively integrated information of man.

Unquestionably, we would say that words are the first industrial tools, for inherently they involve a plurality of men and are also inherently prior to relayed communication and integration of the respective experiences of a plurality of individuals. Due to the fact that nature has disposed the chemical elements around the earth in a very uneven manner, recourse to the total physical resource inventory of unique behaviour advantages to be earned by integrating the totally relayed information does involve man's going all around the earth. Starting from any one point he has to go half around the world - which is always the length of his journey to reach the furthermost earth surface point. The industrial equation involves at maximum going half way around the world and then separating out the desired resources from their matrix, and thereafter a set of progressive separations and progressive forwarding movements of the unique resources towards the special area where you would wish to bring about the highest separation where you have already established a complex of high-advantage tools.

Finally, on reaching the home tool complex, the resources from far and near are separated out to the maximum degree. Men then begin to reassociate the various preferred performance characteristics of these resources in preferred complex patterns, thus accomplishing greater or more incisive tools. Having done so the environment itself becomes permanently altered. The world never returns to the shape that it was before.

It is important to realize that the industrial equation has really altered our physical world relations, the major geophysical patterns, in ways and degrees possibly greater than are popularly realized - as, for instance, England was first exploited by foreign men, the Phoenicians, who discovered England's tin. This low-melting-point metal suddenly opened up new technical capabilities - therefore, economic wealth - and attracted the Romans. The tin ore was finally exhausted here, yet so much machinery of reduction, production and commerce had been developed around it that tin was sought elsewhere by Englishmen who, going halfway around the world from England, found tin in the Malay States, Bolivia, Tanganyika and so forth.

In America we have no tin ore of workable grade or amount. In the industrial equation we need enormous amounts of tin for many kinds of special abilities and tin opens up over and again all kinds of new ventures in industry. For instance, as babbit or bearing metal it first permitted the industrial wheels to go round.

So much tin has been gradually brought into America, and so easy is it to recover, that America's cumulative inventory of available tin has finally become a major world body of the tin reserve. In our aircraft industry today, because it is predicated on very swift changes of design and is a swiftly evolving art, we have so-called soft tools to make possible short runs of entirely new designs, and we learned from England how to make our Kirksite tin-forming dies. Back of every aircraft company in America will be found an enormous store of tin in the form of obsolete dies soon to be melted to form new dies. These tin-die storage yards look exactly like large graveyards but are far more useful. In fact the largest inventory of tin in America is back of our aircraft plants. And there is so much of it there now that the actual tin in concentrated form above ground in America is so great that it is approximately equal to that below ground in Bolivia and the Straits Settlements. That is to say we have in America the largest tin mines in the world, all above ground.

So here we see major geophysical patterns of man's earth irreversibly altered. I have only given one typical case of a myriad in which the earth will never be restored to its previous patterns.

It was perverse in my youth young people were not supposed to know anything. All the grown-ups seemingly knew all the answers and you were simply told to shut up and learn. I was willing to shut up and learn. I decided that if I didn't like the smell of the building I'd better shut up - that I was stupid and squeamish. I stuffed back natural reactions pretty hard. It wasn't very long before I was suddenly out of my home. My father died when I was twelve. He went through a lot of sickness in our home, and I looked out for him. He had strokes and he was out of his mind for the last three years of his life. I had to lead my own father around by his hand, a man I had loved and revered. When I finally got through high school and went to college, I got into a lot of trouble, because I was suddenly on my own. I thought I was going to be a great athlete, and then I busted my leg playing football so I couldn't be an athlete. I was given some money - my year's allowance - and I didn't know anything about money at all. I spent my whole year's allowance in one week. I obviously couldn't stay at Harvard very long, so I got fired. They can't fire you for spending your money - it's your money - but they could fire me for not going to my classes. I got into trouble with Harvard two times, and if World War I hadn't come they would have let me back in again for a third try because I had high scholastic grades.

Each time I was sent out I went to work. I liked the people I met at work and I liked mechanics. I found myself employed as a machine fitter and I made a good mechanic. I worked hard and everybody said, 'We've made a mistake about this boy, he really enjoys work and he's a very sane boy, so let's let him back in again.' Then I would get in trouble right away. What I was getting in trouble with was not the college at all. In fact, I hardly knew the college existed. What I was really getting into trouble with were the social institutions: the club systems and things like that. I didn't like the feel of fraternities and clubs and patterns that were being formed on a basis I couldn't understand. They had nothing to do that I could see with the merits of individuals. I felt there were forces operating that were unreasonable and this was affecting me the same way those buildings originally had when I didn't like the smell of them or like the looks of them. I didn't like the smell or the looks of the patterns that seemed to move some people into power and some people into non-power that you couldn't see and you couldn't seem to deal with.

I've heard people say that I was a rebel; I wasn't a rebel at all. I just didn't know what to do about it and I dropped out. I had a genius for getting into trouble and then getting out of trouble when I had been displaced and moved into an area where there was something I could get hold of, like a piece of machinery. Anything you could weigh or feel or apply yourself to was fine, but not the dealings with the patterns of arbitrary customs and ways in which people were evaluating what you couldn't be - such as some old lady who didn't like your looks or whatever. At any rate, those were the things I had trouble with.

We all have certain tactical events that happen in our lives. A certain thing happened in my life that was tactically important enough to force me to make utterly vital decisions about my life. I was married during World War I and I was in the Navy. We had a little child born and she caught the flu, then spinal meningitis and then infantile paralysis. We seemed to be able to overcome these attacks more or less. That is, she seemingly was cured though she had many traces of paralysis left. Just before she was four years old she caught pneumonia and died.

During those years with a new life whom we loved so dearly, we were continually frustrated with physical inadequacies, such as the kind of apartment we could have. The physical environment conditions seemed terrible. By this time I had had a great deal of experience in flying and new technology. We didn't speak of 'electronics' in those days - we spoke of it as 'radio' or whatever it was - but I had had excellent experience in the Navy. I had been sent to the Naval Academy and I knew how to make big ships work. I knew a whole lot about mechanics.

The fact that the housing that we were in was very poor made me feel many times that the conditions which we were operating under were in many ways responsible for our child's sickness. The fact is, I was right because spinal meningitis, infantile paralysis and flu have since been brought under control in recent years. But in those days they were considered lethal and there was nothing you could possibly do about them. Nobody even tried to do anything about them. So Alexandra died just before her fourth birthday.

Before going into the Navy and in and out of Harvard twice I had been in a cotton mill where, as recounted earlier, I finally learned how to put up each type of cotton manufacturing machine. The second time, I went into the packing house business with Armour & Company. I went to work in New York and I worked in twenty-eight branch houses around New York - as I now review psychologically rather than technically.

In those days the packing house was a very tough business, along with all the other businesses, as far as hours went. We began work at 3 a.m. and perhaps were through at 3 p.m. because markets had to open before the rest of society to get foods distributed around the city. I learned a lot about New York on that job. I really knew something about the patterns of society there. From there I went on, as I said, into the Navy and I did well in the Navy. I got all the experience I could want with all the new technology - with the new aeroplane, the new radio, the new big ships, the new turbines and so on.

After I finished in the Navy I came out and they took me back into Armour & Company again because I had done well. They gave me a very good job; I was made assistant export manager. It was under these conditions that my child went through her sicknesses.

Despite the fact that I was assistant manager of Armour & Company, the pay at that time was $50 a week, which would not be considered very good today. There wasn't much for rent, particularly when we had two trained nurses. We had very tough going. I did well enough at Armour & Company so that an old Navy friend asked me to get

out of there and go into a big truck company, and I was equivalent to national sales manager. My father-in-law was an architect and had invented a building structure. I liked this man very much - my own father having died - and I liked the invention he had. It seemed to make sense and I thought it would be useful if somebody did something about it. He didn't seem to know what to do with his invention, so I decided I would do something about it. I learned a great deal about corporations, and I finally organized five small factories around the country making this material.

Those years came immediately after Alexandra died. I worked very hard and I did build two hundred and forty small buildings in the eastern United States.

This building system was good for any filler wall. It was a light reinforced concrete structure and it would do for garages and residences or small buildings or filling in the walls of big buildings. During these years I worked terribly hard, but the minute I was through work for the day -1 guess I was in a whole lot of pain about our child having died - I would go off and drink all night long and then I'd go to work again. I had enough health somehow to carry on.

Suddenly, I lost control of my company. I'd found myself becoming powerful through it. I met the prominent businessmen and the powerful bankers in the country who were all terribly interested in the idea of building. If you had something that was really going to be a breakthrough in building, you had people coming around looking at it with investment in mind. By 1927 it looked good enough so that others were ambitious enough to try to take it away from me.

I was very unguarded in my personal life and suddenly I found that I had lost the company. When a person happens to play tough games he may be surprised to find himself not only in an embarrassing position, but also in a difficult position. I was in a difficult position and just at that moment a new child was born - five years after our first one died. Under those conditions I was utterly broke, in Chicago, and I had lost much vitally important confidence in those whom I had thought to be my friends - and I was in a mess.

But I had had a terrific amount of experience. I came to a point where I found myself saying, 'Am I an utter failure? If so, I had better get myself out of the way, so at least my wife and baby can be taken over by my family and they will do the best they can with them. Am I going to be a drag on them, or is there possibly any reason I can see why I ought to go on?'

I was forced by these circumstances to start doing some thinking on my own. It was at that point that I decided that there must be a certain first thought that I would have to go into. What is the first question I could possibly ask myself if I was going to do some thinking?

Standing by the lake on a jump-or-think basis, the very first spontaneous question coming to mind was, 'If you put aside everything you've ever been asked to believe and have recourse only to your own experiences, do you have any conviction arising from those experiences which either discards or must assume an *a priori* greater intellect than the intellect of man?' The answer was swift and positive. Experience had clearly demonstrated an *a priori* anticipatory and only intellectually apprehendable orderliness of interactive principles operating in the universe into which we are born. These principles are discovered by man but are never invented by man. I said to myself, 'I have faith in the integrity of the anticipatory intellectual wisdom which we may call "God".' My next question was, 'Do I know best or does God know best whether I may be of any value to the integrity of universe?' The answer was, 'You don't know and no man knows, but the faith you have just established out of experience imposes recognition of the *a priori* wisdom of the fact of your being.' Apparently addressing myself, I said, 'You do not have the right to eliminate yourself, you do not belong to you. You belong to the universe. The significance of you will forever remain obscure to you, but you may assume that you are fulfilling your significance if you apply yourself to converting all your experience to highest advantage of others. You and all men are here for the sake of other men.'

The next few thoughts had to do with the fact that I knew I did have many more types of experiences than most of my contemporaries, just by the good luck of being fired out of *this* and forced into that pattern. I had certainly had an extraordinarily broad pattern. Furthermore, I had known the most powerful people in the American world. I had dined with several of J. P. Morgan's partners, and I knew Al Capone. I was convinced that people on either side of the track in many situations didn't know or understand one another and yet somehow or other I did seem to know them both, and did seem to understand them both - and they seemed to understand me.

The next thing I concluded was that one reason I was in a great deal of trouble was that I had been extremely accommodating in my willingness to believe what the other fellow asked me to believe. I was over and over again in enormous conflict between what had seemed to be good rules given by one fellow who seemed powerful in his area and another fellow powerful in his area. Each one told me his little rule of thumb for things he thought really were important.

I was at an enormous pinch-point of pain in the great contradiction of many of these dogmas. Obviously, one had not thought the other's problems out well enough. The various kinds of tenets different people had were not comprehensive enough to anticipate the kinds of problems I was going to run into. So, it seemed to me, number one was, whether I liked it or not, that I was going to have to do some of my own thinking.

Having been told when I was young to shut up and learn, this was the first time I could possibly say the thoughts I had held for a long time might be valuable. My father-in-law, who invented the building system, was the first older man I had ever met who told me my own thoughts were valid and that I ought to pay attention to them. He encouraged me to go on with inventions, which I did. I took out quite a few patents. I invented the machinery that went into the manufacture of our product as there was none available to do the job.

I had become so impressed with the idea that I wasn't supposed to know anything that, when I wanted to get somebody to back my idea, I got some mechanic who was my friend, and I told him what my invention was. If he was enthusiastic enough about it, then I told the man with money that the mechanic had invented the thing, because I was pretty sure he trusted the mechanic's judgement. If the mechanic said it was good, then I was hopeful that the man would back it. But I didn't expect anybody to back my ideas. I don't know why I had this feeling, but I just didn't expect anybody to back me.

