Man and The World

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Consisting of an astronomical number of cells, the human nervous system is fit to live and function in a great variety of physical worlds. As the experience of so many astronauts has shown, our nervous system can stand up to a lack of gravitation and to the practical absence of both auditory and visual stimulation. In order to maintain awareness at its normal level, it was enough for the astronauts to initiate activities in which a sufficient number of successive cues occurred at close intervals.

I believe that our nervous system would function well in a thousand different possible worlds. It would grow and adapt itself, or better still, it would learn to act and respond to any conditions in which life can exist. Because it seeks order and consistency, our nervous system can, for example, be "wired in" to cope easily with any of the three thousand languages and as many dialects that exist on earth.

The cosmos (meaning "order", in Greek) is not very predictable except for a few things like day and night, lunar phases and the seasons. I am not sure that simpler nervous systems are aware even of these orderly phenomena. Otherwise randomness is the rule. Meteorites have a very disorderly way of falling. No one can predict which atom will disintegrate at a given moment in any radioactive material. The falling of a particular raindrop at a precise place and instant is anybody's guess. The situation is the same with earthquakes, winds, typhoons, suns and galaxies, as well as on the microscopic level with solids, gasses or liquids. Whatever we may choose for examination, there is little that is predictable, orderly, stable and invariant. In most phenomena too many parameters are involved to detect cause and effect, which means to us, order.

But nervous structures look for order and will find it when and where it can be found or can be asserted. Only nervous systems, consisting of such great numbers of units as there are in most living creatures, need consistency and constancy of environment. To form a self, to find a mate, to live in a herd, flock or society it is imperative to have an organization that is repetitive so that it will be possible to learn to cope with the world. For the more complex life forms — monkeys swinging from one branch to another thirty feet away or humans playing tennis or violins — it is essential for them to form sets of invariants which allow learning while growing. This is a type of learning quite apart from academic learning.

All living creatures, when born, are smaller and weaker than their grown-up parents, some for shorter and some for longer intervals of time. Weak organisms need a consistent and constant world in order to grow into strong adults. As we know, an organism is within itself an entire world of micro-beings which needs, in its turn, a consistent outside world so that the internal world can have homeostasis, order and invariance — a condition that must be maintained if it is to exist at all for any length of time.

In short, a living nervous system introduces order into the random, constantly changing stimuli arriving through the senses and impinging on the system. Moreover, the living organism itself is moving incessantly, and the nervous system has to bring order to the mobile changing world, as well as to its own mobility, to make some sense from this whirling turmoil.

Quite surprisingly, the most efficient means for achieving this Herculean feat is *movement*. *Movement* of the living organism is essential for the formation of *stationary* events in the changing, moving environment and the constantly moving organism itself. Even if we are observing inert matter, our senses still perceive moving impressions, since a living organism is never completely stationary until it dies.

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Professor Heinz Von Foerster of the Biological Computer Laboratory, a cyberneticist who nourishes similar ideas, has noted that the French mathematician, Henri Poincare, wrote in 1887 that three-dimensional vision is possible not only because there are two eyes but also because of the movement of the head which carries them. The head movements need the adjustment of the eyes, and three dimensional pictures would not be perceived with eyes that were merely stationary in space.

Von Foerster has also told of a Swiss ski instructor, Kohler, who persuaded some of his pupils to participate in a fascinating experiment. He wanted to find out what would happen if our brain saw the outside world as it is on the retina and not as it actually is. As everyone knows, the eye lens, like any other lens, inverts the image on the retina. When seen, a standing person has his head at the bottom of the retina and his feet at the top. Mr. Kohler gave all the participants a pair of glasses inverting the image on the retina to be the right way up. As expected, he and all the others saw everything upside down. The first hours were very difficult; nobody could move freely or do anything without going very slowly and trying to figure out and make sense of what they saw. Then something unexpected happened: everything about their bodies and the immediate vicinity that they were touching began to look as before, but everything which could not be touched continued to be inverted. Gradually, by groping and touching while moving around to attain the satisfaction of normal needs, objects further afield began to appear normal to the participants in the experiment. In a few weeks, everything looked the right way up, and they could all do everything without any special attention or care. At one point in the experiment snow began to fall. Mr. Kohler looked through the window and saw the flakes rising from the earth and moving upwards. He went out, stretched his hands, palms upwards, and felt the snow falling on them. After only a few moments of feeling the snow touch his palms, he began to see the snow falling instead of rising.

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There have been other experiments with inverted spectacles. One carried out in the U.S.A. involved two people, one sitting in a wheelchair and the other pushing it, both being fitted with such special glasses. The one who moved around by pushing the chair began to see normally and, after a few hours, was able to find his way without groping, while the one sitting continued to see everything the wrong way.

