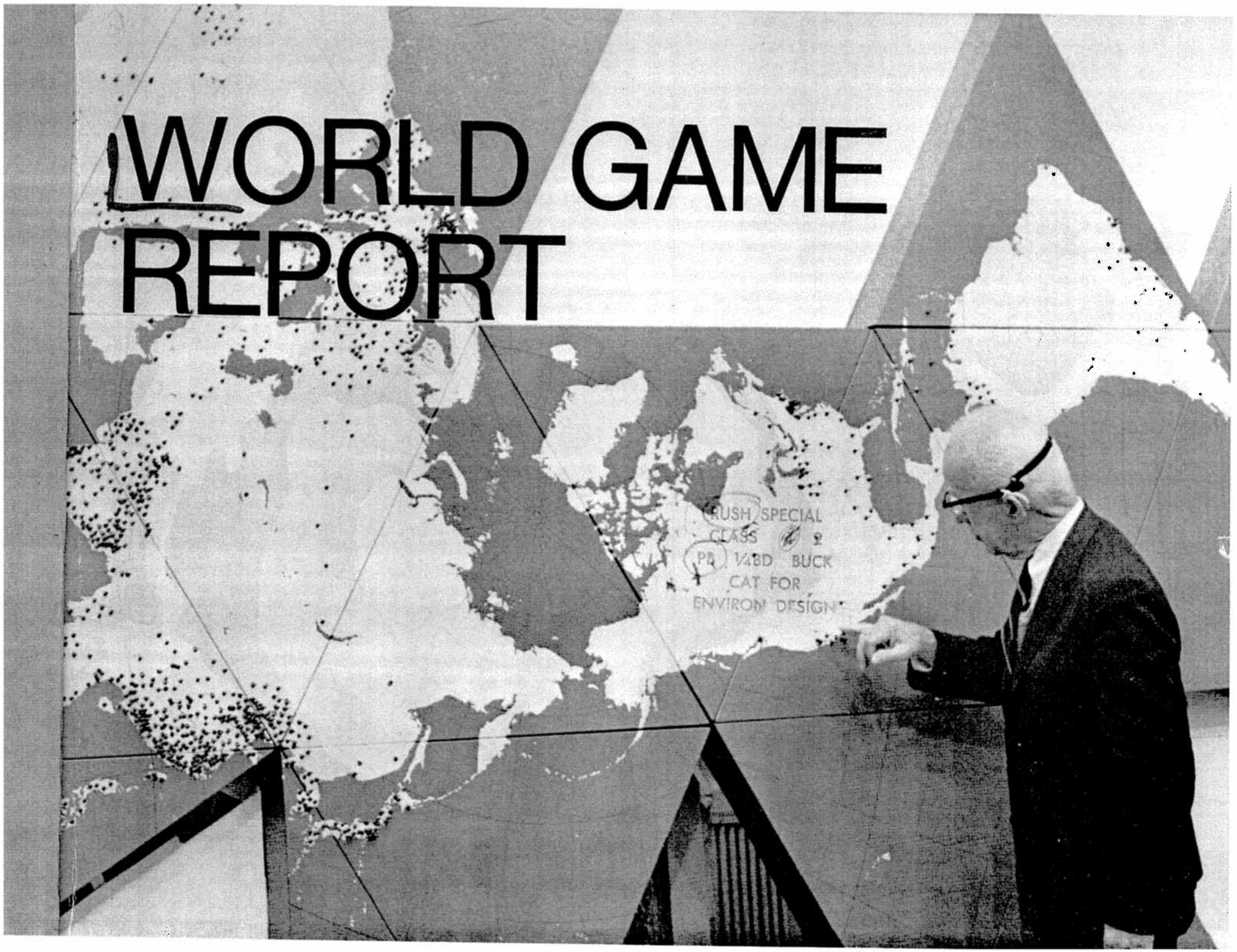
WORLD GAME REPORT



WORLD GAME REPORT

Summary of a project led by:

R. Buckminster Fuller
Edwin Schlossberg
Daniel Gildesgame

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Editors:

Mary Deren
Medard Gabel

Photography:

Daniel Gildesgame
Herbert Matter

The World Game Seminar took place at the New York Studio School of Painting and Sculpture, 8 West 8th Street, New York, New York. It lasted from the 12th of June to the 31st of July. The project materials are now at Southern Illinois University where World Game will be continued.

The project and this publication were made possible by a generous grant from the Rockefeller Brothers Fund.

WORLD GAME

The World Game is a scientific means for discovering the expeditious ways of employing the world's resources so efficiently and omniconsiderately as to be able to provide a higher standard of living for all of humanity-higher than has heretofore been experienced by any humans-and on a continually sustainable basis while enabling all of humanity to enjoy the whole of planet earth without any individual profiting at the expense of another and without interference with one another, while arresting pollutions and conserving the wild resources and antiquities. The World Game discards the Malthusian doctrine which is the present working assumption of the major states which holds that humanity is multiplying much more rapidly than it can supply resources to itself, and compounds Darwin's survival of the fittest, to assume that only the side with the greatest arms can survive. The World Game-an assimilated logistical operation for 40 years-has already demonstrated beyond question that the Malthusian doctrine is fallacious and that committing all the high technology resources now going into the world's annual 150 billion dollar war making facilities, all of humanity can be brought to economic success within one quarter century-thus eliminating the fundamental raison d'etre of war. The World Game employs the general system logistics for the reorganized use of the world's resources and employs comprehensive and progressive series of waves of producing higher performance per units of invested time, energy, and know how and each and every component function of the over all scheduling. The World Game makes it possible for intelligent amateurs to discover within a few weeks of research and interest that the foregoing premises are valid.

R. Buckminster Fuller

INTRODUCTION

We worked with the students in mind. We worked to develop a research and design team to effectively deal with the data and concepts necessary to play World Game. The students came from physics, biology, art, architecture, anthropology, New York, San Francisco, Miami, Oskaloosa. They ranged from 19 to 46 years of age. The first four weeks of the seminar were devoted to input. Mr. Fuller thought aloud about his ideas, concepts, inventions, and discoveries. The students did individual research into trends, energy sources, and many other information areas. They were constructing a base on which to develop ideas about the whole earth. We saw films, read extensively, and traveled through the minds of the others in the room. We watched as man successfully stood on another body in space and could see the earth as a spaceship. The students were working to make visible the coordination of that spaceship in order to accelerate the trend towards physical success for all of humanity. Each day the growth of the students and the growth of World Game was extraordinary. Without fear, without competition, the students worked together to realize World Game as fully as they could. The last three weeks were intense with research and organization on how to display the findings that were being made. There was no duplication, no repetition and the energy and information grew visibly before us. We were working at the frontier and each student was working at his frontier. It is dramatic to see human beings so concerned with the operation and the well being of the earth. Mr. Fuller said at the start of the project that it was the most important work to be done. This document and the strength with which the students left the project are evidence. We will all be involved in World Game as the students were. On the last day of the project there was a lunch gathering. Mr. Fuller said that he would miss their faces but would see them continually. As the students left there were few good-byes. The project will continue.

Edwin Schlossberg

PARTICIPANTS

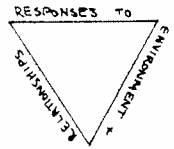
Eric Abrahamson

Tina Croll, born in New York City (Virgo) dancing and choreographing in New York now

Mary Deren

Ted Drake, architecture student

Marty Emanuel



Esther Engle, painter, poet

R. Buckminster Fuller

Medard Gabel, becoming

Daniel Gildesgame

Horace Godwin, Taurus rising-student at Goddard College-Power to the People!

Edward Hauben, explorer

Robert A. Jacobs Jr. second year Columbia architecture

Russell Kolton, I am the walrus

Jerry Laufman "The only thing more powerful than all the armies of the world is an idea whose time has come." (Victor Hugo)

Mira Lehr I paint, study space and invisible relationships, take care of my four children and love everyone-especially since World Game

Charles Maschwitz, I am a painter and I have great inertia; in two days I have one breakfast and one thought, so I record receding events in red and green.

Carole McDonald Leo, anthropology-graduate student (Columbia)-space, anthropology, women's liberation

Nester Raffo

Edwin Schlossberg

Steve Selkowitz

Terrel Seltzer

Jim Smith, wholegrain breadbaker

John Storyk

Ken Versand

Henry B. Walker III

Val R. Winsey, PhD wife, mother, Associate Professor of Anthropology, Pace College, New York City

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It was a little like this-

R. Buckminster Fuller

Dymaxion maps, the room, 26 new people, waiting, Buckminster Fuller speaking, the new world, the whole world, synergy, precession, complimentarity, systems, more with less, design science, Edwin Schlossberg, the documents, the library, Buckminster Fuller leaves for Denver, finding trends, questions, roadblocks, films, Eddy, finding out about energy resources, library, the city, Buckminster Fuller returns, Bucky speaks for two weeks (excitement, revelation, the frontier, mind flying), Bucky leaves for Europe, July fourth weekend, research, examining our pattern changes in life, finding needs for one man, energy resources, trends, libraries, groups, discussion, digestion, questions, internal-external metabolics, form into two groups, energy scenario, food scenario, lunar landing, chart, charting trends, questions, attempting scenarios, attempting scenarios, charting, scenario, Bucky's back(!), people visiting, presentation, lunch, food;

till we meet again,

Mary Deren

Medard Gabel

I Pre-scenario Facts

Our pre-scenario facts consist of the conceptual tools which we found ourselves using most often in our dealings with the whole earth. They are by no means even an attempt at being complete, but are merely a general frame of reference for us, as individual participants, to fit our respective ''specializations'' into. To a large extent the ''specifics'' of the World Game course left with its participants; what is here is the general base we started with and evolved through as our individual understanding and refinement grew.

WORLD POPULATION GROWTH CHART

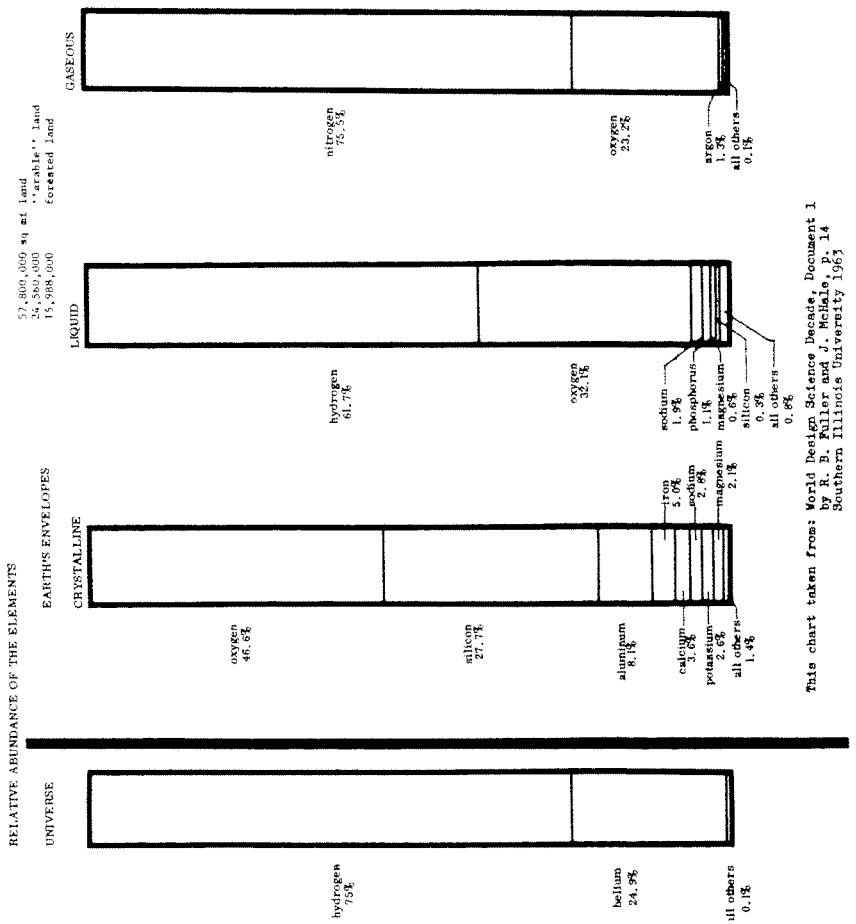
	World	Asia	Europe	Africa	USSR	N Amer	L Amer	Oceania
density*	25	69	92	11	11	10	13	2
1965**	3281020	1826887	441368	306153	231000	214307	243941	17364
1970	3593131	2016843	456473	345334	245700	229329	280447	19005
1975	3953499	2232108	471482	393135	260800	246943	328199	20832
1980	4344283	2467102	487054	449530	277800	267313	372395	23089
1985	4812638	2717081	504724	529888	297246	293243	445069	25387
1990	5352591	2991282	524923	636288	318053	321688	532438	27919
1995	5961902	3315679	543492	750591	328136	353213	640424	30367
2000	6647745	3658829	562620	886508	347824	387829	771094	33041

