

The parasciences

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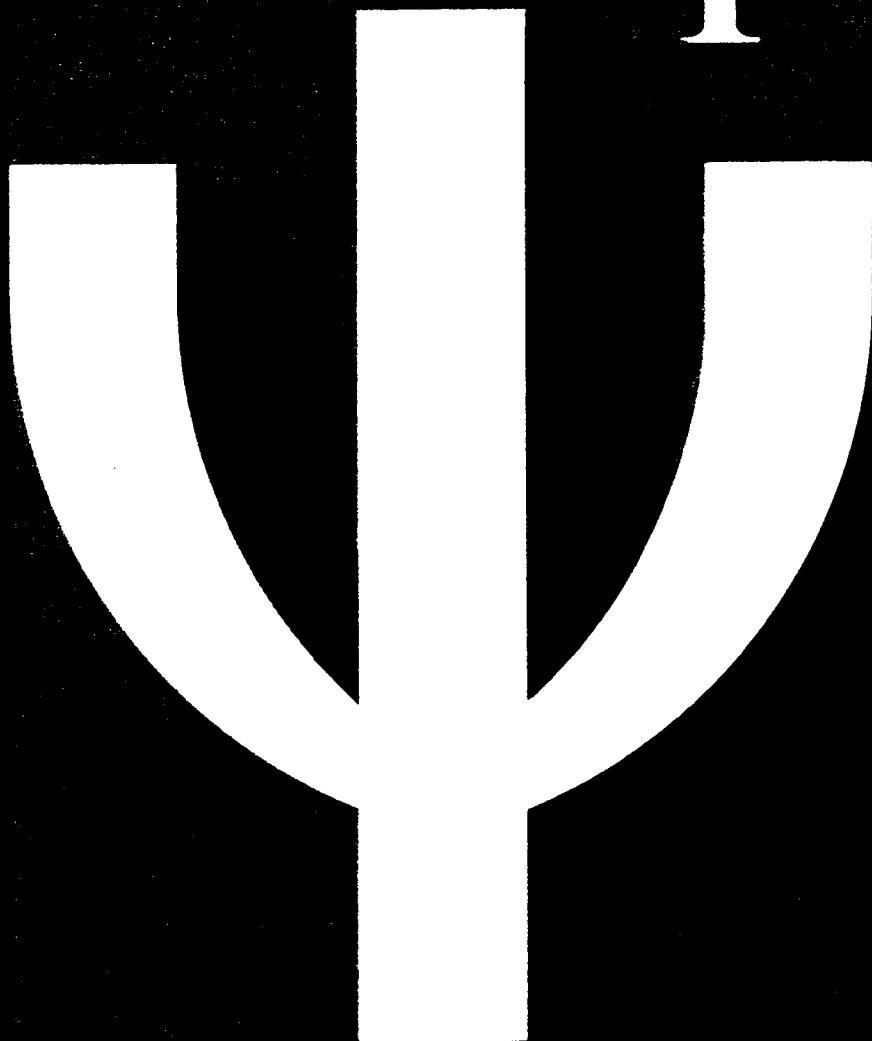
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Ψ



The Greek letter psi, here in capital form, symbolizes the disciplines not yet recognized as belonging to the world of formalized, rigorous scientific research. The 'psi phenomena' refer particularly to the human mind's parapsychological functions (precognition, psychokinesis and quasisensory perception).

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An invitation to readers

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Comment

Budapest-born British author Arthur Koestler, C.B.E., C.Lit., F.R.S.L., is probably best known for his ideological writings (*The Yogi and the Commissar*, *Darkness at Noon*). He has a keen interest, too, in the history and philosophy of science (*The Sleepwalkers*, *The Case of the Midwife Toad*) and parascience (*The Roots of Coincidence*). It is from the last work that the essay below has been adapted with the kind permission of both the author and his publishers, Hutchinson of London. In *The Roots of Coincidence*, Mr Koestler has traced some of the contrasts and many of the comparisons between the established natural (or exact) sciences and some of the parosciences. This article serves to introduce readers of *Impact of Science on Society* to the world of the 'unofficial' sciences—currently enjoying immense popularity in many different parts of the world—and some of their sociocultural implications. Criticism from our regular readers on the selection of the theme 'The Parosciences' is anticipated . . . and welcomed.

There is a certain perversity to physics

In the early 1930s the number of known elementary particles, which were supposedly the ultimate constituents of matter, was three: the negatively charged electron, the positively charged proton and the chargeless neutron. Protons and neutrons constituted the atomic nucleus, in which practically all the mass of the atom was concentrated; the revolving electrons—or electron waves—constituted its outer shells. By today we know about a hundred elementary particles, either originating in cosmic radiation or produced in the laboratory. Some of them are extremely short-lived—lasting no longer than an infinitesimal fraction of a second; others, like the

photon, have a virtually unlimited life-span. Some of these particles are very odd indeed—one of their quantitative attributes is actually referred to by the technical term 'strangeness'.

Other terms in the vocabulary of modern physics are even odder. Murray Gell-Mann has proposed a theory of elementary particles which, with acknowledgements to the Buddha, he called the 'eightfold way' and which enabled him to predict the discovery of yet another previously unknown particle called the omega minus—for which he got the Nobel Prize in 1969. Gell-Man and his co-workers have even suggested that the 'elementary' particles may in fact not be elementary at all, but may consist of even more elementary entities which they decided to call 'quarks'. At the time of writing, these hypothetical entities have not, or not yet, been discovered; but hunting the quark has become accepted slang in physics laboratories. All of which goes to indicate that theoretical physicists are well aware of the surrealistic nature of the world they have created.

But it is also a world of great mystery and beauty, reflected in those fantastic photographs of events in the bubble-chamber, which show the trajectories of unimaginably small particles, moving at unimaginable speeds in curves and spirals, colliding, recoiling or exploding and giving birth to other particles or wavicles. The actors in this pageant are invisible, but they leave trails, rows of tiny bubbles in a liquid, loosely comparable to the condensation trails of high-flying jet planes—except that these tracks are sharp, thin lines whose length, angles and curvatures can be measured with sufficient exactitude to determine a particle's energy, speed, electric charge, and so on. This technique enables the physicist to observe the unthinkable—the transformation of mass into energy and of energy into mass.

When a photon, a concentrated 'package of light', without rest-mass, flies past an atomic nucleus, the photon is converted into an electron and a positron,¹ both of which have mass, or even into two pairs of them. Vice versa, when an electron and a positron meet they destroy each other, converting their joint masses into high-energy gamma rays. To have penetrated to this depth below the world of appearances is one of the greatest triumphs of human ingenuity. Though the physicists themselves keep warning us that the ghosts we find down there elude the grasp of our understanding, at least we can measure their footprints in the bubble-chamber.

1. An electron with a positive charge or anti-electron—see text further on.

The ghost-like neutrino

Of all the bewildering elementary particles in the physicist's inventory, the most ghost-like is the so-called neutrino. Its existence was predicted in 1930 by Wolfgang Pauli on purely theoretical grounds, but it was not until 1956, more than twenty-five years later, that actual neutrinos, emanating from the United States Atomic Energy Commission's huge nuclear piles on the Savannah River, were trapped in the laboratory by F. Reines and C. Cowan. The reason why it took so long to detect them is that the neutrino has virtually no physical properties: no mass, no electric charge, no magnetic field. It is not attracted by gravity, nor captured or repelled by the electric and magnetic fields of other particles while flying past them. Accordingly, a neutrino originating in the Milky Way, or even in some other galaxy, and travelling with the speed of light, can go clean through the solid body of the earth as if it were so much empty space. A neutrino can be stopped only by a direct, head-on collision with another elementary particle, and the chances of such a direct collision, while passing through the whole earth, are estimated at about one in 10,000 million.¹ 'Fortunately', as the science writer Martin Gardner remarks, 'there are enough neutrinos around so that collisions *do* occur, otherwise the neutrino would never have been detected. As you read this sentence, billions of neutrinos, [coming from the sun] and other stars, perhaps even from other galaxies, are streaming through your skull and brain [1].'² Not only physicists were excited by the discovery of the neutrino. John Updike, the novelist, wrote a poem to celebrate it, called 'Cosmic Gall' [2]:

Neutrinos, they are very small.
They have no charge and have no mass
And do not interact at all.
The earth is just a silly ball
To them, through which they simply pass,
Like dustmaids down a drafty hall
Or photons through a sheet of glass.
They snub the most exquisite gas,
Ignore the most substantial wall,
Cold-shoulder steel and sounding brass,

1. Reines and Cowan, the discoverers of the neutrino, have in recent years established laboratories in the depths of salt-mines and gold-mines to trap pure neutrino showers, uncontaminated by other particles from space which cannot penetrate to those depths.

2. Numbers in brackets correspond to references at the end of this article.

Insult the stallion in his stall,
And, scorning barriers of class,
Infiltrate you and me! Like tall
And painless guillotines, they fall
Down through our heads into the grass ...

To the unprejudiced mind, neutrinos have indeed a certain affinity with ghosts—which does not prevent them from existing. This is not just a whimsical metaphor. The absence of ‘gross’ physical properties in the neutrino, and its quasi-ethereal character, encouraged speculations about the possible existence of other particles which would provide the missing ink between matter and mind. Thus the eminent astronomer V. A. Firsoff suggested that ‘mind was a universal entity or interaction of the same order as electricity or gravitation, and that there must exist a *modulus of transformation*, analogous’ to Einstein’s famous equality $E = mc^2$, whereby ‘mind stuff’ could be equated with other entities of the physical world [3].’ He further suggested that there may exist elementary particles of the mind-stuff, which he proposed to call ‘mindons’, with properties somewhat similar to the neutrino’s [4].

Firsoff’s ‘mindon’ is a rather primitive model marred by that atomistic interpretation of mental events which psychology is at long last beginning to outgrow. A more sophisticated approach has been suggested by Sir Cyril Burt, whose ‘psychons’¹ have configurational rather than particle character, but he did not elaborate on it in detail. The most recent attempts to provide a link between the psi function of quantum mechanics and the psi phenomena of parapsychology were made by the physiologist Sir John Eccles and the mathematician Adrian Dobbs. But they require a preliminary excursion to even wilder shores of modern physics than we have glimpsed so far.

Is space really empty?

In 1931, Paul Adrian Maurice Dirac of Cambridge proposed a theory which would have been rejected as outright crankish if its author had not been one of the outstanding physicists of his time, whose greatest previous achievement (for which he got the Nobel Prize in 1933) had been the unification of Einstein’s theory of relativity and Schrödinger’s wave mechanics. However, the unified theory ran into new difficulties, which Dirac sought to overcome by postulating that

1. The term psychon was originally suggested by Whately Carington.

space was not really empty, but filled by a bottomless sea of electrons with *negative mass* (and consequently *negative energy*). Negative mass is of course beyond human imagination; if anything can be said of a particle of this kind it is that if you try to push it forward, it will move backward, and if you blow at it, it will be sucked into your lungs.

Since, according to the hypothesis, all available locations in space are uniformly filled with minus-energy electrons, they do not interact, and do not manifest their existence. Occasionally a high-energy cosmic ray may hit one of these ghost electrons and impart its own energy to it. As a result, the ghost electron will leap out of the sea, as it were, and become transformed into a normal electron with positive energy and mass. But there is now a 'hole', or bubble, left in the sea where the electron had been. This hole will be a negation of negative mass: it will have positive mass. But it will be also a negation of the former occupant's negative electric charge: it will have positive charge. The hole in the cosmic ocean would in fact be, Dirac predicted in 1931, 'a new kind of particle unknown to experimental physics, having the same mass as and opposite charge to an electron. We may call such a particle an anti-electron.'

But the anti-electron, he further predicted, would be short-lived. Very soon a normal electron would be attracted by the 'hole', fall into it, and the two particles would annihilate each other, de-materializing in a flash of high-energy rays.

The theory sounded so wild that Niels Bohr wrote a spoof on it called *How to Catch Elephants*. With the school boy humour which seems to be a characteristic of great physicists, he proposed that big-game hunters should erect at a watering spot frequented by elephants a large poster which briefly summarizes Dirac's theory. 'When the elephant, who is a proverbially wise animal, comes to have a drink of water, and reads the text on the poster, it will become spellbound for several minutes.' Profiting from its trance-like state, the hunter will slip out from his hiding place, tie the elephant's legs with solid ropes, and ship him to the zoo in Copenhagen.¹

One year after the publication of Dirac's paper, Carl D. Anderson, working at the California Institute of Technology, was studying the tracks of cosmic-ray electrons in the bubble-chamber, and found that when passing through a strong magnetic field some of them were deflected in a direction opposite to that which normal electrons with a negative

1. I owe this story to George Gamow.

charge should follow. Anderson concluded that his weird particles must be positively charged electrons, and called them positrons. They were in fact the 'anti-electrons' or 'holes' predicted in Dirac's paper—which Anderson had never read.

Anti-particles are rare

Since the discovery of the anti-electron, physicists have found—or produced in their laboratories—anti-particles corresponding to every known particle. The fifty particles known today and their fifty 'antis' are in every respect alike, except that they have opposite electric charges, magnetic moments and opposite 'spin' and 'strangeness'. But anti-particles are, under normal conditions, very rare: they are either produced by radiation from outer space or by bombarding matter with extremely powerful projectiles; and they are, as already said, very short-lived, because whenever an anti-particle meets its terrestrial *alter ego*, or *Doppelgänger*, they annihilate each other.

It is considered quite possible that other galaxies are composed of anti-particles, combining into anti-matter; and furthermore, that some spectacular celestial events, such as supernovae or powerful invisible X-ray sources, originated in the collision and mutual annihilation of clouds of matter and anti-matter. These apocalyptic perspectives have become a favourite subject of science-fiction writers—and have also inspired some more quantum poetry.

Yet the theory of an ocean of particles of negative mass, though sufficiently striking to mesmerize an elephant, was regarded with distaste by many physicists. Not because it sounded fantastic; but because it could neither be verified nor refuted by any conceivable method; and it had a suspicious affinity with the nineteenth-century ether. The anti-particles were accepted facts, but physicists were looking for a more elegant theory to account for their behaviour.

One such theory was suggested in 1949 by Richard Phillips Feynman, also of the California Institute of Technology. He proposed that the positron is nothing but an electron which, for a while, is moving backwards in time, and that the same explanation holds for other anti-particles. On the so-called Feynman diagrams, which soon became household articles to physicists, one axis represents time, the other space; particles can move forward and backward in time, and a positron travelling, like all of us, into the future behaves exactly as would an electron travelling momentarily into the

past. The time reversals postulated by Feynman are short-lived, because in our world anti-particles are short-lived; whether in a galaxy consisting of anti-matter time would permanently flow backward relative to ours is a matter of speculation. But as far as terrestrial physics goes, Feynman's concept of time-reversal proved so productive that in 1953 he received the Albert Einstein Medal and in 1965 the Nobel Prize. The philosopher of science, Hans Reichenbach, wrote that Feynman's theory represented 'the most serious blow the concept of time has ever received in physics' [5].

Problem of two time dimensions

The history of science has shown over and over again that the fact that a theory 'works' and produces tangible results does not prove that the underlying assumptions are correct; and Feynman's theory presents formidable logical difficulties, even by the permissive standards of modern microphysics.¹ Among various attempts to overcome them is the hypothesis by Adrian Dobbs,² which introduces two time dimensions, instead of one. A five-dimensional universe with three spatial and two temporal dimensions had already been proposed by Eddington and others; but Dobb's theory contains refinements which take into account the unpredictability and indeterminacy of the future in quantum physics. Accordingly, the arrow of time, progressing along the second time dimension, moves through a probabilistic, instead of a deterministic, world; and it resembles less an arrow than a wave front. However, the main interest of Dobb's hypothesis lies in his attempt to provide a physicalistic explanation of telepathy and precognition, more sophisticated than any offered before. So sophisticated in fact that it is almost impossible to understand without some working knowledge of quantum theory.

The gist, however, regarding precognition is that the anticipation of future events follows the second time dimension, where 'objective probabilities' play the same part as causal relations in classical physics. In Dobb's own words he proposes 'a second time dimension in which the objective probabilities of future outcomes are contained as compresent

1. See, for instance, G. J. Whitrow's criticism in J. T. Fraser (ed.), *The Voices of Time*, London, 1968.

2. Adrian Dobbs, who died in an accident while this essay was being written, was a brilliant Cambridge mathematician and physicist engaged in top secret work related to national defence. This was disclosed in a moving obituary by Professor C. D. Broad in the *Journal of the Society for Psychical Research*, December 1970.

dispositional factors, which incline or predispose the future to occur in certain specific ways' [6]. This has the initial advantage of getting round the old logical paradox that foreknowledge of a future event would imply the possibility of interfering with that event and thus nullifying the foreknowledge.

Dobbs uses the term 'pre-cast' instead of 'precognition', to indicate that it refers not to prophecy but to the perception of the probabilistic factors in a system which predispose it towards a given future state. But these pre-casts are not based on guesswork, nor on rational inferences, since the 'dispositional factors' of the system cannot be observed or deduced. Information about them is conveyed to the subject by hypothetical messengers which Dobbs calls 'psitrons' and which operate in his second time dimension. They are particles with rather startling attributes, but not much more startling than Pauli's neutrino, Dirac's minus-mass electrons, or Feynman's electrons travelling back in time—each of which brought in a Nobel Prize.

Dobb's concept of the psitron is, in fact, the joint product of current trends in quantum theory and brain research. It has *imaginary* mass (in the mathematical sense). Imaginary numbers have *negative squares*, although by definition the square of any natural number, whether negative or positive, must be positive ('minus times minus makes plus'). But they are useful tools in quantum physics, where they are equivalent to introducing an added dimension besides ordinary energy, mass or time. Thus, according to relativity theory, the psitron can travel faster than light indefinitely, without loss of (imaginary) momentum.

This 'patterned set', or swarm or cloud, of psitrons of imaginary mass, impinging on neurons in the percipient's brain, which are in a particularly receptive condition, would transmit not only information about the *actual* state of the system that emits them but also 'pre-casts' of its inherently probable future state, which are already reflected in the 'feelers in all directions' which it sends out. Thus the psitrons, Dobbs says, would play an analogous part to that of photons in ordinary vision—except that the psitrons would act directly on the brain, instead of the eye; that they have *imaginary* rest-mass, while the photon's rest-mass is zero; and that they carry information on both *actual* and *virtual* processes, the latter 'precasting' the immediate future. If the reader finds much of this obscure, he must seek comfort in the thought that obscurity is, so to speak, built into quantum physics like the holes into a Gruyère cheese.

Short-circuiting the senses

On the crucial question, how the hypothetical psitrons could convey information direct to the percipient's brain, short-circuiting as it were, the sensory apparatus, Dobbs resorted to a theory advanced some years ago by Sir John Eccles. This eminent physiologist received the 1963 Nobel Prize for his pioneering work on the transmission of nerve-impulses across the synaptic junctions between brain-cells. In the last chapter of his textbook on *The Neurophysiological Basis of Mind*, Eccles launched what he called a 'hypothesis of the mode of operation of "Will" on the cerebral cortex' [7].

Eccles proceeds to work out a concise theory of how a minute 'will-influence', affecting a single neuron in the cortex, could trigger off very considerable changes in brain activity. The trigger-action would affect neurons which are 'critically poised', as he puts it, i.e. in unstable equilibrium, just below the threshold of discharging a nerve impulse. In view of the fact that there are some 40,000 neurons packed together per square millimetre of the cerebral cortex, and that each neuron has several hundred synaptic connections with other neurons, we have here a network of density and complexity [7]. Eccles is a determined opponent of the positivist argument that while 'brain' is a reality, 'mind' is a fiction—a ghost in the machine [7]. In the concluding sections of his book, he includes extra-sensory perception (ESP) and psychokinesis (PK) into his theory. He accepts the experiments of Rhine, Thouless, Soal, etc., as evidence for a generalized 'two-way traffic' between mind and matter, and for a direct traffic between mind and mind. He believes that ESP and PK are weak and irregular manifestations of the same principle which allows an individual's mental volition to influence his own material brain, and the material brain to give rise to conscious experiences. He also reminds us of an unduly neglected hypothesis, which Eddington formulated in 1939, of a 'correlated behaviour of the individual particles of matter, which he assumed to occur for matter in liaison with mind. The behaviour of such matter would stand in sharp contrast to the uncorrelated or random behaviour of particles that is postulated in physics' [8].

Let us now return to Dobbs. Eccles seems to have deliberately abstained from giving any indication of the supposed nature of those 'influences' or 'influence-fields' which are meant to serve as vehicles for the traffic between matter and mind, or mind and mind. Dobbs proposed to provide such a carrier by the psitron which, when it impinges on the

'critically poised' neurons in the brain, can trigger off 'a cascade or chain reaction' of neural events.

Although Dobbs' hypothesis includes telepathy, clairvoyance and precognition, it says nothing about the problem of how mind and brain interact in one and the same ordinary person—which was Eccles' starting point. Dobbs is not directly concerned with the mind–body problem; he takes it for granted that certain processes in the brain give rise 'to certain states of awareness'—and that applies regardless of whether the brain processes in question were induced by extra-sensory, or common sensory, perception. The distance in space which the psitron has to travel is irrelevant—as it is irrelevant to neutrinos.

Sensory and 'extra'-sensory

Thus we arrive at the paradoxical conclusion that physicalistic theories such as Adrian Dobbs', however ingenious, may explain the 'extra' in extra-sensory perception, but leave the basic mystery of ordinary, sensory perception where it was before. But at least these theories, based on assumptions which sound weird but hardly more weird than those of modern physics, go a long way towards removing the aura of superstition from the 'extra' in extra-sensory perception. The odour of the alchemist's kitchen is replaced by the smell of quark in the laboratory. The *rapprochement* between the conceptual world of parapsychology and that of modern physics is an important step towards the demolition of the greatest superstition of our age—the materialistic clockwork universe of early-nineteenth-century physics. 'To assert that there is *only matter* and no mind', Firsoff wrote, 'is the most illogical of propositions, quite apart from the findings of modern physics, which show that there is no matter in the traditional meaning of the term.'

I have suggested that the seemingly fantastic propositions of parapsychology appear less preposterous in the light of the truly fantastic concepts of modern physics. My purpose in describing Dobbs' theory in the context of quantum mechanics was merely to illustrate this point—without any claim that the theory is correct, or even on the right lines; I could have cited other hypotheses to make the same point. Physicists are not shy of producing *ad hoc* hypotheses—or speculations—to accommodate newly discovered phenomena which do not fit into the existing framework. The Greeks knew the electrical properties of amber—or *elektron*—but were not interested. For some 2,000 years nobody was

interested. When, in the seventeenth century, experimenting with electricity became fashionable, previously undreamt-of phenomena were discovered, and scientists vied in proposing hypotheses to account for them—postulating effluvia, liquid fires, currents, fields, without turning a hair. Magnetism and gravity had a similar history: when Kepler suggested that the tides are due to attractive forces emanating from the moon, Galileo shrugged the idea off as an ‘occult fancy’ because it involved action at a distance and thus contradicted the ‘laws of nature’; but that did not deter Newton from postulating universal gravity. *Hypothesis non fingo* is perhaps the most shocking piece of hypocrisy ever uttered by a great scientist.

This does not mean that hypothesis-making is a free for all. To produce live rabbits out of a hat needs a skilled magician. Quantum physics may be mad but it has method, and it works. I talked of a negative *rapprochement* between quantum physics and ESP, in so far as the surrealistic concepts of the former make it easier to suspend disbelief in the latter; if the former is permitted to violate the ‘laws of nature’ as they were understood by classical physics a century ago, the latter may claim the same right. But to stress the point once more, this is merely a negative agreement, a shared disregard for ancient taboos, for a mechanistic world view which has become an anachronism.

That is all to the good. There are, however, phenomena in parapsychology which no physicist, however open-minded, can willingly accept on face value: I mean PK—psychokinesis.

The ‘extra’ bit in extra-sensory *perception* may quite possibly become in the not-too-distant future amenable to theoretical treatment in terms of quantum physics enriched by new ‘fields’ added to the existing ones, and new types of interactions added to the existing repertory of four.¹ But such optimism seems less justified when it comes to psychokinesis. I am unaware of any serious attempt at a physicalistic explanation of how a mental effort could influence the motions of rolling dice. The reason is simple: ESP and PK are operating in different dimensions; and just as the rigid mechanical laws of the macroscopic world do not apply to microphysics, so the freedom enjoyed in the realm of microphysics does not apply to the macroscopic level. An atom is ‘free’ to do this or that within Heisenberg’s indeterminacy relation, and

1. Contemporary physics knows four types of interaction: the ‘strong’ and ‘weak’ nuclear interactions; the electro-magnetic and the gravitational. Each obeys its own set of laws.

all our statements about it refer to probabilities, not to certainties. But, according to the law of large numbers, in a macroscopic body of trillions of atoms, the deviations cancel out, the sum of probabilities results in practical certainty, and the old taboos retain their validity. Thus when an ESP message in the shape of mindons, psitrons or what have you impinges on a critically poised neuron, it operates on the quantum indeterminacy level and can do wonders, so to speak. But this process is not reversible. You cannot influence the progress of a macroscopic body, like a rolling die, by microphysical particles or wavicles of imaginary mass. Thus the law of large numbers, which lends such authority to the evidence for ESP, is at the same time the main obstacle to any physicalistic explanation of PK.

This does not mean that the evidential value of the macroscopic PK experiments, by Rhine and others, is to be disregarded. It only means that, though we have to accept the evidence, we have to renounce any reasonable hope of a physical explanation, even in terms of the most advanced and permissive quantum mechanics. And the same dilemma confronts us as we turn to a type of phenomenon which has puzzled man since the dawn of mythology: the disruption of the humdrum chains of causal events by coincidences of an improbable nature, which are not causally related yet appear highly significant. Any theory which attempts to take such phenomena seriously must necessarily involve an even more radical break with our traditional categories of thought than the pronunciamentos of Heisenberg, Dirac or Feynman. It is certainly no coincidence that it was Wolfgang Pauli—father of the neutrino and the ‘Pauli principle’, a cornerstone of modern physics—who outlined such a theory, in collaboration with the psychologist C. G. Jung. The interested reader is referred to Jung’s treatise *Synchronicity—An Acausal Connecting Principle*, and its discussion in the book on which the present essay is based.

Arthur Koestler

(*For a comprehensive review of the four kinds of interaction invoked to describe physical phenomena, see Steven Weinberg, ‘Unified Theories of Elementary-Particle Reaction’, Scientific American, Vol. 231, No. 1, July 1974. An excellent account of the emergence of quantum mechanics as a theory now fifty years old is Rémy Lestienne and Michel Paty, ‘Il y a Cinquante Ans Naissait la Mécanique Quantique’, La Recherche, No. 47, July-August 1974.*)

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Notice to readers

To cope with rising costs of production (largely the price of paper) and distribution, Unesco regrets that it must raise the price of the journal to 32 French francs annually, effective the beginning of the coming year.

Psychotronics: the state of the art

Zdeněk Rejdák

The field of study known formerly as parapsychology is undergoing a massive renovation, extending to all its ranks, its procedural methodology and its accumulated literature. The renewal of the discipline, now called psychotronics, overlays a new technical-physical dimension on an earlier philosophical-psychological conception. The field embraces the study of many of the psychophysical phenomena discussed throughout most of this issue of Impact of Science on Society.

Psychotronics is the theory of interactions over distance, interactions bound by an energetic form as yet not understood. This form of energy is a property of living matter, and the interactions manifest themselves between 'subjects', between subjects and 'objects' (including living objects).

Workers in various branches of science have long been aware of a range of phenomena which, although they interfere individually with existing branches of science, cannot be understood with the means at the disposal of organized science. This is why the problems related to these phenomena have been sidetracked from the main line of scientific research. Despite this, however, parapsychology came into being to deal with some of the unexplained phenomena; the rapid progress made in scientific research has also shown that the phenomena in question really exist.

The last ten years have been marked by many changes in the field of psychotronics. The problem over-all has been, in some respects, one between generations. Researchers of the older generation actively interested in psychotronic questions conceived their approach to the problem mainly in its philosophical and psychological aspects. Most frequently, they concluded that very complex psychic processes were involved which, besides, were regulated only

with difficulty and were therefore not reproducible. These older persons saw as their main task the proof and defence of the existence of these processes. As far as the collection of facts and the conducting of great numbers of experiments are concerned, their work is evidently worthy of respect.

Younger scientists began to believe, during the same period, that the approach of their elders was one-sided. They preferred to model, intensify, formulate and calculate. Psychotronics has been deemed by the younger generation to be too attractive to overlook, especially since the milestones along its path of development are emblazoned with names like Jan Evangelista Purkyne, Crooks, Lodge, Babak, Richet, Driesche, Bekhterev, Vasilyev, Rhine, Tenhaeff and others. Their efforts to grasp the more technical problems caused them to abandon the earlier view of psychotronics as a borderline interdisciplinary branch. To the unipolar philosophical-psychological conception, the younger breed of researchers added a second pole of technical and physical conception.

■ The degrees of belief

In the vast ground between these two poles, we should be concerned with the relationship between the scientific public and questions of

psychotronics. At present, a qualitative change is taking place: a basic turning point has been reached in the minds of many scientific workers. Not only have they shown growing interest in psychotronic matters, they have begun active research in the domain. To illustrate the scale of interest of the scientific world in regard to psychotronics, the degree of relation would look something like this: 1, positive; 2, neutral; 3, indulgent; 4, expectant; 5, indifferent; 6, negative; 7, *a priori* negative.

The attitudes of the majority of scientists are described by the first four adjectives on the scale. You will note that there is a stepping up of the critical attitude manifested toward psychotronic questions. (I do not assume any uncritical enthusiasm among scientists.) Rather, there is a constructively critical attitude which could be expressed as follows: in principle, they favour investigating these problems, they are interested in the existence of the phenomena investigated in psychotronics, but it is essential that there be available properly elaborated and precise methods of research corresponding to the importance of the problems involved.

I do not want to imply, for my part, that the methods used thus far have been unscientific; they were adequate at the time they were selected, whether to prove the existence of the phenomena, to classify them, or determine the conditions and periodicity of their occurrences.

Let us look now at the scientists listed on our scale as Nos. 6 and 7, beginning with the 'negative' attitude. These believe that psychotronic phenomena do not exist or are the product of the imagination; or if they admit their existence, they come to the conclusion that the phenomenal events occurred by chance, or that the conditions obtaining at their occurrence were falsely interpreted; or else that the specific phenomena really exist but, because they cannot be reproduced at any time in approximately the same conditions, the 'negative' scientists see no clear reason why they should deal with the phenomena. In the last case, they pose the question: is there any sense in investigating phenomena which can occur even intensively (e.g. spontaneous psychokinesis) if we cannot take hold of them firmly enough to be able to describe them adequately?

The Czech academician, Josef Charvat, in his *Life, Adaptation and Stress*, gives an unequivocal response to the requirement to apply mechanically the positivist methodology

to living processes: 'primum movens of the central nervous system is spontaneous activity, inquisitiveness, creativity. We have no model in the physical world for biological behaviour, after all. Therefore any comparison of a stabilized state in living matter with similar states in chemical systems is but approximate and even further removed from psychism.'¹

A scientist with a negative spirit, once he has decided to examine problems in psychotronics, wants to see for himself, to experiment. There is the case of the British mathematician S. G. Soal. He had attacked the statistical proof confirming certain phenomena and reproached the researchers for not having improved their statistical method. Only after he had met two of the experimental subjects himself was he convinced of the reality of the phenomena. And yet we, the practitioners, admit freely that we much prefer scientists who show a negative attitude and a sceptical approach as long as possible to uncritical and naive enthusiasts.