Anyway, in 1927 I decided that the way I had acquired bad rules and conflicting thoughts was through *words* - when somebody *told* me these things. Therefore, I became very suspicious of words. I said, 'Words seem to me to be one of the most extraordinary tool acquisitions of men; I don't think men were born with words, but rather from what I have learned in education and of the educational system I suspect that men have evolved words. There may have been a time when they didn't have words. There are now many more words than there are birds or monkeys. I know

of people inventing words, but most of the words were here before me and they are tools. They are obviously tools, and I'm enough of a mechanic to know that you can use tools in the wrong way. It seems to me that the facility with which we can make these sounds, as a parrot can copy a sound, is possibly one of the ways in which the trouble starts.'

It was very tough on my wife, but I decided I was going to try to hold a moratorium on speech for myself. So for approximately two years I didn't allow myself to use words. I thought I would see if by doing that I could force myself back to the point where I would really understand what it was I was thinking and be sure that when I made a sound that I really meant to make that sound - that it wasn't something I was parroting and that was just coming off my tongue. I had learned how facile I was at popping off things that someone else gave me.

All this was pretty diflflcult for my wife because we were in Chicago and didn't have any money. We had an apartment in the least expensive fireproof tenement I could find, because we did have our baby. I really did stop all sounds, and then gradually started wanting to use a particular sound. I was finally pretty sure I would know what the effects would be on my fellow man if I made a particular sound. I wanted to be sure that when I did communicate that I really meant to communicate thusly and that this was *me* communicating and not somebody else.

In this time of isolated thought I said to myself, 'Out of all your experience what kinds of things do you know? For instance, what are the fundamental ways of looking at phenomena?'

I said, 'Experiences themselves begin and end. When you go to sleep you can never prove when you wake up that you're the same fellow that went to sleep. You may feel quite a lot like "him", but there's no telling whether this is the starting of another kind of dream. At any rate, we certainly do have stop-and-go consciousness, and you might say that there is a finite period of when-I-started-to- think-this-morning and when-I-come-to-a-shut-off-tonight. So that's a package.

'Experience is something that very clearly begins and ends and is finite. Furthermore I don't think that anything I feel or think can possibly come out of anything except experiences. Do I ever think in terms that are not of experience?'

I could never catch myself thinking in terms that did not have something to do with experience. There's nobody around to 'mark our papers' in this kind of a situation. So *I decided* that it was impossible for me to think except in terms of experience. This was my decision.

You might ask, how was my wife eating and how was my baby eating? I decided just to leave that to luck. I didn't know anything else I could do about it. I was confident that the one thing I had to do was think. I was also confident that if I really did think, that there would be a day-to-day survival, provided I really was working hard at this thinking.

If I were just trying to get away with something, I knew what I would do; I would simply jump in the lake. That would be easy and my family would take care of my wife and daughter. The family were not rich but they were comfortable, and would find a way to do something about them. But if I were going to stay around this show at all, whatever I was going to be able to do about it had to be by virtue of my dealing with the only asset I had, and that was my experience. So I had to do something about looking my experience over and though nobody had taught me how to think, I had to learn to think.

'I'm just going to take a chance', I said, 'on the idea that if I'm working at it awfully hard - there won't be any margin here; nobody will be able to encourage me - but if we survive at all it will be because one of the rules of Nature is that she permits us each day the integrity of that day's thinking. I must learn to work this way' - and I did.

When I was nine years old the aeroplane was invented, and it was a very extraordinary kind of experience of fundamental change. I was among the thousands of millions ®f young boys trying to make some kind of a little device that would fly. And suddenly there it was. When my daughter Allegra was born in 1927 (the year of Lindbergh's flight) I was pushing her baby carriage - in Lincoln Park, in Chicago, because at this time I had started in on a research programme. I didn't have any everyday business so I had time to push the baby carriage. The night air mail was not to be flown out of Chicago until two years later, 1929, so it was a rare event indeed that as I pushed my daughter's baby carriage a little light plane flew directly over and I said to myself: Isn't it amazing that, unlike myself, my child is born into a world in whose sky there is an aeroplane as an *a priori* universal event? How different that universal relationship eventually became, even though we didn't see another aeroplane there for the next two years. But a quarter of a century later my granddaughter Alexandra

was born in New York. She was brought by her parents from the hospital to their apartment in Riverdale, just across from the northern end of Manhattan, which is quite a high point of land. This point was directly in the path of the take-off pattern for both of New York City's major airports, La Guardia and Idlewild, with their west-bound American continent flights. The planes were going over frequently, sometimes every few seconds. There was the familiar roar and, on such a high promontory, it was a very important fundamental event to a new life.

The interesting result was that my granddaughter's first word was not 'Mummy' or 'Daddy', but 'air' - short for aeroplane. She was born in the fall of the year and though her parents had a little balcony on their flat, looking out upon some trees, the fact is that she saw many thousands of aeroplanes before she ever saw a bird, and the aeroplane was much more normal in her sky than was a bird. As I realized and thought about this, I wondered if there were other important *a priori* changes, and I looked at the books that were given to my granddaughter. These books were the same kind that I had when I was a child. They were full of donkeys and pigs and goats and cats - but my granddaughter had never seen a donkey or a goat or a horse! They were just as unfamiliar to her as if you showed her microphotography of germs and cold bugs. What had been normal to me was abnormal to her. She was very kind to us about it and was politely amused at the things we were showing her, but they had no relation to reality! This accelerated progression of *a priori* universe alterations is typical of the very swift alteration brought by the industrial equation. Disparity of the successive present generation's norms with those of previous and yet living generations is swiftly widening the gap between aspirations of the old and newer generations.

To make this disparity and its potential solvability clearer for study, I made some figures that I now find useful in comprehending the enormous velocity of change wrought in our evolving relationship to our respectively altering *a priori* universes. I started with a sphere twenty feet in diameter as a model, which was meant to represent the slowest relative rate of negotiability of the earth as gauged by the following calculations.

First, I supposed a path to be put about the earth, there being no dry path around the earth. But I wanted to allow a man to walk around the earth at the rate at which the Army says a man can walk daily, and rest and feed. The twenty-foot globe represented the rate at which he would be able to walk around the earth. Then I gave him a horse. The horse also had to sleep and rest and eat - and, using the Army figures again, I found man can negotiate the earth with a horse so fast that the relative size of the earth is reduced to a ball six feet in diameter.

I gave man a fast-sailing clipper ship and the earth came down to the size of a basketball. When I obtained these figures I realized the historical economic advantage that a man with a ship had over a man with a horse and how much greater advantage they both had had over a man on foot, throughout all history. The clipper ship, of course, was a tool; it was the first really large industrial tool that could not be produced by one man. And it did not have to stop to sleep at night like the horse, but kept on going twenty-four hours, day after day.

Now when you give men railroad trains and steamships, which can negotiate about the same distance daily, because the railroad train has to be replenished very frequently, we find that the relative size of the rate of negotiability of earth comes down to the size of an American baseball. Taking the jet planes, the relative size of man's negotiable earth comes down to the size of a three-quarter-inch marble. Projecting the present rate of acceleration of commercial air transport speed for just five years and taking the figures now adopted for 1968 by the International Aeronautical Union and the American Air Force, the relative size of man-negotiable earth will be the size of a pea, and that is the smallest we need now consider, for it will inaugurate an entirely new era of man-around-earth.

Any who have looked at the jet plane schedules know that they can fly to the furthermost points around the earth from where they start in less than twenty hours, so that within the day they can reach the furthermost point of the earth. Projecting for only five years, you find the speed is such that you will be able to leave your home any morning, go to any part of the earth to do your day's work, and come home for dinner. And if our definition of a town is a place where you work and sleep, then in five years from today we can have a one- town world. What has been a theoretical and idealistic concept will be stark reality.

These are the consequences of altering the relationship of man to his environment as uniquely brought about by the industrial equation - an alteration utterly impossible to craft capability. While we in no way deprecate the extraordinary craft accomplishments of men, we do see the great difference in the relative economic and social effectiveness of the industrial and craft tools.

In 1927 I became interested in discovering in what way the enormous advantages of the industrial equation might come to bear directly on man's means of living, even as it had already been brought to bear on mass production of ways of dying. When first employed, this industrial capability was inherently very scarce - scarce in material, ships and men who would know how to employ it. Its scarcity and complexity of tool-up costs made its initial employment almost prohibitive in cost. Only in great national emergencies, underwritten by mortgaging of whole sovereign states, could men muster the capital credit to use the industrial equation. These national emergencies we know were the great moments of war, and under those war conditions high categorical priority of use was given to the application of those scarce industrial capabilities. In setting these priority schedules we hoped to keep the war to be joined as far away from home as possible, because if the joint of war reached home you had lost. Priority of industrial capability went to the establishment and support of the longest-ranging arm of highly energized hitting power by the world-integrated network of comprehensively designed industrial capability, which first of all had to produce the navy and transport to rule the seas that covered three-quarters of the earth and divided all lands and therefore controlled the principle of longest arms of hitting power.

By making do with industrially unwanted, low-performance materials, men were able to solve non-war production problems. We praised the many ingenious make-do solutions we gave to homefront problems, quite independent of and out of sight of the alternate solutions we might have made with the industrial equation, were its capabilities grown so plenteous as to make universally possible the using of world resources in the most effective kind of manner.

There are several more fundamental aspects of the industrial equation. We have seen that because the industrial equation involves the enormous pattern of half-way-round-the-world resource-centralizing, by the time we have centralized the resources, the capital expenditure is enormous. In order to justify such enormous anticipatory expenditure we have to reassociate the centrally dissociated chemical elements in

such an effective manner that the temporary products of this activity will be so generally advantageous to the world around man as to win an actual commonwealth of a physically regenerative, or inherently increasing, advantage of man over nature's *a priori* patternings - which means the increasing ability to govern the ceaseless evolution of inter-patterning transformations. Therefore, in order to find the largest number of human beings who can be benefited by the newly produced patterns we have to go halfway round the world again - in all directions.

By discovering the highest possible numbers of users we find means of maximum division of initial costs and sharing of further capital initiations. Therefore the industrial equation is inherently involved in underwriting two half-way-round-the-world network ventures. Next we see that the energies expended in doing work all around the world are enormous. We therefore begin to comprehend that the ratios of performances per foot pounds of work done by given units of resources invested or expended are vital data to the comprehension and scientifically designed employment of the industrial equation. In the industrial equation performance ratios per weight of products are very important to the success of the world-embracing economy that is being developed.

In our home-front buildings, however, we do not think very much about weight. The engineers who must calculate the buildings, in order to implement their architectural designs, are forced to analyse and treat with their weights, but weight is not an original consideration of the patron and architect. Does anybody know what a given building weighs? I once asked an American symposium of architects, including Raymond Hood and Frank Lloyd Wright as well as the architects of Rockefeller Center, the Empire State Building and the Chrysler Building what the different structures they were designing weighed. Clearly, weight was not one of their considerations. They didn't know.

If we ask about the weight of one of our major ships, such as the *Queen Mary,* which is obviously of the magnitude of one of our very large buildings, we find that these kinds of industrial pattern weights are very familiar to the public. Therefore, the fact that weight considerations are not primary in buildings tells us how far building is from the industrial equation. No one should think that because we build big buildings and use some industrial materials that industry has therefore embraced the building arts.

One principle governing the industrial equation is that the tools themselves can be used to make more tools. You can invest the industrial capability exclusively in the regenerative function of greatly enlarging itself. Industry really accomplishes self-lifting by its own boot-straps. One lathe man can make ten more lathes instead of consumer products, and then ten men can go to work, each making ten more lathes and each one can be a better lathe than the one before. Thus the whole world's over-all tool capability is swiftly regenerated towards comprehensive and plenteous capacity.

Another aspect of the industrial equation is that it gradually discerns the various functions of humans and differentiates those functions out, developing tools which can carry out those functions. We find that industrialization is inevitably headed towards automation, that is towards disenfranchisement of man as a physical machine. The concepts of Karl Marx are typical of the erroneous and inadequate way in which men at first pondered the industrial equation. They thought of man chained to the machines and grievously exploited by the machine owners. With automation an increasing economic reality, we now see that the industrial equation was all the time heading towards complete elimination of man as a worker. The industrial equation will bring about a condition where, within a century, the word 'worker' will have no current meaning. It will be something you will have to look up in an early-twentieth-century dictionary.

