Vision 65 Summary Lecture
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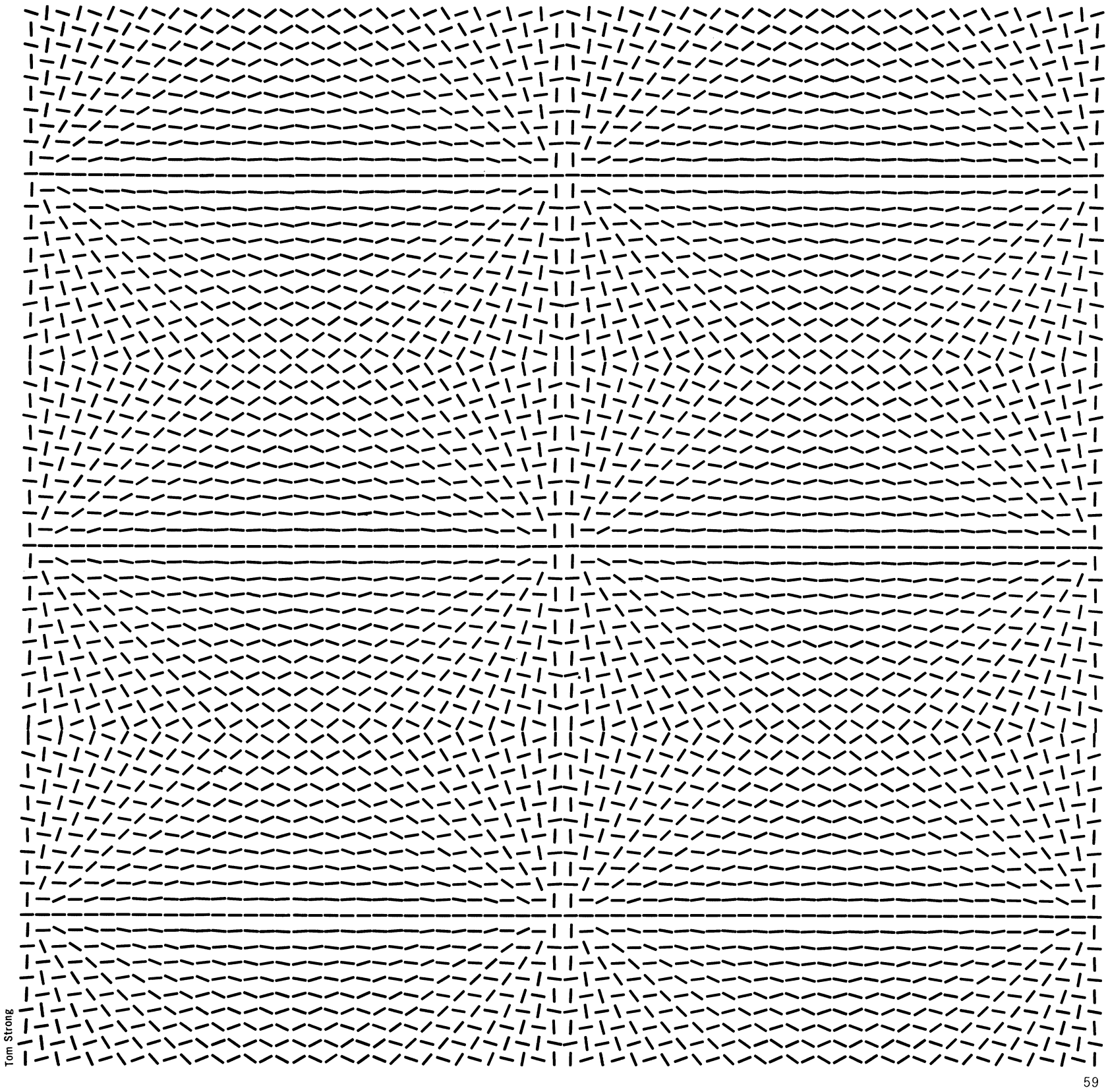
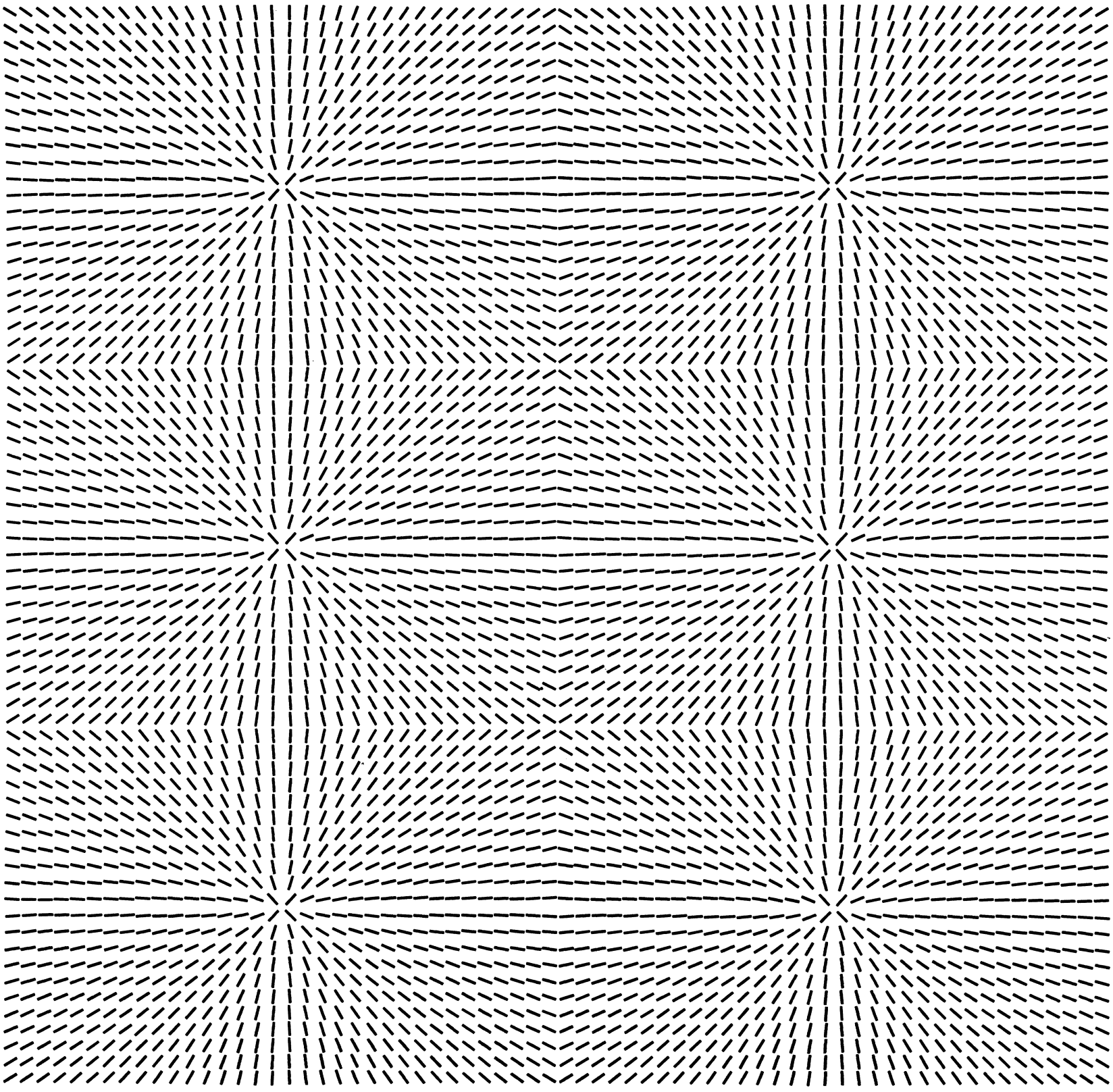
Source: *Perspecta*, Vol. 11 (1967), pp. 58-63
Published by: The MIT Press on behalf of Perspecta.
Stable URL: http://www.jstor.org/stable/1566935
Accessed: 28/06/2014 15:35