■ Hard-core resistance

In quite a special category belong the *a priori* negativistic scientists. There was, in Czechoslovakia, a well-known psychiatrist and hypnologist who repudiated entirely the field of psychotronics. It happened once that an experimental subject seated with his face turned toward a blackboard, yet in a deep hypnotic sleep, began to read what the psychiatrist had written on the board; the subject then read a text the physician had written in pencil on a sheet of paper. The specialist was unhappy about the incident for an entire week, but soon concluded that the subject was able to read because he could analyse the sound of chalk scratching on the board and of the pencil moving over paper. Rather than admit the possibility of some unconventional transfer of information, our scientist preferred to invent a 'substantiation' of an entirely speculative character. He became, in fact overnight, a specialist in subliminal hearing. Noteworthy here is that *a priori* negativists can make incursions, without scruple, into fields alien or incomprehensible to them.

1. See, by way of comparison, the round table discussion: 'Can Thermodynamics Explain Biological Order?' *Impact of Science on Society*, Vol. XXIII, No. 3, 1973.—Ed.

Still, we can consider this speculative brand of *a priori* negativism as being within the bounds of decency. Worse is the case of the scientist who dips into negativism so deeply that he abandons the ethics of scientific work, and even resorts to misrepresentation and falsification. I make reference, for example, to trick photography submitted to disprove positive experiments; this occurred at a symposium held in Freiburg in 1968; a second example is the misrepresentation of fact, as in the case of Professor A. I. Kitaigorodskiy.

What are the motives behind negativism *a priori*? There are several. First, there is the negativism of persons unconcerned with whether paranormal phenomena exist or not; scientific fact to them is only that which is already regarded as scientific fact. Academician Petr Kapitsa, on the other hand, does not divide phenomena into the possible or impossible; he prefers the discovered and undiscovered distinction. 'It is enough to read the works of Newton and his contemporaries' (Kapitsa has written) '... they believed that the knowledge of inanimate nature was completed ... we must not make again the old mistake and believe that there will be no more new discoveries in the future'. The Soviet physicist adds, 'I want to pay attention to one basic question concerning the study of living nature ... the majority of phenomena are explained by existing laws, but it still seems to me that one of the fundamental properties of living nature, the ability of reproduction, can be the manifestation of some natural forces which we do not yet know and which we cannot explain by the rules known so far.'

Second, their attitude is motivated by fear. The field is unknown, and whatever might be observed could lead to mysticism. The opposite is true, however: avoiding the unknown area gives free rein to charlatans broad scope to rampant prejudice. Their fears are fostered further because the negativists cannot imagine how any new knowledge could be integrated with the sciences to which these scientists have become accustomed. They stop being impartial in their science. Their apprehensions are groundless: all knowledge can be broadened, complemented and made more precise.

Third, to be negative *a priori* reflects a motivation of conservatism and indolence. After having become the master of scientific territory, engaging in something new requires

learning now to think in a new way. The desire to have understood everything is not a trait shared by all.

■ Breaking down the resistance

How should those dealing with psychotronics join hands with those still distrustful of this discipline?

They should, first, accelerate elaboration of an adequate methodology in the research on psychotronic phenomena. They should pattern their experiments, secondly, in such a fashion that these can be repeated at any time. Practical experimentation in psychotronics must be one of our main targets. And thirdly, the scientific public should be enlightened by way of appropriate publications. This task is complicated by the flood of information available to scientists today; it is difficult to keep up in one's own field, but scientists in general should be made aware of the growth of literature during the past twenty years in what they consider to be the paranormal fields. Lastly, of course, there is the continuing job of keeping the lay public informed; there the spread of progressive thinking must play a decisive role.

All branches of science are of interest to laymen, but ours has attracted particularly many because it deals with both psychic and somatic questions—what makes man live and be himself. Laymen dealing with our branch do so, however, as rank amateurs bringing their personal problems into the picture, sometimes even distorting and discrediting the work done. Pressing is the question of how to enlighten properly the non-scientific public. The sensational stories about houses haunted by ghosts, about astral projections and the like, these attract the layman but do immeasurable harm otherwise. Psychotronics is not the same as spiritism, which of late has become an opiate to certain elements of the general population throughout Europe, the Americas and elsewhere.

In an age when scientific advance is taking giant strides, the assumption of an interdisciplinary approach is the cardinal condition for the orderly investigation of psychotronic phenomena. Only this will help us extricate ourselves from the current conjecture, uncertainty and disputes—by combining the scientific method peculiar to physics, communication techniques, mathematics, cybernetics, psychology, psychiatry, medicine, neurophysiology

and physiology, bionics, geology, anthropology, sociology and space biology,

It is readily apparent that there is no need to retain the term 'parapsychology'. It fails not only to reflect the multidisciplinary character of the field, it fails too to convey the existence of the energetic component without which none of the phenomena we are concerned with is imaginable. The combination of both psychic and energetic components has been pointed out repeatedly: by the Russian physician Kotik (1908), later by Hans Berger in the 1920s and 1930s, and by the Dutch geologist Tromp (1949). We specialists in the field decided to adopt the term 'psychotronics' proposed, by the French engineer Fernand Clerc, in the radio-technical journal *Toute la Radio*. 'Parapsychology' thus reverts, like mesmerism or metapsychology, to the description of a stage of development of psychotronics.

■ Enriching biology and physics

The main task of psychotronics, now, is to co-ordinate the laws governing the living and inanimate worlds and complement them with new increments of knowledge from physics, biology and psychology; this knowledge will derive from specific manifestations of the human psyche, with man or an appropriate model of man serving as the interlink.

The psychotronic branch of knowledge possesses, today, as voluminous a literature as the entirety existing in other branches. But the sources of the literature of psychotronics are such that a second task of psychotronic specialists is to reevaluate the existing documentation. An analysis of past laboratory experiments will help us, also, to define clearly the methodology of the discipline. A re-assessment of this kind will serve, too, to prevent the division of psychophysical phenomena into discrete psychic and physical segments. It is not by mere chance that some physicists in the Federal Republic of Germany involved in plasma research believe that new knowledge of the interactions between living organisms will enrich both biology and physics.

Parapsychology dealt mostly with rarely occurring phenomena, trying timidly to indicate that these incidents probably will affect everyone to a small degree. Psychotronics, through its pluridisciplinary approach, seeks to establish that psychophysical phenomena affect 90 per cent of mankind. Refraining

from examining the exceptional prodigies psychotronics purposely shapes its experiments in such a way that they can be reproduced substantially at any time. This purpose applies whether we are concerned with the action of the human organism on an easily movable system (e.g. an indicator of negative pressure or vacuum, an easily movable system on a liquid's surface, or the possibility of visual influencing) or using a device (say, a plethysmograph) to determine remote, synchronous neurophysiological processes.

Test results so far are not necessarily sensational, but they show a certain stability. It is now that we realize that all of us observe psychotronic phenomena (such as spontaneous telepathy between mother and child) in our daily lives, that these have been associated with man, even with living matter, since time immemorial. They are comparable to electrical or chemical processes, although it may still be impossible to reduce them neatly into either one. If parapsychology functioned as the model

Individual → Output,

then psychotronics takes as its model

Living organism (Man) → Energetic work → Output.

The introduction of automation control and electronic information processing machines to all walks of life about twenty years ago caused us to proclaim the scientific-technical revolution. After the first flushes of delirium with what these marvels of machinery could do (compose music, write poems, pour forth advertising design), came sober reality. Man began to doubt himself, suffering from an inferiority complex vis-à-vis the all-powerful, all-controlling technology he had created. In the hustle and bustle of this scientific-technical upheaval, man had somehow forgotten himself. Contemporaneously, the qualitatively new investigations into psychotronics came at the right time. This research is helping rehabilitate the basic human values, revealing that man is not so helpless after all.

Psychotronics may lead us to the very brink of a new revolution in science. It is here that we must give substance to that second pole of which I spoke: a scientific-human conception to counterbalance the scientific-technical revolution we are experiencing. Otherwise, we shall flood the

world during the next century with both mechanical and human robots, thereby stepping up estrangement and social disintegration. It is in our power to avoid this.

■ Dr Zdenek Rejdák

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TO DELVE MORE DEEPLY

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Electromagnetic fields and the brain

Yuriy A. Kholodov

All manner of electromagnetic radiation surrounds man's body, yet the possible effects of these pulsed wave fields on the animal organism are poorly understood. Besides these external influences, the body generates its own internal electromagnetic fields; we know little about how these interact. The present finds us on the threshold of a vast new area of research offering multiple approaches toward future comprehension: cognitive, physiological, instrumental, hygienic, therapeutic and ecological.

When the question of the possibility of extra-sensorial influence on living beings comes up, one thinks of electromagnetic fields (EMF) as an example. From the evolutionary point of view, man is adapted to perceive, by means of specialized sense organs, only two small adjacent sections of the range of electromagnetic oscillations. We are all aware of these EMF, which we experience as heat and light.

In the twentieth century, when radio waves are a normal part of our environment, the question of how EMF with a longer wavelength than infra-red rays affect the organism has become extremely important. Here I propose to deal with questions connected with the influence on the central nervous system of radio waves, low-frequency electromagnetic fields, and electrical and magnetic fields. What the EMF listed have in common is their penetrative action and the absence of any resultant specific sensation in man, from which it may be concluded that they act on the human organism in a sub-sensory way.

Before turning our attention to the central nervous system in particular, we must make a classified list of the types of those EMF which exercise an influence on living beings.

From the biological point of view, electromagnetic fields can be divided into four groups (Table 1). Of greatest interest to biologists are the natural EMF, which can be divided into external (cosmic, geographical or biological in origin) and internal, generated by the various structural levels of the organism. Next come the artificial EMF, which can be divided into weak and strong as compared with the geophysical.

While admitting that the classification of EMF which we have given does not cover every case, I think, nevertheless, that this makes it possible to systematize the data which have been accumulated about their biological effects.

The classification is based on the hypothesis that natural EMF have an ecological significance, although this theory is not yet generally accepted and requires further experimental confirmation. It should be mentioned that of the four types of EMF in the second column of Table 1, only the last one, the strong artificial type, can be adequately corroborated by extensive biological research. The other sections contain EMF whose biological influence needs to be studied in greater detail. I can describe briefly what is known about the influence on the functio-

ning of the nervous system of EMF of various origins.

Table 1. Sub-division of electromagnetic fields in relation to living beings.

Origin of electromagnetic fields (EMF)	Characteristics of EMF with respect to living beings and geophysical conditions	Source or means by which EMF are generated
Natural	External	Space Geophysical processes Living beings
	Internal	Systems of the organism Cells Intra-cell formation Biomolecules
Artificial	Weak	Screening Establishment of an anti-field
	Strong	Various technical generators

■ Natural external electromagnetic fields

Biological research into EMF oscillations which are cosmic or geophysical in origin is, generally speaking, conducted on the public at large. There is evidence that when geomagnetic activity increases, more beds are occupied in psychiatric hospitals in the United States of America [1, 2, 3]¹ and epileptic fits and suicides are more frequent. It was shown in a recent paper by Iskhakov [4] that an increase in intensity of the geomagnetic field can affect the formation of the central nervous system in the prenatal period and can certainly increase the number of schizophrenics in the population. It should be

noted that the illness is diagnosed some considerable while after the year of birth.

Books on heliobiology also deal with the possible influence of geomagnetic oscillations on the functioning of the central nervous system. The hypothesis has been advanced that geomagnetic oscillations influence cardiovascular diseases by way of the central nervous system; more precisely, a link has been shown to exist between the aggravation of these diseases and the geomagnetic field [1, 2, 3, 4].

If the oscillations of natural EMF help living beings in some way to orient themselves in time, the vectoral nature of the geomagnetic field helps them to orient themselves in space. There is a well-known theory about how birds find their way by means of the geomagnetic field when migrating over long distances. Laboratory experiments have shown that many species of birds, while their main means of finding their way when migrating is by the stars, also possess the ability to find their way by means of the geomagnetic field—although they use this method only if it is impossible to get their bearings by the first. Use of the geomagnetic field is thus one of the many ways by which birds can orient themselves, and this ability must therefore be taken into account in studying the complex problems of how birds find their way. This is also true of the orientation of fish, insects and other animals and even of plants, the influence of the geomagnetic field on which has been demonstrated in field and laboratory experiments [2, 5, 6].

■ Electromagnetic fields of biological origin

After describing the reactions of fish to natural external EMF, we can go on to the reactions of the central nervous system to natural EMF of biological origin, since it is only in fish that electrical generators and electrical receivers have been found so far [7]. We shall not touch on every problem connected with the role of biological EMF in the life of fish, but simply note the possible significance of biological EMF in the organization of behaviour.

According to the intensity of the biological EMF created by them, fish may be classified

1. Figures in brackets correspond to the references at the end of this article.

as electrical (over 20 volts), weak electrical class 1 (up to 17 volts) and weak electrical class 2 (up to a few millivolts). The biological EMF set up by fish extend over a frequency range of up to 2 kHz, or 2,000 cycles per second. They are set up either by special electrical organs or by non-specialized nerve and muscle structures. The properties of biological electromagnetic fields are no different from those of EMF set up by mechanical generators. In other words, biological EMF have an electrical and a magnetic component, they grow weaker with distance, and so on.

The sensitivity of the fish in one group extends over a range of 0.01 to 0.1 mv/cm, and those in the other group over a range of 10 to 100 mv/cm, a difference of several orders of magnitude. In the first case, there may be a unique kind of 'electrical perception' of the environment. It is thought that the centres governing the electro-receivers are in the medulla oblongata and cerebellum of the brain.

The main uses which fish make of biological EMF are for defence and attack, orientation in space (location and navigation), and the signalling associated with contacts between living organisms. It would be interesting to know why the evolutionary process has restricted the use of biological EMF to fish alone. We must hope that in time it will be found that other aquatic or land animals also use them in some ways. We shall also discover whether a person, by consciously changing his own biological EMF, can transmit information to another person [8].

How does a biological EMF set up by the organism of a fish, for example, influence that organism itself? This is a question to which a definite answer can be given. An internal EMF or biological electromagnetic field can be used for the purposes of electro-location, but in this case the internally produced EMF changes into an external one.

We can leave to one side suppositions about the important role played by EMF at the various levels at which a living being's activity is regulated [2], but we shall go into the question of the ephaptic transfer (or transfer by lateral contact between neurons) of information to the central nervous system.

If we study the conditions under which high-amplitude convulsive discharges caused by strychnine poisoning of the intact part of the cerebral hemisphere are transferred to a neuronally isolated strip of brain cortex,

we find that such transfer is possible if bio-potentials of not less than 500 microwatts are generated [9]. When the electrical activity of individual neurons in the strip was monitored, it was found that ephaptic influence can stimulate as well as slow the impulsive activity of the neurons. It should be noted that neurophysiologists studying the ephaptic diffusion of nerve stimulation do not usually discuss the possibility of representing such diffusion by a model, using the influence of artificial EMF. They regard ephaptic influence as primarily non-synaptic, and we have no information about the parameters of the biological electromagnetic field which create this influence. To develop this branch of research, therefore, we must also know the peculiarities of the nervous system's reaction to artificial EMF, whether weak or strong in comparison with the geomagnetic field.

■ Artificial electromagnetic fields

In view of what has been said above, the problems associated with the influence on a living being of an EMF created by technical devices have ecological implications, even though they arise in connexion with health and therapeutic considerations.

As we know, the experimental verification of the significance for biological processes of a particular environmental factor usually includes experiments under natural conditions and under conditions of the controlled reduction or increase of the stimulus being investigated. This is how the influence of hypo- and hyper-oxidation, hypo- and hyper-vitaminosis, hypo- and hyper-thermal conditions, and so forth, on the organism are studied. The influence on the brain of hypo- and hyper-electromagnetic conditions is studied in a similar way, taking the intensity of the geomagnetic field (about 0.5 oersteds) as normal.

We know little as yet about the influence of weak EMF on the activity of the brain. For example, future astronauts were placed for five to ten days (the time it takes to go to the moon and back) in a special non-magnetic chamber. Their body temperature was taken, electrocardiograms and electroencephalograms were made, the workings of the inner ear were studied and certain psychological tests were given. No serious deviations were noted. Nevertheless, the

subjective perception of general brightness under these conditions was lower than for the same person in a normal geomagnetic field [5].

In assessing data on the action of weak EMF on the central nervous system, we must remember that this physical factor has influenced the activity of the visual cortex in man and direction-finding by means of geomagnetic field in birds, fishes and insects. After several generations of mice had been bred and kept in a weak EMF, their motor activity decreased, and they preferred to spend most of the time lying on their backs, a posture mice do not usually adopt [5].

Further progress in this branch of research depends upon the development of better methods for studying the biological influence of EMF which are strong in comparison with the geomagnetic field; I shall now say something of these methods.

It should be remembered that the questions we are considering involve a number of sciences, the most important of which are biology, medicine, physics and astronomy. This explains why questions concerning the biological influence of EMF are most fully dealt with at present in publications on bionics. This mixture also causes the very considerable difficulties encountered in all interdisciplinary branches of science.

■ The therapeutic and other approaches

Let us now consider the main approaches to the study of the biological influence of EMF. The approach may be cognitive (when it is difficult to find a connexion with any practical or theoretical problems), therapeutic, hygienic, ecological, physiological or instrumental. There is no occasion to say much about the first, but the other five require detailed explanation.

The therapeutic approach to the study of the biological influence of electromagnetic fields has frequently been particularly empirical in nature. It came into being in ancient times in relation with the study of the medicinal properties of the magnet, and a number of accretions have grown up around it in the course of history—valuable observations, errors, mystique and curiosities. Objectionable characters such as Paracelsus and Mesmer inevitably spring to the mind of the average reader in this connexion. The question of the

healing properties of magnetic bracelets also arises.

Nevertheless, progress in this branch of research is bound to the establishment of a theory of the organism's increased resistance to harmful influences. The central nervous system plays an important role (possibly even a decisive one) in increasing the organism's resistance [6]. It was not until recently that a beginning was made on the investigation and elaboration of a theory as to how resistance can be increased by the influence of electromagnetic fields on the central nervous system, but publications have already appeared concerning the use of magnetic fields as a shock-absorbing device as well as other studies about the healing effect that EMF can have through their influence on the central nervous system. Before a theory can be worked out, however, a very great quantity of existing facts must be surveyed, and this necessitates taking into consideration facts discovered in other approaches to the biological action of EMF, particularly as regards health.

The sequence followed in studying the physiological effect of various sections of the range of electromagnetic oscillations was determined in the twentieth century chiefly by technical conditions. Put simply, things were usually as follows. A particular range of EMF was introduced on a wide scale to meet the needs of a given industry. After a certain time, complaints began to be received about various ailments suffered by the staff. Medical and biological investigations were then made to check the complaints received, and permissible levels of electromagnetic influence were defined. Here the part played by biology ended. The work was comparatively unproductive, and researchers turned to the study of other factors connected with industry.

■ Health and ecology factors

We shall now consider the general conclusions of the findings of the health approach to the biological influence of EMF. The important thing is that the decisive role of the nervous system in the reactions analysed is almost unanimously recognized. In consequence, theories concerning the mechanics of the influence of electromagnetic fields on the nervous system need to be worked out, so that the health approach also can be further developed [2, 5, 6, 10].

The next aspect of the study of the biological influence of EMF to be dealt with may be called the ecological aspect. Paracelsus was of the opinion that man needs not only food in order to live, but a magnetic field as well. Since the beginning of the century, this approach has been linked with the name of L. A. Chizhevsky [1, 3, 4] and his teaching on heliobiology. At the present time, the distinguishing feature of this aspect is the astronomical and geophysical approach to the question of which parameters of natural EMF exercise an influence. The characteristics of the living being do not, in this case, play an important role.

It is interesting to compare the parameters of the characteristics of EMF obtained by the ecological approach, when conditions external to the biological system are analysed, with those given by the physiological approach, when the internal processes of a biological system (most frequently the activity of the nervous system) are examined. A comparison of this kind is all the more necessary in view of the highly convincing theoretical basis of these two approaches at the present time.

The opinion has been expressed that any kind of signal with an intensity range of from 10^{-2} to 10^{-12} watts/cm², the optimum being 10^{-7} W/cm², can give information to the organism [11]. These figures are taken from experiments to define the sensitivity of a person's specialized visual and auditory receptors, and are quite acceptable as an initial working hypothesis.

By analogy with the parameters of the electric component of the rhythm of the stimulated receptor, it is thought that the most marked influence on an organ is produced by signals of optimum intensity, provided by a sequence of millisecond exponential impulses with a frequency of 200 to 400 impulses per second. In investigating EMF as a conditioning stimulus, specialists have been able to show that a conditioned escape reflex of mice in a labyrinth was most successful when the movement frequency was 300 exponential impulses/second and the electromotive force at 0.5 to 0.8 volts/metre [11].

In concluding the description of the physiological approach, we must mention one more aspect connected with the idea of the generation of EMF by biological systems. A considerable number of publications on this subject have appeared, containing data about magnetic and electrical fields recorded around the

nerve structure of various animals [2, 10]. If EMF are generated by a living being, one is tempted to assume that they are biologically significant as regards the link between organisms [2, 8] and between parts of an organism [2, 9, 10].

■ The internal influence

It is to be expected that this aspect of research will be greatly developed in the near future, although, in my opinion, progress will depend more on improvements to the technical capabilities of recording apparatus. Nevertheless, biologists, too, can make their contribution to solving this problem. It has been suggested that external EMF may influence an organism (including the nervous system) through changes in the internal biological EMF. This idea is attractive in so far as it may explain the mechanism of the influence of magnetic fields whether they are weak or strong in comparison with natural EMF.

The suggestion that the biological influence of electromagnetic fields works on the 'field to field' principle also illustrates the next approach to the study of the influence of EMF on the nervous system, which may be called the instrumental approach.

In any experimental research into the influence of an artificial EMF on various biological systems, we use the field as an instrument which changes the composition of the biological system. It must be stressed that such research reveals not only new properties in the electromagnetic field (its ability to exert a biological influence), but also new properties in the biological system itself on which this influence is exercised. Some people think that this aspect is the most important. We may recall that most biological processes are based on chemical reactions. The chemical properties of substances can be accounted for in the last resort by the interactions of atomic nuclei and electrons.

The principles of chemistry, therefore, are determined by more fundamental sciences such as electrodynamics and quantum mechanics. Consequently, electrical and magnetic fields serve as an experimental instrument for obtaining information about basic phenomena. It is, nevertheless, extremely difficult to establish an electrical field of atomic proportions if the medium has a conductivity of different natures. On the other hand, a magnetic

field is not subject to the influence of the medium, which we commonly encounter in chemical and biological systems, and so it is ideally suited to the investigation of basic biological processes.

■ Exploiting external EMF

What I have said applies to any living being. If we look closely at the properties of the central nervous system, we shall see that its functioning is closely linked with electric currents and electrical fields. The ephaptic way of transferring information to the nervous system, with the aid of an electrical field, is being studied as well as the synaptic way. In brief, the role of internal EMF in the functioning of the central nervous system has not yet been sufficiently studied, and the use of external electromagnetic fields as an instrument to solve this problem looks as if it might be successful.

The study of the influence of electromagnetic fields on the nervous system has brought to the forefront such general neuro-physiological problems as the direct influence of stimuli on the central nervous system, the appearance of a primary inhibiting state under the influence of stimuli, and the role of glial elements¹ in the activity of the central nervous system [10]. We may take it as proved that artificial EMF with parameters close to those of natural electromagnetic fields exercise an influence on the activities of the central nervous system [2, 6, 8, 9, 10, 11].

No specialized receptor is necessary for the perception of EMF, for since they have a penetrating effect they are able to act directly on the central nervous system, bypassing the sense organs. This was demonstrated in experiments concerning the influence of EMF on the electrical activity of neuronally isolated structures in the brain. Freed from its links with the nerves, a portion of the central nervous system reacted to the EMF even better than a normal brain [10]. The great importance of neurology was demonstrated in research into the role of neuronal and glial formations in brain reactions to electromagnetic fields.

Thus, not only may the use of EMF in neurophysiological research help solve practical problems we encounter at present which are connected with the evaluation of this factor in various industries from the health point of view and from the point of view

of its therapeutic effect, it also widens the theoretical basis of neurophysiology. It must be admitted that research in our day has led to fewer definitive conclusions and has produced more unsolved problems than has so far been the case, and greater attention must be given to these.

The problems of the biological influence of electromagnetic fields raised at the beginning of the century by V. Y. Danilevskiy [12] can be solved today thanks to the achievements of radio electronics and computer techniques and thanks also to improvements in the methods of biological experimentation.

1. The neuroglia are the connecting and supporting tissue of the nervous system.—Ed.

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Psychotronics and psychology

Michael Cernousek

What is the relationship between psychology and psychotronics, and what place is there for psychology in the new, integrative study of psychotronics? Can they exert mutual influence upon one another? What are the possibilities for experimental and clinical applications? These and other questions concern anyone who is interested in the novel, synthesizing science of man and his relations to other individuals and to nature.

From its historical beginnings, scientific psychology did not study psychotronic (originally called parapsychological) phenomena. Stated otherwise, psychotronics fell outside the area of study traditionally investigated by rigorous scientific researchers. This was partly because of the specific nature of the phenomena in question: they are unseizable, according to the requirements of contemporary, positivistic science. Some psychologists went so far as to deny the existence of psychotronic phenomena.

The existence, the very real being of these phenomena—telepathy and psychokinesis, for example—does not depend on the scientist's attitude toward them. The phenomena are, sometimes entering the lived, experienced state of our being as real events: events produced experimentally or registered spontaneously. The truth is that these phenomena introduce a feeling of basic strangeness to our experience; it is this feeling which is primarily responsible for the sceptical attitude of science. And which science is responsible for the rejection of the psychotronic phenomena? It is all science characterized by the stringent requirements of the metaphysics of the new age, that of objective mathematicization.

Thus was created a new branch of the psychological sciences, parapsychology as it was first called, to study, describe and explain

uncomprehended phenomena. One of the synonymous expressions often used in this domain is 'extra-sensory perception', a term which does not and cannot cover all the phenomena we label paranormal. With the advent of the discipline of psychology, the unexplained observations and events should have become explicable and thus manipulable scientifically. But parapsychological models failed, and unsatisfactory explanations were tendered. Why? It is because the reasoning used, based on the uncompromising requirements of positivism, was applied to parapsychology too. Since classical parapsychology's explicative models are based on positivism, we have terms such as 'extra-sensory' which are derived from the positivist manner of thinking: where nothing happens by way of the recognized senses, it must occur via 'extra'-senses.

■ Positive models distort reality

Such conceptions cannot explain the phenomena we study because any parapsychological model is then construed in a way similar to that of optical perception, for example; this is insufficient to explain telepathic communication. The positivist model distorts reality, in fact, not embracing the entire reality in which the phenomena are sited; psychotronics, as defined in Dr Rejdák's paper (p. 285), states very clearly

that the new science must study natural phenomena through an interdisciplinary approach more complex than before. Multidisciplinarity has a greater chance to explain the nature of the phenomena we have not yet been able to grasp.

Of course, psychology is one of the most important facets of psychotronics, capable of feeding many impulses and ideas to psychotronics; the same applies vice versa. Psychotronics can enrich the various sub-fields of the psychological realm, both theoretically and practically, pointing out paths of research not yet explored in psychology. For instance, the theory of perception can be richly reformulated by a deeper understanding of the fundamental perceptive structures and processes made possible by psychotronics.

If we intend to comprehend any of the psychotronic performances of man (telepathy, telegnosis, psychokinesis, the effects of dowsing, man's influence on living plants), we have to deal with a basic question: what is the real influence of man's being on a psychotronic event, and how does man cause it? Analysis of human influence on psychotronic events can help determine internal and external causes, interdependently mixed, of every psychotronic happening. This problem can be resolved definitively because it is man who is primarily responsible for the phenomena studied, but a second question arises. In what connexion can psychology contribute to comprehension of man's states and activities which underlie these phenomena? In other terms, what are the stimuli for research emanating from psychology?

One of the essential questions to which clarification is necessary in building a methodological framework is how to analyse human behaviour with regard to conscious and unconscious involvement during psychotronic activity. That is, in what respects is telepathic communication caused by the conscious state and how is it determined by unconscious mechanisms? Similar problems have to be resolved in dealing with performances of psychokinesis, the reactions of a dowser, the effects of a healer. To be brief, let me typify these problems with the aid of the telepathic phenomenon.

■ Questionnaires, depth psychology

There are several adequate psychological

methods to study man's changes during telepathy, two of which are most important. The first, capable of detecting the interplay of personality factors involved during a psychotronic event, is the use of exhaustive personality questionnaires, those which have been developed primarily to describe the personality's structure. Research with these conducted by empirical psychologists such as Eysenck has led to the conclusion (among others) that the so-called 'sensitives' are inclined toward extroversion. Classical parapsychologists such as Tenhaeff have used the same device to uncover the personality structures of subjects outstandingly susceptible of direct involvement in psychotronic events.

The second significant method consists of applying dynamic, 'depth' psychology to the problem being studied; at these levels psychotronics and psychology can reach over and shake hands. Classical parapsychologists have stressed that alterations of psychical experience occur during the realization of psychotronic performance. It was F. W. H. Myers who first conceived of the 'subliminal self', attempting thereby to explain personality changes which accompany communication by telepathy. An individual involved in telepathic communication must be attuned, differently, at the two levels of experience and emotion.

The individual must penetrate, in other words, into an open horizon of all possible kinds of communication available in the (latent) totality of communicative facilities. Once entered on the horizon of telepathic possibility, the individual must be subject to a free and continuous flow of affectively accentuated associations. He must concentrate on complete withdrawal from concrete reality, from the immediately perceived environment, *hic et nunc*.

The goal of this retreat from reality is spontaneous entry into a state characterized as one of pure, primordial empathy, of attuning oneself sympathetically to the broadest vistas of our living world. This is the tendency which opens for man all the influences of life, enabling him to perceive and consciously articulate those (otherwise dimly, free-floating) stimuli of the external world which have meaning and significance for us. 'Subliminal self' thus corresponds in its general meaning with other terms such as subconscious, coconscious and unconscious. These 'selves' operate as organizing agencies which can be consciously, logically understood only under certain conditions. Solely by the creation of these conditions in

man's psychological perspective can we understand 'entering' the profound layers of personality, exploring the increasingly archaic modes

of psychological function, and appealing to the awakening of those personality features causing the telepathic process.

Psychotronics and the evolution of psychology

Rigorous psychology (behaviourism, for example) does not treat the phenomena of psychotronics at all. There are two exceptions, however, to be found in the range of schools and theories of psychology: psychoanalysis and Jung's analytical psychology. These schools of psychology-in-depth have tried to deal with paranormal phenomena.

Freud conceived telepathic communication to be the archaic remnant of old forms of communication, now largely disused. He was convinced that this primary affective communication could be 'resuscitated' and evoked anew under certain conditions, figuring mainly in the therapeutical relationship between an analyst and his patients. But since telepathic communications appear elsewhere as well, they can enter the ambit of conscious attention, man being fully aware of their presence.

Yet the phenomenon of telepathy occurs by means of unconscious communication between persons. Its result is that of communication perceived, not extrasensorily but, normally through the totality of our perceptive apparatus and by the synthesizing functions of personality. The communication's content must then be decoded, de-symbolized and transmitted in verbal form. It is to be emphasized that regressive reactivation of archaic modes of the functioning of the mind is a condition *sin qua non* of telepathy and other psychotronic activity.

That archaic strata of the personality remain seems to have been proved. Now, further exploration should open new doors on the understanding of the deep psychological processes; psychology cannot be a complete area of knowledge without full investigation of the personality's capacities. Here psychology and psychotronics can meet to influence one another and give birth to new ideas.

It was the psychologist Jung who was convinced that the totality of man cannot be fully understood if there is omitted the study of his capacities in telepathy, psychokinesis and allied phenomena. He introduced the concept of synchronicity to explain observable coincidences during telepathic communication. The term refers to an acausal relationship between two or more meaningful events but where, from the point of view of causal explanation, no chain of causality can be found. Yet the synchronicity of events is so intrinsically meaningful that a relationship is taken for granted: the meaning is grasped through conscious perception just at the moment of the synchronous appearance of two—not causally chained—events or facts.