How, then, does the industrial equation go on? What is man's relationship to it? The answer is that the larger the number served by the industrial equation, the more the unit costs are lowered and the more universally its regenerative pattern stimulations become distributed. This is to say that the greater the number of consumers, the more successful is the industrial equation. The more people served, the more regenerative industrialization becomes. Industrial equation works towards man having infinite significance in the universe as a regenerative consumer.

As a fundamental result at our present moment in history, men are becoming very swiftly disemployed as physical workers. On the other hand, men are now swelling the ranks of intellectually preoccupied experimentalists in scientific and industrial research and development and are getting ready for the launching of the next wave of evolutionary transformations. Men are increasingly concerned with greater anticipa-

tory design of the use of the world- around network of industrial capabilities. Even unwittingly men are accelerating their capability to render the world's total inventory of resources adequate to the comprehensively advancing needs and growth advantage of all men.

I will cite one more pattern governing industrialization as it comes finally to bear upon the building arts. The kind of patterns that we are reviewing are obviously patterns that only come into apprehension, comprehension and reviewability through time and increasing inventories of the integrated experiences of all men. These are not patterns which were discoverable in advance by men.

In architectural circles we frequently speak of buildings as environmental controls, or the local controlling of energetic patternings of the universal manifold of high- and low-frequency events; we have local environmental controls on the land which we call buildings; we have environmental controls on the sea which we call ships; we have environmental controls in the skies which we call aeroplanes. These are each and all vessels of preferred-pattern regeneration.

The environmental controls on the land are installed in the crystalline chemical structures' state. Environmental controls on the sea are installed in the chemical structures' liquid state and the environmental controls of the sky are installed in the chemical structures' gaseous state. In the crystalline state, the amount of energy necessary to disturb the chemical structures is enormous. The amount of energy necessary to disturb liquid phase chemical structures is but a small fraction of that necessary to disturb crystalline structures. The amount of energy necessary to the pattern disturbance of the gaseous phase of chemical structures is but a small fraction of the amount necessary to the disturbance of the liquid phases of chemical structures. Einstein's equation $E = MC^2$ directly governs these relationships. In a universe of energy in which no energy is created nor energy lost, the number of times that Nature has enough energy concentration to disturb the crystalline state at any one locality in the universe is relatively infrequent. The number of times the universe has energy available locally to disturb the liquid structure states is very much more frequent.

Even more often there are enough energies available locally to bring about very large disturbances of the gaseous states. If men are going to build a structure on the land as a local energetic environmental control (knowing the probability of an earthquake at any one point is so low that men for many generations were unaware of its even being a possibility) they certainly would hope to build in between the earthquakes.

The number of times floods might occur is much more frequent but it is considered worth while, because the alluvial plain is so rich the inhabitants would rather climb to the high land as the floods occur and go back to the low land when the floods receded. The number of times that there are avalanches and fires are relatively few, so people build upon the crystalline state, oblivious to the infrequent challenges of earthquakes, hurricanes, floods, avalanches and so forth. They were more concerned with building bulky, inert fortresses which, because of the solidity of the earth, seemed to rest on top of the earth without sinking into it as men developed building arts.

On the sea we are immediately faced with flood all the time, and the best thing to do is to stay on top of it. And when we try to discover how to float, we find that stones don't but wood does. Thus men discovered floatability millenniums and millenniums ago. In dealing by designed actions with controlled environments suitable to the liquid state, men are normally faced with this floatability as a basic requirement, but are also faced with very frequent seaquakes. We probably have seaquakes every day in which the size of the waves will be greater than those of the earthquake. Therefore, we have to design for seaquakes or we won't stay on top of the water. Every time the great seas come combing over and smash down on our decks, the actual tonnages involved are quite equal to the tonnages of the impact of an avalanche.

When controlling environment on the liquid state we also have to design for hurricanes because in fact upon the sea we are going to exploit the hurricanes to drive our ships. In ships we must design directly for structural behaviour superior to all these very hostile behaviours of Nature, specifically regarding the foot-pound energies of Nature's limit behaviours. Once we have learned how ferocious Nature may be, then we ask: Is it worth while going into this very unfriendly, energetic world of the sea? We discover it is, first, because of those resources that occur remotely all around the world, and second, because of the fact that you can float such enormous loads of resources from here to there as to completely outclass the small loads that you can carry on your back or on the backs of animals. Therefore, the ships are potentially very worth while, and in order to make the ship realistically very worth while you have to learn how to establish ratios of preferable investments of the total floatability, how much is to be assigned to the cargo and how much is assigned towards each of the structural capabilities required to meet these enormous stresses, corrosive forces, etc.

Rationing of the performances per pounds per functions became the very essence of shipbuilding design, whereas such ratios were never thought of in respect to building environment controls upon, the crystalline structured land. In fact, the first great buildings were only for fortresses in which weight was desired. They were preceded by nature's own caves, which were occupied and which were later contrived as local modifications of the solid earth and not thought of as separate buildings.

When we go into the air with man-designed environmental controls, we come into conditions where there is no floatability. To stay in the air at all, we have to stay there on sheer intellectual capability. We get out into the sky and stay there by integrating the experience of all men and by faithful consideration of the factors and measurements of the experiences. You cannot stay out there on a myth. First we must start flying at greater than hurricane speed. Hurricane speed is stalling speed, so the hurricane speed becomes minimum normal and in our modern airships we go into six, sometimes eight times hurricane velocities as a normal condition of environmental control designing.

Due to large-size disturbances of the air by very small amounts of energy, even the sun radiation reflecting from the surface of a small white glistening roof will bring about a spirally rising thermal column of air rising hundreds of feet, sometimes a mile high, into the air. In a plurality of these great thermals we get enormous air waves which might properly be called airquakes. The airquakes are enormous in size and of such high frequency as to be almost continuous.

When a great airliner moving along at five times hurricane speed runs into one of these thermals and rises and drops hundreds of feet, the physical dimensions and stresses involved are precisely those of taking the *Queen Mary* over Niagara Falls at full speed and doing it so capably that the passengers believe it's only a 'little bump'.

It is very important to realize the magnitude which man's scientific and technical capability has really reached. In both the airframe and power plant phases of industry today man has really reached astronomically augmented degrees of new advantage in respect to his ability to swiftly alter his *a priori* physical environmental patterning. When we learned of Sputnik's success, we were thereby informed of the arrival of the inter-continental missile rocket. With it, the aeroplane, which in the first decade of this century became the longest arm of striking power, was displaced as the number one weapon. For fifty years the aircraft had enjoyed all highest priorities of access to scientific industrial capabilities. So complex and swiftly evolving was the airframe

phase of the industrial equation that its underwriting could only be financed by major nations and only under the mandate of omni-survival emergency anticipations. So great have been the nationally subsidized underwritings of the airframe phase of man's acquisition of the industrial equation capabilities that the fifty years of man-piloted aircraft development involved a total of international expenditure in the range of three trillion dollars, approximately one hundred times the value of all the gold in the world. It was an over-all undertaking whose magnitude could only be visible in retrospect, and as astronomically invisible to yesterday's private finance capital capabilities as was atomic power to optical foresight.

With the aeroplane industry rendered suddenly obsolete as the premier long-range, highest velocity, highest energy packing and hitting power - the great national subsidy of the aircraft industry automatically relinquished its half century of popular mandate support as the national emergency-anticipating defence measure. This obsolescence became simultaneous in all the major industrial initiativecompeting nations. The aircraft industry should not be looked upon as one industry amongst a myriad of other independent industries. It should be regarded as the total industrial equation, accredited and operating at the highest level of historically augmented and integrated capability. In the aircraft phase of industry, the relative efficiencies of performance realizations as ratioed to invested resources are, for instance, ten-fold the efficiency realized when the industrial equation is operating at the automobile manufacturing level of comprehensive policy integrity. Shorn of its half century of vital subsidy - as a child grown to manhood and at full stature of capability is divested of further parental support - the aircraft phase of industry will now have to employ its superior degrees of capability with even greater discretion and comprehensive usefulness than under its bureaucratic governance. With its sudden reorientations first labelled recession, this release of a ten-fold greater capability into the home-front undertakings will bring about manifold dislocations of the lower order of efficiency phases of industry - but nowhere will its world-around capabilities be more dramatically applied than to the long-time anti-priority area of the comprehensive building arts and to the swift provision of world-around accommodation of the new air-ocean, world-flown embracement of whole earth by all men - in their frequency-modulated, therefore approximately invisible, one-town world of 1968 realization.

In 1927 I undertook a thirty-year series of experimentations, not only in the direction of ultimate participation of landed environment controlling in the most advanced capabilities of industry, but also in relation to the individual and his functioning, and in relation to the questions of whether and how he can take the initiative in regard to various challenges. In searching for the functioning capabilities of the individual in the industrial equation evolution I saw myself as 'any typical, fairly healthy individual'. What impressed me about me in making the experiment with me was that I was so very average. I can say that whatever results are now subject to inventory, are the results of my basic assumption of 'average individual capabilities' at the outset. I knew when I started in 1927 that I could not jump very high and I could not swim very fast and I hadn't earned the best marks in the class. In as much as I was interested in what the average individual could do, I was a very good case for experimentation.

There was one *a priori* requirement to this third-of-a-century experiment that I adopted to give it a cleanly controlled opportunity of producing unprejudiced results. I must forsake altogether the idea of priority of the necessity to earn a living. When I was very young my two grandmothers told me about the Golden Rule, and as a young man of four I thought it was a very excellent rule and I admired the idea. I had a shock later on when I joined the Navy, where it was suggested that this might not be the operating rule of the seafaring people. Later an uncle took me aside and said, 'Young man, I am sorry to have to tell you that about a hundred and fifty years ago we had scientific proof that there is not enough to go around …and so it must be you or the other fellow and it must be your family or the other fellow's. Really, it's very tough, but Malthus and Darwin gave very clear proof of these facts. So I suggest that you learn how to acquire yours quickly and incisively and then get around to applying the Golden Rule as far as is expedient.'

Even if born with an adequate income almost all of us are faced with the necessity of earning ourselves a living. *I* have visited many universities, and certainly the idea seems universal that the boys are preparing themselves first of all to be able to earn a living, hopefully within an area that is interesting to them. They hope they'll earn a good enough living and obtain early security so they may have time to do the things they would really like to do all the time.

Now in 1927, when our daughter Allegra was born, we had no money, and obviously under those conditions I ought to have gone out to learn a living. But it was just at this moment that the kind of picture I have been describing was looming before me and I didn't see how I could escape doing something about it. I first tried to interest people I thought were much more capable than myself in respect to the problem, but I found none who were interested in spending the rest of their years on it. It seemed to me from my industrial lag studies it was a problem that was going to take a mini- mum of twenty-five years to bring into useful scientific treatability. So the question was: How could I peel off and forget about earning a living? I did finally detach myself from conventional preoccupation with living security, but I did not undertake this research and development as an idealist nor, I hope, as a crank. My conviction grew out of my discovery of the comprehensive validity and vitality of the industrial equation and the operative principles apparently governing its growth transcendentally beyond any directed ambitions of men.

I was impressed with the fact that in the primarily agricultural and craft eras the individuals in the little towns bartered directly with one another to arrange for their mutual security. One was a shoemaker, the other was growing potatoes, and so forth; each one produced more of his products than he could use personally and exchanged his surpluses with the other fellows. A man then bargained at 180° with the man in front of him. Each made his own deals and organized his comprehensive security within the visible horizon.

However, in the industrial equations, I saw the man standing or sitting at his production station and the nuts or bolts the machine was making at his station were not going off at 180°, but were going off sideways at 90° to his line of sight. I saw that it was futile for him to fill his pocket with nuts or bolts to exchange with the hamburger man. The industrial products tended to go off around the world until the nuts and bolts, for instance, each arrived in their respective logi-

cal relationship in larger industrial organisms, along with the myriad of other kinds of components; and finally some nuts and bolts would come back to that machine operator, but only as an organized technical complex such as an automobile or water pump or whatever it might be. His basic security was obtained through the increasing capability of all society, thus comprehensively advantaged by the universal tool network.