* 1967-figs. in people/sq. mi.
**population in thousands

One man needs per day today:

Internal Metabolics

1.4 lbs. pure air
5.0 lbs. pure water
3500 Calories
90 grams of protein
12 milligrams iron
0.8 grams calcium
0.80 grams phosphorus
vitamins and minerals
5-9 hours sleep
63-77 degrees Fahrenheit
medical attention



(How much electrical energy is in the human mind?
On what does man's regeneration depend?
How many synapses and miles of neurons does the human brain possess?
What is a toy?
What is the chemical result of frustration in the human body?
What is the minimum caloric intake necessary to develop hydroelectric sources?
What is the best working efficiency for the human body?
How does man's physical efficiency compare with his mental efficiency?
Is brain power a measurable energy source? How can it be measured?)

External Metabolics

access to medical attention
access to information, education, communication
waste disposal
re-creation
ecological sweepout (migration, transportation)

(What are some of the present trends in man's relation to his environment? In relation to man?
On what prime conditions has man's survival, so far, depended?
If one knows more about food and the body, does it automatically mean that he eats better?
What relationship is man now effecting with his universe?
Are internal problems of communications the same as external problems of communications?
How significant is the effect of environment on nutritional optimum (U.S. citizen needs around 3200 Cal/day Japanese needs only 2500)?
Why do we ask questions?
What are questions?
Are we asking the right questions?)

Mankind has:

universe the aggregate of all humanity's all time, consciously apprehended and communicated experience

galactic clusters

Milky Way

(What kinds of knowledge have space experiments made available to man, and what are the implications of this knowledge for man's future?)

stars

our star system: sun, Pluto, Neptune, Uranus, Saturn, Jupiter, Mars, Venus, moon, our satellites, earth

196,950,000 sq. mi. total earth surface
139,150,000 total water area
326,071,300 cubic miles of water; oceans are 317,000,000 cu mi (97.2% of all water), fresh water 9,071,000 cu mi

(What are the areas of agricultural production located?
What is size?)

earth's diameter 7,926 miles equatorially and 1/297 less on polar circumference at equator 24,830 miles

total solar energy reaching the earth's surface 7×10^{17} kwg/yr

The maximum intensity of solar radiation varies between 1.15 and 1.75 cal/sq cm/min

(Can we ever really be exact about anything?)

incoming solar energy is 9% in UV range, 50% in IR range, and 41% in visible light range

(What are the world's essential resources?)

mean wind speed over the globe 2.3 to 6.7 mph

(Would war be eliminated if resources were as spontaneously available as air is?)

2.2×10^{12} tons of carbon dioxide present in the atmosphere 1/50 of this is utilized by photosynthesis each year

the estimated total organic compounds formed per year is 100 billion tons 85% of this occurs in the oceans

(How does one get to see and feel the whole?)

in one year the world's plants store 1×10^{18} kilocalories in the form of photosynthetic products

(How much energy does the earth collect and impound daily?)

daily world requirements:
4 million tons of food (about 200 shiploads of food in Queen Mary-cap. 20,000 tons or 400,000 truckloads of food-10 tons per truck)
12 million tons of water
14 million tons of air (300,000 domes of air-at 50 tons of air per dome (size of Expo dome))

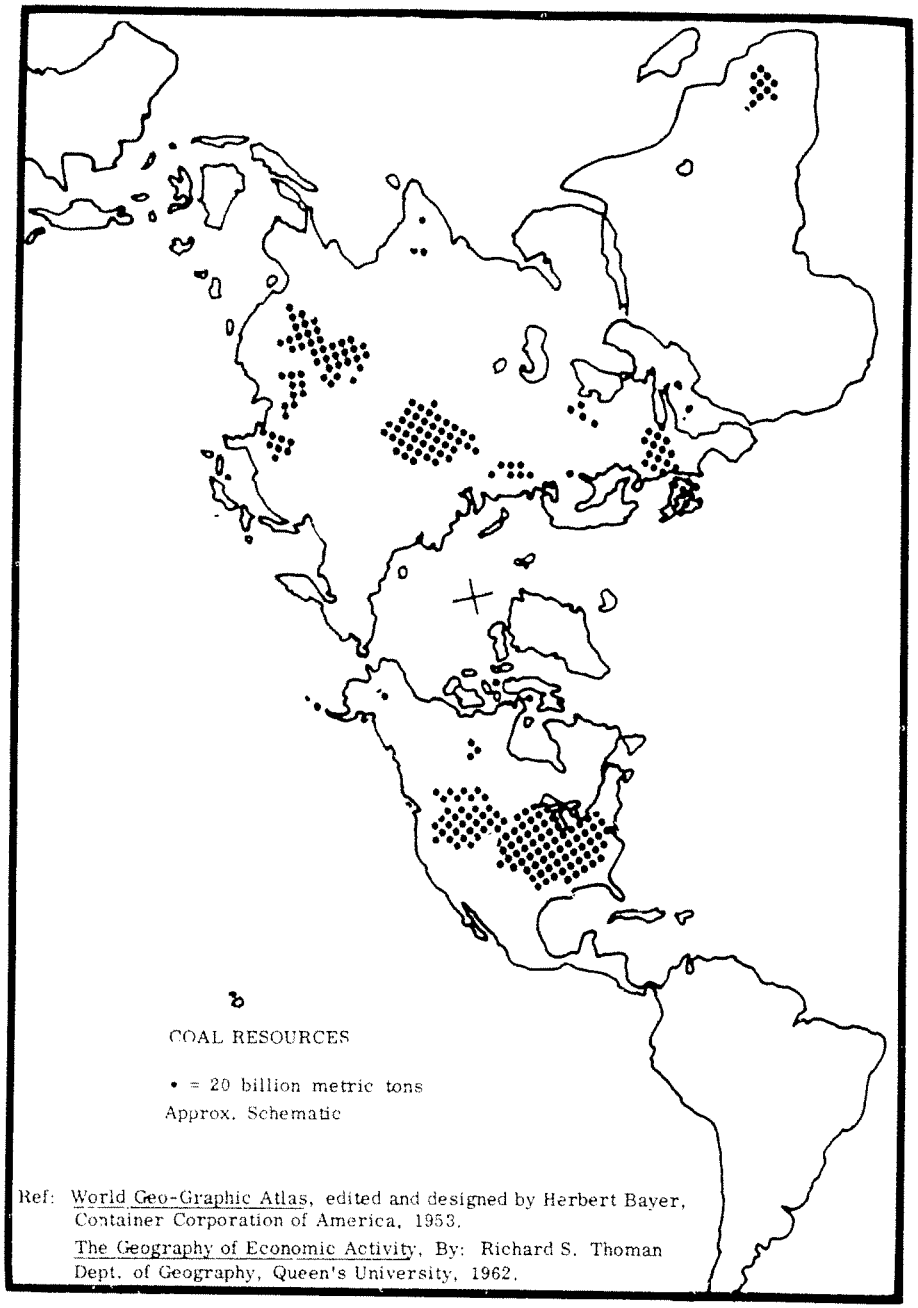
(How much electric power is needed to produce a ton of food?
What is the present protein distribution per capita throughout the world?)

Calories used in different activities (per hour):

lying in bed	77
sleeping	65
sitting at rest	100
walking slowly	200
standing	105
working (painting, carpenting)	240
running	570
swimming	500
walking upstairs	1100

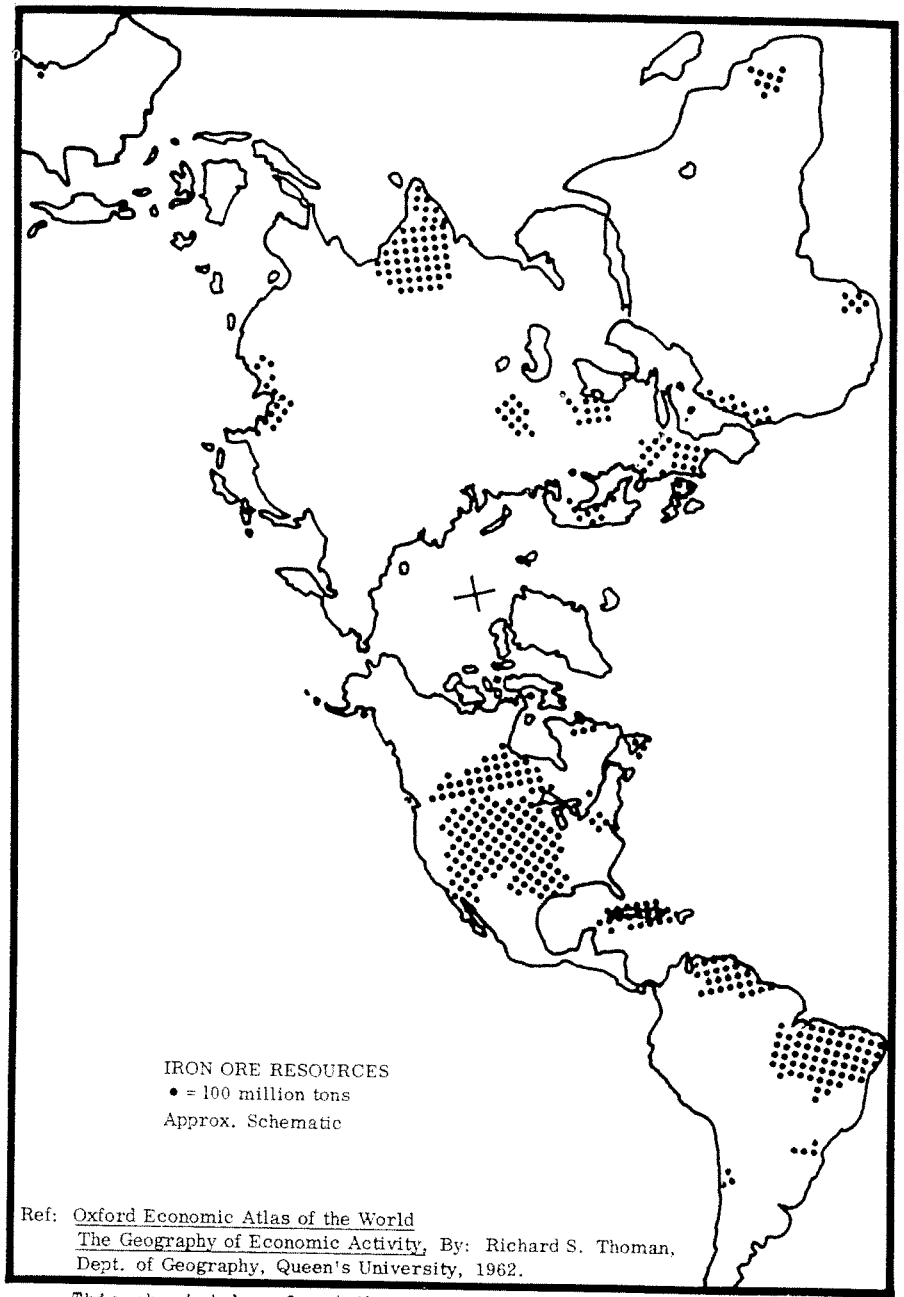
(What is the effect of interruption on human thought?)

world food production in '67:
570.82 million metric tons animal products
1,457.65 million metric tons vegetable products



Ref: World Geo-Graphic Atlas, edited and designed by Herbert Bayer, Container Corporation of America, 1953.
The Geography of Economic Activity, By: Richard S. Thoman Dept. of Geography, Queen's University, 1962.