Jung showed the way. Psychology cannot be complete in its efforts to understand man if it does not take into consideration psychotronic phenomena of all kinds.

Other psychologists-in-depth studying paranormal phenomena have stressed, *inter alia*, factors of the unconscious. Hóllós, Servadio, Róheim and Fodor and, more recently, Eisenbud and Ehrenwald made various contributions to a new understanding of telepathy. They have based their conclusions chiefly on clinical observations; they have referred to the affective and libidinal aspects of communication, to voyeurism, to omnipotence of thought. They laid stress on the symbiotic early relationship between mother and child—where probably the first basis of future telepathic capability appears. The symbiotic bonds are seen as the determinants of all psychotronic performance in later life. Derived in the atmosphere of the remedial processes, these findings are true but subject to re-evaluation by properly designed psychotronic experimentation based on the requirements of adequate experimental methodology.

■ A sensation of oddness

These phenomena were understood by William James, the great American psychologist, and they are concepts which reflect the historical development of thought regarding psychotronics. Being explanatory, they also reflect the first stage of scientific effort: psychotronic events were first observed as spontaneous ones occurring on the lived surface of existence. These manifestations have produced the sensation of oddness which then crystallizes in either an attitude of deep, sceptical denial or one of almost fanatical belief in the reality of the phenomena. So today psychotronics endeavours, following the road already paved by classical parapsychology, to control the induction of the states and processes surrounding the phenomena: controlled development of the states under observable conditions. Psychotronics aims to eliminate the factor of waiting for phenomena to occur. Thus, when dealing with psychotronic phenomena, man must: (a) concentrate (i.e. focus on himself); (b) plunge, by means of regressive processes, into the primitive levels of his psychophysiological equipment; (c) communicate with the world of objects mostly on symbolized levels, and thereby alter his own personality structure and its functions.

From what I have said, it is clear that the development of psychological ideas now imbedded in psychotronics can be traced. Early speculation led to the present concepts of unrigorous—but scientific—psychology. Now an experimental challenge faces us. We need to investigate if there are laws which determine the alterations of psychological experience, enabling us to approach the experimental induction of phenomena with full professional responsibility.

■ The main task of psychotronics

We can conclude (see box, p. 301) that during psychotronic happenings, be they in telepathy, precognition, dowsing or healing, that it is the unconscious mechanisms of man which are most active. The unconscious level of mental function is not permanently accessible to conscious perception; it works with psychical contents in distorted and symbolic forms. This leads to deciding what is a telepathic incident and what is not. The unconscious levels are determined not only by ontogenesis but by phylogenetic inheritance, too. The main task of

psychotronics, once again, is not to be satisfied with mere explanations of these phenomena but to produce them in such a form, more or less, that consciousness can make use of man's unconscious. Another reason why this should be done is that psychotronic phenomena maintain homeostasis of the organism, which can contribute to man's equilibrium at the physiological, psychological, ecological and societal levels.

A balance of this kind can be maintained through careful experimentation since we sometimes witness cases in which psychotronic phenomena are extracted from their natural context; they may appear in hallucinatory form (e.g. paranoid projections), when they are then assumed to be true psychotronic manifestations. Hallucination can accompany psychotronic phenomena, of course, just as true psychotronic episodes produce hallucinatory modification of human perception. Or, the two can mix. So we need to have not only concept, theory and explanations, but a great deal of purely human responsibility as well.

There are many experimental possibilities. With healers, we can verify what is true and what is not. In social psychology, where the inner dynamic relationships in various groups are influenced by both verbal and nonverbal communication, subliminal or psychotronic communication can also be studied.

Finally, are psychotronic manifestations the result of archaic remnants in man or are they at the nucleus of new potentialities? In my opinion both are true, provided we understand their interconnexion. This we can accomplish only by reactivation of obsolete modes of communication. Through training, we should be able to pass more frequently through the doors of archaic dynamics where hidden potential sleeps, showing us the way onward to new individual and social growth.

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From non-science to science: a case of transition

Franz (or Friedrich) Anton Mesmer, a German-born physician educated in Vienna, published in 1766 a tract called *De Planetarum Influixu* in which he contended that celestial bodies exert a direct influence on animal beings. The effect was purported to be caused by a fluid acting upon the central nervous system and which could be used to control the body's function. Mesmer called the process *animal magnetism* and, in concert with an Austrian priest named Hell, made it the basis for the cure of various illnesses.

Mesmer had considerable success with his therapy by 'magnetism', especially in cases of hysteria, at both Vienna and Munich. But under pressure from the practitioners of conventional medicine in Austria who considered Mesmer's method little more than magic, and the (rejected) lure of 20,000 *livres* from the French Government if he would deliver the secrets of animal magnetism, Dr Mesmer moved to Paris in 1778. He was to spend seven years in the French capital. He operated first from a mansion in the fashionable Place Vendôme, whence his prowess became known in court circles; his influence was particularly compelling on Queen Marie-Antoinette. Mesmer moved to larger quarters in the then rural suburb of Montmartre, where he and his assistants practised touching and 'passing' with their patients, assembled in groups round a 'magnetic' basin or tub, waiting only to be healed.

The success of Mesmer's therapy and the comfortable income derived from his growing clientele were to be short-lived. In 1784, the French Government named a commission of physicians and scientists (among whom was the American Benjamin Franklin) to examine the merits of Mesmer's professional activities. Despite the strong support Mesmer enjoyed of such prominent specialists as the botanical taxonomist Jussieu, the commission ruled in disfavour of 'animal magnetism'. It preferred to attribute Mesmer's

apparent healing powers to as yet unspecified physiological causes.

Mesmer quit the medical profession, retiring at first to Versailles nearby and finally, in 1814, to a village near his birthplace on the shores of Lake Constance, near Switzerland, where he died the following year. His legacy is the word *mesmerism*, found in many modern languages, meaning a process of healing by spellbinding fascination of the patient in an effort to channel properly the 'animal fluid' controlling his organic processes.

By 1842 the Manchester physician James Braid had refined the therapeutic technique he called neuro-hypnotism, derived in part from the Greek word for sleep, *hypnos*. By neuro-hypnotism, Dr Braid understood a 'state or condition of nervous sleep' induced in a patient by a skilled practitioner. Whereas *mesmerism* retained its pejorative, charlatan-related connotation, neuro-hypnotism and *braidism* took on a respectable allure. The new terminology described a patient's induced or even auto-suggested trance, sometimes in a state of muscular rigidity and often accompanied by insensitivity to pain. In the 1863 edition of the *Dictionnaire de la Langue Française*, the lexicographer Littré was able to describe hypnotism as a 'terme de physiologie'.

After the First World War, partly as a result of the discovery of the value of hypnosis in the re-educative therapy of severely wounded victims of battle, hypnosis gained new ground. Thirty years later, the professional medical associations of both the United Kingdom and the United States gave official recognition to hypnosis as a valid therapeutic method and discouraged its practice by laymen. Medical groups elsewhere also recognized hypnosis officially. In 1958, the *American Journal of Clinical Hypnosis*, the first periodical of its kind, was founded. The quackery of mesmerism was no more.

Impact

Psi, a new dimension in the sciences

Charles A. Musès

Man has been incapable, since earliest times, of explaining certain phenomena of our existence which do not fit the established rules of science. But now specialists in the exact natural sciences are themselves paying serious attention to non-ordinary states of consciousness, experiences out-of-the-body, and multiple time dimensions. Here follows a brief review of these.

In my view, when the physicist Erwin Schrödinger used the Greek letter Ψ (psi) as the symbol for what has since become accepted as a 'probability wave', he was unwittingly prophetic as to the evolution of all of science in our century. There may have been a circular process involved, too, as the bizarre meaning was grafted to psychology to denote the world of the parapsychological—the world of psi. But there are not really 'parasciences': all are science. 'Parapsychology', 'paraphysics' and all the rest are awkward misnomers. To each science the new dimension of psi (the dimension of noetics, of the state of consciousness) can be, and is being, adjoined. These adjunctions are resulting in nothing less than a new *Weltanschauung*, or world view.

Physics was the first of the sciences to go psi-ward, although scientifically uncanonized poltergeists, precognitions and other weird realities had been observed for centuries. With Maxwell's demon¹ worming its way into statistical mechanics and thermodynamics, these realities began to invade the laboratory; Schrödinger and Werner Heisenberg finally captured something very like a psi factor in their mathematical equations for physics. That was in 1926. It took biology and psychology some thirty years to catch up with the shifting foundations in physics in terms of formal inclusion of a psi factor in their calculations. It is interesting that mathematics, quite consciously from the time

of Pythagoras and Plato, had possessed its own psi component. This was natural for mathematics, reflecting as it does both the nature of the mind and the nature of external reality, and in a way that is excitingly suggestive of deep correspondences between the two.

Nietzsche spoke and dreamed of a 'transvaluation of all values'. Today we are living in just such a period of history; it is agonizing yet wondrous and, above all, it makes huge demands on our readiness to embrace large and more encompassing realms of vision and valuation than ever before. Though all these stresses are evident on the political, economic and social scenes, they are more significant in that they dominate the scientific stage as well, a stage whose over-all setting has not changed radically since post-Renaissance times in the Western world at least.

1. The physicist James Clerk Maxwell (1831-79) invented the 'demon' and assigned him a number of imaginary (microscopic) tasks which lead to violation of the (macroscopic) laws of thermodynamics. The demon may guard, for example, the passageway between two chambers containing gas initially at the same temperature. By 'recognizing' molecular velocities, the demon permits the passage of faster-than-average molecules in one direction and (a corresponding number of) slower-than-average molecules in the other direction. This creates a temperature difference seemingly violating the second law of thermodynamics. The paradox is revolved when we consider the effort made by the demon in making his decisions.—Ed.

And so it is that now, just as in the days of Copernicus and Bruno,¹ the very fundaments of science are readjusting themselves. The need is emerging for a science broader and deeper than before, one capable of dealing compatibly with the innermost structure of matter and the innermost functions of the mind.

■ Psi in ages past

The disciplines which address themselves to negotiating this gap include 'parapsychology' (in other words, telepathy and precognition) and 'paraphysics' (e.g. psychophysiological feedback, and telekinesis or psychokinesis as in the cases of Uri Geller and Nelya Mikhailova). These new fields have attracted persons as diverse in background as educator (turned parapsychologist), physical scientist (become paraphysicist), astronaut (transformed into philosopher), actress (turned psychologist), psychiatrist (become psychic investigator as in the case of Montague Ullman, president of the American Society of Psychical Research); they are all promoters of the new dimensions of psi. The public, both lay and specialized, is aroused as never before. (My own interest

dates, as does that of my friend Ullman, from the age of 12.)

The phenomena we are concerned with are surprisingly old, sometimes even ancient, in their reporting and attestation. The fact that these phenomena have penetrated into the heart of the scientific-educational establishment is what makes them so interesting at the present time.

The facts date from long ago. As a colleague and I reported recently [1],² the ancient Egyptians practised standardized and fully functional trans-induction techniques. One can read of case after case of hypnotic trance capable of heightening paranormal powers (such as 'X-ray vision') in the nineteenth-century British magazine *Zoist*, now hard to find but of which I am fortunate to possess a complete set. I shall refer to X-ray vision hereafter, incidentally, as clairvoyance. *Zoist* also bears witness to many incidents of transmission of thought, or telepathy.

1. See *Scientific American*, Vol. 228, No. 4, April 1973, for an account of the life and times of Giordano Bruno.
—Ed.

2. Figures in brackets correspond to the references at the end of this article.

First personal experiments

I became convinced, myself, of the existence of the phenomenon of telepathy in 1937–38. Together with a university classmate I shall call Jerry (he is now a successful scientist), I would experiment in the large, empty auditorium of the university. Jerry, who was studying physics, happened to be an excellent telepathic receiver or recipient. We would sit diagonally opposite one another in the big hall. As I concentrated on some simple object, Jerry would write down his impressions. After he had called out 'okay', I would say, 'Next object'. 'Okay' meant that Jerry had finished writing his description of the mental images he had seen as I was concentrating on a specific object.

Our results were not 90 per cent, but 100 per cent, satisfactory. This was to my amazement and to Jerry's discomfort: he said that the results caused too much

of a shift in values to be comfortable. By that I mean that the objects were described always in terms of his own training and his most prominent word-thought associations. For example, when I looked at a 10 cent piece resting on a small notebook, Jerry would report, 'a circle in a rectangle'. Similarly, a pocket comb elicited the description of its telepathically received image as 'a series of short, parallel lines'. My concentration on a new, sharpened pencil complete with unused eraser would induce from Jerry the telepathic report of 'an elongated cone with a red spot at its base'. Note how his training in physics and mathematics dominated the descriptions of the imagery received.

Flushed with Jerry's successes, I tried the same experiment with Pauline, a friend of my sister Estelle. We failed miserably

until one afternoon, after she had described 'a knife resting horizontally on the edge of a plate'. What I had been concentrating on did not remotely resemble her description. My curiosity was aroused, and I wondered what could be the source of the impressions Pauline was reporting. Although we had not budged from the living room all afternoon, I went intuitively to the kitchen at the other end of the house; there, exactly as Pauline had described it, I saw a knife lying on a plate's edge. It was a weekend, and someone else in the family had made himself a luncheon snack, afterward leaving the house by

the back door. Neither Pauline nor I had been aware of his activity.

Then and there I decided to change the experimental design in order to test clairvoyance instead of telepathic power in my subject. The switch was totally, excitingly successful: although Pauline could not 'do' telepathy, she was capable of clairvoyance. She repeatedly and correctly described the contents of closed, randomly shuffled boxes. Whatever lay behind the abilities of telepathy and clairvoyance, I became convinced that the two (a) exist and (b) are different in nature and mode of operation.

Telepathy—the transmission of desires or images without the use of the five senses—is by now well attested fact, already established early in the present century by books such as Tischner's *Telepathy and Clairvoyance* (originally in German) and Warcollier's excellent treatise on telepathy (in French). The work of the American Rhine, like that of so many others later in the century, served more to focus the attention of both the public and the scientific establishment: his work was sociological, rather than scientific, in function.

The best way to study talent, after all, is to examine unusually gifted persons. Statistical methods then become largely irrelevant because the evidence of the talent manifested becomes overwhelming in quantity. Control against fraud, of course, is mandatory. But these control procedures become much more effective, in reality, when applied by professional magicians familiar with all the tricks of legerdemain. In this domain laboratory scientists may be, and all too often are, naïve.

■ Hypernumbers and trance times

The evidence is still overwhelming that, beyond the dimensions of known space and time, there lies another realm having its own special energies and phenomena; it is a domain interacting all the while with the physical world, functioning in even so simple an act as deciding to move a certain finger, and then doing it. If our consciousness could establish an equally viable relation with matter other than our own body, we could then move that, too, by choice and will.

That the mathematics of such connexions is to be sought through higher forms of number, another colleague and I have stressed on several occasions [2, 3, 4, 5, 6]. It was only after man had become accustomed to the square root of -1 , formerly called the 'impossible number', that a form of mathematics could emerge adequate to make possible the explanation of radio waves, other electronic phenomena and quantum physics. The last, indeed, makes use of an even higher kind of number so that the product of itself multiplied by itself is $+1$, although 'itself' is neither $+1$ nor -1 . Hypernumbers like this are the basis of the 'spinors' lying at the heart of modern physics.

In regard to the psi dimension, we need something more in order to produce a mathematical explanation. We have proposed the most likely candidate, a higher type of unit we call w , such that $w^6 = 1$, $w^2 = -1 + w$, and $(-w)^2 = -1 - w$. This number's successive products of itself by itself are all points of, not a circle as in the case of $\sqrt{-1}$, but an ellipse: two ellipses in fact, one for the powers of $+w$ and another for those of $-w$.

With reference to the phenomenon in hypnosis known as time distortion [7], I have also proposed that there exist at least two other kinds of time than the ordinary, historical event-time [8]. These are trance time (experienced by everyone in a changed state of consciousness) and trance-induction time. The latter is a kind of time operating during the process (sometimes a very small interval) of changing from one state to another, in either direction.

Trance time operates while one is in the process of changing from ordinary to trance

time. Both of these times operate also in conjunction with probability trajectories and precursor waves [8] to make precognition scientifically recognizable. Precognition can sense only 'released time projectiles', as it were, the unrealized consequences of past acts. Thus there is no inherent contradiction with freedom of choice, which means really the freedom to choose consequences. The operation of fate (or the necessity for consequence), therefore, is part and parcel of the process making free will or free choice possible. If there were pre-knownable patterns of consequence, free choice would be nonexistent. I repeat, free choice means precisely the freedom to choose later consequences by acting now in one way instead of another.

■ Experiences out-of-the-body

We have surveyed briefly telepathy, clairvoyance, the will/body connexion, multiple time dimensions (or hypertimes), and precognition. Let us turn to another enclave of the psi dimension, the out-of-the-body experiences while under the influence of psychedelic drugs.¹ Albert Hoffman, the discoverer of LSD, told me at his home in Basel once that during his first experience with LSD (he did not know that he had ingested it) he 'saw my [Hoffman's] body lying on the couch'. I asked him, 'Did you feel liberated?' His reaction was rather practical: 'I felt highly annoyed. I concluded I must have taken some poison unwittingly and died; I was angry with myself for being so foolish as not to have better prepared by paying a higher life insurance premium.'

Out-of-the-body experiences in the absence of any psychedelic drug are widely reported, often in the cases of persons very near death as the result of illness or accident. Incontrovertible proof of these experiences would be to produce witnessed psychokinetically induced movement while a subject is in an out-of-the-body state, movement occurring at a considerable distance from the body directing it, and accompanied by a description of the location of the displacement—a site previously unknown to the percipient or effectuator of the movement.

Much work thus remains to be done in the field, but it should be accomplished by working with noetically talented persons, not by simply applying obfuscating statistics in an attempt to record possibly minuscule psi-

effects in work with large numbers of singularly ungifted people. History moves too fast to permit time to be wasted on such relatively fruitless endeavour.

Another broad area for research is that of the apparent clairvoyance of dogs and cats who find their way home to their masters from strange surroundings hundreds of kilometres away. Numerous are the well-reported cases. And related to this is telepathy in animals, even in plants. In the last sector, the claims of Cleve Backster, working with a polygraph machine, have re-awakened interest in the field of plant consciousness, first dealt with scientifically early this century by the well known Indian plant physiologist, Sir Jagadis Chandra Bose [9].

Poltergeist phenomena, which seem to be violent and uncontrolled psychokinesis evident among young persons, also must be thoroughly studied. So should 'reading' by touching [10], healing by the laying on of hands (now being taught at the nursing school of New York University); this form of healing is distinct from faith-healing and hypnotherapy.

■ Consciousness and behaviour

Finally, the whole gamut of trance states must be studied, whether the trance be self- or hetero-induced. The range of non-ordinary states of consciousness² includes voodoo and similar tribal-religious phenomena. Acculturation and other forms of conditioning behaviour are closely linked to gradual hypnosis. All conditioning, in fact, consists of techniques of slow induction of an alteration of patterns of acceptance or profound belief. Usually there is a cue involved; the cue activates the pattern of built-up behaviour suggested by the conditioning technique. Only entities capable of pleasure, displeasure and association can be conditioned or trance-induced.

All behaviouristic theory thus rests on a deep and broad concept of repeated, light and

1. For a description of the dangers presented by LSD and other psychodysleptic drugs, see *The Pharmacological Basis of the Control of Human Behaviour, Impact of Science on Society*, Vol. XXIII, No. 3, July–September 1973.—Ed.

2. In 1966 Arnold Ludwig was the first to use the term 'altered states of consciousness', by which he meant unusual states. I prefer the term 'non-ordinary': it focusses less on the more obvious fact that there is a qualitative difference between unusual and ordinary states of awareness.

gradual hypnotic inductions. The behaviouristic phenomena depend on consciousness, the very substratum that behaviourists so vociferously attempt to deny, while their very vociferousness proves its presence! Desire of some sort lies behind every form of behaviour and conditioning as well as behind every entry into auto- or hetero-induced changes of state of consciousness or trance state.

There is also increasing evidence that our consciousness, extending its relation to the molecules of our bodies, can affect directly molecules external to our organisms. That is, we can cause objects to move without touching them, without employing electrical, magnetic or other instruments to do so: psychokinesis. Last year the prestigious science journal *Nature* devoted an article to the phenomenon of Uri Geller, well-witnessed bending of spoons and keys, and the like. Earlier Geller had been investigated at the Stanford Research Institute, but despite the good work of Professor H. Puthoff, *Nature* stated that Stanford's investigating team had used sloppy and unconvincing techniques and not published enough details. It is because the Geller phenomena are so widely publicized that they should be investigated completely.

This is the moment for such investigations. The public is ready for them. Although the phenomena have been observed for literally millennia, a large public today seeks more and clearer data than ever before. We need more highly gifted individuals to be available for this research, as well as competent investigators.

As an illustration of the importance of socio-logical and educational aspects of the current extension of the psi dimension in our lives, let me recall author-producer Gene Roddenberry's phenomenally successful television series *Star Trek*, which gained the most enthusiastic and articulate following of any video series screened in the last decade or thus far in the present one. *Star Trek* was characterized in part by constantly recurring depictions of telepathy and psychokinesis in action.

We are entering a new era of science, too, one in which the psi dimension and the potentials of human consciousness are beginning to be recognized. Historically, the science of the establishment has eaten crow, announcing embarrassing reversals of earlier pronouncements. In 1878 a British scientific commission, reporting to Parliament on the

invention of the incandescent light bulb, stated that the new device was 'unworthy of the attention of practical or scientific men. It is impossible to adapt electric lighting to households. Any attempt to do so is futile for it would flaunt the laws of the universe. On this the most eminent scientists agree.'

The true laws of the universe seem to be singularly impervious to what men—eminent incompetents or not—think those laws should be. So be it with past strictures on the viability of the psi factor. And I have not touched on the greatest implication of all, that independence of consciousness and matter would mean also individual survival after bodily dissolution. But I leave that vast subject for another occasion.

■ Dr Charles Musès

Mathematician and philosopher Musès obtained his doctoral degree from Columbia University. He is the author of studies on higher algebras, modern physics, cybernetics, and time and consciousness. He worked with the late Norbert Wiener and Warren McCulloch, and has published studies of Jacob Boehme, Schopenhauer and the Zen Lankavatara Sutra. From 1968 to 1973 he edited the new Journal of the Study of Consciousness, through whose offices he can be reached at 844 San Ysidro Lane, Santa Barbara CA 93108 (United States of America). The author is, additionally, member of the editorial committees of the scientific journals Kybernetes and International Journal of Bio-medical Computing (United Kingdom).

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Biogravitation and psychotronics

Aleksandr P. Dubrov

Analysis of much experimental and theoretical research in biology, physics and psychotronics has led to the conclusion that a particular kind of field (biogravitation) is formed when changes occur in the conformation of biological macromolecules. As the field forms, forces of attraction or repulsion are set up, acting at both close and long range; at the same time are emitted various kinds of particles and energy, ranging from visible to ultrasonic oscillations. The basis of the biogravitational field is the ability of protein molecules to change from an unordered liquid state to a solid crystalline state. When there are structural deformation and distortion of microspace occurring on a sub-molecular scale, there is created a particular biological field with the particulate properties of gravitation. Recognition of the existence of biogravitation may be of the greatest value for the development of contemporary science.

Since it thinks, one form of the development of natural science is the *hypothesis*. If we were to wait until material was ready in *pure form* for a law, this would mean suspending conscious research until then, and in any case we would never obtain a law by this means alone. (Friedrich Engels)¹.

Scientific and technical progress is pushing back the frontiers of our knowledge further and further and has already gone far beyond the boldest predictions made in the past, with the launching of the first satellite, man's first space flight, the landing of men on the moon, the flight of spacecraft to Mars, Venus and Jupiter, and space laboratories. These research programmes have had a major public impact.

Scientific and technical progress has covered every branch of knowledge and every field of interest. A similar development has occurred in the various branches of biology, biophysics and quantum physics, but one noteworthy feature of this latter development is that the

new, revolutionary scientific ideas cut across and contradict the familiar, traditional, established, classical conceptions in these branches of knowledge.

For example, a biophysicist specializing in biological thermodynamics points out that the celebrated second law of thermodynamics, unconditionally accepted as one of the foundation stones of science, is in fact inapplicable to energy transformation processes either in the living cell or in the functioning biological macromolecule [1].² A well-known biologist has demonstrated how reactions involving the natural transmutation of elements outside the radioactive series, in other words reactions which until now were thought to

1. K. Marx, F. Engels, 'The Dialects of Nature.', *Collected Works*, 2nd ed., Vol. 20, Moscow, 1931.

2. Numbers in brackets correspond to the references at the end of this article.

take place only inside nuclear reactors, can take place in living things [2]. Many more examples of similar work could be given.

One of the ways in which scientific and technical progress shows itself is in a clean break with previous scientific concepts and laws. This can be easily understood through materialist dialectics and is in accordance, in particular, with the law of the 'negation of the negation', the new being brought forth by the old, arising in the depths and on the foundation of the old, and taking its place. In time, it in its turn will have to make way for something new, as yet only gestating within it. This is what has happened in the case of psychotronics, a new scientific discipline which studies the particular physical and biophysical phenomena occurring during human mental activity and during interaction between various living beings.

■ A new biological-physical field

Psychotronics can also be thought of as a science which has duly come into being as a result of scientific and technical progress and which, in our opinion, has extremely promising prospects of development. For those interested in further details of this subject, we can recommend Professor McConnell's guide [3], intended in the main for the university-level student, and a bibliography on the subject [4].

What is so special about this new-born science? Psychotronics carries within it the negation of the scientific disciplines from which it sprang and is the logical continuation and development of those disciplines. None of the phenomena with which it deals (i.e. the well-established scientific facts of psychotronics) can be explained in terms of the traditional concepts of physics, chemistry, biology and psychology. The book by D. Ellis entitled *The Chemistry of Psi* may be mentioned as an outstanding illustration of this [5].

The present study gives detailed consideration to the possible role played by protons and electrons, quantum-mechanical effects and the uncertainty principle in psi-phenomena, but the essence of such phenomena remains hidden. A fundamentally new approach to the facts is required, and we believe that our hypothesis concerning biogravitation provides that approach [6].

This hypothesis claims that a special 'biogravitational field' exists in living things and in man in particular. It is called a biogravitational field because its properties are in some ways akin to those of living matter and in others to those of a gravitational field.

By the term biogravitation, we designate a field-energy system. The biogravitational field is universally convertible, i.e. it is capable of transition into any form of field and energy, and therefore a unified field theory must be worked out especially for it. Many facts reported in the literature of psychotronics give evidence of this property of the biogravitational field. The biogravitational field thus reflects in microcosm the problem of the unified field, which is the cornerstone of the physics of the future. It will be clear to the unbiased reader that the work published in 1965 by the Soviet physicist K. Stanjukovic on the interdependence of gravitation and elementary particles [7] has made a fundamental contribution to the development of these ideas. This theory has now made great headway [8], but at the time when it was published there were of course no grounds to suppose that the real solution to this problem could be found primarily in biology on the basis of facts also observable in psychotronics.

For any hypothesis to be accepted and for it to become the foundation of future theory, experimental findings which fit in with the new theory are needed. Such findings have been made at various levels in the scheme of living matter, pointing to the universal nature of the field we have discovered. The existence of a biogravitational field at the level of complete organism can, for example, be seen from the fact that the human brain has been found capable of thought transference almost regardless of distance and of the type of screening device used [9, 10]. We find this property of transference only in a gravitational field.

It has further been discovered that man is able, with special mental effort, to move any kind of object (the phenomenon of telekinesis) [11, 12]. The latest research fully corroborates telekinesis and provides considerably more detailed information about it, as evidenced by experiments with individuals possessing this kind of field to a very high degree (N. Kulagina, B. Ermolaev, T. Dadasev, U. Geller, I. Swan and others). It is well known that the only force which acts equally on any kind of substance and causes it to move is gravitation. It should be noted that experimental research on telekinesis led H. Forwald to think that gravitation might possibly play

a part in these phenomena [13]; he did not think that human biogravitational forces were involved and believed that the necessary energy was liberated from the mass of the subject under experiment by a psychokinetic triggering effect. To be fair, however, it should be said that Forwald has come close than anyone else to a correct understanding of psi-phenomena and made the first strict quantitative measurements in the field of biogravitation, even though he was wrong about the mechanism involved.

■ Biological basis of biogravitation

Mention was made earlier of the occurrence of biogravitation at the level of a complete organism, but as we said above, it is universal, and evidence of biogravitation can thus be found throughout the whole biological scale. At cell level, for example, there are a number of processes in which there are grounds for believing biogravitational forces to play a part. Let us take the example of cell division (mitosis). A remarkable stage in this process is the migration of the chromosomes towards the poles [14]. All the painstaking research carried out on this phenomenon so far has failed to explain it by means of electrostatic, magnetic, hydrodynamic, reaction and other physical forces [15]. A number of facts, however, point to the possible role of biogravitational forces in this process. For example, it is noted in mitosis that chromosomes of different sizes move at equal speed, their movement tending to be in a straight line and to be uniform, sometimes retarded but never accelerated [16]. This would seem almost to exclude the possibility of a gravitational influence on the chromosomes' movement but it should be remembered that chromosomes move because the centriole (the 'pole' of attraction) and the kinetochores of the chromosomes are linked by the fibres of the spindle, which have special elastic properties. That gravitational forces are here at work in the living cell follows also from the fact that cell division is arrested when centrifugal forces of 300,000 to 400,000 g working in the opposite direction are set up [16].

Other peculiarities of the dividing cell also merit our attention. Simultaneously with the formation of a specific kind of mitotic apparatus having a strictly ordered crystalline structure, the emission of various photons, both in the ultraviolet and the visible range of

the spectrum, can be observed in the dividing cell [17, 18]. It was recently observed that, during mitosis, ultrasonic oscillations with a frequency of from 10^6 to 10^7 hertz [19] and other forms of energy and fields were produced.

These unusual facts are further evidence of the possible role of biogravitational forces in this process since gravitational waves may be quantized and may change into other forms of field and energy [7, 8]. It has been reported, in particular, that gravitational waves can be detected by the sound waves generated in the photon dispersal process. This so-called phonon-graviton dispersal is a characteristic of the emission of gravitational waves by any source [20]. An interesting phenomenon observed in the course of research is that when a coherent light source (laser) is directed on a semi-conducting crystal, the ultrasonic waves produced cause gravitational waves to be generated having an intensity 10^{23} greater than with Weber's resonator and 10^{40} greater than with the rotating rod envisaged by Einstein [21]. Consequently, as these effects may be the basis of gravitational radiation in the cell, they cannot be excluded from consideration, since it is considered quite feasible that the biocrystalline structures of living cells may have semiconductive properties [22]. There are quite a number of other examples at cell level (muscular contraction, the transmission of nerve impulses) and at the level of a complete organism (psi-photography, levitation) which point to the presence and role of biogravitation in these phenomena.

We should mention here, if only briefly, the particular properties of biogravitational forces: (a) they must act at close or long range; (b) they can be directed and focused; (c) they can be positive or negative (and cause attraction or repulsion, respectively); (d) they can carry information; (e) they are able to convert the energy of a field into matter with weight; (f) a field of such forces can persist in the absence of the source which originally gave rise to them; (g) they can undergo transition into any form of field and energy; and (h) they are closely bound up with change of symmetry groups and with distortion of space at the sub-molecular level of biological structures.

It can thus be seen that biogravitation possesses qualitatively new properties as well as the general properties possessed by gravitational fields in the physics of non-living

matter, and this is apparently where the difference between living and non-living matter lies.