It occurred to me that it could also be true in the industrial equation that security need not be a local, 180° negotiation, but an around-the-world circuit-closing principle. If this were so it could also be true that if your experience actually discerned an industrial gap-closing task that needed your particular experienced attention, and no patron of the task could be discovered who was inherently concerned with such tasks, you might then assume you were being directly challenged by natural evolutionary process with doing something about that gap, which challenge and response were no more mystical than the spontaneous dodging from under a falling tree. It might prove to be economically feasible for the individual to apply himself to such gap-filling functions whose developed solution might then go multi-directionally around the world to find its right places in the network of integrating capabilities. Thus, the wealth advantage of man might be comprehensively increased and the gap-filling individual might find himself surviving by all manner of indirect means as integral functioning of the larger network equations.

So it was with the hope of discovering as soon as possible whether that really was true or not that I decided, in 1927, to forget forever the idea that I ought to earn a living. My wife really bore the brunt of that decision. But as months and years were passed safely, I watched young men become interested in my kind of research-and-development advantages and results. The minute you were not concerned with earning a living and really tackled problem after problem that the other fellow was not tackling, there proved to be a wealth of solvable problems. In fact the whole mass of problems that are worth tackling is so great that any average individual who goes into that kind of a paradise wilderness garden ought to make very good progress. If I have made progress that is mildly notable it is only because I walked into a vast, unattended, potential harvest.

Year after year I saw young men become fascinated with those potentials I was dealing with, and then suddenly say to me, 'I'm sorry, but I have to earn a living - I'm different from you, I've got a wife and child. I'm sorry to have to quit you.' Today I am still engaged in this experiment and while I have no right to certify that others may be able to survive working upon these same premises, the fact is that my family and I have weathered more than thirty-five years in search and development relating directly to the application of the industrial equation to shelter and shelter mechanics and their design, production and distribution.

We cannot say that this survival success is not coincidence, but I personally think it would be extravagant to call it coincidence. I think that the principle of indirect industrial realization of survival advantage is as well proven by my experience as is the indirect result of general good health that comes of an integration of a myriad of individual self-disciplines. I am not afraid to suggest to a young man today that it is possible to forget altogether about the priority concept of earning a living.

I had the great honour of meeting Dr Jonas Salk not long after his vaccines had been acknowledged in America as providing immunity to the vast majority of infantile paralysis exposures. Dr Salk said, 'I've always felt that those Dymaxion gadgets - cars, houses, maps, etc. - were only incidental to what you really are interested in. Could you tell me what your work is?' I said, 'Yes, I've been thinking about that definition for a long time. I've been engaged in what I call *comprehensive anticipatory design science*.' And Dr. Salk said, 'That's very interesting, because that's a description of my work too.'

That statement by Dr Salk fascinated me because I have long felt that (whereas medical doctors were at first accredited by society only when men were in trouble, and that whereas cures were difficult, doctors long ago discovered the excellent results to be obtained by anticipatory laboratory research that led to prevention as far more comprehensively effective than cures, and thought that whereas doctors are concerned with the internal organism of man) industrialization might be thought of accurately as the external organism of man. Man's external disorders could best be treated, therefore, not as local curative techniques but as comprehensive laboratory search and research leading to universally effective anticipatory prevention of maladies of the industrial organic evolutionary growth by appropriate comprehensive anticipatory design science.

Comprehensive anticipatory design science assumes that the client knows absolutely nothing about what he needs or what should be done about it. There is a word which I would like to introduce into our thinking, and that is *synergy.* Now the word synergy is as old as the word energy. By energy we meant the differentiated-out local behaviours of comprehensive universe or Nature, for instance as gravity or as optics. By synergy we mean the integrated behaviours of nature, and synergy is said to be *'behavior of a whole system unpredicted by the behaviour of its components or any sub-assembly of its components.'*

Men do not know the word synergy because they do not tend to need the word in their thinking patterns. Behaviours of whole systems, unpredicted by behaviours of their parts, seem to our accepted logic to be a sort of mystical concept. We tend to think in the terms of our elementary strategy of education, where we start by dealing with our local parts and learning how to handle these parts well. Because of our local elemental focus we tend to think it is logical to say that 'a chain is no stronger than its weakest link' - which immediately is thrown out of validity when we first join the other end of the chain back on itself. When we break the weakest link there is still only one piece of chain and we are mildly confounded in our statement. 'Well, chains are not supposed to be linked together at both ends,' and the reason we say that is because we inherited the Greek concepts of linear and plane geometry as elementary and later those of solid and spherical geometry as 'advanced'.

The exclusively local aspect of plane geometry imposed the concept of an infinite surface and the infinite line as logical to the then- prevalent belief that the earth was flat and infinite - *ergo,* all 'straight lines' were open-ended, or infinite. That is why we think a chain ought to be just an infinite line. However, in Nature all the lines are completely curved and all chains do eventually return upon themselves. This fact is reflected in, for instance, the very essence of metallurgical structuring.

Are there, in nature, behaviours of whole systems unpredicted by the parts? This is exactly what the chemist has discovered to be true. Moreover, he had discovered that, contrary to his elementary kind of experience at school, he did not come into the chemical laboratory and find a soda fountain with spigots for hydrogen and oxygen and so forthwith which you mix up the universe as you go,and then begin to make it work. He found the universe already in complex working order. And every time he partially separated out any of the elements from the others, he always discovered that the behaviours of the localized elements never accounted for the associated behaviour of the *a priori* complexes.

The chemist is thoroughly familiar with the word synergy, which is the only word in the dictionary for this omni-operative behaviour of universe. Synergy is the essence of those great changes of man in respect to his *a priori* environment. The essence of the evolutionary realization of the jet airship is chrome nickel steel, by virtue of which the enormous concentrational energies could be released as heat, which would

have destroyed engines of any pre-chrome nickel steel production. Because of the strength of chrome nickel steel, even under conditions of enormous heat, it prevents the destruction of the structural design integrity of the jet engine, which could then translate its thrust to the ship. And chrome nickel steel is very typical of synergy.

The predominant constituents of chrome nickel steel - the primary element components, iron, nickel, and chromium, and their tensile strengths per square inch of cross section - are their primary criteria of relative strength. Taken individually the chrome, nickel and iron square-inch sectional capabilities are in the approximate range of 70,000, 80,000 and 60,000 p.s.i. tensile strength respectively. In association, chrome nickel steel is a pattern, a constellation of behaviours dictated by Nature, not by man, and as a chrome nickel steel casting we will often realize 300,000 p.s.i. tensile strength, which is then five times as strong as its weakest elemental link and four times as strong as its strongest link.

Is this a mystical behaviour or can we account for it? We discover of course that we can account for it in a logical manner. We knew, regarding organics in the previous century, that all the organic structures were tetrahedronally configured. Since 1933 we have also learned that all our inorganic structures are tetrahedronally configured.

6 I Figure

[1]

On 1 November, 1942, eleven months after Pearl Harbor, the editor and staff of Pencil Points Magazine, which later was renamed Progressive Architecture, proposed that I write an article on post-war housing. Chapter 5 - `I Figure' - which now follows was the result. When I turned it in to them in December .1942, they decided against publishing it. By then I was busy in the U.S. Government's Board of Economic Warfare and I put `I Figure' away in my File and Forget file - and did actually forget it - for twenty years until, in preparation of a biography of my thought development, I recalled it and felt that its inclusion might permit a sense of realistic participation by others in the typical circumstances and intuitions that seemed to have uncorked my intermittent prognostic outpourings.

I certify that no changes other than those of spelling or typographical corrections have been made in it and that I had not looked at it for twenty years.

Many of the predictions have proven premature, yet these seem more plausible in 1963 than in 1942, which suggests that they may be realized within another decade or so. Some of the predictions have proven surprisingly accurate not only in spirit but in factual magnitudes, for instance, of housing activity or other social developments.

I apologize to my many friends in the American Institute of Architects for my rugged treatment, but they too will recall war engendered emotions and will, as they have so frequently in the past, once more forgive me.

R.B.F., 1963

1

It is only fair to this soliloquy that those who read it in the inevitably changed mood of the world years from this date - Sunday afternoon 7 November 1942 - take note that as I now sit down to my typewriter the radio programme has just been interrupted with the announcement that 'Strong and modernly equipped American forces have landed on the Atlantic and Mediterranean coasts of North Africa.'

Some day, probably not remote, we may have scientific measurement of the power regenerated in the individual by the telepathetic stream of emotions popularly propagated by such announcement as this. But certainly it is with a sense of unwilling personal remoteness from the excitement of the swiftly unfolding events that cerebral 'I' withdraws to concentrate upon answering the earnest question put to me by a trade-magazine publisher - half in apprehension, half in business necessity: 'What do you figure to be the characteristics of post-war housing, speaking both generally and specifically?' The suppositional setting of this day-after-sometime activity was not furnished. Many months, many years hence, never? Housing. That is an entirely irrelevant subject anyway. Or is it?

Could housing, for instance, have anything to do with whether it will be months or years to war's end? What nonsense! Haven't they shut down on priorities for that housing stuff until the show is over? Has housing, in fact, anything whatever to do with war? If we pass over newly created munitions production that was delayed for months while awaiting provision of housing to bring personnel within operating range as being a matter of poor management, could we say that 'housing' in itself has at least something to do with how it happened that we are now at war? If only in housing's function as incubator of the social components - the individual and the family group?

That is to ask: Is it possible that housing could have been originally responsible for war in its ignorantly rendered task as the environmental factory for mass-maturing the end product, man, which latter perplexing invention psychology is roughly estimated to be 5 per cent a product of heredity and 95 per cent a product of environment?

In view of the fact that the above assumption has been vindicated by scientific measurement, are we brought to recognize that houses are thus scientifically discovered to be incubators of relative degrees of race insanity - incubators of human 'fowl', self-hybreeding for their self-invented lethal pit fighting, on the one hand as the sport of cartel-imperialism (which game they also self-invented), or on the other hand for the self-caged, mass egg-laying industry, or quite simply for self-stuffing, roasting, frying, or adulterizing?

If found materially contributory to the why for of war, would it not follow that the housing issue might have something important to do with how, when, and even where the peace might happen? Haven't we been taking an awful lot for granted about housing anyway, and an awful beating to boot?

Haven't we let opinions of every formal or informal pressure generating group lead us in diametric directions each for its own special easiest-way ends, getting us nowhere and ever dictating to us what we 'want' or 'need' as environment?

And must I not start my aroused conjectures about housing with consideration of the measure of sagacity implicit in the expression of the problem as 'post-war housing'? Doesn't this sophisticated expression seem a bit patronizing, a little too sure, faintly insinuating a tomorrow unrelated to the vital issues of today - an aloof pragmatism that has stood deferentially aside while men fought and which is now discounting the human family expenditure of twenty million of its lives, the most costly investment in its future mankind has ever been called upon to make?

Or even if post-war housing is expeditiously considered as just a temporary re-building programme or an emergency resumption of inefficiency, does it not at least suggest further compromising investment in that outworn, though never trodden, backwards road to normal?

'If what man really wants,' says science, 'is to go backwards to all the troubles of yesterday, packaged tightly in cellophane and neatly labelled "normal", he had better turn around that crate that he has labelled "civilization" and go back where he came from - because this particular highway that he has been travelling all these centuries doesn't happen to lead to a dead end of selfish limitations.'

'The highway leads,' says the referee, 'with many a promising sign along the way for those who can read science's language, to broad green lands so vast that they may only be cooperatively husbanded by the brave and enlightened. In these broadlands directly ahead the selfish isolationists must starve, for the fruits are so large and are hung so high that they are beyond the grasp of the single-handed anarchist poacher.'

May we not throw overboard that slavish 'down-to-business-like' thought of a 'return' to post-war housing, a phrase to which attaches the stigma, be it ever so delicate, of precious self-profit? May we not immediately undertake a solution of housing realistically underwritten with unlimited worldwide commonwealth credit, and with enthusiastic and complete self-commitment to the omniscient custody of the Almighty,

so reliably bespoken by the orderly vastness of energy demonstrations, not only recorded by science, but so magnificently displayed in the heavenly pageantry, or the beauty of a spring day, or the force of thundering, mountainous surf, or of a lovely young human being, for any who will to read!

May we not dedicate that housing project to the scientific insulation of humanity and his so hard-earned civilization against further necessity of industrialized mass destruction of his commonwealth potentials and mass murder of his choicest young lives (albeit the revolting mayhem is statutorily legalized by declarations of war as prescribed by the protocols of the frequently bilious normal monopoly obsessions)?