I am certain that none of the world's problems—which we are all perforce thinking about today—have any hope of solution except through society's being thoroughly and comprehensively educated and thereby able to identify and communicate the vital problems of world society, and thereafter to sort and put those problems into order of importance in respect to the most fundamental principles governing man's survival and enjoyment of life on earth.

Clearly, and sum totally, something very important is happening to man on this planet. Fred Hoyle, the great astronomer, dealing with the regularities found by astrophysicists in the heavens, has been able to say in all seriousness that he now assumes from the observed regularities that there are at least hundreds of millions of stars with planets that could maintain human life. He finds it logical to assume human life to be present in this universe on at least one hundred million planets. This particular big figure he uses is obviously intended to infer astronomical numbers of humans present in universe.

Dr. Hoyle—who is the Plumian Professor of Astronomy and Experimental Philosophy at Cambridge University in England—finds the case of humans on this particular planet to be precarious. He says humans have found atomic energy just in time to overlap the exhaustion of the fossil fuel supplies. Humanity will have to make other vitally important moves in a hurry.

I remember asking myself whether there is anything in our experience that could tell us whether man might have an essential function to perform in the universe. Was he needed in the universe? Or was he—as he seemed to feel himself—just a chance observer, a theatergoer watching a great play called life. I said the only way we can judge whether he has a function or not is to go to our experimental data, and the way it came out is as follows.

With the development of steam, which could propel their ships when there was no wind, the great pirates, who mastered world commerce, saw that science could greatly advance their power, so they put up great amounts of money to back further scientific inquiry. The scientists developed the laws of thermodynamics and showed that energy continually and **always** escaped from local systems. Systems were always running down. This inherent energy dissipation was called entropy. The mathematicians described entropy as the **law of increase of the random element.** This concept is manifest by Sir Isaac Newton, when he said in his first Law of Motion, **a body persists in a state of rest—or in a line of motion** (clearly a secondary thought)— **except as affected by other bodies.**

"At rest" was the great norm. All the scientists went along with the second law in assuming that energy is leached out of the universe and that in due course the universe must run down and become motionless and dead. Life was abnormal and death was the normal state.

I entered Harvard University in 1913 just before World War I began. The Harvard community, and, in fact, Boston's large community of intellectuals, all assumed a universe that would ultimately run down, and that the earth had been spun off from the sun and would finally stop spinning. It is a very short time since people were thinking in that way. But in this century the scientists experimenting with entropy began to discover that when energy left one system it could only do so by joining another system. It did not go out of the universe. They found that energies were always one hundred percent accountable. This forced them into a completely new law, the **Law of Conservation of Energy,** which says: **Energy cannot be created, and energy cannot be lost. Energy is finite.** This eventually brought about Einstein's finite physical universe.

Einstein found himself confronted with this new way of looking at energy and also with the extraordinary experiments that disclosed the speed of light—experiments made not only in relation to visible light but to invisible radio signals, that showed that energy released **in vacuo** was moving at 186,000 miles a second.

Einstein felt forced to think about the universe in a different way from Newton. He said that inasmuch as no energy could be lost, then the universe could not "run down," and "at rest" was not normal. He then assumed a universe of continual transformation and its acceleration normal. He further assumed that normal velocity is the speed of radiation unfettered in a vacuum—186,000 miles a second. While that is very fast, he pointed out that it is not **instantaneous.** Einstein then pointed out that the universe is a complex of nonsimultaneous events, and because there is no inherent composite "picture" of nonsimultaneous and nonidentical events, there can be no possible unit and static conceptual picture of universe. "What is outside the outermost stars?" is a meaningless question. Thus Newton's simultaneous, all interlinked mechanical universe became invalid and obsolete.

