Nonlocality and emotions

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Abstract

The energy/momentum equation $\mathbf{E^2 = c^2p^2 + m^2c^4}$ implies the existence of positive mass ($+mc^2$) and negative mass ($-mc^2$); while positive mass moves at a speed slower than that of light, negative mass moves at a speed which is always faster than the speed of light and therefore with a direction in time from the future to the past. In 1934, the negative solution of Dirac's equation was refused because it implied the existence of mass and energy which move from the future to the past. Today, the validity of the negative solution of Dirac's equation is proved by the "anomalous" phenomena which are observed in the living systems and in quantum mechanics as, for example, the transmission of information at speeds faster than that of light (space nonlocality) and backwards in time (time nonlocality).

Forward

In 1980 Alain Aspect performed the first EPR experiment (Einstein-Podolski-Rosen) which proved the existence of space nonlocality (Aspect 1982). The EPR experiment, suggested by Einstein in 1935, consisted of separating two particles, transporting them at a distance and measuring the quantum states of the two particles, for example the spin. Einstein suggested this experiment in order to show that, because quantum states are identical, it is possible to

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know at the same moment all the information, contradicting in this way Heisenberg's uncertainty principle.

Alain Aspect's experiment has since then been replicated in laboratories all over the world and shows that when two particles are separated, independently from the distance, the measures performed on one particle correspond instantly to the state of the other particle. It is as if the second particle "knows" the state of the other one independently from the distance. It appears that the information which underlies this "knowledge" can travel any distance instantaneously. In Alain Aspect's experiment it was estimated that the speed of the transmission of information was at least 20 time the speed of light in empty space. In a more recent experiment performed in Geneva by Nicolas Gisin (Baggott 2003), according to the most conservative calculations, a speed of at least 20,000 time the speed of light was obtained, while according to less conservative calculations the speed was at least 30 million time the speed of light. In both cases these results violate the assumption of special relativity according to which the limit to the transmission of a signal is the speed of light.

EPR experiments show that in some way the spin of particles are instantaneously connected (nonlocality) and that this connection does not obey the standard transmission of signals which is limited to 300,000 km/s. The most recent experiments have involved an increasing number of particles and have shown the same results: distance does not slow the transmission of the signal. Any pair of particles, electron, neutrons and protons, which has shared the same quantum state in any point of space and time, stays connected independently from the space and the time. The results of EPR experiments lead to the conclusion that the correlation among quantum states is invariant in relation to space and time.

In the Spring of 2004 two teams of physicists, one at the National Institute of Standards in Colorado (Barrett 2004) and the other at the University of Innsbruck in Austria (Riebe 2004), demonstrated that the quantum state of entire atoms can be teleported by transporting the quantum bits ("qubits") that define the atoms. In the Colorado experiment led by M.D. Barrett, the ground state of beryllium ions was successfully teleported, and in the Innsbruck

experiment headed by M. Riebe, the ground and metastable states of magnetically trapped calcium ions were teleported.

EPR experiments have proved that it is possible to transmit information instantaneously independently from the distance in space and time. This fact is now known as nonlocality and it involves the very smallest as well as the very largest structures of the universe. Cosmologists Menas Kafatos and Robert Nadeau (2001) entitled their study of the cosmos “The Nonlocal Universe” and quantum theorist Henry Stapp does not hesitate to affirm that the finding of nonlocality is the most profound discovery in all of science (Plotnisky 2002).

1. Puthoff and Targ experiments and their military applications

At the beginning of the seventies two physicists, Russell Targ and Harold Puthoff, undertook a series of experiments on the quantum properties of the brain. The first experiments placed a “receiver” subject in a sealed, opaque, and electrically shielded chamber, and the "sender" subject in another room where he or she was subjected to bright flashes of light at regular intervals. The brain-wave patterns of both sender and receiver were registered on electro-encephalograph (EEG) machines. As expected, the sender exhibited the rhythmic brain waves that normally accompany exposure to bright flashes of light. However, after a brief interval the receiver also began to produce the same patterns, although he or she was not being directly exposed to the flashes and was not receiving ordinary sense-perceivable signals from the sender.

In 1972 Puthoff circulated a proposal to obtain a small grant for research in quantum biology (Puthoff 1996). In his paper “CIA-Initiated Remote Viewing Program at Stanford Research Institute” Puthoff says that this proposal arrived to Ingo Swann who informed him about the experiments of Gertrude Schmeidler, President of the Parapsychology Association of New York in the years 1959-1971; from this contact a paper was written which was eventually published as part of a conference proceeding (Puthoff 1975) describing the skills of Ingo Swann. In a few weeks a couple of visitors showed up at SRI (Stanford Research Institute)

with credentials from the CIA and asked Puthoff if he could help them to evaluate information arriving from the Soviet Union which showed big military spending in the field of psychotronics relative to the quantum properties of mind (DIA 1978). CIA knew of Puthoff's previous involvement as a Naval Intelligence Officer and a civilian employee of the National Security Agency (NSA).