May our housing not insulate us against this filthy periodic necessity, complicatedly endured, to effect the simple evolutionary adjustments which humanity's ignorantly self-imposed environment conditioning has hitherto failed so repeatedly and miserably to prepare man to peacefully effect for himself?

If man's amazing original spontaneity and speculative previewing imaginative faculties were growthfully nurtured (instead of ruthlessly strafed) by a comprehensive environment arrangement adequate to its necessities and to his creative impulses, practically maintained by scientific dwelling mechanisms, might he not prepare with glad and humble heart the appropriate and scientifically timed adoption of progressively efficient designs for future guarantee of his cooperative industrial welfaring?

Because such a progression constantly does more with less, must.it not harvest an increasing raw-material inventory, self-emanating from 'scrap' for successfully and successively retooling-up man's commonwealth, amplifying a regenerative circuit from out the apparatus thus vacated by obsolescence - a regenerative circuit valved to sun-emanating energy in its many radiant materializations? Would there not thus emerge an automatic increment sufficient to account for the most lavish scientific piloting of the course? Could housing be that important? Can we afford to pass up the chance that it may be?

Naked man had only one advantage over environment which was sufficient to prolong his association with it. This was his cerebral advantage. Man running and bounding on his legs can manage to jump to a height about equal to his own six-foot stature. With cerebral articulation of observed mechanical principles in Nature he can, though seeming superficially to encumber himself with the additional weight of a pole, run forward and, with the same quota of energy employed in the six-foot jump,

now vault over a barrier better than twice his own height. Thus he demonstrates the cerebrally combined mechanical advantages of angular acceleration with the fulcrum principle, a cerebrally detected compounding principle resulting in the principle of dynamic self-leverage.

The cerebral advantages are progressively pyramided upon the compounded and irrevocably cumulative basic-data grid of technology and science. The web-interstices of the basic-data grid, in which there are still many blank spaces, are, however, being ever more closely woven together with the memorial strands fashioned by mind, will and courage out of utter intellectual integrity.

Though the treasured basic-data web is closely guarded by the increasing host of academic science and technology, both its original detections and ultimate domestications were and are solely articulated by that most precious of all characteristics of living man, the power of the selectively precomposing creative imagination, which, as Morley phrases it, is 'The Holiest Ghost we shall ever know.'

Deriving compound advantages out of the basic-data-grid, we have learned in astronomy, navigation and ballistics that the degree of accuracy of forecast is directly proportional to the degree of completeness both of inclusion and evaluation of the convergent force factors, the total resultant flow diagram of which unfailingly prescribes the tracking, time and station schedule of events for those who are faithful and industrious enough to survey scientifically the appropriate dynamic system.

Therefore, confident that the same reliable trend prognostication principles must adhere also to man's social affairs, I can now only apply myself with vigorous humility to the task of prognostication, a process which sincerely attempted might appropriately be designated as Total Thinking, a necessitous rather than a pretentious invention.

I figure: that any planned post-war housing now in preparation by the components of the professional housing world as now and hitherto constituted will get about as far as a ten-ton truck can be jerked by its self-starter before the battery goes dead.

...that this calculation includes every phase of housing from A.A.A. (for academic architectural aesthetics) through A.F.L., A.I.A., A.M.A., and so on down through the seventeen thousand possible combinations of nuances of human association describable by three initials, organized for intentionally better or unintentionally worse public or private purposes, and all fulcrumed upon the simple, exploitable fact that man requires shelter, sanitation, and privacy in varying degrees dictated by the larger factors of environment.

...that the stationary engines of the old-world housing business are permanently stalled. This statement in no way refers to special engineering projects whose activities, having now sincerely adopted scientific method, are each hour turning in more amazing records.

...that old housing is stalled and its post-war planning invalid because its philosophy is obsolete. It is obsolete because its premise is essentially unscientific. Science has been interrogated falteringly about patch-work palliatives, but has never been asked whether the invention of housing as a whole was soundly conceived.

...that the invention of housing, as we have known it, provides no simple and practical means, economically or mechanically, for swiftly interpreting each scientific research gain in principle and precision into the everyday environment mechanics of man.

...that far from coinciding with contemporary scientific concept, the over-all housing thinking lapses backward at least 3,500 years to pre-Greek conjecture for its major premise.

...that its truly ignorant premise derives from the superficially stationary aspect of housing structures. This illusory stationary aspect happened to coincide with the gravitational effect demonstrated by stones accidentally recumbent in a pile.

...that all post-war-wise housing plans as yet coming to light still start with sewer, water, and light arteries laboriously buried in the ground, a 3,000-year-old invention immediately immobilizing all subsequent design. However, wilfully more ignorant than the designers of 3,000 years ago, this start overlooks the fact that the original drains were led to a few of the better-run stone temples and palaces as accessories after the fact, as corrective expediencies. The fact to which the buried arteries were accessory was that the house was usually built of the stones immediately at hand and therefore that the edifice was located on the spot as a measure of energy efficiency and not, as architecture would have it, because housing should aesthetically ‘arise from the bosom of mother earth’, or ‘spring from the native soil’.

...that site planning for post-war will take no consideration of the interim degrees of multiplied mobility developed for man by the war, which would make possible setting down a city of one hundred thousand well-equipped persons in twenty-four hours in the mountain reaches of Tibet, because post-war planning goes right ahead by-passing all scientific gains of the whole 3,000 years' climb from the first emergency sewer systems, and limits the planning to the mechanical advantage rating of man 3,000 years ago, when he had one-twenty-five-thousandth the physical augmentation modern mechanized man has - as he now considers most activities other than housing in the terms of around-the-world in flying-hour tons.

...that architecture starts the plan not only with every limitation known to the Egyptians, but also complicated a million-fold by 3,000 years of clinging growths consisting of every possible scheme of parasitic exploitation of that original Stone Age immobility of the anchored victims of housing. So old are the vines now that most of them are heavy with the cultivated fruits of ethical and legal precedence, and are perfumed with the venerated aesthetic. And then, too, say the 'good old housing' exploiters, 'a rolling stone gathers no moss'.

...that this stationary premise assumed in the formulating of housing concepts continues in utter denial of the scientific and now fortunately quite popular concept of an atomic universe totally in motion, in which one rolling stone can knock over ten pins again and again. Who wants to gather moss anyway? asks the around-the-world-flying man! Plenty of time to raise moss when you are dead.

...that just as communication and transportation have progressed from wire to wireless and track to trackless respectively, with concomitant, manifold increase of their time-space mastery per unit of expended energy, always developing in synchronization with the contemporary philosophical concept of essential motion, that just so will housing of scientific necessity finally progress from its vainly weighted-down footing, from a rooted to a frankly rootless art, with vast gains for man in the terms of environment control per unit of expended energy.

...that the change will come about as a potential motion-for-security's-sake, and not as a motion-for-motion's sake innovation; that this mobility for security will be articulated whenever evolutionary necessity requires repositioning of dwelling locale for consolidation of the progressive interim gains in living, learning, working, and enjoyment standards, or when anticipation of obsolescence or public convenience indicates mutual advantage in change.

...that by thus synchronizing with the reality of motion, the major premise of a new housing industry will become scientifically tenable.

...that in as much as the word 'economics' means the body of knowledge pertaining to household management, the latter's mobilization will cause the whole economic prospect of man to come of scientific age.

...that with mobilization of high standard living equipment, the age will not only have its new-grown wings, but also have powerfully energized talons to secure each freely selected, graceful landing. The American eagle is an excellent symbol of industrial man's future. We are wont to depict the eagle alertly poised with intense potential mobility and therefore with well-demonstrated security, even upon the most precipitous advantage.

...that this derooting will thus actually control the new economics of man by freeing his dwelling from its parasitic subsistence on the back of an industrial jungle host of sewer, water, gas, and garbage systems, and by insinuation of man into individually powered and processing dwellings, unlimited in range of location of secure poise, on mountain top, in remote valley, or island, without time-severance disadvantage and with ever-improving standards of living.

...that in the new economics resultant to flying and securely poised dwelling, man will discard his treacherous misconceptions of wealth, which hold that it is comprised only of the items about him which stand still, and between which little things shuttle with strings tied to them, trolleys to wires, wires to centrals and centrals to mortgages, all reduced to 'securities' that can be placed statically under lock and key. The sunlight has never been called 'wealth' except by the poets or by laughing youths, who are wild poets. The lawyers have never been able to tie a monopoly string to the sunlight or to tie it back to some system of less refulgent sovereign deeds.

...that man will soon set up a new accounting system geared into the true wealth of power-potential truly accounting our dynamic mastery of environment by science-educated control of energy - that is of energy all external to man's integral pittance of that all- pervasive phenomenon which uniquely characterizes life as action (motion) or reaction (heat). This is the new concept, An Energy- Borne Commonwealth of Humanity, instead of monopoly and patronage affluence, pyramided on the bedrock acre base.

...that the mass of materials which the old building world so inefficiently employed will be expeditiously scrapped and run through the mills again. This applies to materials (1) directly frozen into structures and (2) indirectly employed in the concomitant inventory of employed materials to fabricate the heavy plant equipment and rolling stock which in turn process, transport, store, and handle the ill-conceptioned buildings' materials, all of which compound to astronomically inefficient or entirely superfluous tons.

...that these recaptured materials will eventually be reassigned with scientific discretion to efficiently conceived tasks in the industrial cycle.

...that if dancing one-and-a-half-ton automobiles and pounding ten-ton trucks, and thunderingly alighting twenty-five-ton aeroplanes can be initially supported on compressed air structures in pneumatically stressed tension skins with the additional advantage of locomotion, and that if sixty-ton aeroplanes can be supportingly hung from the sky by a pneumatic-lag vacuum, and if a 100,000-ton ship with a relatively delicate steel skin can be supported on a liquid-plastic foundation of water (because of the ship's pneumatic content being maintained in expanding pressure by the weight of the blanket of atmosphere above, whose specific gravity is sufficiently less than the water to permit of its supporting the otherwise sinkable steel by marrying it to the air in efficient comprehensive design), that human families of less than one-half-a-ton total working load, who present no stress requirements of the magnitude germane to aeroplanes, trucks, and ships,' should be easily structured in their miniscule dwelling requirements by a few atmospheres of compressed air confined within less than a ton of stressed skins.

...that all essential pneumatic and hydraulic compression components of structures are comprised of the locally available substances occurring in Nature at or near almost any spot on earth as compound liquids or gases, as, for instance, water and air, or even dry 'dirts', which have hitherto been used in buildings only as constituents of frozen plastic masonry, which cannot dynamically distribute its stresses to the enclosing tension components of the design, as can pneumatic and hydraulic systems of structural composition.

...that only the tension components of structure need be centrally fabricated for wide distribution to structural assembly locations, the compression components being always locally available if pneumatic and hydraulic conceptions of solution are employed by the designers.

...that because the stress-ability of modern, scientifically designed tension components has advantages varying from two- up to ten-to- one over compression component abilities, the production and shipment of only tension components will reduce the over-all industrial loads by as much as 75 per cent.

...that in this war crisis it is technically treason to allow ourselves to be short 65,000 freight cars weighing fifty tons of steel each, which shortage is equivalent to the number of cars required exclusively to transport the solid foundation and flooring materials unscientifically employed as frozen compression elements to structurally support the tiny weights of the one-tenth-of-a-ton load of men who comprise the negligible working loads of housing, or to support machinery from below that could better be suspended, etc.

...that we adhere to this unimaginative stupification of building concoction only because we are confined by a thousand codes to comply with essentially the same designing systems employed 5,000 years ago when the compressive strength of masonry (fifty thousand pounds per square inch) of the post-Stone Age still had a great advantage over available tension components of grass or bark or wooden sections.

...that with eyes trained to appraisal standards of post-Stone Age lore, that industrial engineering, such as that of 'gas tanks', and 'good architecture' were bound to be incongruous, because the gas tank was in tension; and that because 'good architecture' remains 'good' because of race hypnosis, the unadorned engineering design seems monstrous and threatening.