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Does a newborn baby see the right way from the start? Or does he, instead, have to move and touch things in order to be able to interpret and give order to the impressions he receives. I, for one, suspect that movement plays a central role in forming our objective world. And, if my suspicion is not altogether wrong, movement may be necessary for all living things to form their orderly, objective, exterior world and perhaps even their internal image of the world.

One thing is certain: we are not merely the realization of the programme of our given genetic code. We know that the realization of this programme never happens without the growth of the organism bearing that genetic code. Moreover, being born and growing never happens without at least one observer or witness — the one that gives birth to the new organism. And, in addition, no living organism is known to exist outside a gravitational field.

In sum, a genetic programme is incorporated into a body that grows from two cells to whatever number of cells, in an environment inevitably situated in a gravitational field that is never without witnesses. None of these items — the genetic code, the witnesses, the gravitational field — can alone, by any stretch of the imagination, form a living being able to grow and become adult.

All mammals have skeletons, muscles and nervous systems, and they are born to parents, and the earth exercises on all of them the same gravitational force that is never interrupted and cannot be screened. Man, being a mammal, shares this same estate. There are, however, important differences. The human skeleton has the thumbs so structured that he can touch the tips of all of his fingers. An orang-outang or chimpanzee has power-producing muscles in its arms stronger than man, but the fine musculature of the human hand allows for a manipulative range of extreme finesse. Think of writing, making music, watchmaking, etc. The functional differences of the nervous system of man mark him apart from all other mammals. Parenthood in man is also very different. A human child usually has a father and a mother, plus two grandfathers and two grandmothers. The human environment involves the self and the self image as well as the sexual, the social and cultural, besides the spatial and temporal aspects of it.

The movements involved in every action produce a displacement of the entire organism with changes in its configuration, all of which affect different aspects of the environment in order to provide for the necessities of the organism. There is, then, a continuously changing environment with a continuously changing organism, both interacting without cease, so long as there is life in the organism. Different environments affect the organism and the nervous system so as to cause it to act and react effectively and efficiently to these changes.

Living things are classified after the way they move. The swimming ones are fishes, the flying ones are birds, the gliding ones are snakes, the wriggling ones are worms.

We have then, from birth till death, a closed loop of four elements: skeleton, muscles, nervous system and environment. These elements are, in fact, very complex systems interacting with numerous feedbacks and feedforwards all along the loop. The loop can be drawn as a quadrangle with four sides and four summits. In my own work I deal mostly with the summits rather than with the sides. I deal with the linkage at the summits where the elements interact with one another and where the learned use of self is more apparent. The individual life of intentional activity and reacting can more easily be changed through learning than through the more rigid structures

represented by the sides, i.e., bones, muscles, nervous system, space-culture-time-etc. It is also better to improve the *way* we do things than *what* we do. For *how* we do something is often more important than what we do.

These four complex elements can be studied from the beginning of life to the end. At birth the organism-environmental link is largely passive. By and by, passivity is replaced by more and more intentional activity. Were there no gravitation the whole scheme would be radically different. Bones would not be built to withstand compression. Velocity and power of movements would be different. It would be something that we could hardly conceive. As it is, *movement is the best clue to life*. Ever since man could speak he classified all existing things according to their movement in the gravitational field. Vegetation is everything which moves passively from side to side, following the flow of water or air, otherwise its growth is vertical. Living things are classified after the way they move. The swimming ones are fishes, the flying ones are birds, the gliding ones are snakes, the wriggling ones are worms. There are jumping ones, crawling ones, the ones who walk on all fours and we, featherless bipeds, who walk upright. Movement seems to have preoccupied man since he could first remember himself.

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Movement is central to each living cell making up the organism, and the whole of it — the skeleton, the muscles, and the nervous system — is preoccupied with movement. The organization of movement is so complex that most living things need some personal individual apprenticeship, be they fishes, birds, apes or men. The amount of apprenticeship varies from a few seconds or minutes to many years. Some of the herd animals, especially the bovines, horses, zebras and their like, seem to be able to follow the herd almost immediately after they are dropped by the mother cow, mare or whatever. The newborn will make an attempt or two to get on its feet immediately after its umbilical cord is chewed, and it is licked all over. When the second or third attempt at standing is successful, the calf will follow the cow on sand, gravel, or slippery wet grass, no matter whether it is on level, ascending or descending ground. It can not only do everything necessary to cling to the herd, but if it happens to slide or stumble it can right itself. If one thinks of the complexity and ingenuity necessary to construct a machine which is similarly efficient, one can realize what is involved in this extraordinary ability to move without previous experience and with so little apprenticeship.

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Think of the mountain goats where the kids are born on high rocks. The kids right themselves on their feet and then have to leap from one sharp edge to another without previous apprenticeship. Obviously, all the connections, the "wiring-in" of the nervous systems of these animals must be made before they are born. In short, with non-human animals it is the species which has handed down the learning, the evolving, the reflex organization, the instinct which enables them to survive in precarious conditions. However, most birds, dogs, kittens of all sorts, even tiger kittens, have to have some kind of coaching by their parents to finish the "wiring-in," establishing the functioning patterns of their nervous systems. That which can make this pattern reliable, autonomous or automatic needs an apprenticeship of a few weeks.