Thus far I have developed this hypothesis about biogravitation only from the qualitative point of view since not enough strictly defined quantitative measurements have yet been made on which to base a fully developed

theory. It is only a supposition that a general field theory can be constructed from the particular properties observed in studying biogravitation. The qualitatively new properties of biogravitation, as against ordinary gravitation, raise many new and important matters of principle which are reviewed in the box beginning on this page.

How the biogravitational field is formed

The occurrence of biogravitation in a living organism cannot be understood in the framework of present-day conventional biology and physics. From certain data, it may be inferred that a biogravitational field arises in consequence of changes in the conformation of protein structures as a result of the transformations which occur with polypeptide molecules. These changes in conformation induce a strictly ordered, structured crystalline state in the hydrated protein molecules and their oscillations are synchronized, as a result of which a qualitatively new physical situation is established, affecting the atom's symmetry groups and the nature of the sub-molecular space. For this reason, the biogravitational field could equally well (and correctly) be called a 'conformation field', the waves could be called 'conformation waves' and the wave particles 'conforms'. The resemblance to traditional conceptions of particle-wave dualism ends here, however, since the above-mentioned properties of the conformation field also enter into play.

Analysing psi-phenomena on the basis of traditional methods of calculation, one could hypothesize as follows about the mechanism involved. For a variable biogravitational field, according to V. Bunin, it may be accepted that gravitational radiation is contingent on the phased oscillations or rotations of hydrogen electrons or atoms in water molecules. Evaluating the magnitude of the gravitational radiation possible in that case and taking 1 gramme of hydrogen (i.e. 9 grammes of water), we arrive¹ at a mean quadratic velocity of hydrogen

atoms at 0° C of 1,840 metres per second, a moment of force

$$I = mr^2 = 1g \cdot 10^{-8} \cdot 2cm^2 = 10^{-16}g \cdot cm^2$$

and a circular frequency

$$\omega = 2\pi f = 2\pi \frac{1840 \cdot 10^2 cm/sec}{2\pi 1 \cdot 0 \cdot 10^{-8} cm} = 1 \cdot 8 \cdot 10^{13} Hz$$

The power output of the gravitational waves is calculated by the formula given in Braginskij's article [23]

$$P = I^2 \cdot \omega^{21} \cdot 73 \cdot 10^{-66} W = \\ 10^{-16} g \cdot cm^2 \cdot 1 \cdot 8 \cdot 10^{13} Hz \cdot 1 \cdot 73 \cdot 10^{-66} W \approx \\ 10^{-18} W$$

We use the same author's calculation [23] in evaluating the minimum level of a receivable signal:

$$P_{min} = \frac{2kT \cdot t^2}{\tau(n-1)}$$

where: k = Boltzmann's constant;
 T = absolute temperature;
 n = number of measurements;
 t = coefficient equal to 2;
 τ = signal accumulation time.

In actual conditions $P_{min} = 10^{-28} W$, but a more sober evaluation would be $P_{min} = 10^{-23} W$, which corresponds to an accumulation time of 2 hours and is considerably less than the power of the calculated gravitational wave ($10^{-18} W$).

1. Readers who question or challenge these quantities and their interpretations are invited to communicate directly with the author.—Ed.

We may thus conclude that a living organism can be both a receiver and a transmitter of gravitational waves over considerable distances since the power potential is $P^1 = 10^{-18}/10^{-23} = 10^5$, and even 10^{10} according to a less strict evaluation.

The mechanism outlined is possible since, in the cell, the protein molecules together with the layer of intracellular water adjacent to them can be in coherent, high-frequency oscillatory states [24].

We should mention in this connexion that a number of researchers have studied gravitational radiation in respect of rotating particles. This radiation has been examined, for example, by quantum theory methods in respect to the approach of a weak gravitational field in the case of the gravitational radiation in a synchrotron of a particle moving along a circle [25]. The most interesting thing for us in this research is the author's conclusion that the major part of the radiation is concentrated in a small angular region near the particle's plane of rotation and can, therefore, be directed.

After the variable, then the constant field

The process by which a constant biogravitational field is formed can be hypothesized in a similar way using traditional notions. Considering that, during the change in conformation of the protein molecules from a state of random aggregation to an ordered crystalline state, not only does a phased oscillation of the atoms occur but the atoms move closer together, it is to be expected that a considerable constant biogravitational field will appear, owing to the great increase in the density, at micro-level, of the biostructures. There are grounds for thinking that, in the human organism, a constant biogravitational field may be established by specialized brain structures when they are strongly excited (epiphysis, hypophysis). The feasibility of such an occurrence can be seen from the following calculation. We know that the force of the gravitational interaction of two masses is inversely proportional to the square of the distance between them: $F = k m_1 \cdot m_2/r^2$. As regards the interaction of parts of a cell

structure which are brought closer to each other (atoms in a water or protein molecule), the gravitational forces in this case increase considerably. It is also possible that when changes in conformation occur in a cell, there may be a temporary, local accumulation of elementary particles and the cumulative effects in the crystallized structures manifest themselves in the form of a constant biogravitational field. It is possible that a similar situation may arise at micro-level when the brain structures receive a specific stimulus during psychotronic phenomena.

Nevertheless, as has already been said above, the process by which a biogravitational field is formed may be completely different from the one arrived at by the calculations of classical physics. The two approaches should nevertheless not be seen as conflicting. We may, for example, mention yet another physical approach to the phenomenon of the constant biogravitational field. One researcher has described the theoretical calculations of the force acting on a prestressed body in a curved space [26]. These calculations were made on the basis of assumptions which are very important for us—that the diameter of the body being studied is small and the velocities at which it moves are low. The calculations lead the author to the conclusion that in the case of a stressed or 'self-deformed' body, Newtonian mechanics and the general theory of relativity admit of the existence of gravitational fields and their detection.

In another article which describes the unusual surface tension of microstructures in biological systems [27], the author shows, on the basis of thermodynamic calculations, that biocrystals are metastable equilibrium systems with a negative surface tension at the biocrystal's interface with its environment. Unique conditions obtain in the case of the polypeptide molecules contained in biocrystals: on the one hand, the macromolecule chain becomes an ordered structure and acquires elements of symmetry (corresponding to the lattice of a polypeptide crystal), but the flexible lateral substituents have the properties of molecules in liquid and the increased entropy of molecules in solution. This shows the complex nature of the physics of the state

and thermodynamic properties of biocrystals, the molecules of which form part of a crystal lattice and at the same time possess the properties of molecules in solution. Thus, in biological systems, a change in the symmetry groups and a distortion of the geometry of space at molecular level are possible and,

consequently, the formation of a gravitational field, with all its attendant consequences, is also possible. In this way, theoretical calculations support our hypothesis that a biogravitational field may result from changes in the conformation of protein molecules subjected to compression, tension and deformation.

■ Biogravitation and contemporary science

The difficulties of studying biogravitation are, at the moment, that its manifestations are visible but that there are no reliable physical instruments to measure it and new principles are required in order to build them. The efforts of physicists in psychotronics should be directed towards the development of just such an instrument. This is an extremely complex process since biogravitation has properties which are contradictory and mutually exclusive, e.g. close-range and long-range action, and attraction and repulsion. It is nevertheless necessary to develop an instrument for measuring this form of energy, which has still not been studied in a way conforming with modern scientific practice. There are grounds for thinking that an instrument of this kind could be developed on the basis of piezo-crystal sensors [6].

Whatever the mechanism by which a biogravitational field is produced, it is a reality, and the forces it brings into play lend themselves to strict evaluation and calculation; but the further investigation of this problem requires, as usual, public interest and financial support for research.

We thus hope that in the near future, the idea of the biogravitational field as an inherent property of living systems will come to be universally acknowledged, which will lead to a reappraisal of basic tenets in various fields of science. One way to contribute to this process would be to set up (a) scientifically controlled experiments in which the 'effector' (someone with extraordinary abilities similar to those of Kulagina, Ermolaev, Geller or Pavlita who can cause any psychotronic effects) will bend the trajectory of a beam, reduce or increase the weight of an object, produce the Mössbauer effect, and (b) experiments to investigate biogravitation at cellular and sub-cellular level.

Let us now consider briefly the scientific implications of our hypothesis concerning biogravitation.

In psychotronics, the scientific discipline immediately concerned, a feasible explanation is provided for many phenomena known in this field, from telekinesis to clairvoyance (which in Russian we call *proskopii*), since all these phenomena are connected with man's ability to create his own gravitational field with all the unusual properties thereof, e.g. the distortion of space, the possibility for other dimensions to assume spatial characteristics, and the like. Although this sounds fantastic to most people, it is not very difficult for specialists in psi-phenomena to provide examples in support of this view. The recognition of biogravitation frees psychotronics from many unnecessary and unscientific accretions and from mysticism and makes it a genuine scientific discipline, a science of the future. All the phenomena of this field of knowledge which hitherto seemed extraordinary and supernatural will be seen by researchers as actual manifestations of a new and previously unknown property of living systems and of man as the summit of creation.

Is it fair to say 'para'?

Incidentally, I think it incorrect to employ such terms as 'paraphysics', 'parapsychology', 'parascience' (para = near, beside). These terms came into use when the real significance of psychotronics and its place in modern science were not known, and were indicative of its limitations at that time and of the difference between it and genuinely scientific disciplines like physics, psychology and other branches of knowledge. Then, it seemed to stand outside scientific knowledge, but the position has changed considerably over the last fifty years and now leading scientists throughout the world have, as a result of the enormous quantity of documentary evidence which has

accumulated, recognized psychotronics as a completely new sphere of human knowledge, a science concerning a unified physical field which embraces all previously known fields and forms of energy. Psychotronics reflects in microcosm the major problems of physics and biology, the two fundamental sciences which study the world and shape our conception of it. Psychotronics is opening up new paths for modern science and pointing to new directions for the development of world science as a whole. The evolution of psychotronics will have a decisive influence on the emergence of new philosophical concepts and ideas about unity in nature, the difference between living and non-living matter, the specific nature of thought and consciousness, and many other important epistemological problems. In this connexion, we may welcome the desire shown by leading contemporary physicists to give attention to the development of instruments for painstaking research in this new field of knowledge [28].

In biology, the discovery of this property of living systems will further our understanding of the universal relation and interaction between terrestrial and extraterrestrial living organisms. The influence of cosmic factors (planets and stars) on living beings will be clarified, since the possibility of gravitational forces altering the parameters of the space-time continuum of genetically important molecules (distortion of their micro-space) and influencing the read-out of this information in ontogenesis and phylogenesis, will have to be taken into account.

Going further, biogravitation will facilitate the explanation of such complex phenomena as the various radiations from cells and from the complete organism, heat exchange, muscle contraction, enzyme catalysis and, in particular, the formation of the enzyme substrate complex. With the assistance of the theory of biogravitation, it will be possible in biophysics to find a practically useful explanation for the mechanism of muscular contraction and the transformation of the energy of adenosine triphosphate (ATP) into mechanical work in this process. The movement of thick and thin protofibrillae and the characteristic displacement of the transverse connexions between them occur as a result of biogravitational forces brought about by changes in the conformation of protein molecules. New insights into the mechanism of the permeability of biological membranes, the transmission of nerve impulses

and the formation of biopotentials will be possible.

In psychology, new light will be thrown on one of nature's greatest secrets, the workings of the brain. A better understanding of mental processes, the brain's integrating activity, the coding of information and particular states of consciousness can be achieved only with the aid of the biogravitational hypothesis. More detailed information about this can be found in the writings of the well-known Soviet psychologist, V. Pushkin, who is working on contemporary psychological problems using the biogravitational hypothesis [29, 30].

In medicine, psychotronic treatment has shown itself to possess exceptional power and possibilities, first because several very serious ailments like psoriasis, paralysis, endoarteritis and cataracts lend themselves to treatment through the influence of a biogravitational field and, secondly, because recovery is exceptionally quick. The biogravitational theory opens up new prospects for the understanding of psychotronic treatment and its practical application, driving out the mystical and superstitious conceptions which have hitherto prevented these methods of treatment from being accepted by the medical profession. Nevertheless, the new type of biological field and its action on living organisms requires careful all-round study.

■ The infinity of knowledge

It is a fundamental tenet of our biogravitational hypothesis that, for the first time, it is becoming possible in physics to observe and study a completely new phenomenon, that of relativistic effects at the level of small masses. At the same time, the study of phenomena whose existence in the universe was previously only a matter of conjecture, such as anti-gravity, anti-matter, and the annihilation of particles, is becoming a real possibility. The living cell functioning on the basis of a biogravitational mechanism surpasses anything that astrophysicists have imagined existing in the distant galaxies of the universe. Kahuda's hypothesis and demonstrations of 'mental time' [31] are clear evidence in support of our claims.

Fully conscious as I am of the possibilities of the biogravitation hypothesis, I should nevertheless like to end by quoting the words of the great French physicist Louis de Broglie: 'Does not such a growth in our knowledge, occurring at ever-increasing speed, lead us to

presume that we shall soon have discovered all the secrets of the physical world? It would be a great mistake to think so, since every advance in our knowledge creates more problems than it solves [32]. These words fully apply to the hypothesis of biogravitation. The world is infinite and knowledge about it is limitless.

In conclusion, I would like to express my sincere gratitude to Karl Trincher and Valentin Bunin (Union of Soviet Socialist Republics) as well as to Christopher Bird (United States of America), for their great help in preparing this manuscript for publication.

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The author has been associated with the Institute of Earth Physics of the U.S.S.R.'s Academy of Sciences. A biophysicist, Dr Dubrov's current interest is in heliobiology, or the influence of solar activity and of our planet's magnetic field on living organisms. The article above is an expanded version of a paper read by the author last year in Prague at the International Conference on Psychotronics. He stresses that the views expressed are his own and 'in no way reflect those of the Institute'. Address: Institut Fiziki Zemli, Ulitsa Gruzinskaya 10, Moskva 123242 (Union of Soviet Socialist Republics).

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The mechanism by which psi-ability manifests itself

Hiroshi Motoyama

The ability of certain persons, or more specifically the ability of the nervous systems of some individuals, to radiate what is called psi-ability is subject to test and measurement by electrical devices. Here are described some recent experiments conducted in Tokyo which may help explain the mechanism whereby psi-ability shows evidence of its existence.

In the 1930s, researchers Rhine, Pratt, Thouless, Bender and Tenhaeff verified experimentally the existence of 'psi-ability' through tests for extrasensory perception (ESP) and psychokinesis (PK). They did not proceed, however, to the next stage of research—that of making clear the mechanism by which psi-ability manifests itself. I shall try here to summarize my own research to determine the nature of this mechanism.

From personal experience in the practice of yoga for more than twenty-five years, I have found that both yoga and *zazen* (sitting meditation) are excellent means to awaken and demonstrate psi-ability and paranormal phenomena. I have discovered that, in fact, the living bodily functions (including the autonomic nervous function) of yogis who manifest psi-ability are very different from those of ordinary persons. For example, some yogis can control their heart activity and respiratory rate. The president of India's Lanawara Yoga Institute, a doctor of medicine, has published electrocardiographic and related data of a yogi capable of stopping, at will, his heart from beating for a period of about five seconds.

In the psychic person, the range of activity of the internal organs or the autonomic nervous system¹ is very wide. The competitive range, for instance, between this system's sympathetic and parasympathetic nervous functions

is quite broad when compared with the range in an ordinary person. Figure 1 shows (top to bottom) the recording of variations in the volume of different parts of the body or plethysmogram, respiratory rate and galvanic skin resistance (GSR) of an ordinary person, while Figure 2 shows similar data in the case of a yogi.

In comparing the two illustrations, it is quite clear that in the case of the ordinary person the basic tracing of the plethysmogram is flat; with the yogi, the same line fluctuates in a rhythmical wave. This means that in the former case the amount of blood in the fingers is almost always constant, whereas in the yogi the amount of blood present in the fingers changes regularly in a pattern.

If you have ever taken courses in first aid, you will probably recall that the rate of respiration among normal persons is 16.8 per minute. A yogi can vary his rate of breathing however, from fewer than 16 per minute to as much as 30-40 every ten seconds in a breathing exercise known as *bastrika*. If an ordinary person tried to practice such rapid breathing, he would lose consciousness because of the

1. That part of our nervous system which regulates the bodily functions not under conscious control: heartbeat, dilation of the pupils, intestinal movement, and so on.
—Ed.

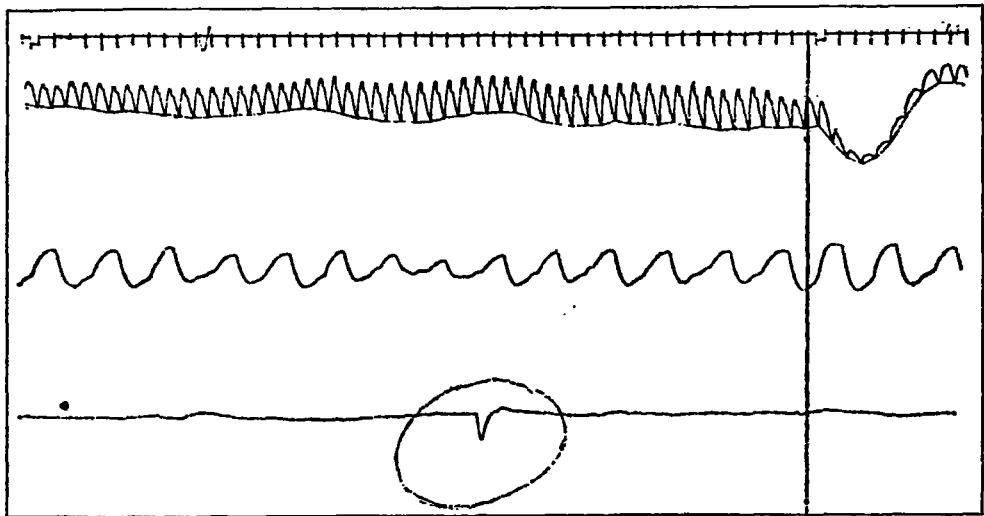


Fig. 1. Recording, in the case of an ordinary person, of the plethysmogram (upper tracing), rate of respiration (middle tracing), and galvanic skin resistance (lowest line).

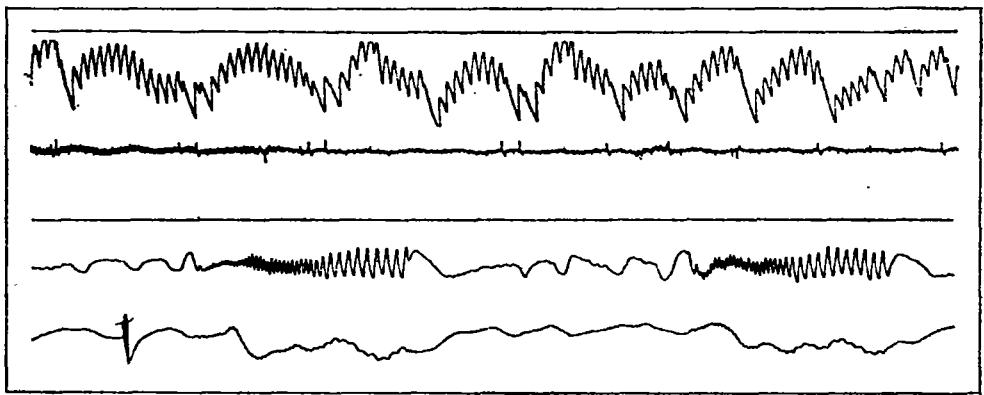


Fig. 2. Tracings comparable to those in Figure 1 for a yogi.

increased intake of oxygen which, in turn, would produce a serious diminution of internal pressure within the ventricles of the brain. And although GSR does not occur in the graph of the ordinary individual, it does often in that of the yogi; this means, simply, that the sympathetic nerves of the yogi are excited.

It is clear from these first figures that the yogi, manifesting psi-ability, can control at will his internal organs and the autonomic

nervous functions while, in the ordinary person, these systems remain 'unconscious' or beyond conscious control. The range of activity of the autonomic nervous system, furthermore, is extensive when one compares the yogi to the ordinary individual. The explanation for these phenomena, according to yoga doctrine, is as follows. Each of the internal organs is capable of being controlled voluntarily by a yogi because he has freed himself, through mental

concentration, from bondage to the physical body by breaking out of the shell of personality—a shell dependent upon the physical body for its existence. Thus, a yogi is able to experience a deeper and broader range of mental activity than others. The functioning of his mind—manifesting psi-ability—is not of a physical nature: it is non-physical and capable

of having a direct effect on the functioning of another person's physical body.

■ Effects of mental concentration

In an attempt to confirm this experimentally, I placed a person who showed psi-ability and a second, ordinary person in separate rooms

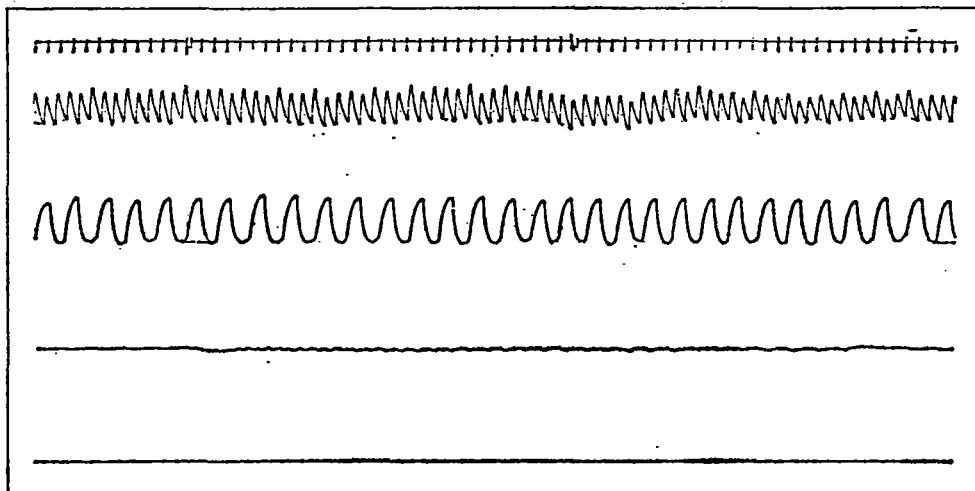


Fig. 3. From top to bottom, plethysmogram and respiratory and galvanic skin resistance recordings in ordinary person occupying shielded room before period of mental concentration by psychic person (see text).

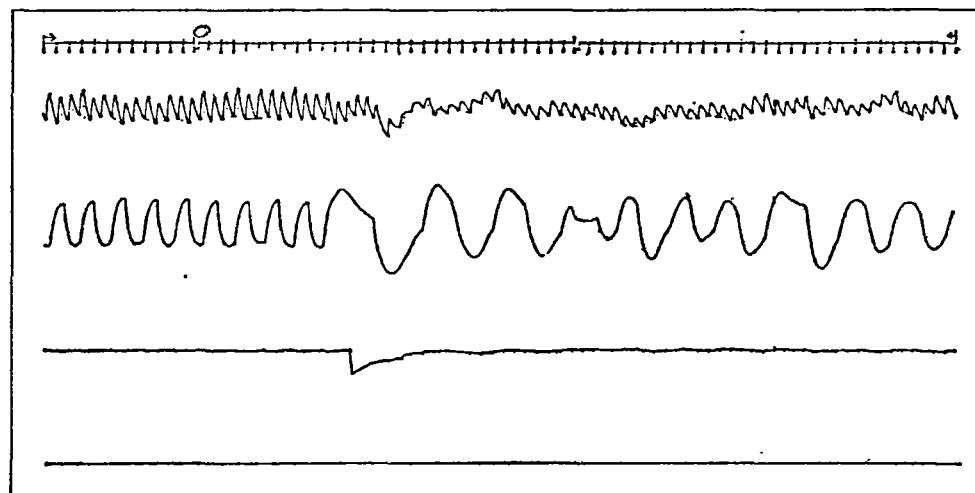


Fig. 4. Tracings comparable to those in Figure 3 after the psychic person's period of mental concentration has begun.

shielded by concrete walls lined with lead. Then I had the subject possessing psi-ability concentrate his mind on the other individual while I carried out various investigations and made measurements to determine if any changes in the bodily functions of the second (ordinary) person had occurred during the period of concentration by the psychic subject.

From Figures 3 and 4, it is clear that remarkable changes in the pulse and respiratory rate of the ordinary person were evident during the period of mental concentration by the psychic person when compared with the controlled conditions prior to the changes. Since the two rooms were shielded against physical energy, I concluded that the psi-ability responsible for bringing about these modifications is essentially non-physical in nature.

The following is the explanation, according to yoga doctrine, of this non-physical energy. When the mind is freed from the physical world by loosening its ties with the human body through a process of deep mental concentration, this non-physical energy (*prana*) is absorbed from the universe through one or more *chakra* and causes certain transformations in the body. A *chakra* is a centre in a subtle body, a higher dimensional entity, and is seen extraordinarily as a circle of light or an aura. *Chakra*, situated along the spinal chord in the body's trunk, in the forehead above and between the eyes, and at the top of the head, control corresponding internal organs and

nervous plexuses within the body. (See Figure 5.)

This energy is transmitted, on the one hand, through the spinal column and transformed into nervous energy; on the other, it is passed along as *ki* (vital force) to the meridians of acupuncture.¹ These two energy forms are thus distributed to every part of the body, controlling it and keeping the body in a living condition.

The real existence of these *chakra* and meridians has been made clear, by myself, in a series of physiological experiments using an electro-encephalograph [1, 2].² The non-physical psi-energy already mentioned radiates from the awakened *chakra* and the meridian points situated at the tips of the fingers and toes, and this energy is capable of having a strong influence on another person's body.

In order to ascertain if some form of energy emanates, in fact, from the meridian points and *chakra*, I proceeded to design and build an instrument capable of measuring the electrical potential (voltage) and current at each of the points along the meridians. With this machine, I conducted a series of agent-percipient tests. By connecting electrodes to the meridian points on the fingers of both hands of the agent (the sender, the psychic person) and the receiving percipient, I measured the current values in two sets of tests, both five times each, in quiescent conditions. I called this group of experiments C5/C5, or control five/control five.

The initial measurements in the next series of tests (C5/E5, or control five/experiment five) also were conducted under quiescent conditions. Then, during the subsequent five measurements, the agent concentrated intensely as he sent his energy or power from certain *chakra* or meridian points to the percipient. Then a test, called a 'T-test', was run on each meridian point in order to compare the mean of the first five runs and the mean of the second five for both C5/C5 and C5/E5 conditions. In the C5/C5 series, the percipient displayed significant variations at almost all of the meridian points measured. In the C5/E5 measurements, however, when the agent sent energy from his *chakra* or meridian points toward the percipient, the large variance

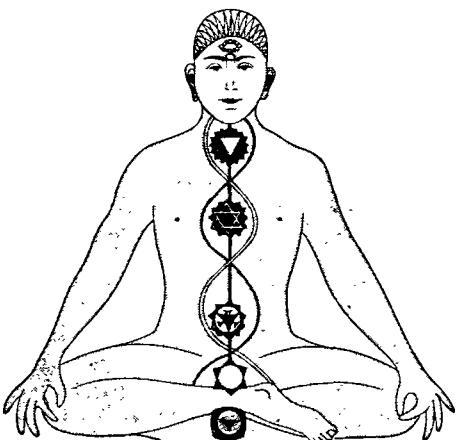


Fig. 5. Disposition of chakra along the human body's longitudinal axis.

1. See R. Melzack, How Acupuncture Can Block pain, *Impact of Science on Society*, Vol. XXIII, No. 1, 1973, p. 65.

2. Figures in brackets correspond to references at the end of this article.

found during the C5/C5 tests disappeared in both agent and percipient. In contrast to the measurements taken during C5/C5, those taken during C5/E5 indicated a remarkable reduction in the number of meridians which showed significant changes in the percipient. It can be inferred from these experiments that the energy or power transmitted from the agent's meridian point or *chakra* can cause change in the percipient's bodily functions.

■ Measuring vital energy

The emanation from the fingertips of a form of energy (perhaps similar to what I have measured) has been confirmed experimentally by the high-frequency photographic equipment devised by Semyon and Valentina Kirlian of the Union of Soviet Socialist Republics. They have photographed successfully auras and luminous radiation emitted round the human hand and various types of plants.

To see if it could be established experimentally that some form of energy emanates from *chakra*, I next designed a series of measurements with my recently developed 'apparatus for measuring vital energy'. In devising this equipment, I had to design and construct a pre-amplifier with an input impedance of near infinity; this I did by using high sensitivity integrated circuits which were then connected to a direct current amplifier. I built a

sturdy, box-like frame (2 m high, 1 m wide and 1 m deep), equipped on ceiling and floor with copper electrode plates (40×40 cm) and four more electrode plates (20×40 cm) mounted on the inside front, back, left and right and isolated from a square frame, suspended from four pulley wheels by a system of ropes; the frame was thus free to travel up or down within the box. The entire structure looks something like a telephone booth.

In order to make measurements of the utmost accuracy, this structure was placed inside an earthed (grounded), lead-lined room to assure maximal shielding from extraneous electromagnetic interference. The basic principle in using the electrode frame was that, by positioning the four movable copper plates opposite any of the *chakra* of the subject standing inside the box, energy emanating from a given *chakra* would be detected as a slight variation in the electromagnetic field set up across the plane of the electrode plates; if amplified, the variation could be recorded on a highly sensitive strip-chart recorder. It was imperative, during the test, that there be no contact between the subject and the electrode plate; otherwise, this would break the pre-amplifier. Test data were obtained in the cases of (a) no subject inside the box, (b) an ordinary person serving as subject, and (c) a subject manifesting psi-ability. Changes in electrical potential recorded from the vertex of the skull, the forehead,

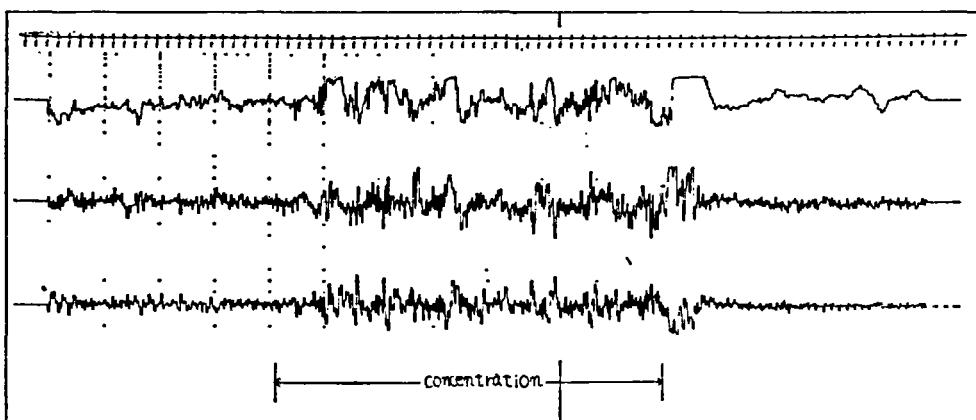


Fig. 6. Recordings made inside test structure (see text) of bodily reactions comparable to those indicated in Figures. 1–4 for ajna chakra. This chakra is situated above and between the eyes. It corresponds to and controls the pituitary gland, and is fully awakened and controlled by the subject. Before and after mental concentration, at rest and relaxed, the subject is not concentrating on chakra.