...that the differences in efficiency of these new dynamic and the old inert structures can be readily discerned by noting that the tops of many public-service gas tanks in large cities are each several times larger in horizontal plan than is, for instance, the waiting room floor of the Grand Central Station in New York City, the station mausoleum designed essentially in the inert classical manner appropriate to stones balanced on stones, though of necessity held together by an enormous hidden steel tension structure insinuated within (instead of efficiently containing) the design. As a deck, these gas tank tops would easily carry a load several times greater than the live load of people who fill Grand Central in a holiday crush. Despite this many times superior spanning and carrying capacity, the gas-tank decks are structured

of one-thousandth the weight of fabricated materials of the station, which had to be transported far in appropriately heavy transport units over appropriately heavy railway systems instead of directly by air as would be quite economical with gas-tank components.

...that the materials - raw, partially processed, or sub-assembled - of old housing (which term includes all the latest prefabrication compromises) have weighed on an average of one hundred-to-one and have bulked on an average of ten-to-one in excess of the quantities necessary to accomplish the desired end result, and have fallen as proportionately short of satisfactory performance as they have of energy-conversion efficiency.

...that the American people, who during the last century have produced their own weight in copper products and 126 times that weight in steel products, were so production-rich that they were product-careless.

...that they have become technologically poor now (haven't enough to meet wants) because of the super-wastefulness of many of their designs, particularly of past housing design. Their assets are frozen in inexcusably inefficient design because those who have managed their affairs have been downright ignorant (no matter what other expedient characteristics they have possessed). The U.S. citizen has 140 pounds of copper per capita frozen into his product designs (mostly building) with only fourteen pounds per capita known to exist per world citizen, including all surfaced metal and all known geological reserves. U.S. man has nine and one half steel tons per capita as his own share of the social mechanism, where less than one ton should suffice, were moderately good design (technically speaking) demonstrated.

...that the inefficient design is due to lack of over-all philosophical discernment of the managers, particularly regarding the vast step forward in civilization, which it was their historical opportunity to make, and lacking which they have instead invested their productivity in a metals imitation of the Old World, starting with cast-iron or bronze replicas of Greek columns, friezes, and didos appropriate to extreme specialization of the Stone Age art, carrying this absurdity through to metal imitations of wood windows, steel coaches, bronze mass-production dough-boys, all representative of an inferiority complex and mistaken identity in history.

...that the Old World (Europe and Asia), having waited long and seemingly in vain for our New World (American) contribution of a cerebrated design for creative living, is now showing us the new design pace, but perversely articulated in destructive instruments, as of a world species committing suicide, having nothing better to do, or rather being denied the right by its ignorant managers to turn its potentials to creative extension.

...that the Old World is leading us the creative perversion pace in design by employing our own unique springboard and only special contribution to social history,, mass production, which might, under comprehensive management less preoccupied in fighting for guarantees of high-risk odds for no-risk arrangements, have been applied to ensure happiness and enlightened growth of man himself.

...that upon inspection of the metals industries' inventory record, the essentially unused copper and iron content of the obsolete and overweight buildings, whose contingent materials inventory accounts for more than one half of all of the metals produced in the last century, is alone sufficient to supply our complete production needs of these two major metals for five more years of war, though we were unthinkably to shut up every iron and copper mine.

...that practically all the metals produced in the last century remain on inventory in the equipment, rolling or stationary, of plant and structure, of which business management in general (including the banks and law firms) has been sole management custodian.

...that the minority, classified as 'business executive, *et al',* rather than the-American public at large, must bear the blame for the lack of comprehension of the potential historical contribution of America and - worse - for debasing American man's otherwise great idealistic frontier objective into money-grubbing.

...that this grubbing is an economic result of the inert characteristic of architecture's environmental imposition on the viewpoint of the individual.

...that this perverted objective has made a static virtue out of grubbing the last kernel out of only the first productive set-up of what might otherwise be recognized, if allowed to grow, as a regenerative and geometrically amplifying system of wealth circulation and living standard advance, a veritable golden-egg-laying goose, destined (eventually, why not now?) to spread its energy conversion service to all people on this tiny planet.

...that despite the seemingly large bulk of metals which might superficially be judged to have been distributed by end-product sale into the personal custody of the individual citizens, the proportion of all processed metal actually reaching them was very small and only seemed large because it was sliced so thin.

...that the small proportion of all the metals in private custody was revealed when the populace was recently called upon to support their fighting boys at the front with scrap badly needed by the steel industry; for then the American home folks, though fanatically combing attics, cellars, yards, pot cupboards, ornament dressers, and tool boxes, scraped together only twelve million tons of iron and iron alloy, which is only four-fifths of one per cent of the surfaced, processed, and placed-in-use iron metal now on inventory in the U.S. economy. Extremists think that the citizen wasn't thorough enough in the first scrap drive and could go back and dig up another, final twelve million tons. If we add to this the twenty-four million tons total of excess metal in personal custody or about the premises of the public, the additional weight in metals contained in its national inventory of automobiles (basing computation upon the record 1941 registration of motor vehicles), the total figure of metals in popular custody as of Pearl Harbor date, prior to the first scrap drive, reached only fifty-four million tons as compared with the billion and a quarter tons in corporate, industrial, or government custody at that eye-opening date. Of this latter huge tonnage, the government portion is negligible, as is typified by the small percentage involved in the unprecedented twelve-million-ton Navy and twenty-six million-ton merchant marine goal now set for war's peak. The combined popular custody tonnage subject to the individual's or his government's mandate might be brought up, by inclusion of state, county, city, and regional authority bridges, dams, and equipment, to a sum total of 200 million tons, in comparison to the 1,100 million remaining solely in corporate or trust custody.

...that this proportion of relative mandate over the surfaced inventory of metals leads to some cogent political conjecture.

...that just as the tongue, as a mechanical invention precedes the phenomenon 'word' as a fact, and *ipso jacto* the political consequences of the word's invention, in exactly the same way *all* mechanics are to be appraised as causal rather than as resultant to political evolution.

...that in view of the fact that mechanics pace political evolution, the development of advancing industrialism in America provoked its political adventure in forthright democracy.

...that the advancing industrialism invisibly threw the complete determination of man's political fate, as dictated by mechanical evolution, to the prerogative in design advance of, first, the industrial financiers, and, subsequently, the self-perpetuating industrial management few - not at all to popular political mandate.

...that political fate rested entirely upon the limited technical wisdom and far more limited world-development vision of the industrial management few.

...that it may be said in strict technical veracity that democratic management has not yet existed in America and that such weaknesses as have up to now been revealed in the social organization of American man are not limitations of democracy at all.

...that the democratic test in the U.S. has been in any realistic sense a trial of Charlie McCarthy for the whims of Bergen.

...that it is no wonder the industrial businessmen sprang to democracy's defence in its hour of need.

...that under the surface cloak of an entirely theoretical application of democracy, a money-minded few have pulled all the mechanical strings and that the manipulators, to play fair with them, are to be criticized for their utter inability to comprehend the broad meaning of such contributory facts as those we have just cited (and which have often been cited to them by their hired technologists), which ignorance explains, though it cannot condone, their consequent failure to act intelligently upon them.

...that, though one hundred per cent 'responsible', they are guiltless of any malevolent attitude towards society.

...that these leaders have been found wanting, and that the failure is at the centre of the world storm, and that their cries for another chance for democracy are provoked only by the pattern of their ignorant association-of-ideas, and that their pleas for democracy and its rainbow-haloed free enterprise (the right of the best corporation lawyers they can hire to write new rules that give them new licence), may be appraised only as their scheme for prolongation of their quite undemocratic custodianship of the works for the sake of relatively diminutive dollar dividends - preposterously diminutive by comparison.to the net earnings in standard of living that will accrue if and when the democratic body politic is given the controlling voice over its industrially organized and mechanically implemented commonwealth.

...that the fifty-four million tons of obsolete end-product metal in direct personal or popular custody of American man is equivalent to only one-half a year's production of his steel mills.

...that you may think the individual has a lot more tonnage than that alone inventoried in his plumbing, heating, and hardware, but realistically exploring, we find that only two per cent of the U.S. population own their own homes outright, which therefore places the essential custody of this 'home' inventoried accessory and arterial system tonnage within the control of corporation trusts or government. Though holding ultimate title foreclosure powers, the government to date has laboriously supported rather than challenged the corporate and trust prerogative over this tonnage, in order to avoid the political disturbances threatened by realistic inspection of the deflated functional value to which this junk tonnage is collateral throughout the vast 'securities' structure of the country.

...that of the billion and a quarter tons of strategic metals in fabricated status now in custody of *others* than the individual, and therefore beyond his control to do anything about until he knows the facts and can support the initial moves of his representatives to remedy legislatively, over 700 million tons were fashioned into their present inventory shape and function before World War I, and much of that tonnage even before the turn of the century.

...that, from the over-all service efficiency viewpoint, this inventory tonnage of 700 million, equivalent to eight years' complete production of our present steel mills' war capacity, is, with no important exception, obsolete as now formed.

...that the fact that the horsepower output per pound of engine metal has advanced 2,500 per cent in the interim, is ample substantiation of the typical cause of obsolescence obtaining in the older portion of the inventory, which, however, so long as it promises any dollar production, no matter how small, is 'good', so far as the short-range viewpoint of its custodians is concerned.

...that the custodians of the plant structure and equipment deem to be potential of earning a pure, even if small, dollar profit, just so long as they are standing, no matter how empty or idle, because the amortization was long ago completed; and therefore as custodians they don't have to take any responsibility for the success of a better service use of the materials involved by a new imprint of energy and technology.

...that they are unwilling to part with the properties on the 'head-achey' basis (from their viewpoint) that its revamping might possibly amplify the effective striking power of America twenty-five-fold, as indicated by the technical gains in scientific service industries such as communications. Multiply any of our industrial or military figures by twenty-five and see what that would mean to the war winning.

...that this inefficient inventory, just by virtue of its existence in such preponderant size, puts a premium on suppression of efficiency increase from a pre-scheduled dollar-income viewpoint of management.

...that the easy monopoly of average *laissez fairs* protects inefficiency by allowing only slow and controlled improvement by trial-balloon introduction of innovations by the least successful divisions of the industry.

...that the no-risk premium on retarded growth is a real behind- the-scenes stumbling block if not an anti-war success motivating force, for, because of it, improvement in design is countenanced only for fighting equipment when our items are directly out-designed by the enemy - lest the war, with its wastes otherwise advantageous to monopoly maintenance, upset the seemingly good-enough system of preferred stagnation.

...that it was probably hoped by the huge, unwieldy, obsolete inventory custodians (if they were aware of it at all, which is doubtful), but at least by the legal tacticians for them, that the public scrap drive as such would satisfy the public demand for solution of the vaguely publicized scrap problem, hopeful that the war might be won without too serious design advance concession, though glad to have the public liquidate its own small tool, accessory, and improvising materials position by tossing in its scrap pittance (which is, incidentally, so inefficiently thin, being mostly light-gauge sheet product and plating, that as scrap it is used only by the metal producers as a last resort).

...that the custodians will, however, finally get the picture straight regarding the advantage in wealth gains accruing through accelerated velocity of scrap recycling, in which each cycle represents an impress of sun-free energy into the cumulative commonwealth standard of efficiency advance.

...that when the problem of its preferred introduction, because comprehended, happens to coincide with survival necessity, then the whole essential economic volition of the world will be converted from an inert to a dynamic asset system.

...that once the scrap is really recycling on an efficient basis, new design will be constantly in demand to warrant a new cycle and that the world-wide industrial wheels will tum as never before.

...that out of the starting phase of tonnage recirculation, industry should net better than a quarter of a billion new dwelling-service units.

...that industry will thereafter not only continually provide more and better housing with its materials inventory, but will also trade tonnages of its inventory as scrap for other materials of greater advantage with the government's strategic materials stockpiling and priority control board, trading on a basis of weight-strength- efficiency formulas resolved to net foot-pound efficiencies.

...that this vital scrap problem had something vital to do, then, with both housing and war, and that scrap trend is one of the major force factors shaping our prognostication trajectory.

...that the traditional *attitude* of new ore producers and ore body reserve owners towards the scrap problem, i.e., that it is just a necessary evil to be classified as a 'monger' activity and 'the less said and the more exported, the better', even if it is to our enemies, is not to be considered seriously beyond noting that they have held it as a matter of policy that the less scrap getting back into recirculation, the better market they theoretically could command. Because design advance would accelerate scrap recirculation potential, they were fundamentally against design advance and brought that attitude to bear throughout every intertwining directorate influence on the whole economy.