The brightest star that we use in our navigation is Rigil Kentaurus. And Rigil Kentaurus is four and one-half million light years away and is of a brightness magnitude characteristic of the stars that burn out in a million years. Quite probably Rigil Kentaurus hasn't been "there" in the sky for three and one-half million years. We only have evidence about man being on earth for about two million years. In seeing Rigil Kentaurus, we are looking at a "live" show taking place two and one-half million years before man came on earth. In looking at stars in the heavens we are not looking at simultaneous events. There is no outside to what is not there. Our thinking gets an entirely new breakthrough with Einstein. In the philosophy of relativity Einstein postulated an all-transforming universe, constantly transforming at various rates. He next hypothesized that although energy was traveling normally at 186,000 miles per second, it could be going around locally in knots and that it could be so local as to be confined to atomic patterning dimensions and that the tighter the heavier, and this resulted in his famous equation of $E=mc^2$ which fission a quarter-century later proved valid as accounting for the amount of energy in any given mass.

There is now a very large inventory of ways in which man has been teaching, thinking and accounting events and values which have no experimentally demonstrated validity. There is no experimental proof of such phenomena as straight lines, solids and planes. There is no instantaneous phenomenon. The word is meaningless. The senses and brains of approximately all our scientists are disconnected from their theories. Scientists see the sun "going down" when they have known theoretically for five hundred years that it isn't "going down." Although our senses are not geared with our advanced knowledge, man has been getting along in a gradually more favorable way. His communication is no longer confined to the mode of his spitting.

Man is born utterly helpless and remains utterly helpless for a longer period than the newborn of any other living species. That's quite an invention—an extraordinary complex like man born utterly helpless. It is valid only under the assumption that he will be taken care of. Although the helpless child often has drunken parents, fortunately gravity holds him in his bed, and fortunately some cow ate some grass and made milk and somebody got it out of the cow and, through a series of pourings by many people, it got into a bottle leading into the baby's gullet. It didn't come out of the mother's breast. In many ways, mankind is utterly helpless, vain and ignorant.

Human beings often say, "I wonder what it would be like to be on a spaceship." The answer is, "What does it feel like?—you are and always have been on a very small spaceship, eight thousand miles in diameter." The nearest star Sun is ninety-two million miles away and the next

brightest Rigil Kentaurus is not even there. You are very much alone in your spaceship. And this spaceship is designed so superbly, all its passengers so skillfully provided for, that they have been on board playing the game of self-reproduction for two million years without even realizing that they are on board a spaceship.

We see that all life has been able to succeed owing to the anticipatory design of a regenerative ecological energy exchange. The mammals give off the gases that are necessary to the survival of the vegetation, while vegetation gives off the gases that are essential to the survival of the mammals. None of them knows that he is contributing gratuitously to vital support of the other. I find that the earthworm is quite as irresponsibly, yet essentially, involved here, as is the bee. All of life is inadvertently and unconsciously involved. All of life has designed subconscious drives. Earthworms do the twist. But none of them realize the vital tasks they are doing for the others.

So I find all life interconnectedly successful and almost completely unwitting of the total ecological balance, which men sometimes speak of as "nature." The little bumblebee goes after his honey and his little fuzzy tail inadvertently knocks off and dusts pollen, which fertilizes vegetation. I think that is exactly the kind of pattern with which approximately all of humanity is preoccupied. I don't know any man who can stand up and say to us, "I am a success by virtue of having consciously designed, fabricated and operated myself, the biosphere, the sun, earth and all the intercomplementing ecology. I can tell you what I am doing with my lunch. I am sending off certain of this food to this gland and that gland, and I am going to use these differentiated energies in such and such ways."

We know humanity can't say that. Humans can't even tell you why they have hair. They certainly can't tell you that they are consciously pushing each hair out through their heads in special shapes and colors for special purposes.