This chart taken from: World Design Science Decade, Document 1
by R. B. Fuller and J. McHale, p. 38
Southern Illinois University 1963



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This chart taken from: World Design Science Decade, Document 1
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Southern Illinois University 1963

(How much bulk food is produced (in Calories)?
How much copper, aluminum and steel is involved in food production?)

at present it takes 42 kwh to produce 1 metric ton of food

(What is wealth?
What are the areas of the world in which no electrical power exists?)

average per capita protein consumption for world: 68 grams (of which 20 are animal protein)
average per capita Calorie consumption for world: 2400 Cal

(What is the optimum Caloric intake of the world?
What is the highest (lowest) per capita food intake and where?)

the livestock in the world are equal to an additional 15 billion people eating (consume 1/4 of total food crops produced)

(Where are all the airports throughout the world located?)

world per capital consumption of apparel fibers in '65: 7 kg

(Can man's knowledge of his universe be conceived entirely in measurable terms?)

'65 world tonnages of fibers:		
	23 million	all fibers
	17	natural fibers
	3.8	manmade fibers
	2	(non &) cellulositic fibers

energy slave the total energy income for the earth as measurably consumed by man in one year, and dividing this by 25 to give a four per cent figure of energy gainfully employed at present rate of overall efficiency. This net energy used, as expressed in kilowatts per year, is divided by the world population of the year, working 8 hours a day. This gives the number of electromechanical energy slave units available.

(How does our planet impound energy?)

energy slave 37.5 million ft lbs of energy

(Are all of man's experiences accommodated by words in his dictionary?
What is the speed and lift capability of a helicopter? How big is the biggest helicopter?
What is the per capita consumption of electrical energy in the U.S. today?)

world electrical energy production--'65 to '66--average annual rate of growth 7.8%

(Of what is the planet earth made? physically and metaphysically?)

nuclear plants in the world ('65) 17,537 (in 67 countries)

(What was the first industrial tool?)

steel production in '65	210 million metric tons	(50% scrap recycle)
aluminum	5.2	(primary production)
copper	4.2	(primary production)

(What is the total tonnage of copper, aluminum and steel in the world? How is it being utilized?
What are our fossil fuel reserves?
How many kwh does it take to make 1 ton of plastic as compared with 1 ton of steel? of aluminum?
How much scrap metal is available to us throughout the world?
Approximately how much more metal can we expect to find in the earth?)

motor vehicles produced in '66: 19 million passenger and 5.5 million commercial

(How much of what metals is being allocated for transportation?
How much gasoline was burned by cars last year?)

it takes 371 kwh to produce 1 automobile

(What is the net physical wealth of world man?
How are we presently using our resources?)

daily newspapers ('62):		
	Asia	1736
	Oceania	114
	Europe	2403
	USSR	457
	Africa	188
	N Amer	2161
	L Amer	765

(What is meant by ''anticipatory design science''?
How much energy does man require to travel at different speeds?)

World ('65)		
book production (titles)		450,000
periodicals		200,000
journals, tech. reports		200,000

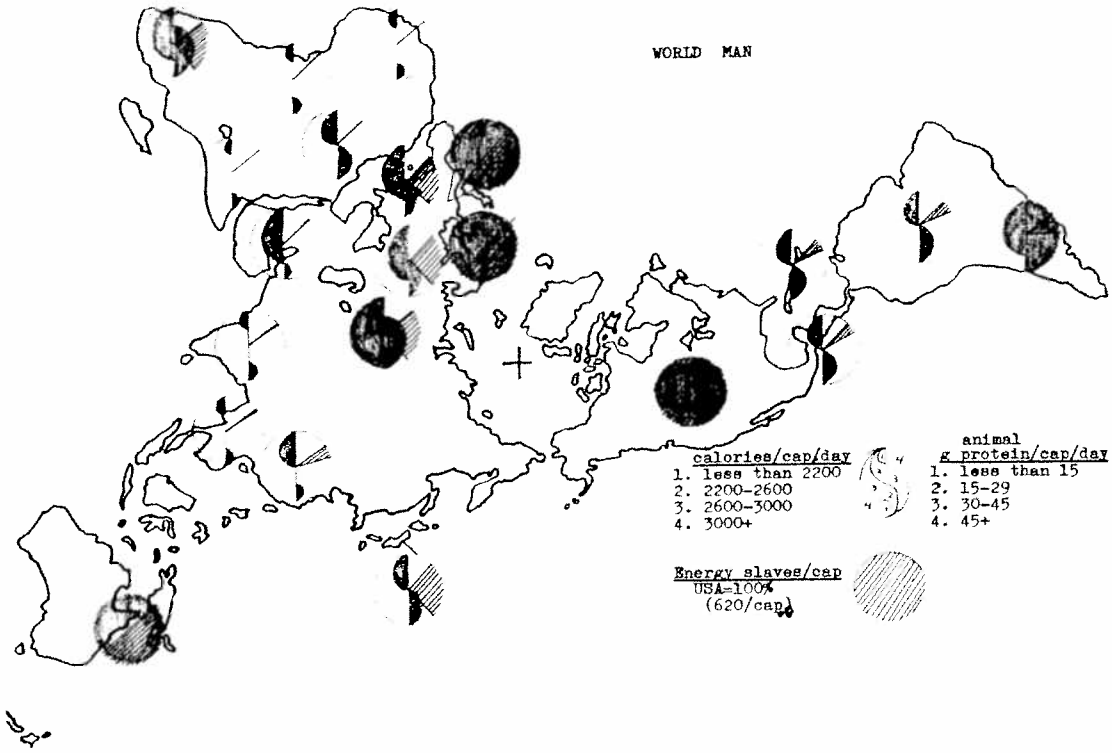
(What are the essentials which a country must have in order to industrialize?
How smart is the world?)

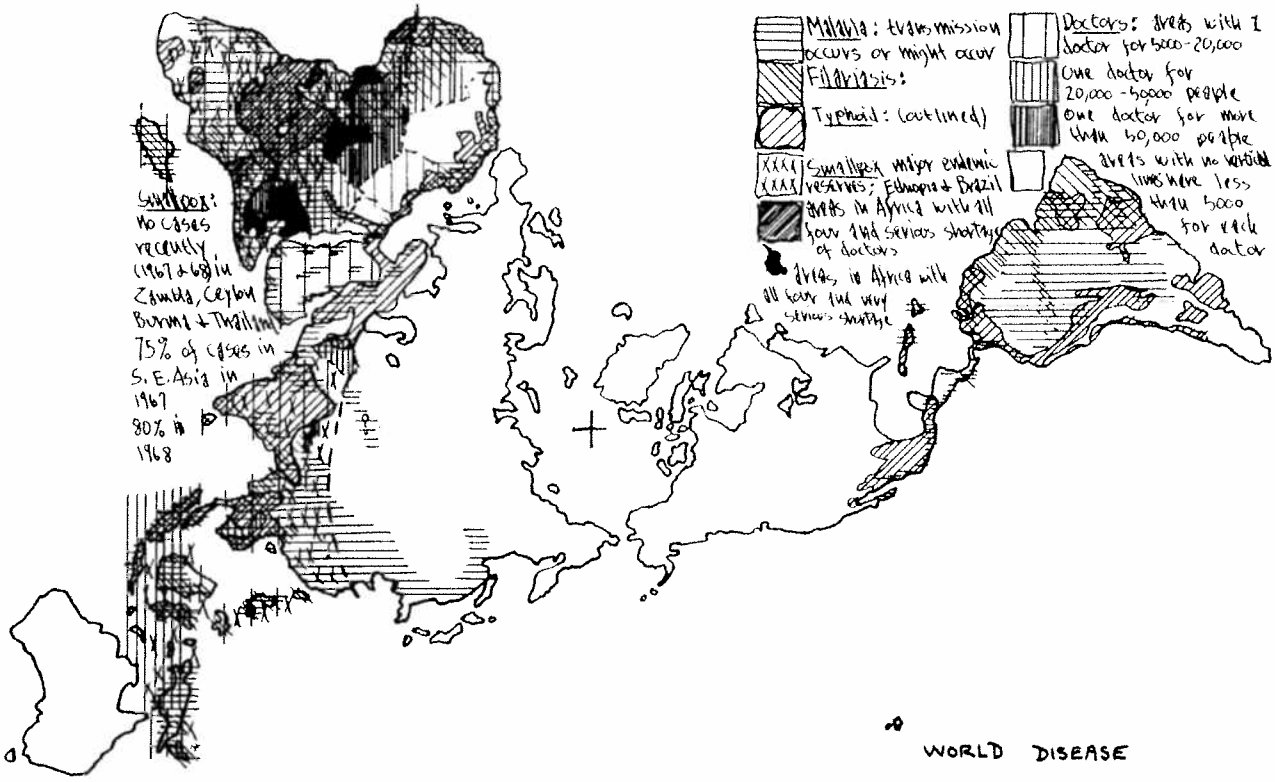
radios per 1000 inhabitants ('60):	
Africa	28
N Amer	720
Asia	22
Europe	220
Oceania	198
USSR	205
world avg	130

(What is meant by reinvestable time?
What is the present rate of literacy; how is it distributed and at what levels throughout the world?
How are resource inventories arrived at?)