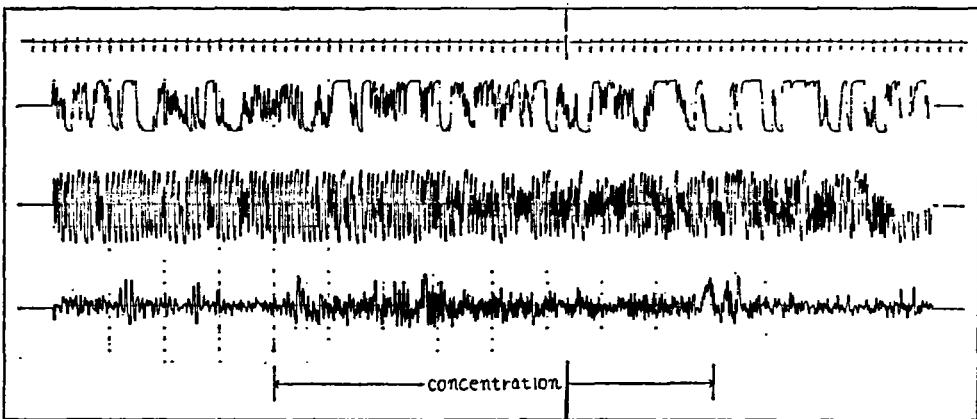


Fig. 7. Recordings similar to those in Figure 6 for swadhisthana chakra, situated 3–4 cm below the navel, corresponding to and controlling the genito-urinary organs. This chakra is partially awakened by the subject, but here not yet under his control. Both this and Figure 6 were made 13 February 1974 on subject K. Y., in an ambient temperature of 10.5° C., using the 'apparatus for measuring vital energy'.

throat, lungs, heart, stomach, navel, abdomen, coccyx, knees and ankles in each case showed, respectively, (a) of course, nil, (b) a slight change, and (c) considerable change. The comparative results of this testing is shown in Figure 6; these data are unique in that they represent the first time anyone has measured, as far as I know, energy of this kind in this manner. It can thus be inferred that a form of energy emanates, in fact, from the *chakra* of a subject possessing psi-ability.

Next, I carried out a number of measurements with a psychic subject to see what kind of difference appeared in the energy radiating from a fully awakened *chakra* and that from a lesser, partially awakened one. The data (measurement of the electrical potential and frequency) recorded in the case of electrodes placed in proximity to a *chakra* easily emitting energy through the subject's will were remarkably different from those data obtained when the electrodes were placed near a *chakra* not readily emitting energy through the will of the subject (compare Figures 6 and 7). There was also a marked contrast in the data when the subject was in a quiescent state (Figure 6). Thus can be reconfirmed, from the data collec-

ted, that a form of energy radiates from the awakened *chakra* of an individual manifesting psi-ability.

In regard to paranormal phenomena such as those known as psychokinesis (and discussed elsewhere in this issue)—also tested in the agent-percipient series described above—it is clear that psi-energy emanates from the *chakra* and meridian points of a psychic person; this energy seems to have a significant influence over the psychophysical functions of the person to whom the energy is directed. I believe that further work in this field of research, done in depth, will also resolve the question of mind-body correlation as well as bring to light accurate training methods; with the latter, it will be possible to verify subjectively that the human mind exists not only on the psychophysical plane but that it is capable of evolving to the point where it can exist and function in dimensions beyond those to which we are physically limited at present.

It is my hope, too, that, with time, this research will aid greatly the laying of a solid foundation upon which man will be able to build a peaceful world community where the family of nations can co-exist harmoniously.

■ Dr Hiroshi Motoyama

With doctorates in psychology and philosophy, author Motoyama believes that 'parapsychology is a science which can open and direct the human eye to pure mind and spirit—different from the "mind" treated in normal psychology'.

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The spaceships of the prophet Ezekiel

Josef F. Blumrich

References in some holy scripture to strange machines have prompted, throughout history, speculation and conjecture in order to lend acceptable, if not rational, explanations of the phenomena reported. Modern technical knowledge and test procedures have been used to reconstruct a model of what was seen and experienced by one of the four great Jewish prophets two and a half millennia ago.

Any thought of visits to our planet by extra-terrestrial beings is immediately stopped by the realization that existing scientific knowledge precludes that possibility. If such visits could be made at all, they would have to originate outside our solar system, and interstellar journeys would require unimaginable lengths of time. Yet this established knowledge is confronted with the wealth of mankind's myths and legends which claim the exact opposite, that 'gods' came from the skies. Their appearances were frequently accompanied by fire, smoke and thunderous noise; their influence on man was, mostly, beneficial. If the source of this information is the 'primitive' peoples' we call it a fable; if the origin lies in the religious scriptures of the more developed civilizations, we interpret the tales in a more spiritual or even holy manner.

That this attitude is unfair and wrong is manifest in at least two respects: it disregards the sincere and honest belief of the peoples who handed down the accounts, and degrades the tales to fictional stories. At its worst, the information is dismissed as the result of hallucination, the effects of drugs, or plain invention. But this attitude also is wrong and unfair with regard to man's future development because it denies even the possibility of progress in the corresponding fields of science.

Thus we seem to be at an impasse because

of an apparent conflict between science and legend. Yet the way is not totally blocked: we can make progress in this very important field of knowledge once we realize that science and engineering are two separate (although not independent) activities, each with its own

Ezek'el Saw The Wheel SPIRITUAL

The musical score consists of three staves of music. The top staff is for piano, indicated by a treble clef and a bass clef. The middle staff is for voice, indicated by a soprano clef. The bottom staff is for piano, indicated by a bass clef. The music is in common time. The title 'Ezek'el Saw The Wheel' and subtitle 'SPIRITUAL' are centered above the first staff. The lyrics are: 'Ezek'el saw the wheel turn-in'-way up in the mid-dle of the air, Ezek'el saw the wheel turn-in'-way in the mid-dle of the air.' The piano part includes a dynamic instruction 'pp' (pianissimo) and a crescendo instruction ' cresc.'

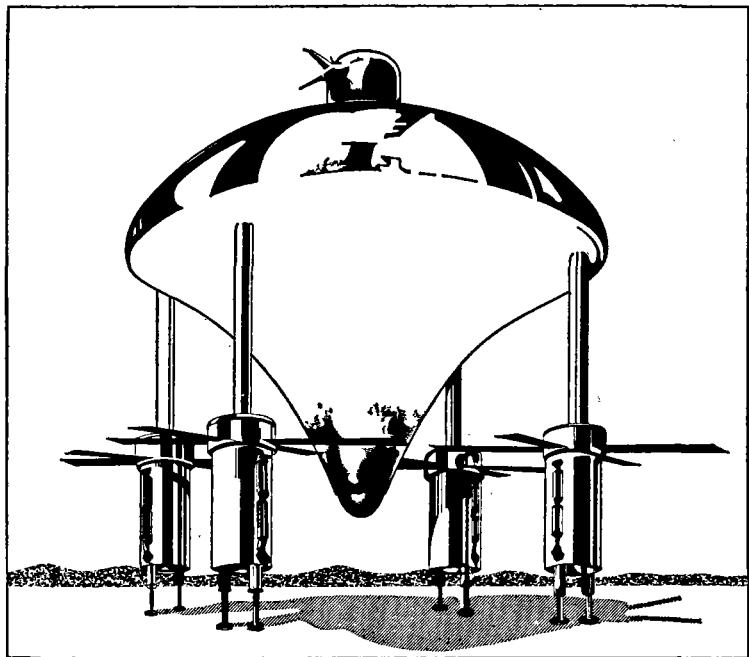


Fig. 1. Artist's reconstruction of spaceship seen by Ezekiel, viewed from a distance of about 60 metres.

area of significance. We must acknowledge the present inability of science to help formulate answers to the question of extraterrestrial visitors, while realizing that engineering and industrial technology have not been introduced to the controversy. The participation of engineers becomes an unconditional requirement in the evaluation of configurations and phenomena implying visits from other worlds. Here it is only natural that our fledgling knowledge concerning space flight emerges as a contributor of prime significance.

■ My interest is aroused

My own involvement in the subject of extraterrestrial visitors began with a vehemently negative attitude. Having worked as an aeronautical engineer since 1934—first in the design and analysis of aircraft, then for the past fifteen years in the design and development of both launching vehicles and spacecraft—I was firmly entrenched in the camp of those who declare visits from outer space to be an impossibility.

It was in this frame of mind that I began to read Erich von Däniken's *Chariots of the Gods?* His claim that the prophet Ezekiel had encounters with spaceships prompted me to read the biblical book of Ezekiel carefully with the intention of proving von Däniken wrong. By the time I had got to Verse 7 of the very first chapter, however, I found myself interpreting a description of the landing legs of some kind of flying vehicle: 'Their legs were straight, and the soles of their feet were round; and they sparkled like burnished bronze.' Having designed and tested such structures myself, I could not deny that it was possible to read in this a direct, yet simple, technical description.

The contrast of that evidently clear passage with the quite hazy pictures sketched by the rest of the chapter made me realize that the prophet could not have known what it was he had seen, could not have understood it. I realized the necessary consequence of this: the prophet could only describe his encounters with space vehicles and their crews in the terms available to him—with words and comparisons familiar to him and his contempor-

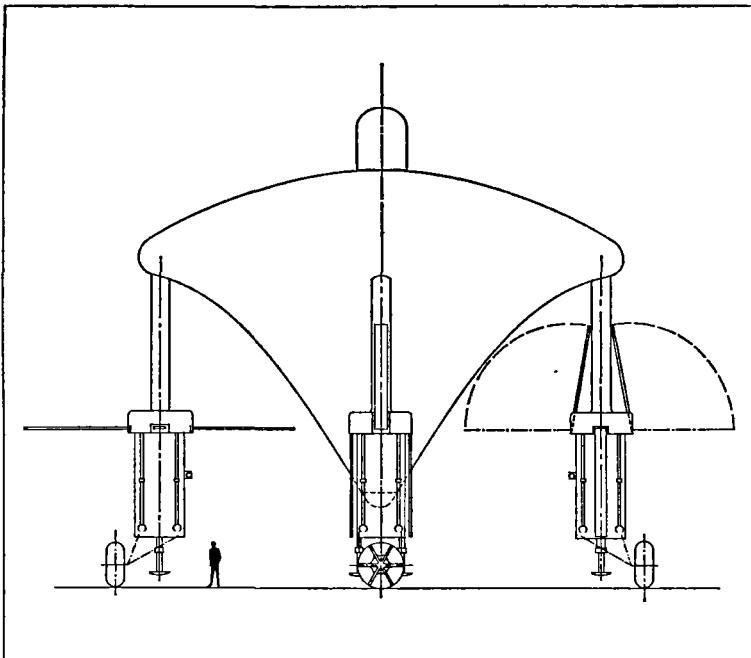


Fig. 2. Engineering depiction of the spacecraft shown in Figure 1.

raries. So I began taking Ezekiel seriously, in an engineering sense.

Because I had to rely on translations, I used six different Bibles, ranging in time from early in the last century to 1972, edited by Jewish, Roman Catholic and Protestant translators. Besides these, I used two highly detailed biblical commentaries:

My application of aircraft (specifically, helicopter) and spacecraft engineering principles to the reports of the prophet resulted in the penetration of Ezekiel's visual descriptions, and the replacement of these by known structural configurations. The final result is shown in the accompanying illustrations. There we see a quasi-conical main body, supported by four helicopter units, which carries the command capsule atop its rounded upper portion. We should consider that Ezekiel first saw this vehicle at a distance of about 1,000 metres; at that moment the nuclear engine fired, probably with some white clouds of condensation (because of the engine's 'chilldown' phase) shooting past the craft's main body.

In these fiery, dynamic surroundings Ezekiel notices the moving rotors, sees the landing legs and mechanical arms attached to the helicopter units. His first reaction is to compare the helicopters with man-like figures, but he then finds in the term 'living creatures' an expression of admirable vagueness to reflect his uncertainty. During final descent and landing, Ezekiel observes the protective covers of the helicopter's gear mechanisms, which he is able to describe best by comparing them with human faces. He notices the red-hot radiator -glowing coals- (Chapter 1, Verse 13) covering part of the lower central body; the prophet is fascinated by the wheels which, in their basic form, are the only element he recognizes and thus describes in great detail.

The visual description of the wheels has been misinterpreted in numerous paintings and texts. Yet no one has ever taken seriously the functional description which indicates that the wheels could move, in any direction, without being turned or steered. The latter has led me to develop a precise engineering interpretation, and for which a patent was granted

United States Patent [19]

Blumrich

[11] 3,789,947

[45] Feb. 5, 1974

[54] OMNIDIRECTIONAL WHEEL

[75] Inventor: Josef F. Blumrich, Huntsville, Ala.

[73] Assignee: The United States of America as represented by the Administrator of the National Aeronautics and Space Administration, Washington, D.C.

[22] Filed: Apr. 17, 1972

[21] Appl. No.: 244,519

[52] U.S. Cl. 180/79.3, 301/5 P

[51] Int. Cl. B62d 5/02

[58] Field of Search 180/79.3, 6.2, 7 R, 8 F; 301/5 P

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Primary Examiner—Kenneth H. Betts

Assistant Examiner—John A. Pekar

Attorney, Agent, or Firm—L. D. Wofford, Jr. et al.

[57]

ABSTRACT

The apparatus of the invention consists of a wheel having a hub with radially disposed spokes which are provided with a plurality of circumferential rim segments. These rim segments carry, between the spokes, rim elements which are rigid relative to their outer support surfaces, and defined in their outer contour to form a part of the circle forming the wheel diameter. The rim segments have provided for each of the rim elements an independent drive means selectively operable when the element is in ground contact to rotatably drive the rim element in a direction of movement perpendicularly lateral to the normal plane of rotation and movement of the wheel. This affords the wheel omnidirectional movement.

5 Claims, 4 Drawing Figures

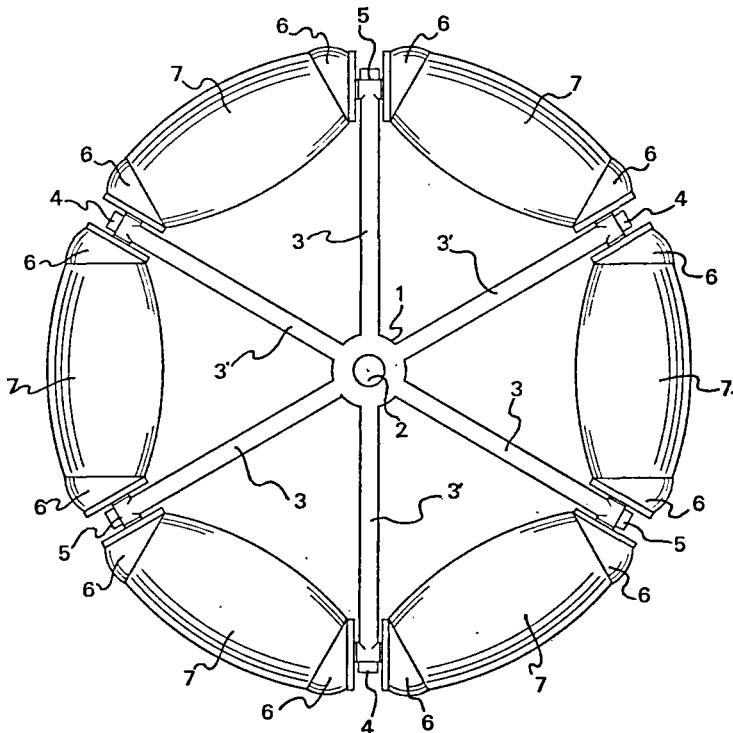


FIG. 1 is a pictorial elevation view of an embodiment of the wheel of the invention, showing the disposition of the rim segments supporting the circumferential rim elements.

Fig. 3. Patent awarded earlier this year to the author for his invention of the omnidirectional wheel.

by the United States Patent Office (see Fig. 3). A particularly gratifying application of this interpretation, incidentally, would be to facilitate considerably the mobility of wheelchairs for the physically handicapped.

■ Prototype, analytical research

Ezekiel ends his technical description with comments on the command capsule and on the commander himself. The amount of detail he includes is astounding. It is significant that the prophet describes features which are of little engineering importance but which, to the eye, carry the same weight as true structural elements. The quasi-conical shape of the spacecraft's central body—ideally suited to permit its combination with the helicopters, and thus a most important feature of the vehicle—is an existing engineering product. It was developed at the Langley Research Center of NASA, and has been studied analytically and in a series of wind-tunnel tests (see Fig. 4).

After establishing the general configuration of the spaceship, I made an analytical investigation; although the configuration appeared to be structurally and functionally sound, its feasibility could be proved only if weights, dimensions, performance and other basic characteristics turned out to be within reasonable limits. The analysis was performed parametrically, that means dimensions, weights and

performance were varied in steps over a wide range of possibilities. From the first crude calculation to the final detailed analysis, the results left no doubt of the vehicle's feasibility: they reveal a general technology of spacecraft construction not far beyond our current, most advanced capabilities. The only element we are incapable of building is the nuclear reactor within the propulsion system. Although this would be a fission reactor, it would require a specific impulse,¹ of at least 2,000 seconds against the about 900 seconds of today's nuclear engines. It is reasonable to assume, however, that we could have this capability within a few decades if we were to invest enough effort in its development.

The over-all result, then, is a space vehicle technically feasible beyond doubt and very well designed to suit function and purpose; its technology is in no way fantastic but, even in its extreme aspects, lies almost within our own capabilities of today. The results indicate, moreover, that Ezekiel's spacecraft operated in conjunction with a mother vessel orbiting the earth. We have no point of firm reference for an exact determination of the dimensions of the landing craft, but we can approximate these within the range I investigated analytically. The illustration shows the shape and proportions. The diameter of the central body would be about 18 m, that of the rotor of a helicopter unit would be 11 m, total weight at the time of lift-off from the earth for the return flight to the mother ship would be 100,000 kg, the engine's specific impulse would be 2,080 seconds, and the craft would carry two or three passengers.

With these conclusions, I had to declare defeat; I wrote to Erich von Däniken, explaining that my attempt to refute his theory had resulted in a structural and analytical confirmation of a major part of his hypothesis. Determining the form, dimensions and functional capability of what Ezekiel saw makes understandable a number of passages in his text that are otherwise meaningless; it also aids considerably in separating the prophetic or visionary parts of Ezekiel's book from those concerning encounters with spaceships. (I confined my study to the latter.) Being an engineer, I am not qualified to investigate the non-engineering portions.

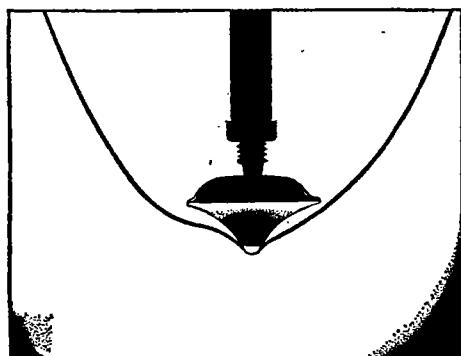


Fig. 4. Sketch made from a Schlieren photograph of a test model of 'Ezekiel's spaceship' as tested in the wind tunnels of NASA's Langley Research Center during the late 1960s. It is possible to change the profile of the lower part of the main body, if desirable, to accommodate the helicopters.

1. Specific impulse is the measure of the kilograms of thrust produced for each kilogram of propellant consumed each second. It is expressed in seconds. —Ed.

Who was Ezekiel, what did he see, and where?

Ezekiel had four encounters with spaceships, occurring over a period of twenty years. The first took place in 592 B.C., five years after Ezekiel and about 8,000 other Jews had been deported to Babylonia. Married and 30 years old at the time, Ezekiel was a priest and came from an upper-class family. When he saw the spacecraft for the first time, the experience was overwhelming and left him in severe shock. In the first chapter of his book he tells us most of what we can learn of the craft's structure and function. Although he tells us later that he was picked up aboard the spacecraft near Tel-Abib where he lived and was later returned there, he has little recollection of the flight itself. Completely overcome by the experience, he flies 'in bitterness in the heat of my spirit' (Chapter 3, Verse 14).

The second encounter follows within a few months. Its description is brief and fragmentary (Chapter 3, Verses 22-4).

In his account of the third experience one year after the first (Chapters 8-11), Ezekiel narrates a fascinating event culminating in what seems to be a maintenance or repair operation on the spacecraft. A mechanical arm (see Fig. 5) reaches from a helicopter unit toward the red-hot area at the lower tip of the main body

(Chapter 10, Verse 7), hands a 'hot' part of some kind to a member of the crew on the ground who had been ordered to take a position near one of the helicopters. The crewman carries away the hot part. A comparison of the temple Ezekiel describes with a plan of Solomon's Temple (still standing at that time) shows that Ezekiel's description is of another temple, but where?

The same question is raised by the fourth encounter, twenty years after the first (Chapter 40). Ezekiel's arrival at a large complex of buildings proves to have been scheduled because he is awaited by a man wearing clothing similar to that of the ship's commander and who takes the prophet on an extended tour through the temple. The report of this encounter, as well as the Book of Ezekiel, ends abruptly and must be considered as a fragment.

Nowhere in these episodes do we find contradiction, neither in the repetition of the vehicle's description nor in the events related to the space vessel. There is also complete agreement between my engineering reconstruction, based on present-day advanced technical knowledge, and the biblical words.

■ Whom did Ezekiel meet?

Ezekiel was surely a man of high intelligence, gifted with rare powers of observation. He had the incredible ability to keep his intellect unimpaired by the emotional turmoil caused by the first encounter. Yet he was in a condition of shock by the time he observed the commander of the vessel. Ezekiel wrote that it took him seven days to recover from the experience. One could therefore expect him to say that he had seen God, and that God spoke to him, yet he compared the figure of the commander to that of 'Adam' or 'man', and very soberly says 'one spoke to me'. Never in all his encounters with the commander and other members of the crew does he show any reverence.

The information conveyed by Ezekiel leads us to conclude that he came in contact with part of an expeditionary force; there are unmistakable suggestions of rank, formal communication and organization. This, combined with the assumption that extraterrestrial civilizations too would have to have economic control of activities they undertake, leads us to surmise that—even for financial reasons—Ezekiel cannot have been the sole purpose and target of the enterprise.

With such notions, however, I obviously begin to leave the territory of provable engineering affirmations. For several reasons, I conclude that Ezekiel's encounters with spaceships and his prophecies do not coincide in time. He could have seen the space vessel on one day and have had his prophetic expe-

accordingly. Since his revelations were written down long before the advent of flying machines or rockets, the only way man could interpret Ezekiel's enigmatic statements was through religion and, especially, mysticism.

The application of engineering knowledge leaves no voids in the text's interpretation, nor does it require any force to achieve agreement. Attempts to explain the same phenomena by vision, hallucination, or psychological or astrological effects requires one to accept a long series of coincidences. These would be necessary, indeed, to substantiate the congruities which I have established technically.

Today's established position concerning visitors from beyond the earth can be summed up by the statement: 'We do not know where they came from and how they arrived here, so they cannot have been here'. With time, the evidence will grow into a more understandable pattern, so that we can then declare: 'They were here, so they must have come here'. Advanced technology provides a means to make progress in this field, and I hope to stir enough interest in other engineers (not only design and structural specialists) to perform similar studies. And we cannot work for long without the support of scientists—physicists, archaeologists and ethnologists. What is needed foremost is open-minded co-operation, and I plead for that.

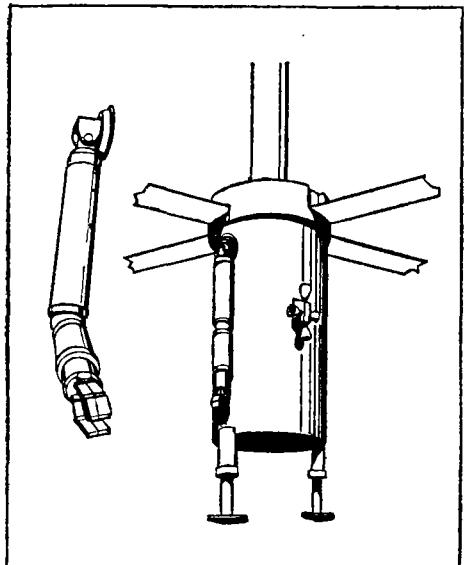


Fig. 5. Details of mechanical arm and control rockets, both housed in each of the four helicopter units.

riences months or even years later. Yet the commander spoke to the prophet. We know from the history of the biblical Book of Ezekiel that it was edited some time after it had been written. Several points of my engineering investigation show that editing to have been done with complete honesty and truthfulness, although the lack of knowledge of what Ezekiel really meant becomes evident in some places. We are justified to assume, consequently, that some of the commander's sayings may be contained in what we now consider as Ezekiel's visions and prophecies. It would be of very great interest, of course, to have these non-technical parts of the book of Ezekiel searched

■ Josef F. Blumrich

A native of Steyr, Austria, engineer Blumrich is the holder of patents on numerous inventions. Until recently the author was chief of the Systems Layout Branch at NASA's Marshall Space Flight Center. In earlier years, he developed the structural design of the Saturn V booster and participated in the design of Skylab. He has left NASA in order to spend his full time on research concerning extraterrestrial visitors in ancient times. He wrote the book Da tat sich der Himmel auf (The Spaceships of Ezekiel, in its English version) based on original research described in the article above. Address: 2721 Briarwood Drive, Huntsville AL 35801 (United States of America).

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Ezekiel makes his own wheel

*If intelligent beings came from beyond our globe to make contact with humans, as the prophet Ezekiel would have us believe, modern man has taken steps to make informative contact with beings beyond our world.*¹

The *Pioneer 10* spacecraft, conceived to be the first man-made object to escape from our solar system into interstellar space, carried a pictorial plaque designed to show to scientifically educated inhabitants of another star system—who might intercept it millions of years hence—when the space vessel was launched, from where, and by what kinds of beings.

Launched on 2 March 1972 from Cape Kennedy, Florida, by the National Aeronautics and Space Administration, *Pioneer 10* required about two years to ‘fly’ beyond the orbit of Mars, pass through the asteroidal belt, and observe Jupiter and discover its atmosphere of helium. *Pioneer 10* was flung, afterward, into the trajectory now carrying the spacecraft continuously away from our sun and its planetary system.

The plaque aboard (see Fig. 1) was etched into a gold-anodized plate of aluminium measuring 15.2 by 22.9 cm and 1.27 mm thick, attached to the supporting struts of the craft’s antenna. The plaque was positioned in such a way as to help shield the metallic illustration from erosion by interstellar dust. The radiating lines at the left represent the positions of fourteen pulsars (cosmic sources of radio energy), arranged to indicate that the sun is the home star of the civilization that launched the spacecraft. The bar-and-hyphen symbols at the ends of these radii are binary numbers representing the frequencies of these pulsars at the time of launching *Pioneer 10*; the fre-

quencies are relative to that of the hydrogen atom shown at the upper left with a unity (I) symbol. The hydrogen atom is thus used as a universal clock, and the regular decrease in the frequencies of the pulsars will aid another civilization to determine the time elapsed since the launching of *Pioneer 10*.

The hydrogen atom is used, too, as a universal metre-stick in order to give size to the human figures shown standing in front of the spacecraft’s outline, to the right. Hydrogen’s wavelength—roughly 20 cm—multiplied by the binary number representing ‘8’ (shown at the left of the woman) indicates her height, 160 cm. The figures depicted are those of the type of creature that made the spacecraft, the man’s hand being raised in a gesture of good will.

Across the bottom of the plaque are the sun and its planets, ranging toward Pluto to the reader’s right. The space vessel’s trajectory arcs away from earth, past Mars, swinging by Jupiter.

The suggestion that *Pioneer 10* carry a plaque in an effort to make contact with extraterrestrial intelligence came from a number of specialists. The plaque chosen was designed by Carl Sagan, director of the Laboratory for Planetary Studies, Cornell University; his wife, Linda Salzman Sagan, a painter and filmmaker; and Frank Drake, director, National

1. Further details can be found in *Science*, Vol. 175, No. 4024, 25 February 1972, p. 881.

Astronomy and Ionosphere Center, also at Cornell.

It is perhaps needless to add that no reaction to the plaque has been recorded since *Pioneer*

10 left earth two and half years ago. The time for the spacecraft to reach the nearest star, at a residual interstellar velocity of 11.5 km/sec., will be about 80,000 of our years.

Impact

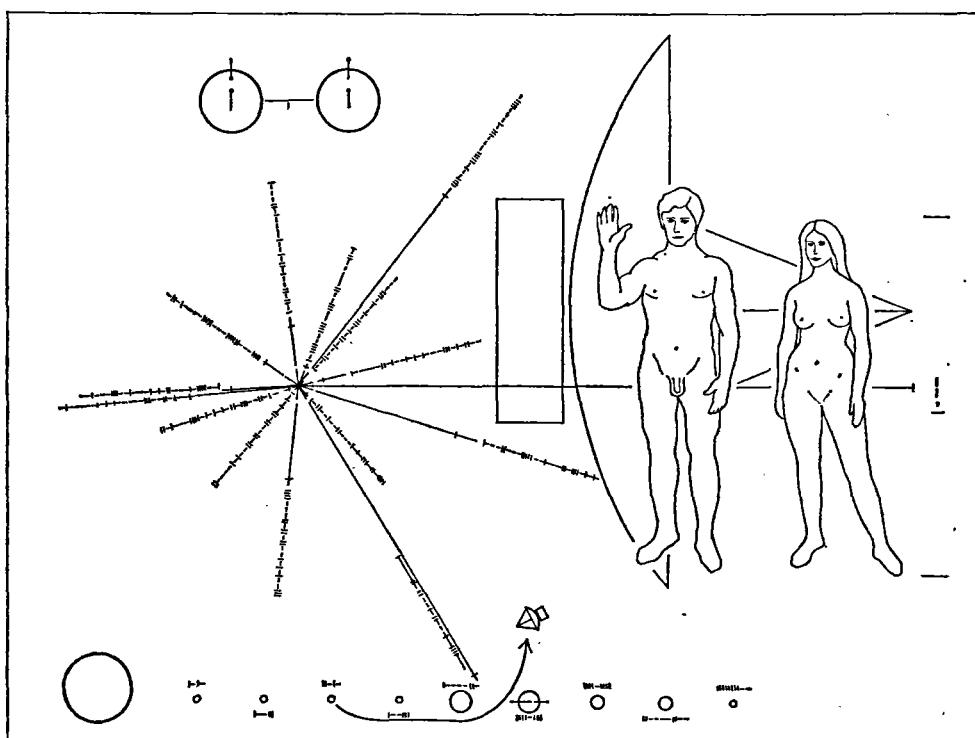


Fig. 1. See text for an explanation of the illustration.

Induction of psychotronic effects in altered states of consciousness

Stanley Krippner

In early societies dreams were thought often to be the work of supernatural entities, appearing to mortals with messages of hope or despair. Dreams, as well as various trance or 'possession' states, could provide a glimpse of the future, reveal events happening elsewhere, or indicate others' thoughts. Not until the development of psychotronics could these precognitive, clairvoyant and telepathic effects be studied in the laboratory. Then it was found that psychotronic phenomena in altered states of consciousness were elicited most frequently by experiments designed to integrate elements such as emotionality, spontaneity and expectancy.

Psychotronics can be defined as an interdisciplinary science which studies the interaction of matter, energy and consciousness; specific phenomena explored by psychotronics include telepathy, clairvoyance, precognition and psychokinesis.

In William Shakespeare's play *Julius Caesar*, Calpurnia has precognitive dreams of her husband's death. As Caesar reports in Act II, Scene 2,

Thrice has Calpurnia in her sleep cried out,
'Help, ho! They murder Caesar'
... She dreamt tonight she saw my statue,
Which, like a fountain with a hundred spouts,
Did run pure blood; and many lusty Romans
Came smiling and did bathe their hands in it;
And those does she apply for warnings, and portents,
And evils imminent; and on her knee
Hath begg'd I will stay at home today.

Caesar disregarded Calpurnia's dreams and, according to Shakespeare's play as well as tradition, was assassinated in the Roman forum later the same day. In more recent times, Abraham Lincoln did not take proper precautions when he went to Ford's Theater in Washington, disregarding the premonitory dreams in which he saw himself in a coffin—the victim of an assassin's bullet.