We don't know anyone who knows much about what he is doing and why. Yet, one of the prominent, built-in behaviors of the occupational game-playing is the ego-claimed credit for its inadvertent successes.

There are many indications, however, that man is just about to begin to participate consciously and somewhat more knowingly and responsibily in his own evolutionary transformation. I include evolution of the environment as a major part of the evolution of humanity. In his unconscious participation in the past he has carelessly ruptured his earth, polluted his air and water, corrupted his children in order to sell any kind of toy guns, dope, smut and anything that would make money, and has made all moneymaking sacrosanct. But if we discover that man is necessary to the invention of universe, we can understand somewhat better what he is inadvertently doing.

Some years ago, I asked myself whether man had a function in universe and if so, what it might be. My experience-informed answer went as follows:

The astronomers have given us their observation of the "red shift," which indicated that vast and remote star groups are probably receding from us in all directions because the light coming from them is redder than that from nearer groups, which in turn indicated an expanding universe. The expanding universe is also called for by the law of entropy or increase of the random elements which must ever fill more space. So I thought, we have also learned experimentally that unique behaviors are usually countered by somewhat opposite behaviors; therefore, an expanding universe would probably infer a concurrently contracting universe. So I said, "What experience do we have that may demonstrate such a contracting universe, even though none has been observed or mentioned by the astronomers?"

I saw that around our own planet we have high and low atmospheric "pressures," which might better be called expanding and contracting atmospheric patterns. I discovered clues to the operation of a contracting universe to be operative as our own planet. Our planet Earth is not radiant. It is not sending off energy in any important degree. As compared with a star it is "dead." Earth is receiving energy from the sun but is not losing it at the same rate. For instance, we have learned from the Geophysical Year that we are receiving about one hundred thousand tons of stardust daily. Our physical imports from the universe are as yet much greater than exports. Therefore, we are a collecting or concentrating center, possibly one amongst myriads in universe. All planets in universe may be collecting points as focuses of the contracting phase of universe. At the surface of the earth, in the top soil, the ecological balance becomes operative. The vegetation's chlorophyll inhibits the sun's radiation instead of allowing it to be reflectively rebroadcast to universe. The sun-inhibited energy impounded in the vegetation is further inhibited by insects, worms and mammals, and both botanicals and zoologicals are gradually pressured into the growing earth crust and finally are concentrated into coal and oil rather than being broadcast off to universe in all directions. By dissipating these energy concentrations, man may well be upsetting the expansion-contraction balance of universe.

The ecological balance is fascinating when viewed chemically. We find all biological systems continually sorting and rearranging atoms in methodical molecular structures. To ensure performance each species is genetically and environmentally programmed. Each sorts and reassociates atoms as its genes cope with and alter environment, which in turn alters the species' behaviors.

Thus we see that all the stardust, cosmic rays and other radiation randomly dispersed into universe by all stars are being methodically converted by the biological activity around Earth's whole surface—in the sea and on the land—into progressively more orderly "organic" chemical structures. Thus biological life on Earth is antientropic. Earth is acting as an antientropic center as may all planets in universe.

Of all the antientropic sorters and rearrangers on Earth, none compares with brain-driven man. We find man continually differentiating and sorting out his experiences in his thoughts. As a consequence we find him continually rearranging his environment so that he may eat, be clean, move about and communicate in more orderly and swifter ways.

Dr. Wilder Penfield is the head of the Neurological Institute of McGill University in Montreal, Canada. He is one of the world's leading electrode probers of the brain. The brain probers have now identified, for instance, the location of various memory banks. Dr. Penfield says, "It is much easier to explain all the data we have regarding the brain if we assume an additional phenomenon 'mind' than it is to explain all the data if we assume only the existence of the brain." Why? Because they have found, so to speak, the telephone sets of the brain, they have found the wires connecting the telephone sets, they have found the automatic message-answering service and the storage system; but, a great deal goes on in the conversations over the wires that is not explicable by the physical brain's feedback. I have submitted what I am saying to you to leading neurologists and they have not found fault with it. A good scientist doesn't applaud you publicly or right away, even though he is favorably impressed with your theory. But he does let you know whether he objects to what you are saying and what his objections are. And so far there have been no objections and there seems to be some affirmation of what I am about to say to you.