...that the basic metals producers have their faults but they are not particularly dumb and are certainly not afraid of major physical operations, as any who have reviewed far-flung mining operations must admit.

...that their potential of efficient public service is now great because of a number of combinable circumstances which will eventually gear together; that these circumstances are, for instance, to be discovered in the fact that today their investment in processing and fabricating equipment is distinctly greater than their amortized investment in ore bodies, and that scrap processing is less costly than new mining processes.

...that a new world industry of housing, for instance, if well developed in its organization and on daring enough lines, will bring the metals refiners and intial-use-form fabricators into active forward motivation.

...that the successful manoeuvring of this attitude change towards emphasis on design advance instead of on blind support of mass production of 'or equal' products will spell the difference between democratic victory and defeat, which is all the difference there is.

...that realistically appraised in productive cost comparison to raw production, it is not unlikely that this unexpected scrap increment of the U.S. commonwealth could and would be accountingly arranged by legislative enactment to wipe out the national deficit.

...that before this World War fate is really over, we will witness an American Unbuilding Programme which will exceed the highest rate of building activity ever attained in the past boom years by many-fold, and which will exceed even the rate of concurrent war bombing demolition, which latter accidentally releases materials for new uses, and is an unmartialled articulation of the inevitable trend. In the American case, forced by the materials and manpower emergency, the demolition will be premeditated because of the distinctly greater metallic content of the American structures as compared to European.

...that in either case of planned or bomb-wrought demolition, evolution will be demonstrating the large-scale incorporation into popularly comprehended industrial phenomena of the recycling of material elements into progressively more efficient use forms, a phenomenon which was becoming popularly evident in automobiles and ocean liners, but was not hitherto importantly evident in the housing world, whose end product the economic-supporting propaganda schematically inferred to be desirably permanent in arrangement.

...that so strong was this economic sentiment of 'permanency' regarding housing in an otherwise dynamically developing world, people at first considered their purchase of an automobile in the light of a permanent family acquisition, wherefore a 5,000 dollar investment in a well-built permanent Winton Limousine seemed cogent in 1910. Mankind went so far with its permanence whimsies as to consider its breeding complements not as free-will partners but as permanent material possessions.

...that one of the major changes to be wrought in world thinking by this war is the acceptance of the concept of change itself, relative to which equilibrium is the word which describes controlled design arrangements of dynamically desirable complementary associations. This constant change and progressive equilibrium is the propagative key to the infinite vitality of the democratic principle, which, if never

schematically allowed hitherto to take realized command of man's affairs, was always pumping along, dynamically active in his behalf, when his best interests seemed to be hopelessly frozen. Certainly, adaptability to constant change will be a characteristic of post-war housing, and dynamic equilibrium the key-note.

...that the erroneously titled 'credit' system, that crude-fuelled the now stalled old housing world, was constantly rediluted at a one- for-two mortgage equity rate,, and that the credit-less credit system

I Figure will be summarily abandoned by even the most powerfully conspiring secret forces of tide fighters.

...that inasmuch as the 200 per cent collateral forfeiture 'credit' system is devoid of real substance in the scientific sense, nothing of its vacuum will be available for recirculation, and that with its vanishing will also disappear the whole legal fiction of real property and its extenuated nonsense of chattel mortgaging.

...that thus will exit deathage as a fulcrum of exploitation of an acceleratingly live world which of necessity is learning to eliminate the vain fear of death from its cosmos.

...that if fixation on death preoccupies the manager, we had best get him out of the control seat. Practically the whole of the change in contemporary history is written in the natural substitution of the designation 'pilot' for that of 'drive' of our most special era transportation.

...that the economic issues of the now stalled housing world were so snarled and entwined about that housing world's throat that its hungrily gulped first pre-war breakfast choked it to death instead of reviving it as many an interest had hoped.

...that housing's deathbed watching almost scared the official war effort to death, and that, after having inspected the deflated and pitifully inadequate legacy of that old housing world, the war effort has finally had to go ahead the hard way without the seemingly desirable advantage of a well-ordered housing organization to gear its manpower to general mobilization and essential decentralization of production and to a world flow system.

...that the possibility of a newly incepted scientific industry of housing to expedite and vastly facilitate the initial American war effort was sentenced to solitary internment by priority rulings comprehendingly issued six months before Pearl Harbor.

...that the infant scientific housing industry was mercilessly kicked around for a year previous to its 'duration' sentence by a host of forces now useless to recall by name, but all of which were dominated in the last analysis by fear, by cerebral paralysis or selfish preoccupation that failed utterly to witness the accelerating evolution, preoccupations, be it well marked, that must be completely abandoned by those who will witness war's end. These are not earmarked criticisms. The inseparable ramifications of the old housing world are as broad as the whole economic system built thereon.

...that you may say, 'Why don't you cut out all this political- economic stuff and get along with the stark facts of description of precisely what you think the post-war housing is going to look like?' And I say to you it isn't going to look like anything until the war is over and that I can't envision its coming at all except in the terms of the meaning of the war. I say, and I have given realistic testimony to prove, that is why we have had to have a war: because we couldn't free ourselves for thinking without the detaching effects of war. Short of war, we just let well enough alone. We were swivel-moored to the rooted-down tonnage of our lugubrious past.

...that within the broad ramifications of the old housing world lie embalmed all the essential causes of the now-unleashed total war, and that therefore we cannot toss aside the question of housing until the war has been won, as we are urged to do by the unthinking and superficially patriotic in the phrases characterizing the shortening temper of busybodies who have long been frustrated in their attempt to revive yesterday in the midst of the upheavals and splintering of the scaffolding in the building dock as the ship of dynamic world commonwealth, its release interminably postponed, starts inexorably down the science-greased ways towards self-launching as the blockings of wooden structures give way to rot and termites. Soon she'll be majestically water-borne and riding the tide, capable of being manoeuvred over every ocean and of weathering all storms.

...that this total war is a World Civil War, amplifying into full cry the prototype local civil war of the United States of eighty years ago, which marked the first popular phase of transition of man's wealth-making from the anarchial, ignorance-limited and seasonably hazardous agricultural method of energy husbandry to the richly amplifying commonwealth method of industrial production piloted by science; employing vast, inanimate energy augmentations applied to ever more precise mechanical and chemical arrangement advantages.

...that the extent of this wealth is so unlimited, having reliably harnessed forces as lasting as the solar system as to allow of fabulous piracy so long as the new wealth source remained properly unaccounted for by any adequate, new, scientific book-keeping system.

...that true audit would clearly reveal to popular comprehension that the solar system, rather than the 'First National', or 'The Federal Reserve', or 'The Treasury', is the source of all physical wealth when released by science through technology.

...that, with sun energy wealth (in one of its many conversion phases) leaking in from a myriad of new sources from which, by any recognized feudal agricultural economic precedent, wealth was not supposed to gush, the astonished discoverer of each latest leak could stand in front of it and fill his back pockets without question of his legal proprietorship to that wealth, by any precedent of the obsolete accounting system's stewards.

...that this world-shocking impact of a meagre realization of a potentially unlimited commonwealth upon the awareness of a civilization which had with superstitious ignorance struggled for an existence within the arbitrary and cruel limits of the system of 'one against the many' and 'survival of the fittest - only', detonated the one hundred years' civil war of man.

...that because the cause of his revolutionizing was too brilliant for him to face and believe, he listened with misgiving and resilient distrust to the sanctimonious inventions of the equally bewildered pocket-fillers who were afraid to be wise, lest they lose their newly gained smart advantage.

...that this World Civil War is being waged, wittingly or unwittingly (and mostly the latter), for the total emancipation of man, not only from the swift ravages of a ruthless war, but from the slow and far more painful ravages of a ruthless peace, with its unsung heroisms and its betrayed self-communion over its mutual survival problems.

...that social telepathetic self-communion over vital and mutual survival problems is betrayed because it is misbespoken by popularly published perversions of its mutual intent—the perversion being accomplished by omission by any special interest, Baptist, Communist, Episcopalian, or Democratic, of the required balancing components of any dynamic system of mutual volition.

...that this perversion of socially generated volition is hard to detect, not alone because it is a vacuum instrument, but also because it is practised by all 'sides'.

...that the ruthlessness of an unworthily arranged peace must ever be promulgated by the principle of might makes right, whether the kinetic monopoly be imposed by the few or the many, through vacuum stress or pincer pressure; and that man's insulation against the selfishness of monopoly of his commonwealth or common sense, and therefore his emancipation from that selfish fixation, will be provided only by scientific organization of his physical environment and wealth-making into a starkly mechanical reality, a reality the benefits of which politics can *at best* but promise the individual a chance to seek — a promise easily forgotten.

...that right here, in the cited difference between scientifically comprehensive engineering anticipations and political promises, is where our total Civil War thinking encounters the theory of the origin of the post-war housing. *What physical guarantee does man need of certain realization of his promised emancipation?* Obviously, scientific extension of his environmental control - not a political gesture.

...that from the curves of those trends which are apparently converging towards integration of the multiple of plus factors, i.e., those promising man's increased welfaring - that the particular phenomena, which will eventually be identified (probably years after the fact) as constituting origin and prototype of the true post-war housing, will occur only by critical emergence for causes as yet certainly unknown.

...that the virginally emergent, that is to say, unheralded post-war housing will appear in important volume during 1945 and will have attained enormous proportions by 1948, proportions that will dwarf into insignificance any previous historical performance of new housing on any per-capita-per-unit-of-environment cubage as yet put under a measure of successful control by man.

...that this enormous volume of post-war housing will range rapidly upward within a decade to an equilibrium level of production in the magnitude of 200 million new units annually, grossing an annual rental income of approximately one hundred billion dollars, though computed at the fantastically low figure of five of today's American workman's hourly-wage-geared dollars per month per capita - including heat, light, and maintenance in private, individual quarters.

...that these individual quarters will be substantially proofed against fire, flood, pestilence, violent atmospheric disturbance, physical *I Figure* or psychological injuries or discomforts caused by inadequate design, scientific knowledge or technical performance.

...that this emergent post-war housing will be a mechanized human container service, purveying to you a controlled atmosphere of seventeen cubic feet of air per minute per person, free of toxic or disagreeable odours and dust, at a dry bulb temperature of 74° K, relative humidity 45 per cent, wet bulb temperature of 60–5° F., dew point 51–3° F., vapour pressure 01869 pounds per square inch, with reasonable plus or minus controls, with a noise level below the audible threshold, and with every essential refreshing and resting and sensing (illumination, etc.) device necessary to your happy wellbeing ready to hand.

...that the mechanized containers will be but incidental apparatus of a World-Wide Dwelling Service—that is to say, the mechanized containers will be incidental in the same way that the telephone table hand set is an incidental (though obviously integral) mechanical item in the vast interconnected system of scientific apparatus which together makes up the world-wide communication system, a system which you voluntarily join up with by expressed subscription and in which you have no technical function except that of 'user' and a system in which no mortgages, replevins, etc., occur.

...that if you don't play ball, the service is 'shut off'—engineering simplicity replacing legal complexity.

...that by this latter, larger mechanical continuity it is now physically possible for anyone near the earth's surface to speak to anyone else anywhere about the global premises, provided both have contact with at least a portable radio transceiver set.

...that it must be realized that this universal permeation of 'self' completely obsoletes the old economic concept of things, immovably 'in place', or absolutely 'at rest', and of a few slowly shuttling, mobile gadgets that were ever a legal control headache to a system strictly predicated upon the proposition that wealth is 'fixed property'—estate that is 'real' only when 'static'.

...that the now-developing, scientific, world-girdling air transport and communication services, together with the new, scientific dwelling service, will all be part and parcel of an encompassing larger unit system, eventually complemented and insured of direction by world-girdling energy distribution services, sometimes beamed by radio, sometimes by wire, and sometimes transported in batches as fuel—a sort of 'American plan' Living Service, a De Luxe Travel-or-Stop-Over-as-You-Please Service, ticket good for a lifetime, anywhere on earth, and available to all.

...that this total living service will reliably provide a complete set of ever-advancing standard-of-living conditions, whether you be speeding, poised, lingering or dwelling, upon the surface of the dry land, the high seas, in steaming tropic, on the fly-teeming Arctic tundra, on floating ice, high in the sky, on a mountain top, under the sea, or within the depths of the earth.