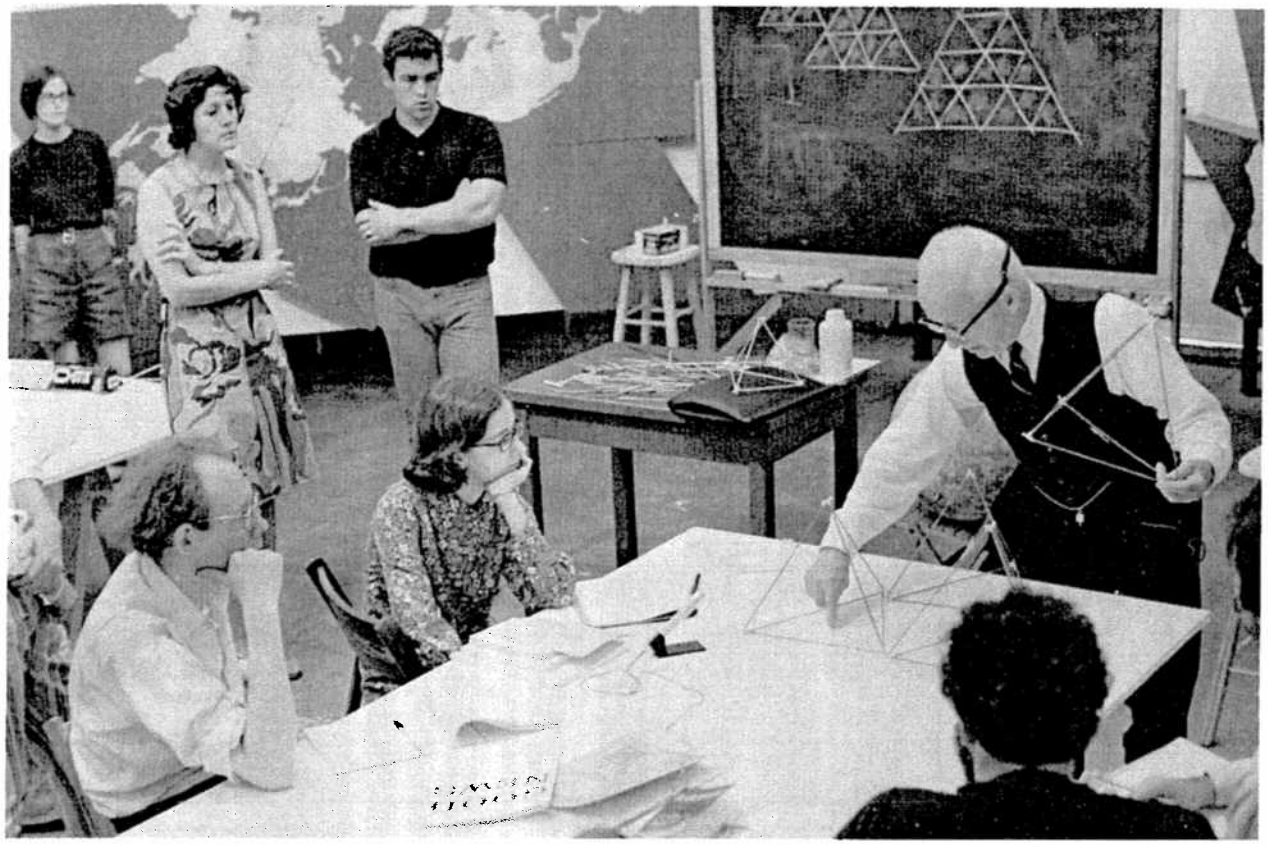
% illiteracy:

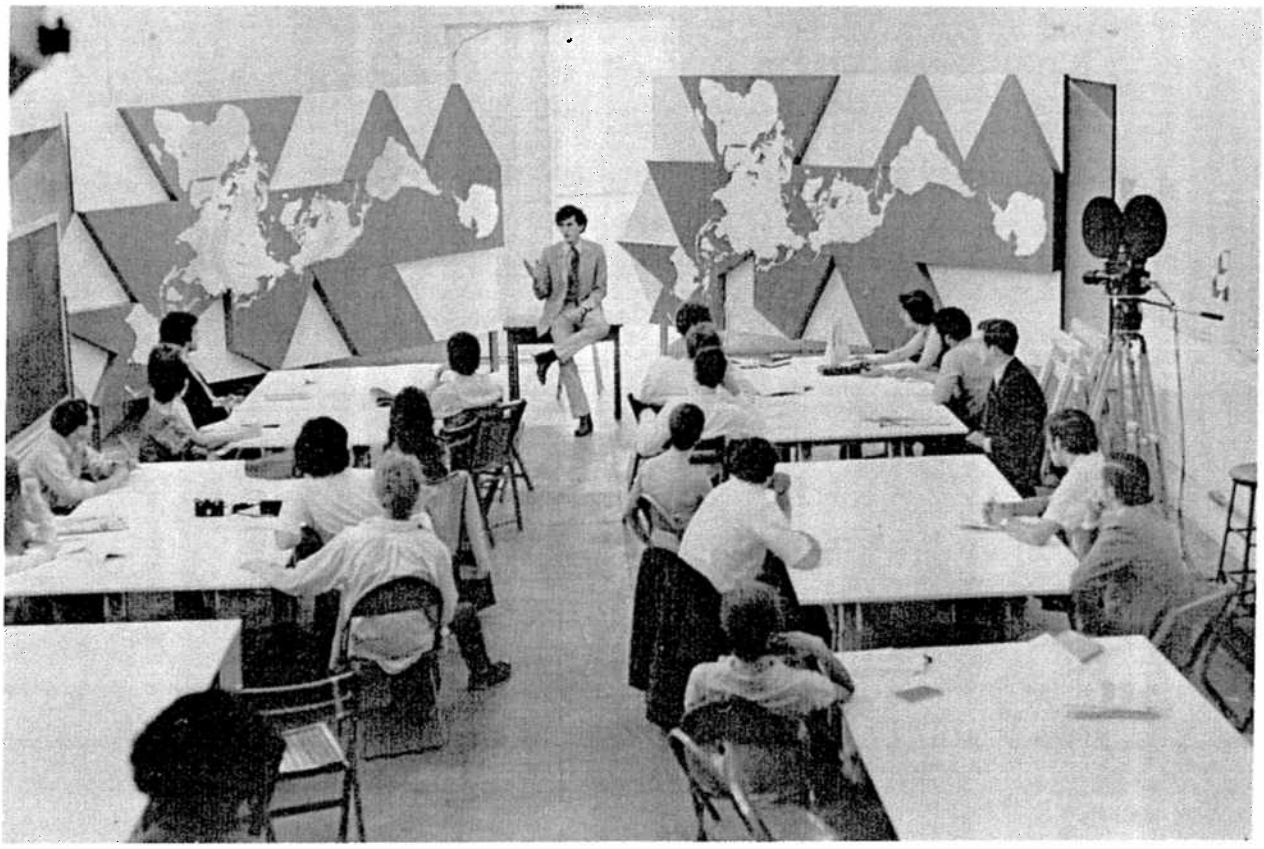
age	Afr	NAmer	SAmer	Asia	Eur	Oceania
15-19	66.5	17.5	18	37.5	6.5	4.5
20-24	70.5	21.4	23.5	43	8.5	4
25-34	75	22.7	32.6	47.8	10.3	4.8
35-44	73.6	24.3	33.9	54.6	13.8	6.8
45-54	85	30.5	37.6	61.7	18.5	9.8
55+	83.3	38.5	46.8	70.2	28.8	13.5


WORLD MAN
calories/cap/day
1. less than 2200
2. 2200-2600
3. 2600-3000
4. 3000+
animal
g protein/cap/day
1. less than 15
2. 15-29
3. 30-45
4. 45+
Energy slaves/cap
USA=100%
(620/cap)


Smallpox:
No cases recently (1967 & 68) in Zambia, Ceylon Burma & Thailand
75% of cases in S.E. Asia in 1967
80% in 1968
Malaria: transmission occurs or might occur
Filariasis:
Typhoid: (outlined)
Smaller major endemic reserves; Ethiopia & Brazil
areas in Africa with ill four and services shortage of doctors
areas in Africa with ill four and very services shortage
Doctors: areas with 1 doctor for 5000-20,000
One doctor for 20,000-50,000 people
One doctor for more than 50,000 people
areas with no statistics but where less than 5000 for each doctor
WORLD DISEASE

	1965 1 TOTAL ENERGY CONSUMPTION × 10^6 MT	1965 2 HYDRO + NUC. EL. ENERGY CONSUMPTION × 10^9 KWH	1965 3 THERMAL EL. ENERGY CONSUMPTION × 10^9 KWH	1965 4 THERMAL EL. ENERGY WAT. EQUIV. × 10^6 MT	1965 5 TOTAL ELEC. ENERGY CONSUMPTION × 10^9 KWH	1965 6 TOTAL NON-EL. ENERGY CONSUMPTION × 10^6 MT	1965 7 POPULATION 1965 × 10^6	1965 8 EL. ENERGY CONSUMPTION PER CAPITA KWH/yr.	1965 9 NON-EL. ENERGY CONSUMPTION PER CAPITA Kg/yr.	1965 10 ENERGY SLAVES PER CAPITA (EE + 4% NEE)	1965 11 TOTAL ENERGY SLAVES × 10^9
WORLD	5222.7	923.5	2425.9	1455.5	3349.4	3767.2	3331.3	1006	1131	97.5	324.8
EAST ASIA	534.8	94.0	167.1	100.3	261.1	434.5	905.3	288	480	31.7	29.0
SOUTH ASIA	166.6	24.5	44.7	26.8	69.2	139.8	975.5	71	143	8.3	8.1
Middle South	94.6	17.3	22.6	13.6	39.9	81.0	659.6	61	123	7.1	4.7
South East	27.5	4.1	8.8	5.3	12.9	22.2	248.5	52	89	5.8	1.5
South West	44.5	3.1	13.3	8.0	16.4	36.5	67.4	243	151	20.6	1.4
EUROPE	1417.5	323.4	675.3	405.2	998.7	1012.3	441.3	2265	2296	213.8	94.4
Western	518.1	104.8	264.6	158.8	369.4	359.3	140.3	2636	2568	236.2	33.1
Southern	159.4	82.7	56.7	34.0	139.4	125.4	122.4	1138	1028	104.4	12.8
Eastern	370.2	9.2	161.0	96.6	170.2	273.6	100.6	1683	2709	182.8	18.3
Northern	369.8	126.7	193.0	115.8	319.7	254.0	78.0	4103	3256	365.4	28.5
USSR	832.8	81.4	425.3	255.2	506.7	577.6	231.0	2191	2501	213.4	49.2
AFRICA	88.0	14.3	44.3	26.6	58.6	61.4	306.2	193	201	18.3	5.6
Western	5.6	.4	2.1	1.3	2.5	4.3	97.8	25	44	2.9	.3
Eastern	8.2	5.2	1.1	.7	6.3	7.5	82.8	76	91	7.5	.6
Middle	1.5	3.8	.6	.4	4.4	1.1	30.3	147	36	11.1	.3
Northern	18.3	4.8	6.4	3.8	10.6	14.5	75.4	141	192	14.5	1.1
Southern	54.4	.1	34.6	20.8	34.7	33.6	19.9	1735	1683	161.8	3.2
NORTH AMERICA	1939.6	318.0	984.0	590.4	1302.0	1349.2	214.3	6684	6305	619.3	132.7
SOUTH AMERICA	111.1	40.0	32.4	19.4	72.4	91.7	165.6	436	553	43.7	7.3
MIDDLE AMERICA	46.0	10.3	10.0	6.0	20.3	40.0	55.3	364	727	43.3	2.4
CARIBBEAN	23.0	.5	11.0	6.6	11.5	16.4	22.8	504	713	52.3	1.2
OCEANIA	60.8	17.2	30.5	18.3	47.7	42.5	14.0	3407	3036	301.5	4.2





Finding the needs of one man led us to finding the needs for mankind. As we began to deal with man on the collective level we realized the need for establishing a frame of reference or conceptual tool to deal with collective mankind's needs. The ''bare maximum'' was what evolved. Rather than take what was thought to be the bare minimum for mere subsistence levels, we elected to establish levels which would allow man to realize, (What is the bare maximum frustration level for man?) not his minimum potential, but his maximum potential. Anything less than this being, by our definition, sub-human. (What is pain?) So, in looking at calorie levels, we found the highest calorie needs to be that of pregnant women who need 3300 Cal/day and that of working men who need 3500 Cal/day. Thus if we could insure that caloric level for the world no one would be deprived. We did the same for protein levels. Between 30 and 45g of total protein per day is the minimum level of protein that must be replaced by the body; we therefore took 90g of protein/day as the bare maximum which should be available to everyone. (How many acres per capita are necessary to produce the bare max food requirements?) (What are the minimum requirements that would give us the most survival?)