We have a phenomenon that we speak about as a generalization. In science, a generalization is very different from a literary generalization. Generalization in a literary sense means that you are trying to cover too much territory with some statement. The scientific meaning is precise; it means "the discovery and statement of a principle that holds true without exceptions."
I will give you an example. I am going to talk about a special piece of rope. I could have in my hands a foot length of three-quarter inch manila rope. But I can also say to you, "I am going to take an imaginary piece of rope," and I, not mentioning whether of nylon or manila, immediately generalize a rope concept from our mutual experiences. I am going to pull on that piece of rope and as I pull on it very hard it contracts in its girth. As it gets tauter, it gets tighter. This means that it goes into compression in its girth in planes at ninety degrees to the axis of the pull. I have found a great many human beings who think that tension is something independent of compression. I find experimentally, however, that tension can be only operative when compression is also present.
A cigar-shaped vertical compression member that is loaded on its neutral axis tries to "squash." This means that its girth tries to get bigger, which means also that its girth expands and is tensed. So I find that compression is never innocent of tension, but that they are cooperative in axes arranged at ninety degrees to one another. Sometimes I find tension at what we call "high tide," or a highly visible aspect, and compression at "low tide," or at almost invisible aspect, and vice versa. We have here a generalization. We have found by experiment that "tension and compression only coexist." That is quite an advance over the first generalization just saying, "I take a piece of rope and pull it," which was a second degree generalization. And it is a third degree generalization when I say, "tension and compression only coexist."

A system subdivides universe into all of the universe that is outside the system and all of the universe inside the system. Every system, as viewed from inside, is concave and, as viewed from outside, convex. Concave and convex only coexist. Concave and convex are very different from one another. Convex diffuses energies by increasing wave lengths and widening angles. Concave concentrates energies by decreasing wave lengths and reducing angles. Although not the same and not exactly opposite, concave and convex only coexist.

In addition to tension and compression and convex and concave, I can give you a number of other such coexistences. This brings us then to another and further degree of generalization wherein we say that, "There is a plurality of coexistent behaviors in nature which are the complementary behaviors." That caused the mathematicians to generalize further. They developed the word "functions." "Functions" cannot exist by themselves. Functions only coexist with other functions. They are sometimes covariables. When I say, "Functions only coexist," I have gone a little further than the special cases of concave and convex or of tension and compression which were themselves highly generalized. Then I'll go further still and say, "Unity is plural and at minimum two." Which is the generalization that greatly advantaged quantum physics. We may go a little further in generalization, as did Einstein when he gave us his "Relativity." You can't have relativity without a plurality of cofunctions.

Now, I will give you another progression of events. You have seen a dog tugging at one end of a belt. He tenses it as he grips with it compressionally—with the concave and convex surfaces of his teeth. I am sure that you will agree that the little dog will never say, **"Tension and compression** only coexist," even though his brain coordinated them. The dog will not say, "**concave** and **convex,** tension and compression are similar cases of coexistence of functions."

I think the neurologists go along with me in saying that, "What we mean by mind—in contradistinction to the brain of the animal or of man—is man's ability to generalize."

The ability to generalize—in its incipient phases—seems to me to be also a tendency to moralize. For instance, to say that, "If a man does so-and-so, he will get into trouble. . ." I feel that in religious scriptures we come time and again to semi-generalizations showing how some men get into trouble and how you and your children may avoid such trouble.

We have seen how an enormous amount of special case experiences finally led to a progression of generalizations. There are about six degrees of progressive generalization. As we went from the one case to another and to higher degrees, it was accomplished with fewer and fewer words. We finally came to just one word, "Relativity."