...that the duration of location occupancy will be proportional to proximity to strategical conditions and to population density, and that government land lease will be predicated in time limits upon reasonable pleas—socially beneficial custodianship, etc.

...that in the role of occupant you will have nothing to do personally with the mechanical process of moving nor with the design and semi-automatic operation of the mechanized containers' energy processes as thermal, light, or work phases, any more than you have to do with the moving of your telephone or with the original design and upkeep of a suite on a liner.

...that you will notify the Service that you wish to move at such and such a time to this or that spot, and will be advised promptly whether the spot is already busy and, if not, for how long you may engage it and what the rate differential above local zone service will be, if any, as predicated on zoning distances from service centrals.

...that, dimensionally, the containers with all apparatus will average per occupant about fifteen hundred cubic feet and not over five hundred pounds when fully in use, including all machinery; or approximately three cubic feet of controlled environment per pound of scientifically arranged materials.

...that the mechanized dwelling containers will compact in service transit to less than fifty cubic feet per occupant, or one-thirtieth of its in-use bulk.

...that these 'living service' weights and volumes will include everything that the individual does not carry in his personal luggage, tool kit, files, and display miscellany.

...that the balance of the individual's possessions, outside of his customary reference requirements, will be expediently deposited in, or loaned or donated to, vaults or public collections without loss of access on the one hand and with increased public enjoyment on the other, while at the same time freeing the individual to enjoy his world-girdling freedom of motion and poise.

...that the dwelling containers will be fashioned out of the whole family of new alloys and chemical synthetics in increasing variety, as demonstrated by the scope of materials that enter into air transport fabrication.

...that the metals, broadly speaking, will be more generally found in the production and service phases of the industry than in the end product, with the notable exception of the latter's primary energy propagator and its mechanical equipment.

...that the synthetics (plastics) will predominate in the end product's visible surfaces, though probably skeletonized delicately within by metallic reinforcements.

...that the mechanized dwelling containers, considered as end product, will be constantly improved in design and that new models will be progressively fed into the broad service operation as the service organization progressively scraps and recycles the materials in improved efficiency of disposition, essentially unheeded as a process of change by the service user, exactly as does the telephone service evolute by scientific expediency, the user being a 'party' to its evolution only as a potential or kinetic statistic.

...that the individual or single family-mechanized dwelling service containers will constantly reflect the latest advantages of scientific knowledge gained through pure and applied research, thus affording man direct, co-operatively effected benefit of the environmental complements to his welfare, without conscious designing initiative or effort on the part of individual man as practised in the past only through inspection of his own selfish immediate requirement, spotlighted exclusively for his consideration because 'No one is going to look after my best interests if I don't myself.'

...that man has been working against his own welfare, because his unscientifically appraised individual requirements were always so wasteful and inefficient as to keep the commonwealth bankrupt and innocent of increment which, if allowed to accumulate, might be scientifically diverted towards instrumenting the organization of his scientifically cooperative 'living service'.

...that the educational system enjoyed by the new life incubated in the evolving 'living service' facilities will be a combination of radio, movie, television instruction, industrially devised and recorded by vast mutual programmes of service and the arts, and that this instruction, freely tapped by the occupants of the containers, wherever they may be, will be amplified by actual experience at the source as a practical proposition made possible by the energy work efficiency gains of the world-girdling 'living service'.

...that, in reality, the whole globe will become every man's backyard.

...that any detailed discussion now of the mechanical 'features' is petty and superfluous, other than to note that it is probable a worldwide scientific service of the magnitude now looming up will engage in such terrestrial development as that of utilization of the cold of the Arctic and Antarctic and of the upper reaches of the air, together with the constant winds and reciprocating tides which will all be gathered into the heat exchange system and energy-storing operations by production of liquid oxygen in vast quantities in those cold polar and stratospheric regions and development of its controlled expansion uses in the energy cycle.

...that long before employment of these cosmic sources of energy, today's wastes of the sanitation cycle will be converted to energy work, providing as they do by natural process 110-octane methane gas; and that synthetic fuel for human bodily processes, together with other new food forms already developing, will sum-totally affect the mechanical apparatus requirements of the dwelling containers in a revolutionary manner.

...that it is possible that competition of these over-all services for annual contracts with the individual will become the new major political diversion of the world, as Imperial Dwellingways proselytes for voluntary contract constituents in competition with Pan-American Plan or Intercontinental Cooperatives.

...that these mechanical containers will serve as constant referendum voting booths, recording the temper of their vast intercommunicated population.

...that the new life incubated within these containers will be energy-conscious to an amazing degree, will think dynamically in foot-pounds of energy involvement (not by consciously mumbled calculation). The new life will know how to psychoanalyse itself and its social proclivities, learning how to do away with destructive war as a means of evolutionary growth.

...that unselfishness will be as practical a concept as the ability of a steel ship to float by the cooperatively arranged disposition of its atomic body politic, and that the individual will be guaranteed his inviolability, by the nature of mathematics, and that life will be essentially a lesson to be enjoyed.

...that in order merely to survive, when environment is comprised of unscientific structure, equipment, philosophy of concept, or environment represents an outright hodgepodge of ignorance, the human occupants must 'rise above it' by exercising a strict schedule of self-limitation, together with an immaculate discipline of person and premises.

...that when the occupants of unscientifically conceived environment fail in sanitary self and environmental discipline, then the standards of their lives rapidly degenerate.

...that when the environment is scientifically conceived and rendered, the human occupants can then divest themselves of the necessity of onerous and Puritanic hardship of conduct and yet accomplish successful and happy living in naturally engendered sanity.

...that because cleanliness is popularly accepted as next to Godliness, daily routines tallying by categories one and a half hours of dishwashing, one and a half hours of clothes, towel and bed linen washing, one hour of house cleaning, two hours of cleaning and preparation of food, one hour of self-cleaning, externally and internally, interspersed with an hour for back-resting, all add up to an eight-hour day devoted to yesterday's dirt, lest that dirt become today's filth and tomorrow's disease. And in all those eight hours devoted to the clean-up of yesterday, not one constructive act nor forward gain in the standard of living is accomplished.

...that it takes a seventh day, hallowed for resting, and considerable preaching, praying and psalm-singing, to keep a mother housekeeper in good humour as she progressively relinquishes her own potentials to the next generation.

...that in the sense that a child is pure, all people of any age are also innately pure, and that they are not made better by practice of severe routines of religion or self-discipline, but that those routines, which have been pivoted for millenniums upon development of habits of effective sanitation of the body and physique, have been instituted out of survival necessity as a sort of fervent sing-song sanitation, akin to Negro slave spirituals, or Volga boatmen's chants, or even to sailor's chanties, invented out of many psychological causes, not one of which today has any obvious relationship to the actual rhythm of exertion.

...that if people were synchronized and instrumented in mutual inter-services, designed *creatively* throughout, that is, anticipating tomorrow as one with yesterday; and these services were focused upon the most simply effective scientific control of our environment processes, that people could then continue to maintain the purity of spontaneous action and reaction with which they were born, and do so quite unconsciously, that is, without having to cite or recite a moral under which they were acting.

...that, granted a scientifically designed interservice, people would be able to continue in the original purity and dignity of nativity without having to go through the innocent corruption, realized degradation and reform-or-perish cycles, heretofore inherent in the ignorant chaos of unscientifically encountered environment. And out of these cycles of initial purity, subsequent corruption, degradation, and reform, few, if any, whole beings are ever recreated in the flesh or even in spirit.

...that, sum-totally, the whole gamut of religious and moral codes of the past have been necessary to man as palliatives of environment rather than as improvements of his innate qualities; that the words sane and sanitary, which both derive from the Latin *sanus,* meaning healthy, sound or wholesome, originally intended to communicate that the integrity of original process or phenomena remained unblemished.

...that so old have the fundamental sanitary requirements become, most of them have acquired a patina of aesthetic or religious tradition, which celebration of them in itself obscures the original cerebration, or why for, of the simple, sanitary requirements; until finally meaning has been obscured entirely by the dilettante vacuum accruing to all art for art's sake—or specialization pursued for special rather than comprehensive issue.

...that, in its broadest philosophic sense, this reasoning indicates the enduring superiority of benefit to man inherent in loving as compared to the temporary and miniscule advantages accruing to selfishness.

...that the degree of probability of preservation of inherent sanity in the individual is proportional to the degree of maintenance of inherent sanitation in environment; that beyond the inherently functioning sanitation there is no super-sanity to be attained by passion or formula - by mysticism or morality.

...that here man may actually help himself to a higher degree of living enrichment by scientific design, not to improve, but to protect the original radiant beauty of curious energetic life, of truthful process, of paradise never lost.

...that the modern disaffection from religious dependence decried by the sect proprietors springs from the release from sanitary precaution in its broader, necessitous sense, provided by modern mechanics and science, through which shower baths, sulfa compounds, steri-lamps, and radio-summoned air ambulances, and scientifically pooled cooperative blood banks, have retained people nearer to God than they have

ever been returned by the moral sanitation of the sect proprietors, whose original founders gained their popular strength through effective admonition in these fundamental problems of sanitation and survival, and not by initiation of collection plate routines, abracadabra, sage political moves or real-estate investments.

...that I conclude our world-wide contemporaries are not less fervent, loving, trustworthy, and individually aware of the profound mysteries and universal omnipotence than were their forebears. In fact, I figure that quite the contrary is true.

...that the people are now more deeply conscious than ever before in history of the existence and functioning principles of universal, inexorable physical laws; of the pervading, quietly counselling truth within each and every one of us; of the power of love; and—each man by himself—of his own developing, dynamic relationship with his own conception of the Almightiness of the All Knowing.

...that our contemporaries just don't wear their faith on their sleeves any more.

...that people have removed faith from their sleeves because they found out for themselves that faith is much too important for careless display. Now they are willing to wait out the days and years for the truthful events, encouraged individually from within; and the more frequently the dramatic phrases advertising love, patriotism, fervent belief, morals, and good fellowship are plagiarized, appropriated and exhibited in the show windows of the world by the propaganda whips for indirect and ulterior motives, no matter how meagre the compromise—the more do people withdraw within themselves and shun taking issue with the nauseating perversions, though externally exhibiting quiet indifference, nonchalance or even cultivating seemingly ignorant acceptance.

...that this wholesale and published exploitation of integrity and squandering of the meaning in words has come to such a pass that people the world over no longer trust any impersonal corporate statement and promise, although seemingly accepting the mandate of the moment in quiet resignation that might superficially appear as subscription to interpretive pronouncements of the limited-liability oracles.

...that all these profound developments in the exterior and interior relationships of man and his privately intercommunicated intelligence are precisely bound up with the mechanics of his environment.

...that men know and have known for long of the relative security to be found, on the one hand, in values of the static system, as developed by proclamation and necessary acceptance, and, on the other hand, within the dynamic system, as discovered by reality of awareness. For I note that throughout history when men sought to punish one man, they first demoted him, that is deprived him of degrees of his net motion privileges; on second offence they forthrightly arrested him; next they imprisoned and, if he still struggled, shackled him. As complete and final punishment, they killed him. Here indeed was complete demobilization of the individual.

...that that is why men spoke long ago of the 'quick' and the 'dead' - true freedom of articulating individualism must permeate the whole of environment. The only limitations must be those discovered sanely by the individual in the relationship of operation of universal physical principles.

...that 'quickness' in sanitation—that is, in degree of spontaneity equivalent to unconscious and therefore natural act, making possible free action in every direction, accomplished through the complete integration of intelligent universal principles into cooperatively performed services, which we call industrialization—must find its broadest historical application in production and development of the scientific dwelling service.

...that mankind's pre-war plight is similar to that of the fellow who painted himself into the middle of the floor because he was so preoccupied with the technique. Man has applied the benefits of industrialization—at least a priming coat—to everything except his most important spot, the worn-out place in the centre where he most frequently treads, his habitat. Man is at last willing to apply industrialization to his home itself, now that its air-conditioned brightness and efficiency have come so provokingly to his attention with the new war-effort manifestations, but he doesn't know how to get out of his own way to effect that final application. Suddenly the air-raid warning sounds and he streaks for the door, paint or no paint, only to find himself when the 'all clear' sounds unexpectedly outside the situation and free at last to attack the problem objectively. There, outside of each of their houses, contemplating them with critical eye, stand each and all of his neighbours. That is where man and his housing are today.

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