In order to supply mankind with his internal needs we found it necessary to evolve a bare maximum parameter for external metabolics which would guarantee the maintenance of man's internal metabolics. This bare maximum is 1242 energy slaves per capita per year in 2000 A.D. Broken down, that is 15,000 kwh and 8 metric tons of coal equivalents per capita per year. This non-linear yardstick for establishing external relative levels of the development of man's potential to be ''human'' was arrived at by taking the projected U.S. needs (present need is 7,000 kwh) for 2000-because it was the maximum, or in this case the highest-using these parameters we found that manking will need a total 100 trillion kwh, 8.5×10^{15} Calories and 21.9×10^{7} tons of protein in the year 2000. We used the U.N. figures on the projected population for these calculations, (What is the best visual presentation for all our incoming data?) (How can the bare max requirement be made available to all?) choosing to use the

relatively high figures that didn't take cognizance of the trends towards the stabilization of the population for the same reasons we chose the highest figures for our other bare maxima.

(how do the bare max requirements compare with the present per capita consumption?) What is the bare max of communications systems for the world?) (At present what percentage of the people can be guaranteed bare max?) (What is the bare max for transportation?)

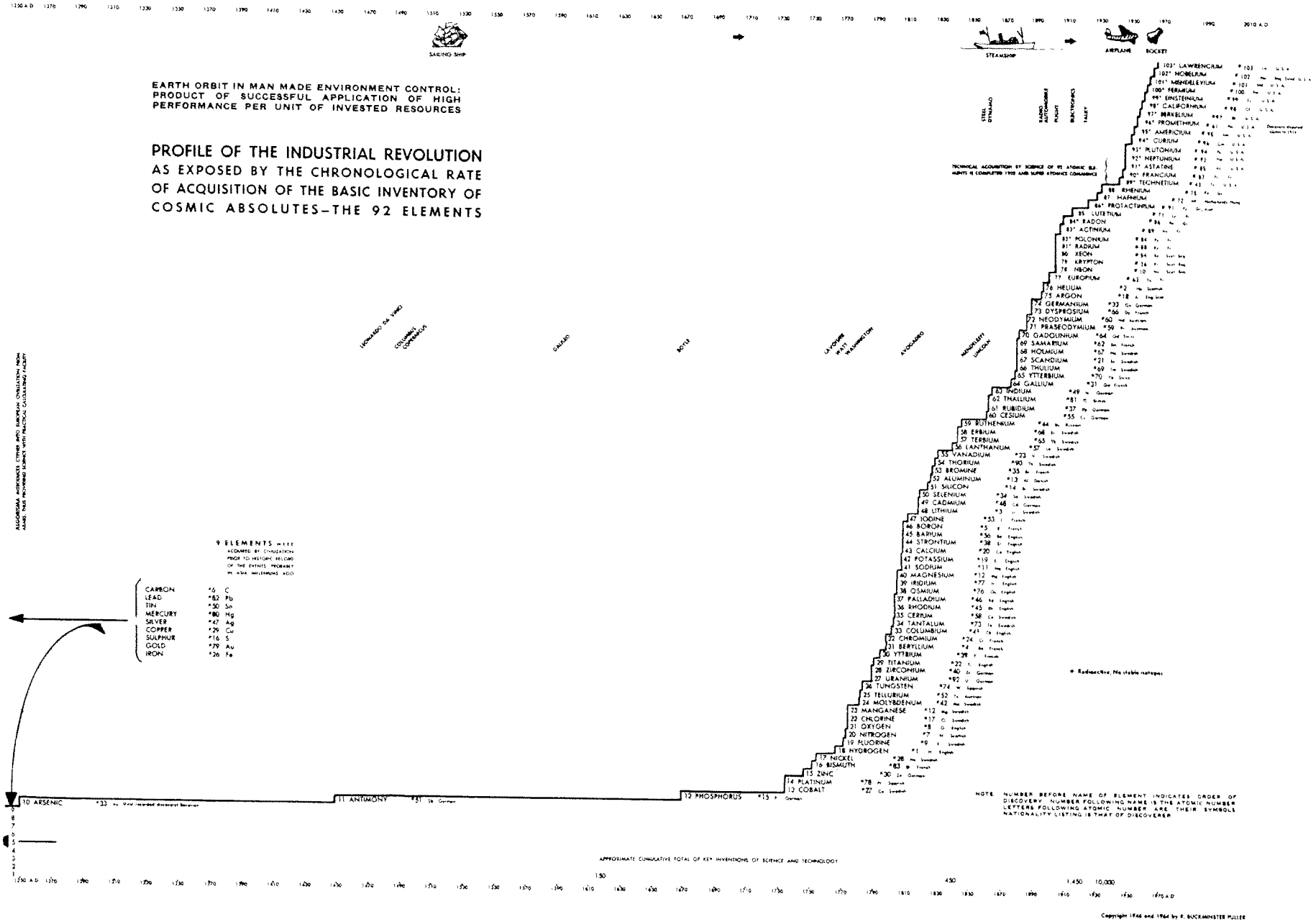
In order to correlate the vast amounts of data we were accumulating about the world we devised a chart with which we could clearly display visually our basic working information. The chart was a triangular grid on which one of the three axes were the 22 major geographical areas of the world and their individual countries. The second axis consisted of, in five year increments from 1965 to 2000, figures on population, population density, calorie and protein intake, total kwh, metric tons of coal equivalents and energy slaves, and per capita kwh, metric tons of coal equivalents and energy slaves. The last axis could indicate up to 20 possible world trends for each area and country (we used 13: fossil fuel potential, life expectancy, mortality rate, arable land, housing, amounts of copper, aluminum and steel, food literacy, reinvestable time and hydropower).

The chart was four feet high and stretched 60 feet around the ''game room.''

We also employed two 10' by 15' Dymaxion World Maps with five clear acetate overlays each to visually present our data on a geographical ''whole earth.'' Information about the world's metals sources, World Man, the power network, alternate power sources, present population and 2000 projection, food production and transport, was presented on seven of the overlays while three remained free for use during game playing.

EARTH ORBIT IN MAN MADE ENVIRONMENT CONTROL:
PRODUCT OF SUCCESSFUL APPLICATION OF HIGH
PERFORMANCE PER UNIT OF INVESTED RESOURCES

PROFILE OF THE INDUSTRIAL REVOLUTION
AS EXPOSED BY THE CHRONOLOGICAL RATE OF ACQUISITION OF THE BASIC INVENTORY OF COSMIC ABSOLUTES—THE 92 ELEMENTS



II Scenario

Once we knew what mankind had and what he needed to have, we began to experiment with ways he could go about getting his needs. These ''ways'' we called scenarios. (What are the ways in which man may be enabled to participate more effectively in his relation with the universe?) Throughout our work we found ourselves returning to one common denominator. (Can you industrialize an area without electricl power?) (How can man take care of all of his essential physical needs so as to allow himself to develop his unique metaphysical abilities.) Whether we had researched food, communication, travel, housing, or economics we always returned to electrical energy once we began to formulate any hypothesis about satisfying man's needs. (What are the priorities of the tasks that need to be done in terms of doing more with less?) In order to enable people to be fed properly, we found that they would first have to have a sufficiently high input of electrical energy to process, transport, and store food and dispose of wastes. We found that, when dealing with collective mankind, it was imperative that we attend to man's external metabolics first, and these would then take care of individual man's internal metabolics. Thus the ''energy scenario'' became our first move in the World Game. (What is the first thing you must bring to a non-industrialized area?)

After researching and then plotting the world's electrical network (generating stations and transmission lines) on one of our dymaxion world maps we devised a way of developing and improving its overall efficiency as the first step towards the bare maximum for all mankind. (How long would it take to get a minimum of kwh distributed throughout the world?) By utilizing the world's hydroelectric power (rivers and tides), without any further development of thermal plants and taking advantage of the increased efficiency of super high voltage (1,000,000 volt) long distance (1500 mi) (What are the efficiencies of electrical transmission lines?) transmission lines (How much copper wire is needed to carry the power needed by the year 2000 for both industrial and home use throughout the world (with present efficiency)?) in a day/night and seasonal hookup, we were able to demonstrate that with present methods (What is the relationship of efficiency to availability of energy throughout the world?), technologies, projected population figures, metals resources, and efficiency levels in power generation and consumption, it would be possible to bring everyone on earth to a minimum 2000 kwh per year by 1980. (How far ahead can we conceive a future life-style?) 2000 kwh is the present level of Europe and as such not below our projected bare max of 15,000 kwh for the year 2000, because with Europe's level of industrial development it would be possible to raise the per capita kwh to 15,000 by the year 2000. (What's the time lag between installation of electrical energy and an adequate food supply?) (How much metal is involved to produce the kwh needs for the year 2000?) When the energy input of an area is raised, there is a corresponding rise in communications capacity which in turn increases the necessity of the ''have-nots'' to become ''haves'' (What is the comparison between present availability of communication systems and the bare max essential for industrialization?) (Is it more efficient to have many small decentralized electrical generating units than one large unit?).

In the scenario the vast hydroelectric potential of both South America and Africa (How much metal is essential to meet the power needs of India, China, Africa and South America?) is utilized to raise their respective levels to the per capita figure of 2000 kwh and the surplus transmitted via the electric network to areas where there are deficits of electric power (What is the sequence of industrialization?). Because we do not have a global network at the present time, the U.S. and other industrialized countries produce and use during the night hours only a small percentage of their electrical power capacity (What degree of communication is necessary to bring electrical energy into an area?). With a global electric grid, power could be generated at day and night total capacity and transmitted to the daytimy peak needs around the earth. (Using our present technology, can we provide electrical needs for everyone without polluting our air beyond human endurance?) (What is pollution?)

	Hydroelectric Power			
	Capacity ($\times 10^3$kw)	Production ($\times 10^6$kwh)	Potential ($\times 10^9$kwh)	Undevel. potent. ($\times 10^9$kwh)
east Asia	20118	86951	528.7	442
south Asia	6088	24397	1991.2	1967
Europe	83128	299682	629.8	330
USSR	22244	80617	1407.5	1327
Africa	3740	13255	3210.0	3197
N America	66260	313694	903.6	590
S America	8956	36814	2173.0	2137
Middle America	2666	8523	319.0	311
Caribbean	148	340	15.0	15
Oceania	4240	16786	184.0	167
world	217588	881059	11361.8	10480

Efficiencies of Power Sources:

fossil fuel (coal and oil)	40%
nuclear power plants	40%
magnetohydrodynamics	55%
fuel cells	40 to 60%
thermoelectric	40%
thermionic	10%
heat engine	32%
solar furnace	70%
silicon battery	15%
fusion	10%
hydroelectric	80%

The scenario utilized hydroelectric power for other considerations than what is presented above; besides the efficiency and pollution problems of thermal plants it became overwhelmingly apparent that our ''savings account'' of fossil and nuclear fuels would soon be depleted at the bare maximum level of consumption. Our constantly replenished ''income'' energies were the obvious choice (How long does it take to build a hydroelectric plant?).