Now this orderly simplification happens to be exactly the opposite of the mathematician's **law of increase of the random element.** It is the decrease of the random element. Generalization is the law of progressive orderliness.

I found myself in 1951 having to write in a book, which I was about to publish, that the mind of man seemed to be the most advanced phase of antientropy witnessable in universe. And if there is an expanding universe there is logically a contracting universe. Possibly man's mind and his generalizations, which weigh nothing, operate at the most exquisite stage of universe contraction. Metaphysics balances physics. The physical portion of universe expands entropically. The metaphysical contracts antientropically.

It is interesting that within a few months after my publication of the hypothesis someone told me that Norbert Wiener had just published the concept also that "Man is the ultimate antientropy." I talked with Norbert Wiener about this and we found that we had both written this at approximately the same time—starting quite diffently but coming to the same conclusion.

So now we have found a function for man in universe, which was our objective. Man seems essential to the complementary functioning of universe. Therefore the probability of humanity annihilating itself and thus eliminating the antientropic function from universe is approximately zero.

This does not, however, mean that man on Earth may not eliminate himself. It suggests that there are—as the Cambridge University astronomer, Hoyle, suggests—hundreds of millions of other planets in universe with men living on them.

This brings us to the observation also that to keep her ecological balance intact, when nature finds the conditions are becoming unfavorable for any of the "cog wheel" species necessary for the system, she introduces many more starts of that species. She makes enormous numbers of babies, enormous numbers of seeds of this and that tree when she sees that such trees are not going to prosper. The seeds multiply in number, float off in the wind, randomly distributed in order to increase the probability of an adequate survival number to keep the system in balance.

I also go along with Hoyle in his concept of the possibility of the enormous numbers of human beings on an enormous number of planets simply because not all of them are going to make a success of life on their respective planets.

Man is beginning to transform from being utterly helpless and only subconsciously coordinate with important evolutionary events. We have gotten ourselves into a lot of trouble, but at the critical transformation stage we are getting to a point where we are beginning to make some measurement—beginning to know a little something. We are probably coming to the first period of direct consciously assumed responsibility of man in universe.

Every day, when it is available, each human consumes an average of two pounds of dry food, six pounds of water and inhibits the amazing figure of sixty pounds of air out of which he consumes six pounds of oxygen.

Food has often been very scarce, and often men have fought to the death for it. Water has sometimes been scarce and has been fought for. Air has rarely been scarce. Nobody has ever thought of putting a meter on the air for human consumption. But, we have had some terrible panics in theaters when there was a fire. Suddenly human beings—completely unused to competing for air—lose all reason, go mad and trample their fellowmen to death.

So I would simply say that there is nothing in our total experience that shows that when there is not enough to go around, it is illogical for men to fight to the death, because they are going to die anyway. There is also nothing illogical in the concept that when there is enough to go around men will not even think of fighting.

We now know scientifically that for the first time in history there can be enough to support continually all of expanding humanity at previously undreamed of and ever advancing standards of living and intellectual satisfaction in effective participation in the evolutionary processes. But we are frustrated from realizing our success by our different political systems and laws, which have all been devised to protect the few who have or have not adopted the system that promised the most in a bad bargain, or the most just system such as that which would provide for those whose labor produced the little that there was to go round.

I have made measurements in terms of work that can be done by human beings, measured by army engineers, in elevating foot-pounds per hours, days and years. From these studies I developed what I call an "energy slave" or the energy equivalent of the work a healthy human youth could do. The energy slaves in operation were determined by the amount of energies we were consuming from nature as waterpower, fossil fuels, wind, foods. Because up to now the distance that electrical energy could be delivered economically was only three hundred and fifty miles, industrial prosperity has been temporarily localized and has expanded only gradually. Therefore I took the total annual energy consumption of, for instance, the United States (of North America) for 1940 and reduced it by ninety-six percent because the machinery and processes used by man are of so overall low-grade design that he is only able to realize four percent of the consumed energy in potential effectiveness in the work accomplished. Despite this necessary reduction, I found that a very large number of energy slaves are working for humanity in our U.S.A. industrial economy. On the Eastern Seaboard of the United States in 1940 we had a hundred and thirty-five energy slaves working for each man, woman and child, and they were able to work continuously in extremes of heat and cold in which humans would swiftly perish. The inanimate slaves work with extraordinary precision at tolerance millionths finer than permitted by human sight.