When we pass in review many of the species, it becomes evident that the *lower* a species' place on the ladder of evolution, the more complete is the wiring-in of the nervous system at birth. The connection of the synapses, neurons or whatever are ready and the apprenticeship is shorter, the lower the species are on the ladder. In man, we see the extreme end of this process. The human infant has, to my knowledge, the longest apprenticeship of all the species. Although everything necessary to maintain life and growth is already connected in the nervous and glandular systems at birth, the specific human functions are not wired-in at all. No baby was ever born who could speak, sing, whistle, crawl, walk upright, make music, count or think mathematically or tell the hour of the day or night. Without a very long apprenticeship lasting several years, none of these functions has ever been observed to develop. As far as these specifically human functions or activities go, the connections or the wiring-in of the neural structures are non-existent at birth.

It is the individual, personal experience or apprenticeship that is necessary and without it the baby will not be a human being. It is as if there were not inherited learning in the human species whatsoever. The "lower" animals have phylogenetic learning — the inherited and evolved learning of their species. The "higher" animal learns through his own individual ontogenetic experience. The "lower" and "higher" have little meaning other than to refer to the complexity of our way of putting together the ladder of evolution. Almost all the lower animals can do things that the highest can never do without prolonged learning, and then only through imitation, usually with a great variety of auxiliary instruments or structures.

Put simply: a thing is alive if it has a boundary separating it from the rest of the world, if it can reproduce itself, if it can maintain itself and if it can preserve itself.

The tendency to repetition leads in the end to repetitive constancy and order. Most happenings are ruled by chance and are so disorderly that most goings-on are not predictable. We make the laws of nature by singling out the parts of events to which we can add what we consider order. Newton made order in an impressive

array of disorderly falling bodies by promoting gravitation to the status of being.

Only nervous tissues and systems are capable of conceiving and realizing. In human beings it is the neural substance that organizes order in its own functioning; it makes order in its environment which in turn improves the orderliness of the human, and so on. The neural substance organizes itself and thereby selects and alters the incoming messages from the environment into invariant sets, thus making repetition possible. Many continuously changing messages are received from the environment before the organism succeeds in perceiving them as unchanging entities. So great is the ability of the nervous system that it creates order where instruments made of any other matter will register a blur or continuous variations. Just think of taking a photograph of a greyhound running toward you while you are sitting on a galloping horse. We can understand each other while a fan or an air conditioner makes so much background noise that no recorder will reproduce an intelligible record of what we said. We have no difficulty extracting invariant order out of many varying interferences. In anything we see, hear, smell, or feel, we actively organize ourselves so as to be impressed by those invariant sets that allow us to cope with the disorder both within ourselves and outside ourselves in the environment, whether interpersonal, social, spatial, or temporal.

Put simply: a thing is alive if it has a boundary separating it from the rest of the world, if it can reproduce itself, if it can maintain itself (i.e. draw energy from outside its boundary), and if it can preserve itself. All these functions cannot occur without self-direction, i.e. movement. The widening of awareness through movement is a learning process that has been used ever since the first cell took on a membrane, becoming an individual needing to direct itself.

It is necessary to divorce the aim to be achieved from the learning process itself. The process is the important thing and should be aimless.

Awareness through Movement is a learning process that makes self-direction easier and more pleasurable, because it resembles the learning that occurs with growth itself. The two methods I use, Awareness through Movement and Functional Integration are essentially an efficient, short and general way of *learning to learn*. In traditional learning it is *what* we learn that is important. But the higher function of learning to learn is free of such restrictions. Learning to learn involves an improvement of the brain function itself which carries it beyond its latent potential.

To facilitate such learning it is necessary to divorce the aim to be achieved from the learning process itself. The process is the important thing and should be aimless to the adult learner just as is learning to the baby. The baby is not held to any time-table nor is there any need to rely on force. Re-education of the adult has been corrupted by the teaching methods traditionally learned in schools and by academic teaching in general. In both, the teacher is presumed to be superior to the learner and is an example to follow and to imitate. Achievement is the aim, not learning; and precise times are fixed for specific achievements. Learning such as this has nothing to do with growth: it can be delayed at will or even abandoned altogether. But the learning that is dependent on growth cannot be delayed with impunity, nor can it be accelerated beyond the normal pace of growth.

I believe that the possibility of a better future humanity is nearer to our grasp than is presumed by the gloomy outlook of self-destruction that is predicted and held by many. A society in which its members are only so many units composing it is not the final form of society. A society of men and women with greater awareness of themselves will, I believe, be one that will work for the human dignity of its members rather than primarily for the abstract, collective notion of human society.