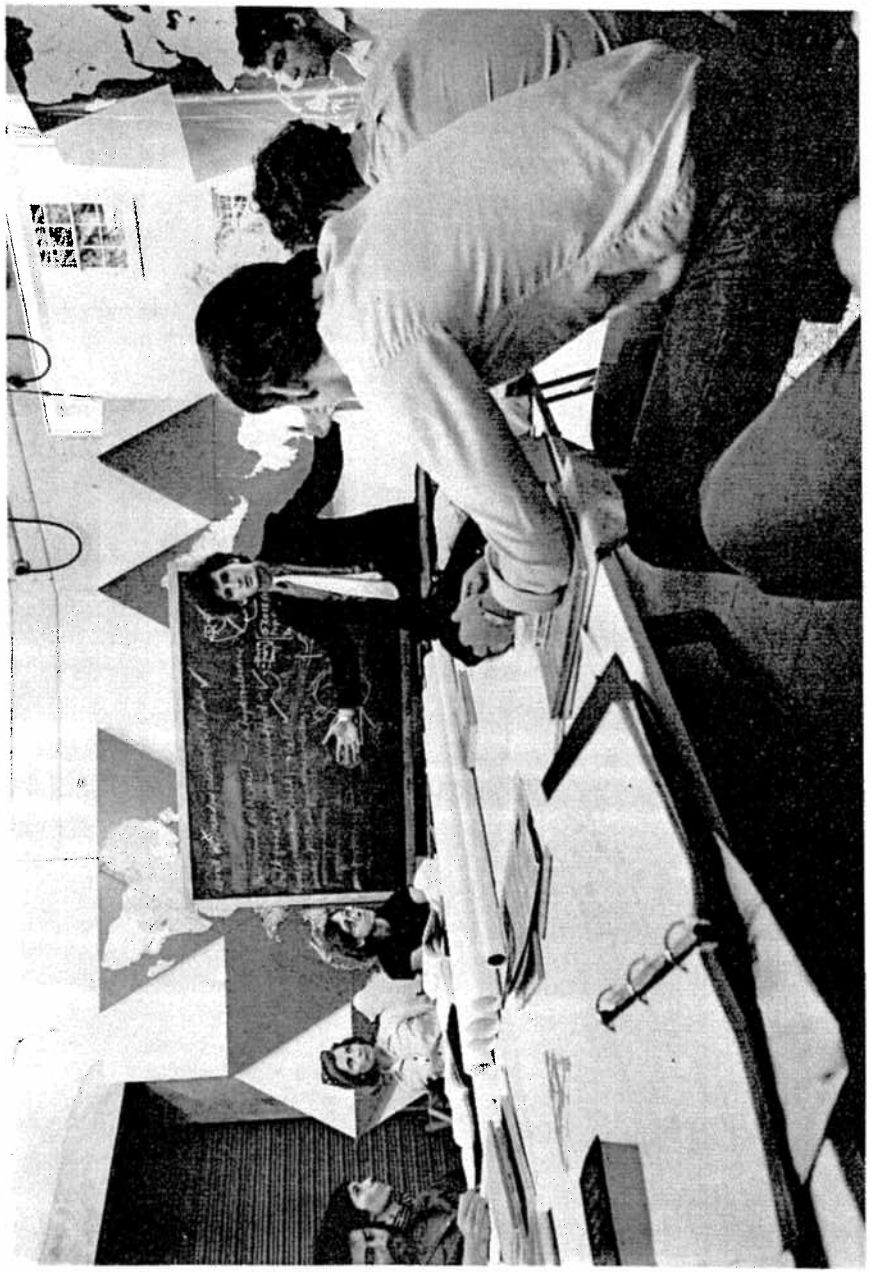
The amounts of metals, principally copper, aluminum and steel, that would be needed for such an undertaking-approximately 9000 tons of steel per 1000 million watt hydroelectric plant and 60 tons of steel and 25 tons of aluminum for a mile of power line (at present efficiencies)-are within grasp of earth's present economic and industrial development (How can we accelerate efficiency throughout the world?). We chose to keep efficiency levels and technological competence at present levels to show we could do this today, with what we have (How much metal is needed for 100 miles of power lines?). (When is a game a game?)

After demonstrating man's potential competence for bringing the world average per capita kwh up to 3613 with no one below the present European level of 2000 kwh, stage two of the electric scenario began. Utilizing increased efficiencies, technological progress such as laser beam power transmission, and some of the earth's varied income energy (What is the potential kwh from wind power? Tidal power?) sources the per capita level of kwh is brought up to the 15,000 bare max in the year 2000.

Furnishing an area with enough electric power for its industrialization brings to that area the potential to satisfy its bare max food requirements. Knowing from the energy scenario that we could count on using 2% of the total electric power for agricultural uses (What percentage of electric energy is essential for food production?), we then looked at ways to increase the per capita Calorie and protein levels to the bare max. A startling fact which became obvious upon looking at food production was that the world produces more than enough to feed its people adequately, but that in transport, storage and pro-

cessing 90% of the tonnage of food is lost (How do we identify waste?). If we could bring methods to increase worldwide efficiency, at the rate we increased food production in the past, the world could feed its population for some time to come. Shipping food halfway around the globe is inefficient (for ex: in '67 Asia imported and exported the same amounts of rice). Ships could be used to transport materials not native to a particular area or the metal from the ships could be used more profitably elsewhere. Part of the electrical power set aside for agriculture could be used to increase efficiencies in short transport to some areas (because of their low farming efficiency) we needed to look at ways to increase production efficiency. The increased use of fertilizers and farm equipment, in addition to the increase in knowledge of farming brought about by the higher communications capabilities, would be helpful (also the possible use of pesticides or other pest control facilities after their ecological implications had been thoroughly examined). (What is the ratio between dairy and beef cows?) (Does the world need tractors?) (What are the key problems for meeting the food needs by the year 1980?)

The above methods could bring the needed increase in efficiency necessary to have the entire population at bare maximum by 1980. The efficiency would be somewhere between the U.S.'s (feeding about 2 people/acre) and Japan's (feeding 6 people/acre). (What period of time did it take for Japan to become industrialized after WWII? Why?) It would be difficult to raise the world's efficiency to that of Japan's using her methods because a tremendous amount of manpower would be drawn into agriculture (approximately 40% of her people are engaged in agriculture as opposed to 9% in the U.S.). (How many man hours are involved in building a hydroelectric plant?) There are many new ways to produce food of which the following are just a few examples—using algae (Chlorella and others) for food, feeding bacteria plant wastes (such as stalks, sawdust) and letting them convert these to food for man, and synthesizing amino acids. However, we didn't employ them in our scenario because we

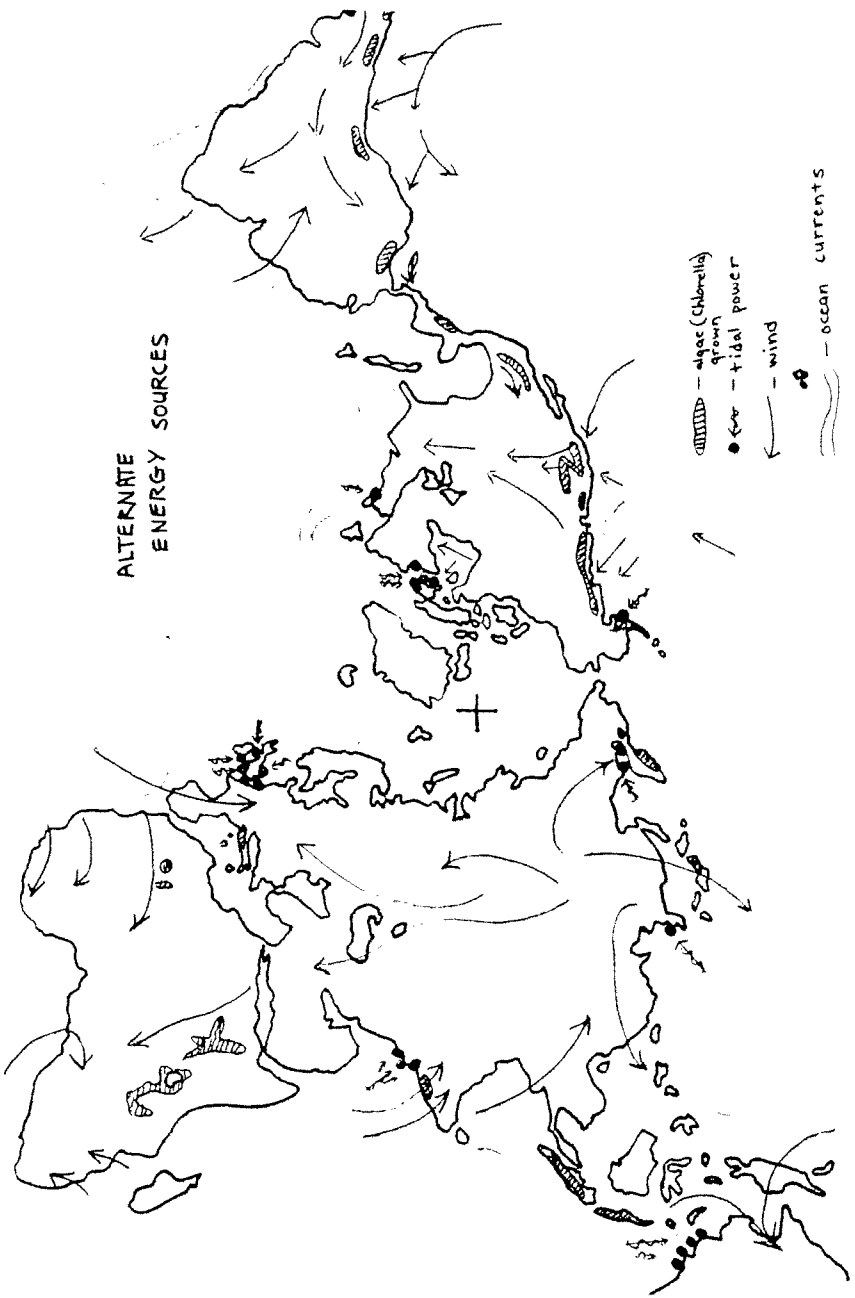


did not want to make a move which would assume changing people's food habits.

Looking past 1980, continuing to feed the population using old methods, although possible, would demand an increasing amount of manpower. (How much food is being used annually on airlines?) However, we felt that the metaphysical manpower released by this time-reinvestable time-would cause a fundamental change in agriculture. (Do areas of inefficiency indicate underdeveloped capacities?) (How does protein manifest as a source of metaphysical energy?) The change would be the transformation from a craft (an essentially open system) to an industry (closed system). At the present, most of the important variables in farming are not controlled. (What are the various acidity ratios of rain throughout earth?) In a closed system such variables as weather effects, insect pests, loss of water and nutrients-would be controlled or the detrimental effects eliminated. One experimental system could feed 500 people/acre-which would mean a population of 6 billion people could be fed using only 24 thousand square miles of land (we're now using around 7 million square miles), or approximately the area Japan uses to feed her people today.

Given enough electrical power, the external metabolics, the earth could feed as many people as she needed-up to 7.8 trillion, for example, on presently farmed land using the aforementioned experimental system.

From this scenario we went on to examine some of the effects these scenarios would have on other areas of man's life.