I found, however, that an enormous proportion of all energy slaves' capabilities were going only into the development and production of weapons. Putting aside all the energy going into weaponry and retaining only that necessary to keep the people themselves going at a healthily high standard of living, I found that a family of five could be maintained at the high standard of living level with only one hundred energy slaves working for them in their economy—very few of the slaves work actually inside the house —they are employed in building the highways and keeping their telephone system in operation et cetera. And this standard of living for a family of five produced by one hundred energy slaves was so high that it had not been known by any national sovereign before the twentieth century.

I found that in 1900 less than one percent of humanity were industrial "haves," but that changed very abruptly in and after World War I.

World War I witnessed intense mechanization of the world. In the year 1917, man took out of the ground, refined and put to work more copper than he had taken out of the ground in the whole cumulative history of man's copper mining and refining. He did so because copper is essential to energy distribution. He developed such intense mechanization in World War I that the percentage of the total world population that were industrial "haves" rose by 1919 to the figure of six percent. That was a very abrupt change in history suddenly to have six percent of humanity surviving at a high standard of living. By the time of World War II twenty percent of all humanity had become industrial "haves" despite the fact that the population was ever increasing. At the present moment the proportion of "haves" is at forty percent of humanity.

Consisting mostly of recirculating scrapped metals, eighty percent of all the metals that have ever been mined are still at work. And all those metals are now occupied in structures and machinery which operating at full capacity can take care of only forty-four percent of humanity: that is they can take care of four percent more than are now being taken care of. During this twentieth century the combined amounts of scrap and newly mined metals per each world man has been continually decreasing because population is increasing faster than discovery of new ore bodies.

For man to go from less than one percent to forty percent, living at high standard—despite decreasing resources—cannot be explained by anything other than by doing more with less.

We find doing more with less has come about entirely through the unique technology of the less than one percent of humanity that cast its lot with life on the ocean to master the great commerce routes of the earth. They developed technology that could float in contradistinction to the dry-land custom of protecting oneself with great stone walls—of which the greater the thickness and height, the greater the popularly assumed security.

On the sea one couldn't use stone—one would sink. On the sea men took fragile materials such as wood that would float naturally and, by scientific designs, produced extraordinary and powerful ships with which they battled the seas and one another, seeking to control the great sea lanes of world commerce, seeking to be the greatest power. They developed more and more speed, hitting power and cargo space with ever less of invested resources in time, material and energy per each and every function of the ship and its equipment and that brought them to steam and the steamship, brought them to steelmaking, to make the great ship. Half a century later they began to have enough steel left over from shipmaking to put some into buildings on the land. From the battleship to the land came electric dynamos, refrigeration, radio, desalination, et al.

To control the world even more effectively with the airplane forced an international race to do even more with less. In doing more with less we have recently gone, for instance, from the latest seventy-five-thousand-ton transatlantic cable of copper wires to telstar, which provides more communication more effectively with less than a ton of materials. We have not been thinking correctly of this technological do-more-with-less revolution as being only a by-product of our scientific preoccupation with weapons. But it is now obvious on study that this is what has changed man's condition on earth. It takes on average, twenty-two years for the "dynamo to come off the battleship" into our domestic use. If we have to wait for twenty-two years to bring the curve of "haves" to one hundred percent, this may be fatally slow.

If humanity understood that the real world problem is that of upping the performances per pound of the world's metals and other resources, we might attempt to solve that problem deliberately, directly and efficiently.

So I'll say to you that man on earth is now clearly faced with the choice of Utopia or Oblivion.