The development of psychoanalysis caused the observation of this type of dream to move from the anecdotal to the clinical level. A number of reports have appeared in psychiatric literature describing presumptively paranormal dreams occurring in the context of the psychotherapeutic situation [1].¹ In 1911 Freud joined the British Society for Psychical Research and, in 1915, became a member of the American Society for Psychical Research. He later suggested:

Telepathy could be the original archaic means by which individuals understood each other and which was pushed into the background in the course of phylogenetic development by a better method of communication, i.e. that of signs perceived by the sensory organs. But these older methods of communication may have continued to exist in the background and they may still be able to manifest themselves in certain conditions [2].

With the development of the detection of rapid eye movements and other psychophysiological techniques for the monitoring of sleep it became possible to move from a clinical to an experimental level of observation. In 1962, a Dream Laboratory was established at the

1. Figures in brackets correspond to references at the end of this article.

Maimonides Medical Center, Brooklyn, New York, for the investigation of paranormal effects in altered conscious states [3]. Formal work involving standardized electro-encephalogram psychophysiological monitoring began in 1964. Since then, thirteen formal experimental studies have been completed as well as a number of pilot studies. These studies will be summarized briefly, followed by the conclusions reached by studying both the formal experiments and the exploratory pilot studies.

■ Experimental psychotronic studies

For the first experimental study, twelve volunteer subjects (*Ss*) spent one night each at the laboratory. Two staff members, one male and one female, alternated as transmitters or agents (*As*), attempting to influence *Ss*' dreams psychotronically by means of telepathy. *A* was always in a distant room while *S* was asleep; *A* was the only person who knew the identity of the 'target' for any given night. Target materials were famous art prints, randomly selected for each night once *Ss* had gone to bed. On the following morning, *Ss* were asked to match their recall of dreams against the entire collection of target pictures, selecting the art print which most closely corresponded to their dreams and ranking the others in descending order of correspondence. Four outside judges (*Js*) followed a similar procedure; statistically significant data emerged from *Ss*' rankings and from one of the *J* evaluations. Significant differences between *As* were also obtained when the six *Ss* were paired with the male *A* obtaining closer target-dream correspondences than when the six *Ss* worked with the female *A*.

In one instance, Chagall's *Green Violinist* was randomly selected as a target picture. The *S* on that particular night conjectured that the target had 'something to do with music'. For another *S*, Gauguin's picture *Still Life with Three Puppies* was selected; *S* dreamed about 'a couple of dogs making a noise'.

For the second experimental study, W. Erwin, the *S* whose target-dream correspondences had been the most direct in the first study, was paired with the male *A* from that study for a seven-night series. Statistically significant results were obtained from both *S*'s evaluation and the average scores of similar evaluations done by three *Js*.

For the third study, twelve different *Ss* and two *As* were utilized in another twelve-night

series. The results did not attain statistical significance for either *S* or *Js*. All of the Maimonides studies have been reported in the literature—both those in which psychotronic effects were present and those in which they were absent [4].

In the fourth experimental study, R. Posin, who had participated also in the third study, was paired with the *A* she had worked with during her previous night in the laboratory. Evaluation by neither *S* nor *Js* produced significant data for this eight-night series.

The fifth study involved hypnosis. Two groups, each consisting of eight *Ss*, were created: a hypnosis group and a non-hypnosis, 'relaxed' group. Each *S*, having been paired with one of four *As*, produced waking imagery in the laboratory, produced imagery during or following a rest period at the laboratory, and kept dream diaries at home. On the basis of *Js*' evaluations, significant results were obtained for the hypnosis group for the imagery produced in the laboratory and for the non-hypnosis group in the imagery produced at home and recorded in the laboratory. A case could be made that hypnosis facilitated and 'speeded up' the processing of the telepathic material.

The sixth experimental study involved T. Grayeb, another *S* from the third study. Without the knowledge of *S*, *A* concentrated on a target during eight nights of the study; for the other eight nights there was neither an agent nor a target. The condition was determined randomly, once *S* had gone to bed. Neither condition produced significant results.

For the seventh study, Erwin was again paired with the *A* from the second study for an eight-night series of experiments. The art print was accompanied each night by a box of 'multi-sensory' materials to enhance the emotionality of the target. For example, Daumier's painting *Advice to a Young Artist* was accompanied by a canvas and paints to enable *A* to act out the artist's role. On that particular night, *S* dreamed about artists such as Klee and van Gogh, as well as 'a portrait of someone who is sort of an authority'. Analysis of the average scores of the three *Js*' evaluations produced significant results.

For the eighth experimental study, R. Van de Castle, a *S* who had produced several direct target-dream correspondences in a telepathy study at another laboratory [5], was allowed to select his own *A* from the laboratory staff during the eight-night series. He selected a total of three *As*; one for a single night, one

Maimonides Medical Center
Department of Psychiatry

Dream Laboratory
Judging form

Subject _____
Target _____
Protocol _____
Judge _____
Date _____
Number _____
Notes _____

Very great correspondence

Great correspondence

Moderate correspondence

Some correspondence

Little correspondence

DIRECTIONS: Using a red pencil,
color the space that represents,
in your judgment, the correspon-
dence between target material and
protocol content.

Fig. 1. Blank judging form used by experimenters at Maimonides Medical Center to rate degree of correspondence between influencing 'agents' and voluntary subjects of tests.

for two nights, and one for five nights. Both S's evaluations and those of an outside J were statistically significant [6].

The ninth experimental series was a study of clairvoyance which utilized sixty Ss, divided equally into a highly suggestible hypnosis group, a little-suggestible hypnosis group, a highly suggestible waking-imagination group, and a little-suggestible waking-imagination group. All Ss attempted to guess the nature of art prints in four sealed envelopes, either while hypnotized (producing a 'hypnoti dream') or while using imagination (a daydream). Ss evaluated their own material. The judgments of the high-suggestible hypnosis Ss were significant while the data produced by the other Ss were not [7].

For the tenth experimental study, each of four Ss spent eight nights in the laboratory. For four nights, the same randomly selected target was used by A. For another four nights, a different randomly selected target was used each time the experimenter noted psychophysiological evidence (e.g. rapid eye movement activity) that S was beginning to dream. As two Ss were tested at one time, the study involved sixteen sessions. S evaluation produced statistically significant results for the three Ss who evaluated their own material. When a J evaluated the material, significant results (favouring the condition in which several targets were used each night) were obtained for two Ss. None of the significant data favoured the condition in which the same art print was used for four nights. The results suggest that the element of novelty is important and that telepathic effects do not 'build up' but occur quickly and spontaneously.

The eleventh study involved precognition. Malcolm Bessent, S for this eight-night study, attempted to dream about an experience which he was to have the following morning. The experience was built around a randomly selected word; when the word 'teaspoon' was selected, for example, he was given soup to eat with a teaspoon. Three Js evaluated the material; their average scores produced statistically significant results, confirming the precognition hypothesis.

The twelfth experimental series also involved precognition. In a sixteen-night study with Bessent, the experiences were combined or 'packaged' (e.g. a slide projection programme about birds was accompanied by recorded bird calls; on this particular occasion, S had several dreams about birds before the target

was actually selected). S was exposed to the packaged experience the evening following his attempts to precognize it; he then went to bed again, so that his post-experience dreams could be compared to his pre-experience dreams. Based on the evaluations of three Js, S's dreams on the eight pre-experience nights corresponded to the packaged experiences at a statistically significant level, again confirming the precognition hypothesis. Significant data did not emerge for dreams on the eight post-experience nights, however indicating that precognitive target incorporation produced a stronger effect for this S than direct incorporation of target elements into dreams.

A pilot study [8] had discerned telepathic effects on Ss' dreams over a distance of fourteen miles. Therefore, in the thirteenth experimental study, A (Bessent) viewed multi-sensory target material in New York City while eight female students rotated as Ss in Laramie, Wyoming. Evaluations by the three Js for this eight-night study did not attain statistical significance [9].

■ Discussion

Seven conclusions have been formulated on the basis of these thirteen studies as well as from exploratory studies in which equally rigid precautions were taken against 'sensory leakage'. Future research could expand upon these seven conclusions and their implications.

Telepathy in dreams can be demonstrated in a laboratory setting.

Of the nine formal experimental studies involving attempts for A and S to communicate telepathically through S's night-time dreams, significant results have been obtained in five instances. Significant results were also obtained in two pilot 'long distance' telepathy experiments: one was a four-night series involving eight Ss and the other was a six-night series involving two Ss [10]. An analysis of the first night spent by each of the seventy-four Ss participating in telepathy experiments between 1964 and 1969 produced significant data, fifty-two telepathic 'hits' and twenty-two 'misses' [11].

Of the attempts to replicate the Maimonides experiments, three have been successful [12, 13, 14], two have been unsuccessful [15, 16], and one has produced equivocal results [17]. All six studies represented the investigator's

initial attempts to study this type of psychotronic phenomenon. It is difficult to conjecture what the results would have been if long-range studies had been planned. In any event, there are now enough well controlled studies in the professional journals to show that telepathy in dreams can be demonstrated in a laboratory setting. (Fig. 2),

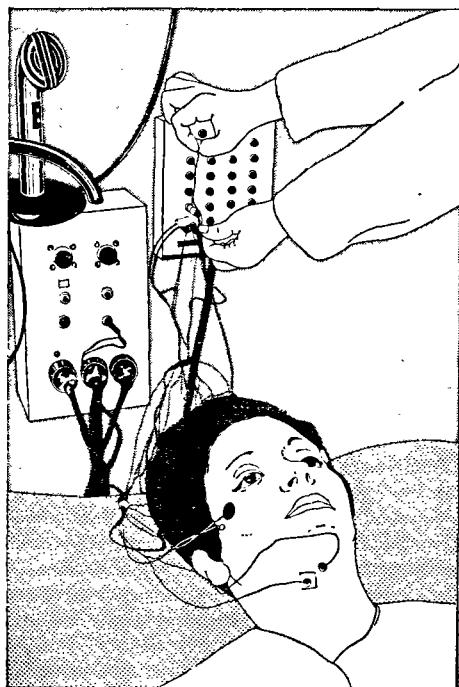


Fig. 2. Laboratory arrangement to test subject for manifestation of telepathy by way of dreams.

The elements of orientation, expectancy, and volition appear to be necessary for psychotronic effects to occur in dreams

During 1966, several pilot sessions were run in which *S* was not told that an *A* would attempt to influence his dreams telepathically; these sessions were devoid of target-dream correspondences. In a four-night pilot study, an *S* was told to attempt to dream about a randomly selected art print placed in a box attached to the ceiling of his room. At the same time, an *A* was attempting to transmit telepathically a different picture—but without *S*'s knowledge. Direct target dream correspondences were detected

by *Js*, on all four nights of the study, for the clairvoyance targets but on only one night for the telepathy targets. These results suggest that orientation, expectancy and volition are necessary for ESP to occur in experimental dream studies.

Another pilot study which studied this factor involved two *Ss* and 2,000 *As*. *As* were ticket-holders to six concerts held by The Grateful Dead, a rock-and-roll musical group. At a half-hour before midnight each night, the audience was exposed to a six-slide sequence projected on a large screen. The slides announced:

1. You are about to participate in an ESP experiment.
2. In a few seconds you will see a picture.
3. Try using your ESP to 'send' this picture to Malcolm Bessent.
4. He will try to dream about the picture.
5. Malcolm Bessent is now at the Maimonides Dream Laboratory in Brooklyn.
6. At this point a randomly selected art print was projected on the screen.

Without the *As*' knowledge, the dreams of a second *S* were also collected. But *Js*' evaluations of target-dream correspondences were significant only in the case of Malcolm Bessent, the *S* toward whom *As* were oriented to 'send' their target material.

Male subjects have been more effective telepathically as receivers in the dream experiments than females

Between 1964 and 1969, 55 experimental sessions and 79 pilot sessions were completed in which telepathy was attempted between an *A* and a sleeping *S*. For these 134 night-time sessions, a total of 14 male *As*, 41 male *Ss*, 9 female *As*, and 33 female *Ss* were included. A statistical analysis was performed on the first night each *S* attempted telepathic incorporation, reducing the number of available sessions to 74. In all, there were 52 telepathic 'hits' and 22 'misses' on the basis of *Js*' evaluations; this distribution is statistically significant. When a male served as *S*, there were 31 hits and 10 misses, which is significant. When a female served as *S*, there were 21 hits and 12 misses, a distribution which is not statistically significant. It was further found that male *Ss* produced just as significant results when paired with a male *A* as when paired with a female *A*.

The basic reason for this finding is unknown but may relate to: (a) findings that male *Ss*' dreams contain more aggressive, violent and

sexual material than the dreams of female Ss; (b) studies demonstrating that males are more willing than females to volunteer for dream studies and to report their dreams more fully. A more complete dream report would give Js more information in making target-dream evaluations. In view of the observation that aggressive and sexual material is often linked with ESP in dreams, a full and uninhibited report would be necessary to reveal this material.

Telepathic effects have occurred in dream experiments when subject and agent have been separated by great distance

A formal investigation of the effects of distance in telepathic dreams has never been attempted, but, distance has been no impediment in the studies already concluded. Most of the experimental series have involved the distance of 29 metres between A's room and the sleep room. Significant results were also obtained in a pilot study in which As and Ss were separated by 23 kilometres, and another in which the distance was 72 kilometres. Some of the most vivid target-dream correspondences have occurred in the studies involving a separation of several kilometres between A and S. On the other hand, an experimental study failed to yield significant results when the distance was increased to 3,200 kilometres.

Target stimuli that are emotional in nature appear to be more effective than non-emotional in the dream experiments

In surveying target material used in the telepathy-dream experiments, we have been struck by the likelihood that art prints most apt to be incorporated in Ss' dreams were those which could most readily evoke emergency response mechanisms relating to either individual survival or survival of the species. Targets with clear sexual and aggressive themes appeared to evoke corresponding imagery and feeling in the dreams of the percipient.

It is also apparent that targets containing religious themes have been successful in eliciting telepathic responses; of eighteen Ss whose As were assigned randomly selected targets containing religious content, telepathic hits were made in fourteen cases. During one session, a male university student from India was paired with his twin brother, also a student. The randomly selected target picture was

Demuth's *Box of Tricks*, which depicts a rectangular church with several spires and a steeple. The subject's dreams contained references to 'blocks', 'candles', 'a rectangular marble plaque', and the 'impression of continuously eating rock candy'. During the post-sleep interview, S stated:

When I got up I had the taste of rock candy in my mouth . . . I have had rock candy in India but only at religious festivals back home. And that's where the candles probably fit in too. Back home, rock candy . . . would be lying around at almost any religious festival. But I'm trying to think whether it would be within my religion or in the Hindu religion . . . I'm trying to see which religious ceremony the rock candy that I ate might be associated with in terms of religious ceremony . . . Yes, I'm sure it was probably a religious ceremony from my own faith . . . the Zoroaster faith . . . very close to the end of the ceremony, usually in the far temple. That's our place of worship . . . It's the usual building . . . a couple of rooms that are used for meditation . . . My only association to the rock candy is the religious ceremony that I could have attended back home.

'Multisensory' target material (always involving visual and auditory material and sometimes including gustatory, olfactory and tactile-kinesthetic material as well) was used in three additional ESP pilot studies, all but one of which yielded statistically significant results.

Upon analysing the content of the art prints used during dream telepathy sessions, representing the first night spent at the laboratory by seventy-four Ss, additional data were obtained. Using adjectival check-list ratings from three Js, it was found that telepathic hits tended to be associated with such descriptive words as 'aggressive', 'alert', 'deliberate', 'imaginative', 'masculine' and 'unpleasant'. Telepathic 'misses' tended to be associated with such adjectives as 'bright', 'feminine', 'formal' and 'pleasant'. Thus the importance of emotional involvement on the part of A has been demonstrated by both selection of potential targets with themes that are emotionally involving and the inclusion of multisensory material for A to work with.

Two initial dream studies have supported the precognitive hypothesis

Spontaneous examples of precognition in dreams have been noted in the Maimonides Laboratory since its inception. For example, on 21 May 1965, S had the following dream:

I was dreaming that the experiment was over and that I was getting ready to leave. And there was a friend of mine, Harold, who I haven't seen for about twenty years--oh, I guess well over twenty years. And he was in the dream. He was being set up for the next experiment.

S referred to this dream in the post-sleep interview:

Some of the things in the dreams were about things that had happened years and years ago. . . . It seems to me it's quite some time that I've had dreams that really seem to have taken place about twenty years ago. . . . I remember there was a chap that I hadn't seen for about twenty years or so—I guess more than that—by the name of Harold, who was being set up for the next experiment.

A week later, the subject wrote the laboratory staff this letter:

This is to inform you that as 'predicted' in my dream of last Friday night, I met a friend of mine named Harold. I was in a restaurant rather out of the area where I usually eat. I was sitting with an acquaintance and had just told him of the dream and that I had not seen Harold for about twenty years, since high school. I had been saying that, since Harold seemed to have no integral part in my dream, I expected to meet him momentarily. We got up to leave and there, standing in the line near the doorway, was Harold. (I had been seated facing away from the door.) I tapped him on the arm and informed my friend that this was the fellow I had just told him about. Harold recalled that we had met in passing at Lewisohn Stadium some time since high school, but I don't remember the incident. I haven't been there for many years.

Several months after this incident, one of Maimonides' staff members was lecturing on telepathy and dreams in Huntington, New York. A member of the audience came up after the lecture and introduced himself. He had been *S*'s friend in the restaurant episode, and corroborated the story of the encounter with Harold.

With the inception of the Central Premonitions Registry in Manhattan, a clearing house became available for those individuals who had presumably precognitive dreams and wanted to place them on record. One of the individuals with the most consistent record of hits was Bessent, whose services as *S* were obtained for two experimental studies. These studies demonstrated, at statistically significant levels, that precognition in dreams could be demonstrated in a laboratory setting—in the case of at least one *S*.

Altered states of consciousness appear to be favourable for the occurrence of ESP

The association between ESP and altered states of consciousness has been pointed out by several investigators. Studies demonstrating the differential effects of altered conscious states on ESP have been carried out at the Maimonides research centre. In one of these studies [17], a self-report scale was taught to each *S* to denote the degree to which his conscious-

ness was altered while undergoing training in alpha brain wave control. *S* was informed:

During the course of this experiment, we will be interested in the degree to which your state of mind stays the same or changes. . . . In order to make it easy and convenient for you to tell me this, I am going to teach you a rating scale. . . . zero indicates that you are normally alert. . . . one indicates that you feel especially relaxed. . . . two indicates that your attention is being focused more on internal feelings and sensations. . . . If this shift is not only recognizable but strong, you should report three, and if it is strong and very impressive to you, report four....

Psychotronic performance, in this study, was statistically significant and appeared to be a function of *S*'s conscious state—as measured by the self-report scale—during alpha brain wave control. The experiments conducted in the Maimonides laboratory thus have presented data from various standpoints, demonstrating the utility of altered conscious states for the occurrence of psychotronic effects.

■ Conclusion

Emerging from the data collected at Maimonides are themes which remind one of the anecdotal and clinical material collected by workers in psychotronics over the years. Especially pertinent is the finding that telepathic effects have been noted in laboratory dreams; this has been observed particularly if the target material is emotional in nature and if the elements of spontaneity, orientation, expectancy and volition are given due consideration. More recent work with precognitive effects follows the same path, that of learning from life and making the controlled experiments as life-like as possible within a scientific setting.

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Does para-optical perception exist?

Yvonne Duplessis

Since author-dramatist Jules Romains published his Vision Extra-rétinienne more than a half-century ago, experiments have been conducted to establish that the human body can 'see' with organs other than its eyes. Current research, notably that done in the Union of Soviet Socialist Republics, shows that some individuals can achieve a certain degree of detectability of graphic symbols and especially colours by developing sensitivity of the hands. These investigations are described briefly, together with some of the theories they have raised.

Everyone knows, at least vaguely, that fairly frequently certain people are capable of seeing subjective colours which are occasioned by a sensation other than that of sight. These phenomena are generally referred to under the name of synaesthesia, the most frequent type of which is 'colour-hearing' in which the hearing of a sound results in a visual impression. What is not known, however, is that in exceptional cases some subjects are capable of seeing objective colours without the help of their eyes; it is this which is referred to when one speaks of para-optical perception.

The first person to pay attention to these phenomena and to study them was the famous novelist and playwright Jules Romains. He designated them by the name of *vision-extrarétinienne* (extra-retinal vision) in a book of the same name published by Gallimard in 1920. In an effort to explain them, Romains did his utmost to interpret them in terms of a genuine faculty—the 'para-optical' faculty—which, according to him could be developed through training. Such vision, still according to Romains, is optical in character but derives from miniature eyes, 'ocelli', spread over the whole of the epidermis. It can thus be developed not only by the face but also by the chest and even the

nape of the neck. It can be reduced to none of the four other senses.

In his work, Romains outlines all the ingenious methods which he used to induce and to analyse this type of vision, enabling subjects without any special abilities to read blindfold within the framework of what he claimed were genuine laboratory experiments.

Under normal lighting, para-optical vision is in fact similar to normal vision, but goes beyond the limits of normal vision except as regards black and white. It is, Romains tells us, without recourse to hypnosis that this faculty is enabled to emerge, though the subject has to undergo special training which leaves him wide awake while extending his consciousness. He performed this training on himself and also on subjects who had lost their sight as a result of accidents. In addition, he entrusted to his disciple René Maublanc, a philosophy professor, the task of giving such para-optical training to a woman blind from birth. In the first part of his work entitled *Une Education Paroptique*, which appeared in 1926, Maublanc relates the successive stages of this training and in the second part the subject herself analyses her impressions on discovering the visual world.

■ Patience and optimism

Para-optical training calls for a great deal of patience and unshakable optimism on the part of both the experimenter and the subject. Certainly, the unevenness of the results is often disappointing in the course of a period of training which has to be very regularly followed. The subject's state of health and mind and the presence of other persons may influence the results. One has to learn to 'see', so to speak, just as one learns to read or to play the piano. Face-training begins with the 'seeing' of signs, of letters placed under glass, followed by the recognition and classification of coloured papers. The subject also practises 'seeing' via his hands. In this case, sensations which are associated with colours seem to predominate.

Although similar observations made particularly in the U.S.S.R. tend to confirm the existence of the phenomenon and the interest in the possible development of this faculty, they reject the explanation in terms of ocelli. Strictly speaking, seeing does not take place but there would appear to be, rather, an induction, in particular an induction of colours on the basis of tactile impressions, whence the new name given to these phenomena: instead of a 'para-optical faculty', one now speaks of 'dermo-optic sensitivity'. This, despite the name, seems to be the possibility—neither dermic nor visual—of identifying printed texts and colours by the following roundabout way: the strange impressions experienced are necessarily but inadequately translated into the language of tactile and visual sensations. But what hypothesis could explain this new interpretation? Dermo-optic sensitivity would appear to result either from the kinaesthetic and thermal influence of colour on the skin, or from the effect of photo-reception, that is to say an absorption of light-waves by the epidermis.

Novomeysky, who first coined the expression 'dermo-optic sense', believes that the faculty in question stems from differences in electric potentials produced under the influence of the coloured surface. These potential differences, according to this view, give rise to differential interactions with the skin of the hand as a surface possessing its distribution of natural electric charges. But his recent work shows that the palm of the hand and the coloured bodies which it approaches emit infra-red radiation; their interaction varies depending on the colour, and this gives rise to impressions

(generally unconscious) which constitute the dermo-optic sense.

In the works published by the Sverdlovsk Institute of Education under the direction of Novomeysky, research on the psychological, physiological and physical conditions of the development of this dermo-optic sense is described. According to the first investigations of certain research workers such as Dobronravov and Guylev, this dermo-optic sense functions in a way which is similar to normal vision. Light is therefore its physical agent.

For Novomeysky and his collaborators, on the other hand, dermo-optic sensitivity first of all appeared to be quite distinct from normal vision, the subject being able to detect the stimuli both in the darkness and beneath opaque screens. It emerges from their present research, however, that the only reason why this is so is that the infra-red radiation emitted by the different colours is not consciously perceived by the eyes, whereas developing dermo-optic sensitivity means bringing from the unconscious into the conscious mind the impressions which are thus aroused.

■ Tactile impressions

Irrespective of the theories put forward, all investigators study the development of this sensitivity via the hands, with or without contact. The objection that the eyes are insufficiently masked by a blindfold does not, of course, stand up to analysis since a hood can be placed over the subject's head or an opaque screen placed in front of their faces between them and the texts or colours which are detected by their hands.

The training is based on learning to associate the tactile, thermal and affective impressions with the colours which produce them; and gradually the subject learns to identify and to name these colours. Thus, Guylev's students manage to differentiate red from blue, then yellow from orange, and finally black from white and grey. The tactile impressions of the subjects are classified in the order of the spectrum:

Warm colours

Red: adhesive, coarse-grained, sticky.

Orange: coarse-grained.

Yellow: smooth, slightly coarse-grained, non-sticky..

Cold colours

Violet: very coarse-grained.

Dark blue: sticky, slippery.

Blue: smooth, fine-grained, non-sticky.

As for thermal impressions, they are roughly the same for blue and yellow as for orange and violet. Green is neutral, black is warm, white is less warm, and grey is fairly cold.

Novomeysky's research, which focuses mainly on the physical conditions underlying this faculty, contains an analysis of other criteria of colour-recognition. Experiments in which the hands do not come into contact with the coloured surfaces show that the impressions produced are felt at different levels of intensity. These various thresholds are called colour-barriers and are measured with an apparatus consisting of graduated scales. These measurements make it possible, in the first instance, to investigate the relationship of the seven colours of the spectrum to these same barriers and to study the variations in their levels of intensity under different lighting conditions: daylight, electric light, monochromatic light, semi-darkness and even total darkness. Thus, in the light of day and by electric light, a higher reading is obtained for red, a lower one for yellow and green and, again, a higher one for blue and violet. But what appear to be more baffling effects are obtained when opaque screens are placed over the colours; screens made of snow, wood, and different metals, including lead. Colour-sensitivity is re-inforced if the colours are beneath an aluminium sheet and it varies according to whether the metals are good or bad conductors of electricity and, as emerges from the results of experiments published in 1973, according to how permeable they are to the infra-red radiation of the coloured surfaces which they cover.

■ The role of optical experience

The investigations were extended, as they had been by Romains, to subjects who had lost their sight as a result of accidents. These subjects proved to be more apt than others in making these detections, although the results depended more on the intensity of the lighting and on the electrical insulation of the stimuli. After two months of training, they succeeded in making out, for instance, white, black and grey. Furthermore, they were able, unlike, non-blind subjects, to identify the colours of various pencils. The laws governing the mixing of colours were the same for them as in normal vision, and in this connexion Novomeysky

stresses the important part played by the subject's optical experience before going blind. As for subjects blind from birth, they managed only to make out red from blue. Those who had lost their sight in accidents were also trained in recognizing graphic signs: geometrical figures, numerals and letters, there being no direct contact and the signs being 6.5 cm high. In order to be able to distinguish these signs, the kinaesthetic sensations of the fingers and hands are indispensable. The subject sketches the outline of the shape to be recognized, which is placed 2 to 3 cm beneath his hand. Like Maublanc, Novomeysky observes that training in reading causes a falling-off in the results obtained for colours.

For our part, we have carried out tests on the effects of variations in the light and the colours of the environment on blind subjects or almost-blind subjects wearing blindfolds (Figure 1). These tests, which were begun in 1968, were held at the Centre d'Eclairagisme where we were granted the use of the visual testing laboratory by Maurice Déribéré, the president of the Centre d'Information de la Couleur.



Fig. 1. Type of test using electric light.

The differences in the intensity of the light as well as the nature of the light—fluorescent or incandescent—were more easily made out by the seventeen subjects tested than were the different colours that the walls, which had been specially modified for this purpose, were able to present to them simply revolving on themselves.

Twelve subjects noted roughly the same impressions for the same colours: greyish-white: brightness, impression that the room was growing larger; dark greenish-blue: cold, impression of space; salmon-pink: warmth, reduced space.

On 23 April 1971, Jules Romains paid us the honour of personally attending one of our testing sessions and subsequently encouraged us to continue carrying out research on extra-retinal vision. This we were able to do thanks to the backing of Parapsychology Foundation Inc. As regards, in particular, blind subjects, we divided the training sessions in order to carry out two investigations: vision via the face, and detection via the hands.

■ 'Seeing' by means of the face

As regards vision via the face, we proceeded in the following way. The subject is seated with his back to the window or with a source of light on his left. The stimuli are first of all objects placed in a plastic box, then cards with geometrical designs printed on them, then vowels. The experimenter holds them at a distance of 5 to 30 cm from the subject's face. The subject then tries unaided to 'see' the stimulus or the signs on the cards placed under a plastic covering. He starts off seeing a sort of haze from which emerge, initially, lines without any form to them and these the attempts to make out more clearly. If he turns his palms towards the stimulus, perception seems reinforced. As for colour-vision, this takes places by daylight or electric light. First of all differences are perceived, such as that between red and white, or between yellow and green. In the blind subject's face, the left temple appears to be the most sensitive. Blue produces slight visualization, which is more pronounced for yellow, and above all for red.

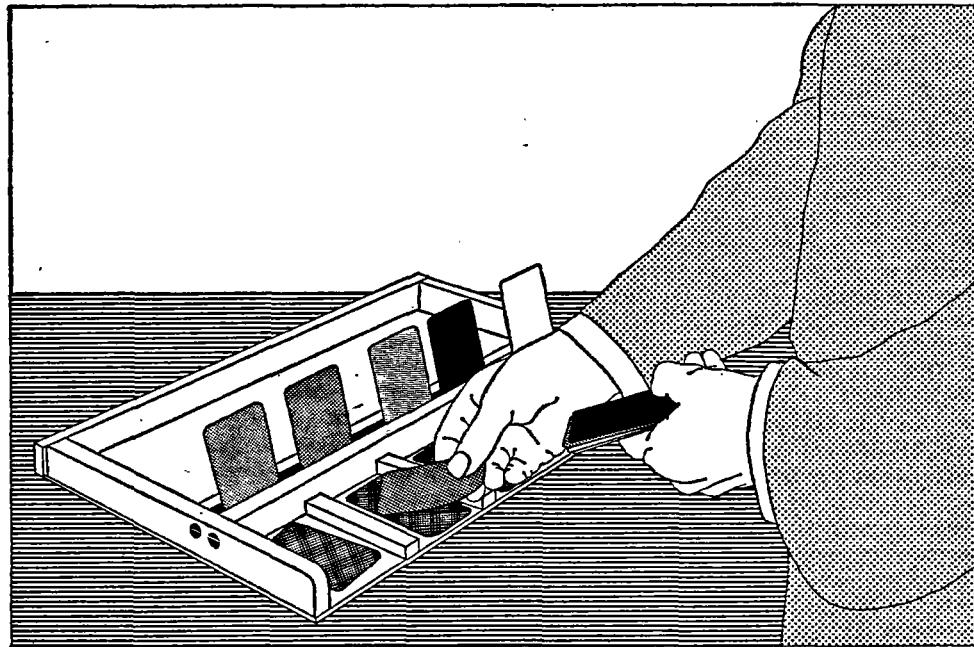


Fig. 2. Test to sort coloured cards.

Tests under electric light were conducted sometimes with vertical rows of coloured light-bulbs and sometimes with coloured sheets with a source of light beneath them. The most telling impressions were produced by red; the green and black sheets were neutral. With training, one subject managed to distinguish green from black but only by placing his hands 20 cm above the sheet, the green sheet giving rise to motor impressions.

As far as detection via the hands is concerned, the subject must, in our opinion, learn consciously to relate his impressions to the stimulus from which they proceed in order to identify it clearly. For this reason we use, at the beginning of the training, stimuli consisting of raised forms which make it possible for the subject to check by himself the accuracy of his detections. These are geometrical forms cut out of wood: triangle, square, circle, rectangle. The subject starts by locating one of these objects a few centimetres below his hand; than he learns to feel its shape, by clearly differentiated impressions of heat and tingling. Next, less pronounced raised forms are used: small black discs stuck on white cards. These cards are then placed in plastic cases. Finally, printed forms without any raised features have to be detected, and these the subject must identify without contact. Exercises in sorting or classifying unevenly distributed coloured sheets are then carried out. Some of the subjects experience tactile and thermal impressions whilst others use subjective criteria of recognition: thickness, weight and the affective impressions aroused by the coloured sheets. A surprising fact to emerge is that when they are asked to classify the colours, the subjects tend to do so in the order of the rainbow.