ELECTRICAL ENERGY - PROJECTIONS

	1965		1970		1975		1980		1985		1990		1995		2000	
	Per Capita El. Energy Cons KWH	Total El. Energy $\times 10^9$ KWH	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total
WORLD	1006	3349.4	1544	5405.5	2025	8005.7	3613	15697.9	6314	30389.9	9216	49329.6	12049	71836.5	15000	99720.0
EAST ASIA	298	261.1	340	309.7	620	424.5	2100	2186.1	5200	5761.6	8500	10030.0	11700	14543.1	15000	19620.0
SOUTH ASIA	71	69.2	120	132.7	400	502.8	2100	2994.6	5200	8366.8	8500	15385.0	11700	24254.1	15000	35250.0
Middle South	61	39.9														
South East	52	12.9														
South West	243	16.4														
[redacted] EUROPE	2265	998.7	4100	1869.6	5900	2778.9	7700	3749.9	9500	4797.5	11400	5945.0	13200	7167.6	15000	8445.0
Western	2636	369.4														
Southern	1138	134.4														
Eastern	1683	170.2														
Northern	4103	319.7														
USSR	2191	506.7	4000	984.0	5800	1513.8	7700	2140.6	9500	2921.5	11400	3625.2	13200	4329.6	15000	5220.0
AFRICA	193	58.6	260	90.0	520	204.4	2100	945.0	5200	2750.8	8500	5406.0	11700	8786.7	15000	13305.0
Western	25	2.5														
Eastern	76	6.3														
Middle	147	9.4														
Northern	141	10.6														
Southern	1735	34.7														
NORTH AMERICA	6644	1352.0	7900	1809.1	9000	2223.0	10200	2733.4	11400	3340.2	12600	4057.2	13800	4871.4	15000	5820.0
SOUTH AMERICA	436	72.4	480	90.2	720	159.1	2100	518.7	5200	1523.6	8500	2958.0	11700	4867.2	15000	7470.0
MIDDLE AMERICA	369	20.3	420	27.7	660	51.5	2100	145.3	5200	592.8	8500	1190.0	11700	2012.4	15000	3180.0
CARIBBEAN	504	11.5	560	14.6	820	23.8	2100	67.2	5200	147.6	8500	374.0	11700	608.4	15000	915.0
OCEANIA	3407	47.7	4100	77.9	5900	123.9	7700	177.1	9500	237.5	11400	319.2	13200	396.0	15000	495.0

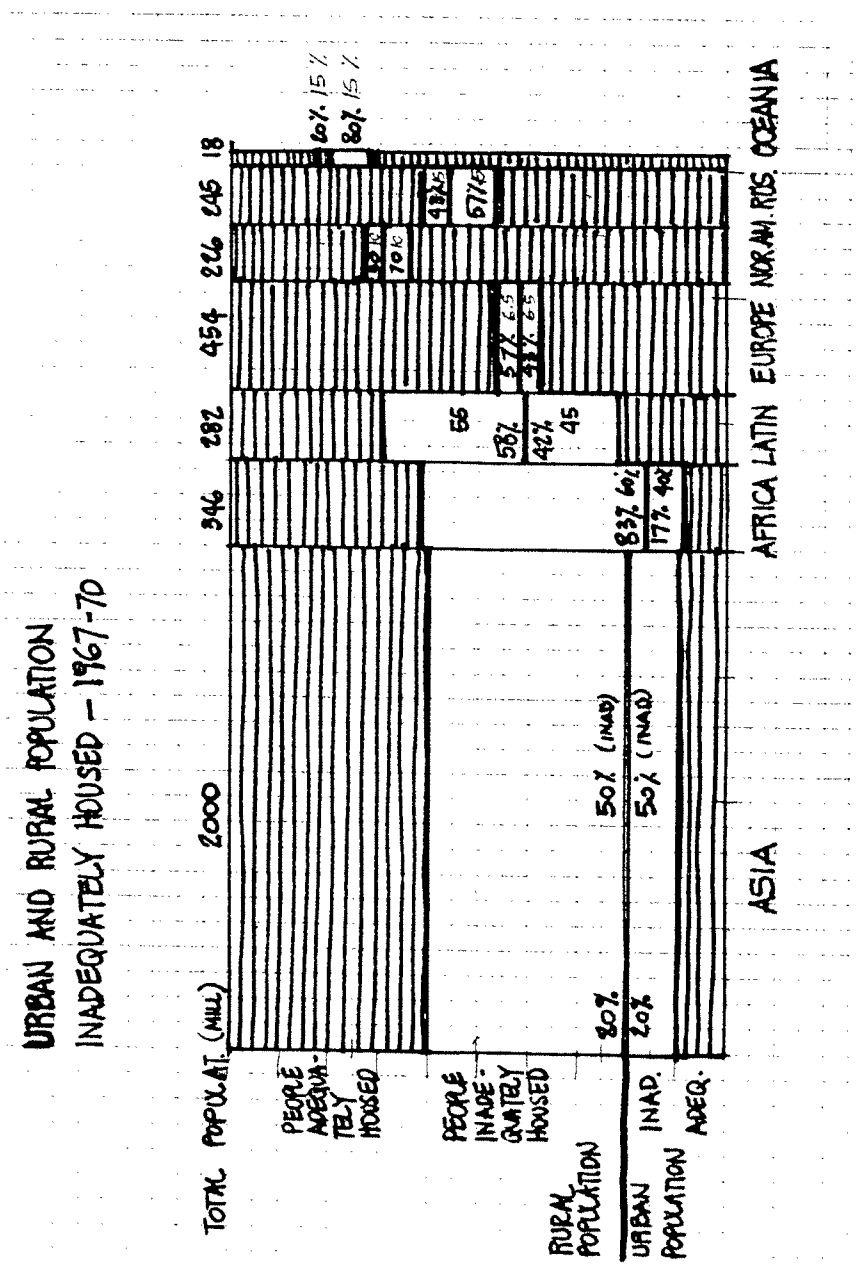
III Future Directions
(Discovered, uncovered, but not covered scenarios, trends, and etc.)

After working out scenarios for satisfying what we considered the two most vital bare maxima, external electric energy and internal food supply, we evolved into some of the possible synergetic scenarios that would result from the first moves.

The establishment of bare max levels of the above throughout the world would engender the need for bare max's in housing, medical attention, income, communications and travel.

The housing scenario we were working on clearly showed the inadequacy of our present system. At the present rate, the use of metals in housing would prove to be totally insufficient. Metaphysical engendered materials such as the plastics will have to be developed if we are to solve mankind's housing needs. The housing scenario encompassed more than just the shelter needs of the world? as it evolved we saw that it would encompass communications and mobility. With the trends of increasing mobility throughout the world, we foresaw the possibility that no one would be staying at any one place long enough to warrant the construction of ''permanent'' shelters. As a total service facility, the housing needs would encompass not only shelter but communications—with its own resultant education (via TV, computers), medical information and attention (via telephone to a world central medical computer), personal telephone contact with anyone, anywhere, and mobility—with anyone going anywhere.

Some future directions/scenarios we brushed upon were the possibilities of a world guaranteed annual income, the potential of fluidics as a source of energy, information and automation, the use of heat pollution from thermal electric plants to heat soil to improve crop output, the efficiency gain by using



gasoline or alcohol to run electric power plants and electricity to run cars, the production of alcohol from algae, farm wastes, or garbage and its substitution for gasoline in present day combustion engines, the laser beam transmission of power and information, the amount of reinvestable time that will be available to mankind as a result of freeing him from the drudgery of having to ''earn a living'' (by bringing man to the bare max food and energy levels, by the year 2000 we will have 16 trillion more hours per year than at present to reinvest into the metaphysical regenerative functions), the increase of efficiency rates for power production and consumption, communication, transportation etc., and the possible surplus and increase of efficiency through the stabilization of the population.

Many other possible trends were intuitively uncovered throughout the course, most of them needing research for verification. They are presented here as a few possible steps towards working out future scenarios.

Trend of abstraction of media of exchange:

no credit card
credit card
credit cards
checks
paper $
coin
gold coin
cattle exchange
craft exchange
trade/barter
''goods''

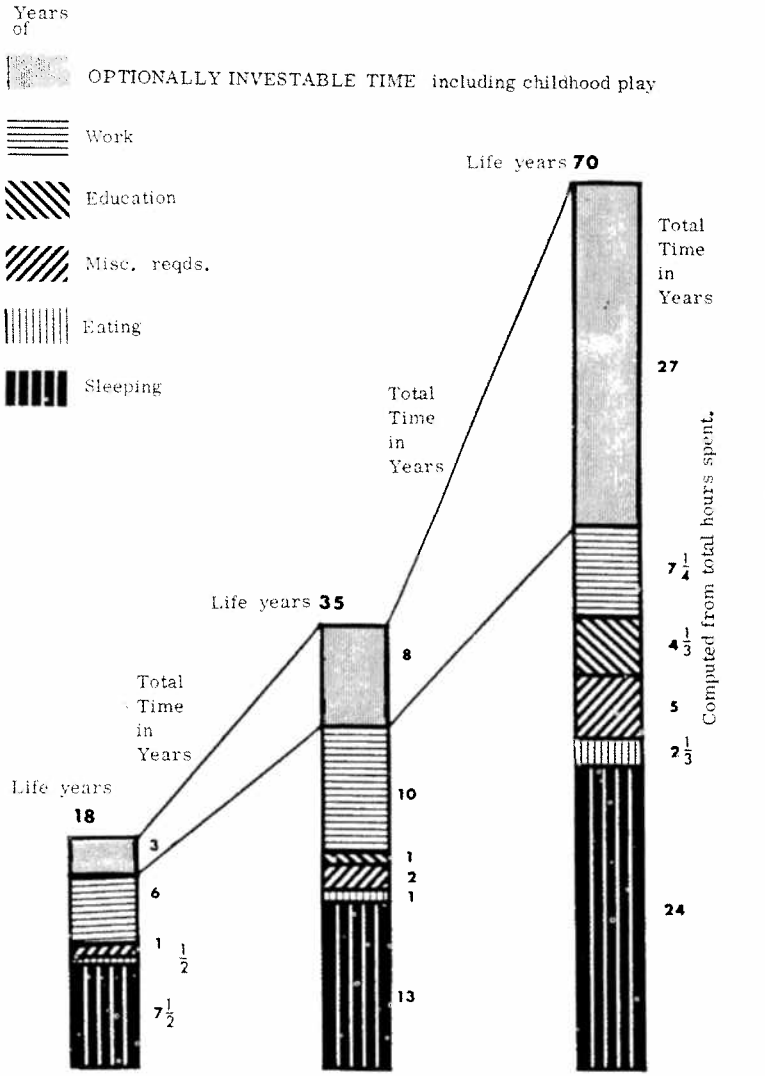
last position (no credit card) is the same as the first point (goods). Each succeeding media being an abstraction of the preceding media; acceleration of acquisition paralleling industrialization

trends towards:

use of 92 basic elements
transportation of man around earth
abstraction
specialization
comprehensiveness
doing more with less
self-fulfillment
increased life expectancy
higher education
automation
non-ownership (leasing)
multiple citizenship

increase of energy slaves/cap
increased leisure
increased weather prediction
omni-directional (away from linear)
miniaturization
autonomy

TOTAL TIME SPENT IN VARIOUS ACTIVITIES BY PRIMITIVE, AGRICULTURAL & INDUSTRIAL MAN.



This chart taken from: World Design Science Decade, Document 1
by R.B. Fuller and J. McHale, p.16
Southern Illinois University 1963

trend of: conservation of the physical, use of metaphysical
energy network growth
realization of metaphysical ideas into physical reality
declining birthrate/deathrate
man's ability to regenerate life
decrease of restraints on man
increasing identification of man (I.D.'s, photos, etc.)
interdependency
micro, macro environmental control–cloud seeding, heated socks etc
world migration
do-it-yourself-ness
revolutionary discoveries
amounts of mail
availability of the international cultural environment

The following words are new, this list being extracted from the sum total new words compiled by Merriam Webster:

1943–homeostasis, pesticide, bazooka, walkie-talkie, pin-up girl, Snafu

1944–DDT, jet plane, V-2, gobbledygook, hump, D-Day, L.S.D. (landing ship dock), milk run, P.O.W., X-day, skytroops, bobby socks, skytrain, teenager, jeep, deepfreeze

1945–plutonium, A-bomb, Atomic Age, banzai, cloak and dagger, genocide, Globester, May Day, bogey, buzzbomb, loafer, pedalpusher, VIP, hubba hubba.