Another criticism which never fails to be made may also be rejected here: that which consists in reducing para-optical perception to a phenomenon of clairvoyance or telepathy. In all the cases studied, neither one nor the other was possible since various precautions were taken to eliminate them; the experimenters were left in ignorance of the stimuli or were frequently changed.¹

In addition, training is gradual, like, as we have said, that of a child who is learning to read and may reach a quasi-absolute level of perfection. Finally, if training is interrupted, one has to start again from zero. But this does not mean that here too some form of unknown energy is not involved, such as that to which recent discoveries in psychotronics have been pointing.

■ What the blind do not know

How is it that no one woke up to the existence of this possibility before and why is it not used to a greater extent? According to Romans certain blind people avail themselves of this faculty episodically but, not knowing how to develop it, or being unable to do so, they do not progress beyond their first gropings. Moreover, this possibility relates above all to those who have lost their sight in accidents, and who have preserved a certain potential in the form of optical memories. Novomeysky, for his part, thinks that one subject out of six is capable of developing this dermo-optic sense. It is therefore highly understandable that the blind do not know that they might be able to learn to detect colours by means of signals received in a tactile, thermal or kinaesthetic form. It should be borne in mind that what is involved is a rational learning process and the educational technique which is being elaborated is still too recent and, unfortunately, too little known to be systematically applied.

The essential point to be retained, however, is that these phenomena exist, for their latent character is undeniable. A further factor of prime importance is that they must form part of an extended system of consciousness which our so-called civilized life has doubtless hidden from us. Lastly, enough about them is already known for it to be plain that they have a wide field of potential application.

1. One should bear in mind that subjects gifted telepathically and capable of precise communication are rare.

■ Yvonne Duplessis

The author studied at the universities of Montpellier and Paris. Yvonne Duplessis, who holds a doctorate in literature, published in 1950 the first edition of her book *Le Surréalisme*, the tenth French edition of which has just appeared (Paris, PUF, 'Que Sais-je?' series.). In 1952 she began taking part in the experiments being carried out at the Institut Métapsychique International by René Warcollier. In 1966 she began conducting research on subjects deprived of sight. Since 1971, after a personal encounter with Jules Romains, her studies have centred on extra-retinal vision and dermo-optic sensitivity. Address: 67 Avenue Raymond Poincaré, 75116 Paris (France).

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What happens when radio waves penetrate the human skin

Andrija Paharich

The earth and the creatures it shelters have been bombarded by extraterrestrial radiations for thousands of millions of years. Lightning, the auroras and perturbed radio communication are some of the effects of this bombardment which man can detect. But since the human body is not equipped with a completely insulating barrier, what exactly happens when radio waves reach the human organism's casing? Can the interaction between the two systems be used to the body's advantage, and what are some of the specific possibilities in this regard?

One of the most obscure and complex biophysical effects occurs when ordinary radio waves penetrate the skin. Since we are continually being bombarded by radio waves, this is of some importance to everyone. I will try to describe what we know about this phenomenon.

Radio waves are electromagnetic oscillations in space or in solid or gaseous media covering a frequency range from a few Hertz (cycles per second or Hz) to thousands of millions of Hz—the upper-frequency range of which we perceive as light waves. The simplest radio wave is a sine wave oscillation in which all the waves are of the same height: this would look like a long, coiled spring viewed from the side. Such a radio wave is also called a carrier wave because it has the potential of carrying information. Once information is added to a carrier wave, the wave is said to be modulated.

The 50 or 60 Hz frequency of our alternating current power systems is not modulated, i.e. the height of each wave (the voltage) is constant. Any surges in voltage or wave height causes electrical appliances to be perturbed abnormally, but controlled surge of voltage is called amplitude modulation (AM). In an ordinary radio broadcast it is amplitude modulation that impresses music and speech signals upon the carrier wave.

Another form of modulation is called frequency modulation. Here the carrier wave is continuous and the voltage height is constant; the frequency of the carrier is not constant. That is, the frequency of the carrier wave is varied (or modulated) by the variations of pressure and frequency of, for example, the human voice.

Now to put my readers at rest with respect to possible hazards from ordinary radio wave penetration of the skin, there is no known danger. Risk occurs only when high-power bursts of radio waves penetrate the skin. Sources of high-power bursts are lightning, high-tension power lines, and military radar. Let us now look at studies in which radio waves are allowed to penetrate the skin in a controlled manner and their effects scientifically observed.

■ Radio waves from deep space

Long before the scientific discovery of radio, the earth had been continually bombarded by radio waves of many frequencies. These originate in deep space and are used today by radio astronomers to map the heavens. The earth has a charge of high voltage between the atmosphere and the ground which behaves like a giant capacitor, or reservoir of electrical charge. This atmospheric capacitor is constantly

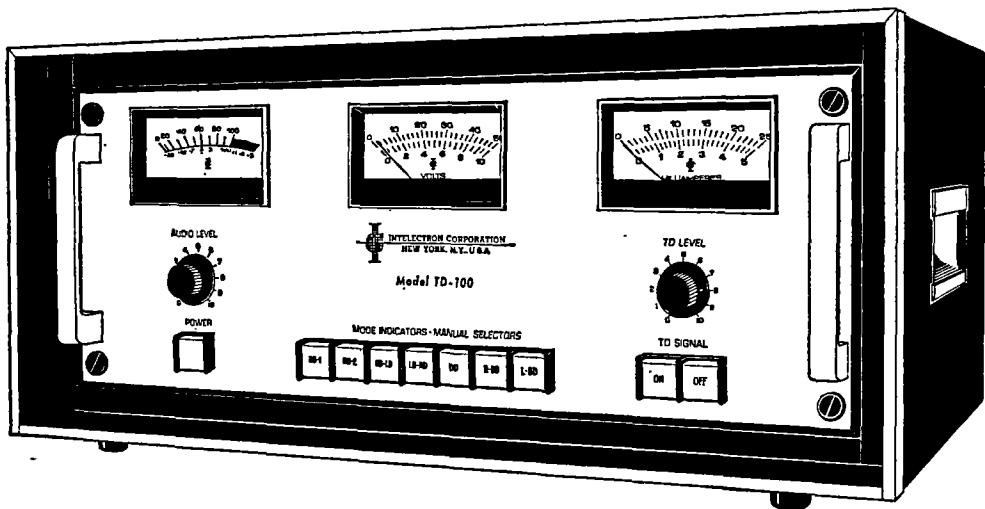


Fig. 1. Transdermal instrument (TD-100).

being modulated in one way or another by light energy from and magnetic storms on the sun, by changes in the weather, and lightning discharges. These modulations of the earth's electrical environment often disturb normal radio communication systems. They also give rise to the majestic beauty of the aurora borealis. Man has evolved, in short, within a very active environment of radio waves.

In order to determine precisely the effects of radio penetration of the skin, it is necessary to apply radio waves directly to the skin rather than by broadcasting them through the air. The radio technology involved is quite complex, and I shall avoid the technical details.

Together with my colleague Joseph L. Lawrence, we have devised a radio-wave instrument for electrostimulation of humans through the skin, a device we call the Transdermal Instrument (or TD-100, for short) (see Figure 1). The results reported here have been obtained with the TD-100, unless otherwise noted.

The radio-wave carrier used in the stroking of skin with radio wave-energized plates operates over the frequency range from 7-30 kHz and can be amplitude-modulated by human speech. The radio wave is applied to the dry (normal) human skin by means of circular metal plates 5 cm in diameter. The output of the TD-100 is through a circuit which comes into resonance with the skin and its

underlying tissues permitting the transfer of radio-wave energy with maximal efficiency [1, 2].¹ The two plates of the TD-100 can be placed (in one experiment) on the skin, using either side of the forearm as a stimulus site. The TD-100 is then modulated by man's speech. The human subject will not hear the voice signals being transmitted as long as the plates are stationary on the skin. But if one of the metal plates is lightly stroked over the skin (with the kind of pressure applied to a violin bow moving lightly over the strings), an unusual effect occurs.

The person being tested will not hear the voice's sound in his head coming from his forearm, but an outside observer-listening to the skin near the moving plate-will clearly and distinctly hear the sound of speech being transmitted. The plate, energized by radio waves and moving over the epidermis with a stroking motion, sets the skin into vibration in the same way that an electrical signal puts an electro-mechanical speaker into vibration at the output end of an electronic amplifier. If the human receiver moves the plates from his forearm to his head skin (to the skin around each ear), he will not hear the voice signals when the plates remain stationary on the skin. But if he

1. Figures in brackets correspond to the references at the end of this article.

strokes one or both of the plates over his skin, he will hear the transmitted voice signal as clearly as if he were hearing through his normal hearing apparatus by means of airborne sound [3]. The explanation of this effect is that stroking the skin causes a stretching of the protein keratin molecules in the skin. When the keratin is stretched in the presence of amplitude-modulated carrier waves, the substance becomes a detector of radio waves.

The commonest example of a radio-wave detector is the old-fashioned crystal-detector radio set. Detection is a solid state effect in the skin which clips, or removes, the upper half of the carrier sine wave impinging on the skin; this allows only the lower half of the sine wave (the negative half) to pass through the skin. This phenomenon has broad general importance in biology, and I have described its molecular mechanism elsewhere [4].

■ Treating deafness with radio waves

If we interpose an insulator—such as polyester film 1 mil (0.00254 mm) thick—between the plate and the skin, this allows us to apply a higher amplitude or voltage of the carrier wave to the skin by at least two orders of magnitude, i.e. from ten to several thousands of volts. Increased voltage of the carrier wave permits new effects of the modulated carrier waves to occur. For example, a person who hears normally can now hear the information carried by the radio waves without stroking the plates. It is also possible to apply the carrier radio wave to the skin at any desired voltage, from 1 to 2,400 V without any discomfort or hazard.

This flexibility enables one to vary all the different parameters of the radio wave applied to the skin (such as voltage, current, wave form and modulation) and has led to the discovery of a number of important effects when applying radio waves to the skin. Foremost among these is the use of programmed radio waves to alleviate loss of hearing attributable to sensorineural origin, in a significant percentage of patients undergoing TD-100 electrotherapy. In addition, patients suffering from dizziness because of Meniere's syndrome were relieved of their malaise by TD-100 electrotherapy [5]. Other beneficial effects have been reported in accelerating the healing of bone in cases of fracture, improving short-term memory loss due to senility, and control of blood clotting by slowing the process of coagulation.

The culmination of this research has found

an application in the problem of deafness resulting from sensory damage, particularly in children. Children used as subjects in this study were those who could hear some sounds but could not discriminate between word sounds: so-called clinical deafness. The youngsters were given a course of TD-100 electrotherapy over a period of several months and, since they did not know what speech sounds meant, they were also given therapy in the hearing of speech. A significant percentage of the children treated were able then to hear, discriminate, and understand speech sounds by means of a laboratory-type hearing aid sending radio waves to the brain as a speech signal.

While this work is still in the early stages of laboratory research, it holds great promise for the alleviation of the problems of nerve deafness [7]. As far as we know today, radio-wave penetration of the skin in a precisely controlled manner is the only known means at our disposal to give aid in cases of severe or total human deafness of sensorineuronal origin.

■ Corona discharge photography . . .

I stated earlier that, by placing an insulating film between the radio-energized plate and the skin, we can obtain an injection of high-voltage carrier signals into the human body. This method has been known for some eighty years, first being discovered by the Croat, Nikola Tesla [8]. Tesla was able to pass in safety, 500,000 V of radio carrier waves through the human body by this means.

If one places two insulated plates of the kind I have described across any part of the human body and applies AM carrier waves of about 1,100 V, at 11 millamperes, some unusual effects occur. First, by observing an energized plate on the skin in the dark, one sees a bluish glow between skin and plate. This blue glow is the result of atoms in the air being energized to a higher quantum level and emitting light radiation. If one amplitude-modulates the carrier (of approximately 50 kHz) with an audio frequency of 1 kHz, another unusual effect occurs. By monitoring the region of space surrounding the energized human body for a distance of a dozen of so metres with an electromagnetic wave-spectrum analyser, one finds that the human body radiates waves in the frequency range from about 1 kHz continuously toward the light-wave frequencies. It must be

emphasized that the only input to the skin is the two signals, one at 50 kHz and the other at 1 kHz.

The mechanism of this effect is simple. At each voltage peak of each cycle of the 1 kHz audio signal imposed upon the carrier wave, there is a spark discharge into the skin. This spark discharge (of about 1,100 V) on to the skin generates the frequencies of the entire electromagnetic wave spectrum below that of light waves. This all-wave spectral corona discharge from the energized human body can be measured in yet another way: by applying a photographic plate to any part of the skin surface. An image will be formed on the sensitized plate, with properly timed exposure, corresponding to the corona electrical discharge pattern at that part of the skin. And the explanation of this type of photography is simple, too.

The points at which corona discharge will occur are rather sensitive to the insulating, or dielectric, constant in that region of space. The dielectric constant here is determined by four parameters: (a) the absolute voltage and electromagnetic frequencies between a point on the skin and a point on photographic film; (b) the ionization of the gases between the skin point and the film point; (c) the dielectric constant at the film point; and (d) the dielectric constant at the skin point.

This 'corona discharge effect' can be used with any organic or inorganic material for photographic purposes. The Union of Soviet Socialist Republic's effect has been named Kirlian photography [9]. What this kind of photography measures in living things is the subject of vigorous debate these days. It is too early to state what corona discharge photography can be used for, although interesting findings for medicine are already being reported.

■ . . . and mind-to-mind perception

I have described how it is possible for normal humans to hear radio-wave information and how, with proper electronic conditioning, a deaf person can hear speech sounds by means of radio-wave signals directed through the intact skin to the brain. In the latter case, since the normal auditory sensor is non-functional, one could say that radio waves can induce an 'extra-sensory' perception.

These studies have been extended into the area of true extra-sensory perception, i.e. where information is transmitted from one human being to another, both of whom are completely

shielded from any sensory perception between one another [10]. Experiments of this type have been conducted recently by Harold Puthoff and Russell Targ at Stanford Research Institute on Uri Geller [11]. Under controlled conditions, Geller was able to demonstrate his ability to perceive information (die faces and drawings) when he was completely shielded from the source of the data. This is considered to be good evidence for the existence of extra-sensory perception.

The question was raised as to what would happen to Geller's extra-sensory perceptive powers if he were subjected to energization by radio waves. The problem was whether his perceptive powers would be adversely affected, i.e. that he would not be able to show extra-sensory sensitivity. In preliminary tests by a student, Jonathan Skutch, a high-voltage energization was applied to Geller, with one finger placed on a Polacolor film surface. Geller was able to control the image that appeared under his finger: triangle, square, etc. [12]. The result was not surprising, however, in that Geller previously had been shown to be able to project mental images on to photographic film sealed off from activation by light.

A new series of tests was then tried to see if Geller could create images on a film—when the choice of image was given to an outsider's control. The preliminary unpublished findings are of great interest. Geller's body was energized by the TD-100 signal source at 1,100 V (peak to peak) and a 49 kHz carrier frequency with amplitude modulated by a tone of 900 Hz. The subject of the experiment placed his right index finger on a Polacolor film plate in total darkness (in a darkroom). From another room in the same building an agent sent (mentally) to Geller the numbers from 1 to 9 in a randomized order. Geller's task was to call out the numbers he received from the agent by means of extra-sensory perception while his finger remained on the film plate. In ten tries Geller received the number from the agent correctly ten times. In nine of these ten correct perceptions, there appeared on the film the images of the number correctly perceived. This number always appeared on the film directly under the fingerprint of Geller. While very preliminary, these findings open new possibilities for future research.

■ Possible future developments

Although these results obviously need more

replication, with intensive research efforts, they are important in that they suggest a new way to energize the human biological system. One theory to explain these reactions holds that all the effects noted on humans, and described above, can be the result of one action, namely the injection of free electrons into the biological system. There is some evidence to show that free electrons and negatively charged ions have an anti-fatigue effect on humans. With a deeper understanding of how radio-wave energization through the skin works, we may find entirely new applications—in the normalization of disease processes, in medical diagnosis, to enhance the learning process, and in the area of extra-sensory perceptive processes.

It is anticipated that the general state of health, or its converse, fatigue, can be normalized by electronic means, principally by adding free negative ions to the biological system. Other areas of normalization may be found in preventing depositions on the walls of the cardiovascular system, and in maintaining the integrity of the cerebrovascular system.

■ *Andrija Puharich, M.D.*

Dr Puharich has long been interested in therapy by radiation, and has prepared the article above in order, in his words, 'to bridge the gap between audio perception and the Kirlian phenomenon'. Dr Puharich has also published, earlier this year, a best-selling book on the paraphysical powers of Uri Geller of Israel. The author can be reached at 87 Hawkes Avenue, Ossining NY 10562 (United States of America).

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TO DELVE MORE DEEPLY

Information concerning the treatment of deafness or about the TD-100 instrument can be obtained by contacting directly the Inteletron Corp., 432 West 45 Street, New York, N.Y. 10036 (United States of America).
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Is the Kirlian aura a life force or a fact of life?

Rudolph P. Guzik

The Kirlian aura is evidence, to some, that psi-forces exist or that there is a supernatural 'life force' emanating from living organisms. To a physicist, the effect can be explained as a high frequency corona discharge. If we ignore the claims and reports that are based on faith in the supernatural and 'psionic' forces, the phenomenon stands independently as an interesting scientific curiosity and may, in fact, have value as a psychophysiological tool.

During the early transatlantic voyages, sailors were comforted by what they believed to be the presence of St Elmo, the patron saint of seamen: on a dark night, at the tip of the mast, they could see a blue-violet glow against the sky. These were probably the first recorded observations of a corona discharge, and the phenomenon was attributed to supernatural forces as the Kirlian 'aura' is today by some people.

In both cases, the effect results from ionization of the air caused by the stress of an electrostatic potential gradient. With constant voltage, the corona is not very dramatic and can be seen as a symmetrical and diffuse glow radiating from a single point, as in the case of St Elmo's 'fire'. In the case of an oscillating field, the corona becomes a spectacular display, more extensive and brilliant. The corona on a flat object forms a halo of planar, radiating flares emanating from the object's edges. There is variation in the apparent colour of the radiation, and irregularities on the surface of the object strongly affect the corona's pattern. This is known as the Kirlian aura; an impressive display which has triggered the imagination of those who presuppose the existence of mystical forces in the real world.

The pattern of the radiation surrounding a

dying leaf is said to change as the leaf's 'life force' ebbs, and the pattern of radiation round a hand, finger or even a fingerprint is said to reveal changes in the emotional state of its owner because the aura reflects the 'psionic equilibrium'. The pattern round a leaf does change, in fact, and the radiation pattern about a hand placed in the field appears to change with psychological stress, but not because of unsuspected forces. The changes are determined predominantly by the surface resistivity of the object, acting as an electrode; colour variations are a complex result of the air's ionization and how photographic film records are made. The questions which should be answered by serious experimenters will become clear if I introduce some of the phenomena associated with corona emission. Experiments designed to consider this kind of emission and other aspects of electrostatic fields and dielectric materials will both advance our understanding of Kirlian coronas and possibly lead to serious applications.

■ Simple corona discharge

Electrostatics is concerned with phenomena caused by the separation of electrical charge. Because of the forces associated with charged

particles (as described by Coulomb's law), any accumulation of charge will result in forces tending to neutralize or dissipate the charge. Densities of high charge exert forces on other charged particles and can cause neutral molecules to be dissociated or ionized. We can accumulate a large amount of charge about a large, round object without reaching a state, at any local point, at which high charge densities occur. We can thus develop large potentials, or high voltage, without dissipation into the atmosphere. But if the electrode is shaped to a point, the local charge density at the point can become sufficiently great that the air is ionized, whereupon conduction away from the charge will occur. These ionization and collision processes produce radiation of light, mainly ultra-violet. The typical corona is seen as a blue-violet glow.

An arc will occur if the potential is sufficiently high that the air can be totally dissociated along the entire path of the discharge; for an electrode of large diameter, then, as the voltage is increased an arc may occur before a corona is seen. Whether or not a corona occurs, in other words, is determined by whether or not dissociation is local or crosses the entire gap between electrodes. An arc will occur as 10,000 V cross a gap of 1 cm, regardless of the geometry of the electrodes; if we manipulate the geometry of the field so that 10,000 V/cm occur only locally, a corona discharge will be seen. The latter can be done by applying 2 kV to a wire of 0.1 cm isolated from any adjacent electrode by a gap of about 1 cm.

Although the physics and chemistry of corona discharge are not simple, the corona's current (amount of charge dissipated in the air) and, consequently, the intensity of the corona's glow at constant voltage are related to: (a) the applied voltage; (b) the geometry of the electrode; and (c) the atmospheric parameters such as barometric pressure and relative humidity.

■ Kirlian corona factors

Ionization and colour

Since the conduction process is controlled by the drift velocity of ions, more current is carried away in a low-pressure environment (for the same applied voltage) because collisions are lessened. High relative humidity decreases the total corona current because the ions formed are heavy, hydrated complexes and move

slowly. Gases and vaporized materials introduced in the vicinity of the corona can affect the colour of visible light because different energy states are involved; the total current can be affected by the ion's particular drift velocity. These factors undoubtedly influence, at least in part, the colour and density of Kirlian coronas. A corona's apparent colour is determined by the specific gases being ionized and their energy states. In air, the dominant spectrum is that of nitrogen; it results in the blue-violet glow. For higher fields this glow turns bluish-white, with nitrogen spectra still dominating. At higher potentials other spectra may become dominant, and organic electrodes can introduce other gases to the corona.

Yet the bright red colours found in some Kirlian photographs are not easily explained by these arguments; this is an area requiring careful analysis. Studies should be made as to the gases present and in what concentrations, what potentials of ionization are achieved, and which spectra dominate. The answers could determine, indirectly, the physiological processes producing the anomalous red flares. Also (and with no intent to degrade the experiments already reported), it is not clear that red flares are consistently observed phenomena in particular conditions. Flares seem to occur, then mystically phrased explanations are proffered *post facto*. It should be noted that most of these photographic records were made with the sensitive emulsion exposed to the electrostatic field. In my few observations, I saw no evidence of red flare in the corona emission — yet red colours appeared occasionally on the recording film. This may be attributable to the emulsion's dielectric properties and other effects within the film; it deserves further exploration.

Corona and electrode

Any material can form a corona electrode. In the Kirlian corona the nature of the electrode as well as its composition and geometry are extremely important. A sharp piece of plastic with sufficient constant voltage applied shows a characteristic corona glow, although the emitted current is lower than for a similarly shaped metallic electrode and the glow is not as brilliant. (The plastic acts as a resistor, limiting the flow of current to its tip.) The electrode is affected by the emission and ionization processes; even in a non-corrosive metal like tungsten, emission pits will develop

in time because of local heating, evaporation of the electrode material, and oxidation. These factors surely affect radiating electrodes in Kirlian coronas, at least at some local points. Thus the fact that material is placed in an electrostatic field and becomes the electrode in corona discharge means that it will be affected by the corona and modified.

So there is another question to be answered: how is the electrode material directly changed by: (a) the corona emission; (b) the high voltage; and (c) the high-frequency field? Flakes of carbon introduced in the corona can cause red flares, but sufficient quantities can be produced only by destruction of the electrode through combustion. And modifications of the electrode may not be limited to local processes. Microwave ovens heat foods very rapidly because of the moisture present in the edibles, the operation of the ovens being based on the fact that a high-energy oscillating field drives the conductive liquids in food by what is called capacitive coupling. This coupling can become significant in oscillating fields formed across a narrow gap between parallel plates. Material such as cardboard or paper is not affected by a microwave field because its moisture content and conductivity are much lower. But a plant's leaf placed in this kind of oscillating field must experience at least slight elevation in temperature—even for much lower frequency and energy level, an effect that should be examined as a specific modifying influence. Energy levels must be determined and exposure carefully controlled.

Corona chemistry

With the processes of ionization under way, much more occurs than the formation of ionized particles. There are other dynamic processes, and new compounds are formed. Ozone, a strongly active chemical, forms in large concentrations. (Ozone destroys bacteria and is an excellent bleaching agent.) Because nitrogen as well as ozone is present, another even more aggressive and corrosive compound is formed through the development of nitrogen oxides in the presence of water vapour: nitric acid. Other agents are formed, in lesser proportions, but capable of profound effect on other materials in the environment (such as organic materials and photosensitive emulsions).

Another question, therefore, immediately suggests itself: what compounds are formed in the particular corona of the Kirlian aura and

what effect have they on the radiating electrode and the recording emulsion? Strong bleaching agents will clearly affect dye-sensitized layers of a film as well as the chemistry of the entire emulsion. Obviously the same kinds of action will modify organic material used as an electrode, especially at its surface. With extended exposure, perhaps the bulk of the electrode's material will be similarly affected.

Dielectric breakdown

A well-behaved corona can be formed between a point and a ground plane. At a specific distance of separation, the corona's current has a predictable limiting value. If a sheet of plastic is laid over the ground plane, the current will be greatly reduced. If the plastic film has small perforations, however, the current is greater than if the film were not present: at each perforation, microcoronas are formed which contribute independently to the total number of conductive ions and the effective conductivity of the corona's gap is increased. Without the perforations and if the dielectric strength of the film is exceeded by applying sufficiently high voltages, the film experiences dielectric breakdown. That is, small arcs are created joining the sheet's two surfaces by punching, really burning holes, through the plastic. Thin organic materials (such as a leaf) experience similar breakdown, affecting the resulting corona patterns. If the decomposition is great enough, all kinds of materials can be introduced to the corona thereby affecting apparent colour and intensity of glow.

Our discussion leads to another important question for the Kirlian experimenter: does dielectric breakdown occur, where, and to what extent? (Under controlled conditions, modification of the corona's emission can easily be determined.) Another effect, probably minor in most cases, is the phenomenon of electroluminescence—the emission of light subsequent to the excitation of certain energy states within a given material. There are many phosphors, dyes and comparable organic materials which exhibit this effect, although the condition may not create sufficient light to dominate the corona's radiation. The possibility of this complication, however, should not be overlooked.

Photographic emulsions

Most of the Kirlian patterns seen recently are electrophotographs, not photographs. A dis-

The Kirlian effect: background and some research tips

The experiments first reported by S. D. and V. K. Kirlian imply careful control of the voltage source and apparent filtering out of lower frequency harmonics. Records were made with a camera through a transparent electrode or by directly photographing an object serving as electrode. Film itself was not exposed to the field. Spectral analysis of corona flares was done with a monochromator, and some attempt was made to identify the apparent spectrum of emission. Most recent reports of comparable experiments have not taken, unfortunately, the pains to ensure such simple precautions. After the early reports originating at the Kazakh State University, most translations since that time continue to be incomplete and confusing.

Yet in the early studies there was neither suggestion nor implication of supernatural force. Poor experimental technique and mystical embellishment have been added by subsequent authors, creating a morass of misleading confusion. To clarify for those who seriously undertake the study of this fascinating phenomenon, I presume to point out features of the effect which should be omitted or included in new research on the subject.

1. Disregard reports citing 'life force' or 'psionic aura', and avoid the terms in future reports.
2. Become familiar with reputable works on corona discharges, electrophotography and photographic emulsions.
3. Control the power supply; record frequency spectrum, peak and

root-mean-square voltages, corona currents, input power level, and exposure time.

4. Do not make film records so that the film is exposed directly to the electrostatic field unless the effects on the films are carefully analysed; record photographic exposure levels, film speeds and processing times, and measure light intensities independently.
5. Measure carefully the geometry of the active electrodes; determine the extent of dielectric breakdown and surface destruction caused by the applied field.
6. For more advanced study, determine the chemistry and spectra of active corona, using calibrated, reliable instrumentation. Isolate individual flares and patterns; correlate them with physical measurements of the test electrode. Determine electrical bulk and surface properties (resistivity, dielectric constant and strength), physical measurements (surface smoothness, cross-section geometry, porosity) and similar properties. This may require examination by microscope. Determine the electrode's surface chemistry.

For initial black-and-white studies, I suggest that recordings be made on electrophotographic paper placed in the field instead of photosensitive emulsions. These materials will record the shape of the flares electrostatically and are available from any manufacturer or supplier of business copying machines, and can be purchased in small quantities.

inction should be made between using a camera to record the emission or placing the recording film directly in an electrostatic field. With the emulsion exposed directly to the corona and field, complications arise. We have already seen some of the phenomena capable of modifying film: direct electrical effects, bleaching agents, and dielectric breakdown. In a black-and-white emulsion there are also formed Lichtenberg figures, resembling the branching and feathering of discharges of lightning. These figures result from lateral discharge within the

emulsion; they are not apparent within the corona pattern since they characterize a form of dielectric discharge in light-sensitive emulsions. In the case of colour films, each of the three layers of dye and silver halide compound can harbour independent Lichtenberg figures.

What is to be emphasized here is that the discharge within the emulsion(s) is accompanied by the emission of light capable of fogging the film around the Lichtenberg branches. A colour found upon development, therefore, may not have been present in the corona's

radiation; it was created among the layers of the emulsion by both dielectric breakdown and Lichtenberg patterns. Add to this the complication of the development of the film, what can result may be as much a product of the film itself as the corona radiation which was to have been recorded. Adequate concern for this must be part of any really useful research.

Alternating fields

The applied potential's polarity affects corona emission. The shape of corona patterns and the characteristics of current differ because of the unsimilar processes involved. The negative corona produces what are known as Trichel pulses, brush-like emission cones of up to several centimetres in length. The positive corona is a soft glow surrounding the electrode, and is known as the Hermstein sheath; the positive element is limited to a radius of less than a centimetre. The threshold voltage at which the corona appears is lower for the negative than for the positive corona; thus, in an alternating field, the negative corona predominates. For voltages near the threshold potentials, the corona acts as a current rectifier and, without careful measurement, it may appear that only the negative is present. In the negative corona, electrons are carried away from the electrode; in the positive, the electrode accepts electrons and the processes of conduction are slower. Because the conduction processes cannot follow the high-frequency field fast enough, ion velocities become very important at sufficiently high frequencies.

To my knowledge, not enough is known about these details at high-frequencies and the processes involved could absorb the attention of a good theoretical physicist. It is interesting, for example, that the Trichel cones are formed at isolated points along the electrode for the negative potential. Where these cones of emission occur may be the consequence of surface irregularities or slight variations in internal resistance. For mixed frequencies, the emission appears to become more uniform; isolated cones tend to move rapidly round the electrode, as opposed to the static case in which the cones are frequently fixed in place. This adduces the complication of controlling exposure time carefully since, for relatively long integrative recordings, the pattern could result from an averaging process and thereby be misleading. Another complexity is that the slight variations in resistivity (which determine

where the emission will occur) is an important physiological parameter and may be hard to determine independently.

The 'skin' effect

At sufficiently high frequencies, also adequately free of lower-frequency harmonics, two important complications develop. First, for the same power input as in a static field, peak voltage levels can be extremely high. When only 2,000 V are required to form a negative corona and if identical power is applied to a high-frequency generator, peaks can reach as high as 20,000 V. At that electrical-field stress the average corona current can be higher and greater ionization potentials can be attained. This will affect, of course, both the colour and intensity of radiation. It is extremely important to know exactly the applied potential in terms of peak, root-mean-square voltage, and frequency of oscillation.

Second, at 'pure' high frequencies the field is confined to the surface of the emitting electrode. This is the 'skin' effect, a straightforward property of electromagnetic fields. The surface of the electrode becomes, therefore, the dominant factor in the intensity, colour and shape of corona flares. Surface irregularities, moisture, the presence of salts and surface oils, and the like determine the nature of a corona display. If psychological stress is measured in term of perspiration, dilation or constriction of blood vessels, or the generality of galvanic skin response, the corresponding corona patterns will be strongly affected. A leaf placed in the field need only dry at its surface for a change to be evident in the corona. If the voltage, is supplied as a spectrum of frequencies, the resulting combination of bulk and surface properties will probably defy analysis. Sadly enough, most recent studies have been made with unfiltered, mixed frequencies; the results are unpredictable and confusing.

■ Future of the Kirlian corona

It would be arrogant for physicists to presume that their model of nature is complete or irrefutable, but the model can explain a phenomenon such as the Kirlian aura if sufficient care is taken with experimental constraints (see above, page 360). Physicists rely on the laws of cause and effect because they believe that Mother Nature is not a mystic. Were a physicist of today called upon, however, to

explain the glow at the tip of a mast to sailors of five or six centuries ago, the scientist would undoubtedly be thrown overboard or burned at the stake. Not because he could not make himself understood (although that is probable), but because St Elmo's fire implied the presence of the sailors' patron and that presence was a comfort. It is possible that life force and 'psionic aura' are a similar comfort to today's parapsychologists.

Regardless of the comfort such mysticism brings to those who must justify their 'science', this kind of prejudice places obstacles in the path of legitimate study and application. The appeal of the supernatural has allowed many to become wealthy at the expense of a gullible public. All kinds of things from miracle cures to mythical pyramids have found a market because of sensationalism; that kind of irresponsible promotion guarantees the eventual obscurity of the cause of the parasciences.

And even more unfortunate than this fraud and public extortion, legitimate science becomes hardened to unorthodox and sensational claims; phenomena carrying the stigma of mysticism are not received seriously, much less given open-minded examination. The Kirlian corona has inherited the worst of these obstacles because of the manner in which it was presented and promoted. Whether or not the Kirlian phenomenon will have value in the advancement of science—or in specific technical applications, such as in psychology—will depend on how well the effect survives its association with mystics.

■ Rudolph P. Guzik

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Most human 'aura' have simple non-psychic explanations, but Kirlian photography could become an important tool in research and diagnosis.
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Brazilian research on paraphenomenal events

Jarbas George Marinho

In a country whose culture is derived in part from African tribal customs, popular belief in what many call the supernatural has become a part of the way of life in Brazil. Only a decade ago some Brazilian specialists organized a national centre for 'psychobiophysical' research. Planned study has been formulated to examine closely the phenomena of life not explicable by classical scientific analysis.

Brazil has a great deal of lost time to make up in the field of parapsychology, which we prefer to call psychobiophysics for reasons to be explained later. Although our country produces an abundant supply of seemingly paranormal phenomena of many kinds, it was only in 1963 that a sustained effort was begun to study these phenomena by scientifically qualified researchers.

That was the year in which the Instituto Brasileiro de Pesquisas Psicobiofisicas or Brazilian Institute for Psychobiophysical Research (IBPP), was formed by a small group of idealists headed by electronics engineer Hernani Guimaraés Andrade, a civil servant who today holds a senior post in the São Paulo state electrical power authority.

Hernani Andrade had already spent some twenty years studying the history of psychical research in other countries. He had also worked out a detailed hypothesis of his own concerning the structure of 'psi-matter'; he published this theory in two books which appeared in 1958 and 1959 [1, 2].¹

By the time IBPP was ten years old (1973), the institute had amassed an enormous amount of first-hand evidence of paranormal phenomena, concentrating at first on areas in which evidence was more readily available. These have included, so far, spontaneous phenomena (such as poltergeists and sup-

posedly mediumistic communication), evidence coming from children to support ideas concerning reincarnation, and (perhaps most significant of all) controlled laboratory experiments with machines especially constructed for the purpose—including the first Kirlian apparatus to be assembled outside the U.S.S.R.

As in the case of the original founders of the British Society for Psychical Research (SPR), the majority of IBPP's founding members were spiritualists, or 'spiritists' as we prefer to call them. But unlike SPR, spiritists in Brazil have remained in the majority at IBPP; and, although there was some initial suspicion to overcome, the institute now enjoys the best of relations with the spiritist movement in Brazil where, unfortunately, one had never noted a scientific attitude toward the unusual things which take place.

■ The Mirabelli affair

Brazil is a very long distance from much of the rest of the world, a fact which explains partly why, until recently, our efforts have failed to make much impact in countries where there is already a long tradition of psychical research. Isolated attempts by foreign visitors

1. Figures in brackets correspond to the references at the end of this article.

to study phenomena occurring here have been, on the whole, unsuccessful. About fifty years ago, for instance, the Brazilian-born medium Carmine Mirabelli attracted considerable attention with his prowess concerning every kind of physical phenomenon, from automatic writing (or psychography) to the materialization of complete forms and levitation. Reports of his feats, written for the most part by close friends, were so unbelievable that a handful of foreign researchers was persuaded to make the long journey to South America in order to see him at work at first hand.

Representatives of the SPR of both Britain and the United States wrote reports on their attempts to investigate Mirabelli, while Hans Driesch (at that time president of SPR in London) was sufficiently impressed by what he saw to invite the Brazilian medium to the British capital in order to be examined under controlled conditions [3, 4]. Although the invitation was readily accepted by Mirabelli, these tests regrettably never took place.

We feel thoroughly ashamed that no Brazilian, with the sole exception of Eurico de Goes, has made a serious attempt to investigate Mirabelli; it was de Goes who wrote a long and extremely carefully documented book on Mirabelli [5], a work which stands alone as an early attempt locally to examine paranormal phenomena on some sort of systematic basis. De Goes, who also founded and managed São Paulo's first municipal library, has left us virtually the only reliable source material on this extraordinary medium. We are determined that a situation such as this will not be repeated regarding any other medium in Brazil.

A fairly typical example of the interest Brazilians show toward phenomena occurring in their own country is a long book by the psychoanalyst Antonio da Silva Mello [6], which was published in English. Only about ten of the book's 494 pages even mention Brazil, and most of that space is devoted to the suggestion that reports of the feats attributed to persons such as Mirabelli—feats which the author never bothered to check—are pure invention.

■ New interest in parapsychology

The situation has changed in more recent times. The first serious study of spiritism and assorted phenomena in Brazil to appear (in

English and French) was written by Pedro McGregor [7], a writer who is also a very experienced, practising medium. Another, more popular book which featured the exotic aspects of Brazil's African-inspired cults is a work by David St Clair of the United States, a book reaching a wide public [8]. Both of these publications served to introduce foreign readers to two outstanding Brazilian mediums: Francisco Cândido ('Chico') Xavier, author of 125 books written while in states of trance and the psychic surgeon José Arigó.¹ At, about the same time that this issue of *Impact* appears, British author Guy Lyon Playfair is publishing a detailed survey of the Brazilian paranormal scene; Playfair lives in São Paulo and works with our institute.

Brazil is a young nation, in many respects, but one possessing great faith in its future. Its young generation, proportionately larger than in many countries, is showing keen interest in parapsychology and related fields and is beginning to show a critical interest in extranormal phenomena occurring in Brazil. Unfortunately, however, there is a number of supposedly parapsychological institutions in our country which are run by religious groups (some of them foreign); their sole aims are to make money and confuse issues, seeking in the process to discredit the constantly growing spiritist movement. These have succeeded to the extent that many young Brazilians today believe that parapsychology was invented by the Roman Catholic Church! Incalculable harm to the minds of our young has been done by these pseudo-parapsychologists.

We chose the rather unwieldy word *psico-biofísica*, borrowing it from the Italian, to describe our field of interest because neither 'parapsychology' nor 'psychical research' seems to embrace both sciences: biology and physics; both of these are just as interesting to us as is that of the human psyche. Our basic approach is the same, however, as that of research workers in many other countries. We collect evidence, study it, and draw tentative conclusions when we believe these are justified.

Our first full-scale investigation, lasting more than two years, was into an alleged case of communication (in 1961) originating with the spirit of a soldier killed in 1932. This case,

1. Real name José Pedro de Freitas, a peasant from the mountains north of Rio de Janeiro, killed in a traffic accident in 1971.—Ed.

which was published as the first proceedings of IBPP [9], gave us valuable experience in the field of inquiry; it left us satisfied that communication from a discarnate entity was the most probable hypothesis. The only major weakness in the case was lack of detailed evidence recorded at the time of the supposed communication; this has taught us the necessity to record carefully any kind of evidence, no matter how trivial, at the time of the occurrence.

■ Apparent poltergeist activity

By far the largest files in our archives are those dealing with the topics of poltergeists and reincarnation; we believe that we have gathered much worth-while evidence in support of each of these phenomena. We have studied about twenty cases of apparent poltergeist activity, at first hand; our researchers were rewarded, on four occasions, when phenomena occurred in their presence. They were able to record some of these on magnetic tape.

One of the cases (July 1972) took place in a boarding-house only a few streets from the commercial centre of São Paulo (South America's largest city), and a short walk from the home of our research director, Suzuko Hashizume; she was able to follow the events for more than a month, collecting six hours of recorded testimony. Although the evidence from this case is still being tabulated for presentation at an international congress in 1975, we hope to show that objects can be projected through solid matter—including glass, previously considered poltergeist-proof—and that poltergeists can be exorcized; with immediate and total success, by the use of traditional Brazilian spiritist methods.

Four other poltergeist cases deserve brief mention. In one, at the town of Sorocaba, we were able to observe a poltergeist 'moving house' in pursuit of the family seeking to escape its presence after the poltergeist had virtually wrecked their home. It was there that we first recorded an unmistakably paranormal event: a heavy wooden shelf crashed to the floor, seemingly spontaneously, while our of our researchers were on the premises, everyone in the house being under someone's observation at the moment of the incident.

In another case, at Suzano near São Paulo, our witnesses included the local chief of police who described how he had seen, with

his own eyes, an event of para-pyrogenia, or inexplicable spontaneous combustion. He described how some objects, although wet from dousing with water, suddenly burst into flame. We have an exceptionally large number of events of this kind recorded in our files, involving mattresses upon which people had been asleep, clothes inside locked wardrobes, and even heavy pieces of furniture.

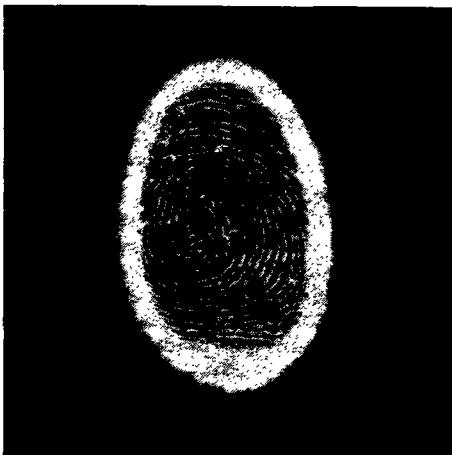
In the third case, occurring in a residential suburb of São Paulo, we were able to reconstruct a story of poltergeist activity that had lasted for six years, driving the family concerned to move house no less than three times and bringing one member of the family to the verge of suicide on two occasions. The case taught us that poltergeists, although often apparently comical in character, can be a serious social problem and cause considerable distress and damage. Indeed, we have a case on file indicating murder had been attempted; a small baby, not yet able to walk, was discovered at the bottom of a clothes basket that has just burst into flames. The baby's life was saved by a matter of a few seconds.

We also have a documented case of a poltergeist that appeared to be place- instead of person-directed. The case occurred in Paraguay and was notable for the transport, in the presence of our investigator of a 2.5-ton jeep-type vehicle over a distance of almost fifteen metres.

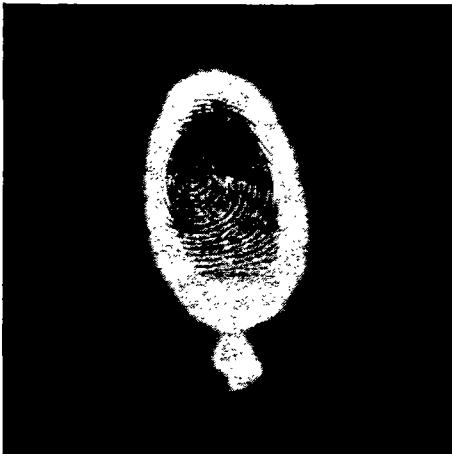
■ Research on reincarnation

Reincarnation, which implies automatically the survival after bodily death of some human component, has been accepted as a fact of life for more than a century by millions of Brazilians. This may explain why we have had so much success in gathering evidence to support reincarnation. We are pleased to acknowledge the part played in this realm by Ian Stevenson, who first drew our attention to the need for exhaustive research; it is he, in fact, who provided us with the first of our cases which now number more than eighty.

With few exceptions, our evidence suggesting the reality of reincarnation has come from children up to the age of 4 or 5 or else from the parents of these. We have been able to follow cases in which young children spontaneously have begun speaking in foreign languages of which they could not normally have knowledge. There are other cases of children with birthmarks which correspond to fatal wounds

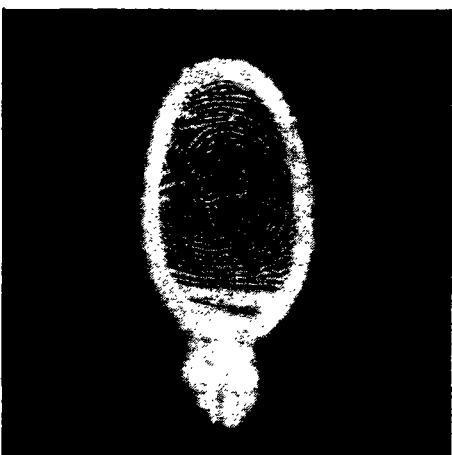


(a)



(b)

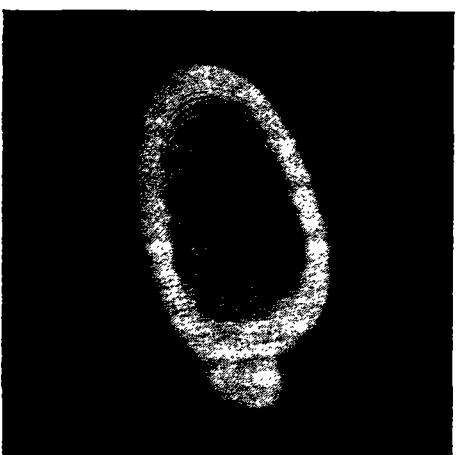
(d)



(c)

(e)

*Fig. 1. Kirlian photograph of fingertip of
(a) patient, normal; (b) patient during healing;
(c) patient after healing; (d) healer, normal;
(e) healer during healing.
(Photographs supplied by the author.)*



received previously during incidents which the youngsters seem to recall in detail; these are in addition to the many cases in which children state, simply but with conviction, that they 'were big once', or even that they had been their own parents' parents. Allowing for the creativity of childish imaginations, we consider that we have gathered good evidence showing that reincarnation is a probability worthy of very serious consideration.

Our practical research programme has been hampered by the lack of funds, time and qualified personnel. Our scientific department (headed by Hernani Andrade) has, nevertheless, made considerable headway in a short time. Our first project was the construction of an electromagnetic space compressor, known as a TEEM after its initials in Portuguese. Hernani Andrade and a leading bacteriologist were able to observe, with this machine, the behaviour of bacteria within a cube of compressed 'empty' space. Although the first results were far from conclusive, they were quite encouraging. They suggested that the growth of living cells may be affected by artificial conditions simulating what Hernani Andrade postulates as the four-dimensional space within which all life is controlled and programmed by means he terms a *biological organizing model* and a *biomagnetic field*.

As I have mentioned, we believe that we are the first institute outside the U.S.S.R. to have built Kirlian camera units. We have two of these, and have been experimenting in this intriguing new domain for five years with results that are far more than encouraging. Our early success in producing what is known as the phantom leaf effect (whereby a cut-off portion of a leaf seems to remain visible in the photograph taken under the influence of an electrical high frequency field) has stimulated us to experiment further with lizards' tails and the tips of human fingers. With the former, we think that we have been able to observe evidence of the remaining biomagnetic field after a tail has been severed. In our experiments involving humans, we have conducted hundreds of tests in a great variety of conditions; we are far more cautious than many of our colleagues when it comes to hypothesizing on what the Kirlian process reveals. Our most interesting trials to date have been those involving a 'healer' and a 'patient', in which we have observed striking alterations in the visible discharge from fingertips while the healer makes what we call healing passes,

or simple transfers of energy, to the patient. (Fig.1)

■ Need for international co-operation

In its short life thus far, the IBPP has cemented friendly relations with many leading figures in the world of parapsychological research. We correspond regularly with researchers in twenty-six countries in the Americas, throughout Europe, and Asia. We were honoured to represent Brazil at the first International Congress of Parapsychology and Psychotronics held in Prague last year. It was our pleasure to welcome to Brazil such distinguished researchers as Ian Stevenson (already mentioned), H. N. Banerjee, John Cutten, Stanley Krippner, George Meek, Hugh Lynn Cayce and our colleague Lívio Vinardi from neighbouring Argentina.

We believe strongly that only real international co-operation can help parapsychology, as any other science, to achieve a position where it will be regarded as useful and, indeed, essential, instead of merely interesting. Our close contacts, both personal and by correspondence, with North and South Americans, Soviets, Czechoslovakians, Indians and many others have left us with the conviction that we must all work together in an attempt to understand man's full powers and potential. We are one human race; each of us obeys the same natural laws. Let us get together to help identify these laws which have remained obstinately hidden for too long.

■ Jarbas G. Marinho

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no. 1, July 1974.

Letters

■ Tempo of Soviet activity in psychotronic research

The writer is vice-president for the eastern hemisphere of the International Association for Psychotronic Research. Professor Samoylov, a specialist in jurisprudence, can be reached at Pochtovoye Otdeleniye 743, Moskva 117313 (Union of Soviet Socialist Republics).

Given the present state of psychotronics and its prospects for development, the efforts of scientists in various countries to solve this problem (in my opinion extremely complex and important) will undoubtedly be consolidated with time. The problem to which I refer is that of the power systems in man, systems by which he carries on mental activity as well as volitional and other acts; these include his extrasensorial links with the environment. It is by means of all these that he makes optimal use of his intellectual resources throughout life.

It is particularly important that original work be supported at the present stage in the development of psychotronics, for the subject is only in its infancy as an independent field of knowledge. I hope that the following information about the activities of our scientists will be of use to all.

Of the latest publications (i.e. those brought out approximately over the last year), mention should be made first of the abstracts of scientific papers to be found in the collected materials of the first International Conference on Psychotronic Research (Prague, Czechoslovakia, June 1973). I shall not attempt to summarize their contents, but I imagine that you would like to have a general account of the research we Soviets have done.

These studies by Soviet scientists, as well as

attempts to discover the essence of the physical nature of the human psyche's bioenergetic systems from a theoretical standpoint—works on biogravitational theory (A. P. Dubrov), the theory of bioplasma (V. Inyushin), the biophysical effect (N. N. Sechenov, a university lecturer) and the theory of physical fields and magnetic radiations (Y. A. Kholodov)—also contain methods for determining the parameters of bioenergy according to an individual's mental state (S. D. Kirlian, engineer).

Many abstracts containing the findings of research also include material that is of practical significance. For instance, there have been published accounts on possible applications of the biophysical effect in geology, for mineral and ground-water prospection (A. G. Bakirov); the use of bioenergy therapy in medicine for the diagnosis and treatment of a number of illnesses (A. Krivorotov, an experimental worker); the intensification of the learning process in higher education, using the 'mental tension' effect, which can be introduced into the methodological structure of the course (my own work); and the acceleration of certain physical processes, for example the precipitation of colloidal solutions (T. G. Neeme), and others.

Press reports (see the Polish journals *Polytika*, 18 August 1973, *Kultura*, 12 August 1973, and *Literatura*, 11 August 1973; the American journal *Parapsychology Review*, Vol. 4, No. 5, 1973; the Italian journals *Metapsichica*, Vol. 28, Nos. 3 and 4, 1973, and *Scienza Ignota*, No. 3, 1974; and the Czechoslovak newspapers *Svoboda* of 11 August 1973 and *Prace* of 7 July 1973) also show that the work done by our scientists, which was examined by the International Conference on Psychotronic Research held in

Prague, was quite deservedly rated very highly.

Some earlier work

A few words should be said about earlier work done by Soviet scientists in an attempt to solve the main problems. These concerned:

1. Research into the informative role of electromagnetic fields in the vital activity of biological systems: (P. I. Gulyaev, V. I. Zabotin et al., *Elektroauragramma Celoveka i Zivotnyh* [The Human and Animal Electroauragram], Leningrad, State University, 1968. (*Nervnaja Sistema*, 9.)
2. The remote recording of the parameters characteristic of the state of the systems mentioned: G. A. Sergeev, D. A. Yanutsh: *Statisticheskie Metody Issledovanija Prirodnyh Ob'ektorov* [The Statistical Methods of Studying Natural Objects], Leningrad, 1973.
3. Investigation of the functional bases of the activity of the cerebral hemispheres in man: V. V. Efimov 'Ob Odnovremennoj Rabote Polusarij Golovnogo Mozga Celoveka' [On the Simultaneous Working of the Cerebral Hemispheres in Man], p. 150-1 in the collected works of the Prague conference on psychotronics already mentioned.
4. Establishment of the informative link of living cells with the aid of a light signal in the ultra-violet spectrum: V. P. Kaznacheev et al., *O roli Sverchlabyh Svetovyh Potokov v Biologiceskih Cistemah* [On the Role of Very Weak Light Currents in Biological Systems], Moscow, 1967 (Bio-energetika i Biologiceskaja Spektrografija Moscow, 1967).

These studies exemplify the composite approach to the solution of problems involving several branches of knowledge, and they are applicable to many different fields. In particular, they are being used in research into the phenomena with which psychotronics is concerned.

We can confidently assert that the articles recently published by our country's leading psychologists, who are members of the U.S.S.R. Academy of Pedagogical Sciences (V. P. Zinchenko, A. N. Leontev, B. F. Lomov and A. R. Luriya: see *Voprosy Filosofii*, No. 9,

1973), contain not only a fundamental analysis of everything which in their opinion constitute the essence of psychotronics, but also an attempt to define the place of psychotronics in the general system of scientific knowledge. The material they examine is set out in such a way as to invite discussion, and embraces many aspects of the problem under consideration.

Other recent publications include:

1. Studies setting forth the problems being investigated by psychotronics, for instance, the articles by the well-known psychologist V. N. Pushkin, 'Autogravitacija' [Auto-gravitation] (see *Socialisticeskaja Industrija*, 9 September 1973) and an interview on 'Cto takoe Psihotronika?' [What is Psychotronics?] setting out the main points in this field of knowledge (see *Trud*, 7 February 1974).
2. Publications concerning other fields of knowledge which contain the results of observations or conclusions that either support or throw more light on the phenomena studied by psychotronics; in this connexion, the conclusions of the well-known scientist and member of the U.S.S.R. Academy of Sciences, V. A. Engelgardt concerning the presence of a biological field of force in living systems are of great interest (see *Filosofskie Problemy Biologii*, p. 261-2, Moscow, 1973), as well as the description of an invention by L. S. Termen (Moscow State University) enabling an electrical musical instrument to be sounded at a distance, using the bioelectric currents produced at will in the muscles of the experimenter's immobile hand (see *Pravda*, 11 March 1974).
3. Informative articles such as 'Javlenie iz-za Gorizonta' [A phenomenon from Beyond the Horizon] (see *Zurnalista*, No. 2, 1974), and 'Energija Psihiki' [The Energy of the Psyche] (see *Tehnika i Nauka*, No. 3, 1974).

I have made no attempt to review our author's books, which would be indeed impossible in a letter, but have merely given their names.

G. A. Samoylov

■ For a renewal of craftsmanship in art

The writer of the following letter, Lincoln Rothschild, is editor of the periodical The Pragmatist in Art. He may be reached at 63 Livingston Avenue, Dobbs Ferry NY 10522 (United States of America).

Frank J. Malina's essay 'Reflections of an Artist-Engineer on the Art-Science Interface' (*Impact of Science on Society*, Vol. XXIV, No. 1) deals with a subject that has interested me as an artist and art historian. The apparently diametrically opposed art and science do not indicate a categorical or inevitable difference in our understanding and control of environment; this situation is, rather, a momentarily distorted cultural emphasis needing reconsideration and adjustment.

Social co-operation (dating from the neolithic age) has produced ever-increasing bounties, partly through individual concentration on specialized roles which require systematic patterns of assignment and distribution of these. Dedication to the common good was reinforced with the emotional support of religion, combining (in quasi-mystical revelation) needed ethical prescriptions with a mythological cosmogony as well as rites and totems for vivid realization of the community's solidarity.

Unfortunately, as social growth enabled human practice in these once integrated areas to evolve increasingly realistic distinctions, the surviving religious formalities lost their unifying force. Indeed, they often generated divisive sectarianism when special interests commanded established religion for their own advantage.

Thus set adrift, the community's components grew in an isolation that has too often neglected its primary function of support. Ethical dedication through fear or respect for a supernatural power was displaced (in the practical arena) by the growth of statutory regulation, as complex philosophies constructed academic systems of terminology too esoteric and *a priori* principles too arbitrary for general use.

Dramatic escalation of the control of natural environment by organized science, at first hailed as a humanistic demonstration of the effectiveness of logical thought, developed elaborate techniques of experimental observa-

tion that seemed to downgrade intelligent vision to a simple machine for weighing objective evidence.

The appearance of superiority

Emphasis in the arts swung from the role of rallying the community to the assertion of the individual, with encouragement of aesthetic considerations for a clientele concerned with sensuous delight and dramatic novelty. Elegant display, at first, then esoteric obscurity were elaborated to support the appearance of superiority among those in positions of economic power—regardless of practical contribution to the common good.

So as the scientist was forced to limit his view to physical minutiae or abstruse theory, the artist was induced more and more to abandon craftsmanship for presumably more spiritual objectives. Their parallel aims of advancing social solidarity and controlling nature, in the general interest, became lost from view. The potential practical effectiveness of the artist's creative attitude was manifest in the ages when craftsmanship was held in high esteem, when childlike impracticality was not considered a prime qualification. Leonardo da Vinci's speculations in the scientific area, the architectural achievements of Renaissance artists like Raphael and Michelangelo, and the mechanical inventiveness of painters such as Samuel F. B. Morse and Robert Fulton are notable.

The attempt to isolate 'spiritual' values is simply anachronistic exorcism of 'material' concerns that had been presumed to be sinful in mediaeval times. Many scientists have allowed themselves similarly to be turned away from practical enhancement of the general welfare toward realms of speculation of interest to the few or else toward commercial and political pursuits.

A new dedication to the welfare of the community would find the roles of artist and scientist converging, along separate paths but toward a common goal, to clarify and advance mankind's co-operative control of environment. Renewed respect for craftsmanship again would attract practically inventive personalities to the arts, and recognition of the now world-wide integration of the human community would re-introduce ethical priorities and moral standards to the laboratories of science.

Lincoln Rothschild

■ Influence of climatic change on the quality of human life

In conjunction with Impact of Science on Society's issue devoted to the theme of 'A New Look at the Earth's Resources' (Vol. XXIV, No. 3), the International Federation of Institutes for Advanced Study (IFIAS) has brought to the attention of Unesco the following statement concerning the effects of climatic change on the character and quality of human life. The statement is made unanimously by twenty-two specialists from eleven countries, both industrialized and developing, convened in Bonn, Federal Republic of Germany, by IFIAS earlier this year to discuss the impact on our lives of climatic changes.

Signs of the onset of a new climate are many. Most important, perhaps, has been the steady cooling of average surface temperatures during the past thirty years. The total magnitude seems small—a drop of only about 0.3°C in the earth's annual average since the 1940s.

Even that slight cooling, however, has trimmed about a week or ten days from the growing season in middle latitudes where most food is grown. More serious, a cooler climate (for complicated technical reasons) means a more variable climate. Extremes of cold and hot, wet and dry weather become more likely. We have already seen a pattern of extremes developing since about 1960, marked for instance in the current, tragically prolonged drought in the Sahel region of Africa; in the repeated droughts in India, unprecedented in their frequency and impact in this century; in the hot, dry summer of 1972 in the Soviet wheat fields; in the unusual spells of weather including droughts and floods, both of which were suffered in parts of Africa; Australia and Latin America.

Such deviations or anomalies will recur. At this moment the world is unprepared to cope with them. Grain reserves, which used to be abundant in some regions, are no longer sufficient to serve as insurance against disaster; by some estimates, these have dropped to such low levels that they can supply the world's needs for less than one month at present rates of consumption. At the same time wasteful and excessive consumption by the affluent, along with increasing numbers

of mouths to feed, strains the capacity of farmers to deliver enough food even from the best of harvests. It becomes ever more difficult, expensive and risky to open up new arable land, and at least as difficult to limit the use of marginal lands highly vulnerable to erosion and worsening of climate.

In short, the current system of food production has little flexibility with which to meet emergencies. What we have regarded hitherto as occasional emergencies, moreover, can no longer rationally be so regarded.

The facts of present changes in climate are such that the most optimistic experts would assign near-certainty to major crop failures within a decade. If national and international policies do not take these near-certain failures into account, they will result in mass deaths by starvation and probably in anarchy and violence that could exact a still more terrible toll. It would be irresponsible in those circumstances to continue passively in our present condition of helplessness—without food reserves or alternative technologies to produce food and without adequate means to redistribute food from the more favoured nations, or more favoured groups within nations, to the less favoured in time of urgent need.

The most obvious and immediately practicable steps to reduce that helplessness are to encourage the production and storage of food in excess of current consumption. This should be the policy not only of the bread-basket nations, but so far as possible of those who are most vulnerable themselves to climatic catastrophes. Even modest reserves will need some years of grace in good growing weather in order to accumulate. For the longer run (remembering that what we face is not a temporary aberration in a normally benign climate but a new norm), there must be intensified research into the causes of climatic change and intensified research on new sources of food (from conversion of cellulose or marine farming, for example).

Wasteful consumption and social justice

New, or at least newly urgent, ethical problems loom in what perhaps will be unavoidable decisions to allocate food supplies that are grossly inadequate to keep everyone alive. Age-old problems of social justice inherent in the current distribution of wealth among economic classes will, at the very least, be sharpened. Furthermore, these may have practical as well

as ethical significance. One way to find reserves would be to eliminate wasteful and physiologically excessive consumption among the affluent of the world; another might be to improve the processes of food handling to plug the holes through which so much grain now goes to waste; finally, further reform is needed in the land-holding systems of some of the poorest countries that too often have discouraged farmers from increasing production.

In view of the importance of climate to all mankind, we urge the dedication of the climatic system to peaceful purposes. In recent years, there have been efforts made to try to develop techniques to change the conditions of weather and climate. We need to take the necessary measures to ensure that such techniques, once developed, are not used for hostile purposes. With the present lack of flexibility, any change of climate (whether natural or induced by man deliberately or inadvertently) is very likely to involve stress and suffering before the human economy becomes adjusted to the new conditions.

We are aware of differences among experts as to the cause-and-effect relationships of observed climatic facts and, consequently, as to the most likely prognoses. Professionally the differences are important, but they do not—and should not be allowed to—obscure the larger consensus that the observed changes

are neither trivial nor ephemeral. Extreme variations in climate inevitably entail disasters if people are locked into expectations that the climate will not materially change.

We urge that while scientists continue to seek more perfect understanding which will lead, among other things, to an improved ability to predict climate, those directly charged with making policy in national capitals and in international organizations not wait but begin to act now. Among research needs we note that insufficient effort has been made so far to improve our knowledge of the past record of climate by collaboration between meteorological, archaeological and historical research efforts. Furthermore, transdisciplinary research on the implications of climatic change needs to be encouraged. The evidence is imperfect, yet convincing, that our new climate will develop problems very soon that will dwarf most—perhaps all—others.

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