1946–carbon 14, push button, shock wave, truth serum, snowmobile, atomic cloud, iron curtain, existentialism, baby sitter

1947–electronarcosis, sonic barrier, AEC, CARE, cold war, hot war, one-worlder, police state, airletter, chain reaction, hot rod, new look

1948–copter, cybernetics, servo-mechanism, transistor, UNIVAC, Israel, expressway, LP, profile, thruway, TV

1949–automation, electronic brain, freeze drying, hyperzonic, reactor, antihistimine, space medicine, H-bomb, UNICEF, Veep, welfare state, bikini, Howdy Doody

1950–cinerama, heliport, radio star, spacemen, sub-miniaturization, nerve gas, 2 stage rockets, apartheid, captive audience, litter bug, rat pack, theater-in-the round

1951–dacron, NATO, brainwashing, frogman, ground zero, roadblock, hard core

1952–printed circuit, space platform, telethon, whirlybird, bamboo curtain, astrogator, hackie, panty raid, pony tail, zip gun

1953–bit, jet stream, count down, bookburning, cookout, discount house, drag strip, egghead, name dropper, split level, 3-D, triskaidekaphobia

1954–moonlet, radar-cop, sonic boom, desegregation, fall-out, megaton, cat music, do-it-yourself, goof, highway hypnosis, toll way

1955–brain print, death control, Atlas ICBM, Dew Line, certified mail, GAW (guaranteed annual wage), brush fire war, cha-cha-cha, classic car, cue-card, demolition derby, dream car, junk mail, rock and roll, UFO

1956–electroluminescence, moontracking, SCUBA, space biology, sputnik, meter maid, subliminal projection, total theater, teachers aid

1957–DNA, jump-belt, lift-off, lunar probe, moon dust, moon shot, orbit, re-entry, retro-rocket, solar flare, overkill, Parkinson's Law

1958–action painting, beatnik, beat generation, carry-out, hot dogger, sick joke, swivel dance, wilderness park

1959–aerospace, silo, SNAP, soft landing, back-up, earthman, go-kart, weirdie

1960–atomic time, closed ecological system, cosmonaut, Echo, fuel cell, laser, molecular electronics, recycling, sit-in, anchroman, bluegrass, cliff-hanger, compact car

1961–A-OK, G.E.M., Mohole, parking orbit, smithereens, solar wind, teaching machine, Black Muslims, freedom rider, New Frontier, high rise, New Wave, soul, bossa-nova, fastback, hairy, phase-out, red-dog, spin-off, status seeker, Theater of the Absurd, fail safe, antimatter, Apollo, black box, computer revolution, heat shield, ion engine, LEM, module, probe, plasma engine, RNA, thalidomide, voice print

1962–astrocommuter, hyper velocity, soft ware, solid-state, tokenism, brain drain, Cosa Nostra, found object, happening, jet set, multiversity, peacenik, pop art, psychedelic, surfer

some word trends——

popular expressions and those words which are a product of government activity have a one year life-span. They are replaced yearly with whatever 'current events' that become popularized.

pure science suffers during war years.

military terminology trends towards the use of acronyms and euphemisms, which tends toward a coding of information.

the public trends toward the use of acronyms.

during war years the trend is toward coinage of words designating maneuvers rather than those object inventions which instrument those maneuvers.

post-war years are characterized by an abundance of new nouns, due to those inventions which are a product of the military application of science and technology, which were held back during the war.

post-war years see an increase in scientific and technological terms, trending towards pure science returning to its studies.

with the advent of TV by 1950 there is an increase in popular expressions, because of a new means of mass communication.

What do we mean by universe?
Has man a function in universe?
What is thinking?
What are experiences?
What are experiments?
What is subjective?
What is objective.
What is apprehension?
What is comprehension?
What is positive? Why?
What is negative? Why?
What is physical?
What is metaphysical?
What is synergy?
What is energy?
What is brain?
What is intellect?
What is science?
What is a system?
What is consciousness?
What is subconsciousness?
What is teleology?
What is automation?
What is a tool?
What is industry?
What is animate?
What is inanimate?
What are metabolics?
What is wealth?
What is intuition?
What are aesthetics?

What is harmonic?
What is prosaic?
What are the senses?
What are mathematics?
What is structure?
What is differentiation?
What is integration?
What is integrity?
What is truth?
How many questions have you had? How many thoughts?
What is the potential of World Game as an educational tool?
Is there a hierarchy of the characteristics of human behavior?
What techniques are being evolved to make visible the increasing innumerable invisible forces affecting man today?
Is every human being in his own state of evolution? Implications for education?
Can learning be defined?
How can we better understand man's ability to discover generalized principles?
Can you conceptualize the whole universe with your mind?
What words do you consider unpolarized?
Where is the frontier?
What is the efficiency of a computerized automated factory?

IV Tools

speed of light c = 2.988×10^8 meters/sec

1 metric ton of coal equivalent: 1666 kwh (assumes efficiency of 21%)
or 8000 kwh (heat equivalent)
or 28.8×10^6 Btu

1 kilowatt hour (kwh): 3413 Btu

1 energy slave: 37.5×10^6 ft lbs or 14 kwh

1 metric ton coal equivalent: 24 energy slaves (at 4% efficiency)

1 energy slave: 14.2 kwh (100% efficiency)
or 12.1 kwh plus 6.5 kg coal equivalent

1 metric ton of gas or jet fuel: 1.5 metric ton coal equivalent

1 lb uranium can perform as much work as 3 million lbs of coal

1 calorie: 3.087 ft lb or 3.968×10^{-3} Btu or 1/1000 Calorie

1 cubic mile of water: 1,101,117,143,000 galons

1 square kilometer: 100 hectares

1 square mile: 259 hectares

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Any of the U.N. documents

World Design Science Decade, Documents 1-6 (invaluable to anyone who wants to look at the whole earth)

What does World Game mean for our lives? Western man has been on a 6000 year (Neolithic) thinking trip based on his need to survive in a security environment in which his schizophrenia has increasingly intensified-the United is lost and power-domination-brutality-hierarchy grow as the macro-microcosmic splits widen: conscious vs. unconscious, mind vs. body, parent vs. child, man vs. woman, life vs. art, man vs. man (class society), man vs. nature (destruction of ecological balance), East vs. West (world war), man vs. God-until we have the ultimate horror of New York City with its filthy air, filthy water, noise, knives, winos, plastic food, hating each other, stomachs rigid, alienated from work, on the treadmill, unable to stop and find Center, social games, lying, stealing, murdering.

Now-the wheel turns-joyous Revolution! World Game says there is enough for all, no more ''them'' only ''us,'' and life's purposeless purpose becomes to generate/regenerate cosmic body/mind energy flows and direct them in ever-changing evernew magic patterns. We (youth) intuitively understand this end of Western civilization and we begin to leave or destroy the existing constricting idea/institutional structures: patriarchal family, university, government, cities, money, private property, armies, ideologies, repression, work, authority, bourgeois egos, morality, pay toilets, time, and Newtonian space. We discard these for lives of (w)holiness, play, sex, music, and unfettered creativity. The divine natural life pleasure pulsations of the organism break through the crust of repressed awareness, we reclaim control of our everyday lives. We are beginning to heal the splits and resolve contradictions, to get back to the cyclical/eternal/sacred life of early man with infinite consciousness; the spiral returns but at a new level, our machines will provide us with all we need and take us anywhere. We will be children with the whole earth as our playground. We are one. Paradise is the only thing now practical.

-Eric Abrahamson

constant pressure
put on the mind
to keep it in
touch with itself
always learning
about oneself
and about others
necessary to climb
so to control is important
shift change and
alter the mechanism
gathering information
which never ceases
using our senses
being in touch
we continue to grow
to stop is disasterous
movement spiralling
ever greater and higher
into the field of
the unknown
searching for some
thing which goes
beyond the imagination
today we experience
tomorrow we experience
for ever we shall
for to experience
is to learn and
growth proceeds from
learning
to be awake is a key
and we must not dis-
miss any clue which
informs and lets us
see clearly. So let us
be aware
constantly we are
reminded for it
is always slipping
from our grasp
we must stay awake
and be of use to others
there are many
but few survive
because there is
constant pressure
put on the mind
to keep it in
touch with itself
always learning
about oneself
and about others
necessary to climb

so to control is important
shift change and
alter the mechanism
gathering information
which never ceases
using our senses
being in touch
we continue to grow
to stop is disasterous

-Ed Hauben

Before/after thoughts

worldman

you are the beak
of embryo earth

seeking nutriment

you broke the shell
and we emerged

finding nutriment
you fed us all
universe
now, only the impossible happens
to be perfect
is to happen

-Medard Gabel

Rocky Road

3 shakes of kelp
1 tea. liver powder
1 tea. sunflower seeds
1 tea. dehydrated milk
1 tea. wheat germ
1 tea. soy lecithin
1 tea. honey
2 tea. yeast powder

and the liquid flavoring of your choice (usually milk; can be orange juice etc.)

Projected English Language (past 2000)
either-the same connective continuity with a change of vocabulary,
or-the same connective continuity with the vocabulary deleted, i.e.,
Connective Discontinuity-all those words that do not prevent you from thinking and more, or all those words which, past 2000, will be reminiscent of conjunctions, as, if-then, and, or and but, and more, and more. What I see before I open my eyes must be close to real.
(the following text includes extracts from R. Buckminster Fuller 'thinking out loud')
So I'll close them.
When I opened them again, I saw no need to color SPACE.

In between space was REAL. already painted.
Within REAL was me already.
(I stepped into the present)

I am no longer the painter.
Irreversibility guarantees REAL.
I am now the painter (of me).

-John Storyk

As a non-proponent of everyday language, 'annihilation' is not descriptive of turning inside out a left hand glove.
As a non-proponent of everyday language I admit that speaking of 'annihilation' with regards to ''turning inside out a left hand glove,'' is not being descriptive of turning inside out a left hand glove.
And set up in a better league than you were, belongs in quotes, rather than, how I followed through during this half century. I always found numbers always going around.
(No scientist could tell the difference between two metals. He might ring a cylinder and tell you something of the ring. No scientist could tell you which one is stronger. He might ring a cylinder and tell you something of the ring.)
All that came in here. There is hardly a very big way to develop whatever comes in here by big fortune. You might for the moment do much too much, much too little with much too much. Assuming that every tool we can see is a man. Since the time we were beginning to show the very well informed, doing was not listening, he decided to make this my subject.

Bucky

to speak with someone is to share
your life's experiences, observations,
and responses that have made manifest
your fundamental good will.

through your sharing as a man
comes a realization that we will yet
see man as a fulfillment of his
function as man in universe.

dialogue, that thinking relationship
whose progeny is integrity, precludes
dogmatism, which does not think.

and your design for the success of man,
carried by dialogue with man
for man becomes reality without
bitterness.

-Martin Emanuel

(In as much as I used the words all the crystals made, you can say I recognize these as beautiful and asymetrical. There is a pattern that holds less fingers than two leaves never being alike. And you always just know where the end of the leaf is just always.)
('Intellect and gravity are the same.')
'I try to think through what I am saying to be sure I don't get caught using expressions of yesterday. The best way to prevent you from thinking is for me to shoot the shoot from here to there very easily on an expression of yesterday.'

-Ken Versand