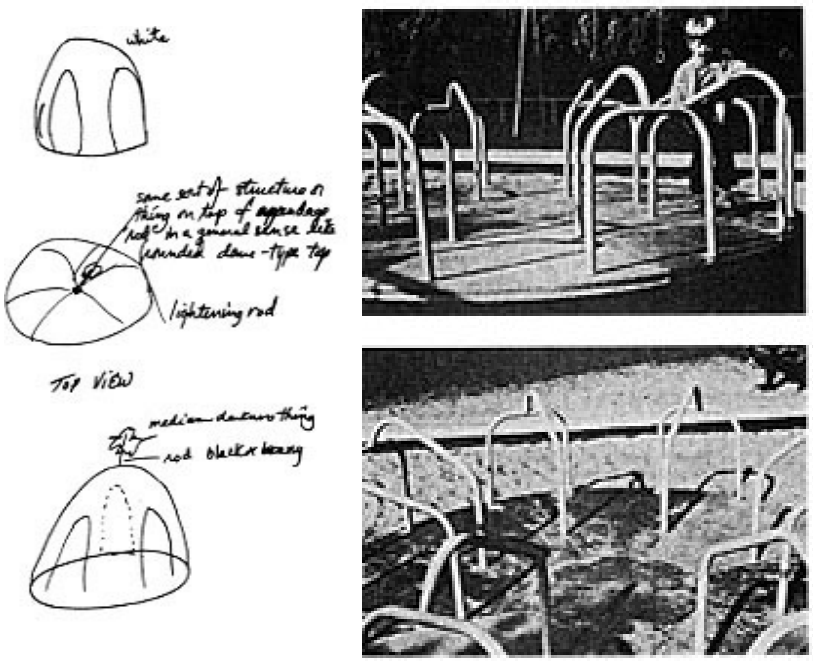
- Early experiments

CIA gave Puthoff a grant for 8 months for a "Biofield Measurements Program". In these 8 months Puthoff started to perform double-blind experiments regarding the transmission of symbols hidden in boxes and envelopes. Soon after he initiated experiments with sender and receiver subjects; the sender was located in the San Francisco Bay and the receivers had to describe or draw the objects around the sender.

The results of these experiments are now public (Puthoff 1974, 1976, 1977) and the replication of these results has been performed by many independent laboratories (Bisava 1979, Dunne 1979, Jahn 1982, 1986, 1987).

In 7 experiments out of 55 the CIA monitors were involved as experimental subjects and the results obtained were statistically significant, showing that the transmission of information was possible also using subjects which did not show any particular ability.

In the IEEE document Puthoff compares the photos of the selected targets and the drawings and descriptions performed by the experimental subjects. The results were encouraging:



Example of one of the first drawings produced using the information transmitted using remote viewing technique devised by Puthoff

These results led CIA to conclude that the techniques developed at SRI allowed the transmission of information. As summarized in the Executive Summary Final Report (Puthoff 1974b, Puthoff 1 Dec. 1975) of the second year of the program: "The development of this capability at SRI has evolved to the point where visiting CIA personnel with no previous exposure to such concepts have performed well under controlled laboratory conditions (that is, generated target descriptions of sufficiently high quality to permit blind matching of descriptions to targets by independent judges)." What happened next, however, made these results pale in comparison.

- Acquisition of remote information using geographical coordinates

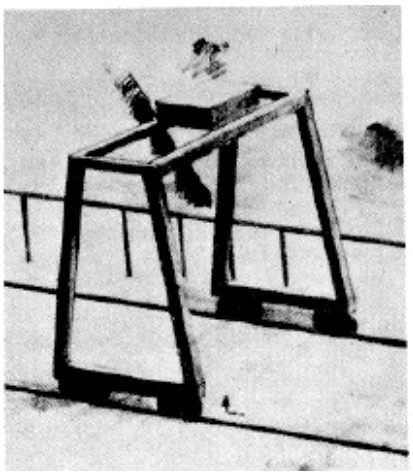
The experiments were soon expanded to test remote acquisition of information without a sender subject, but just using geographical coordinates such as longitude and latitude in degrees. This new technique was named Scanate (scanning by coordinates) and its main difficulties are discussed in detail by Puthoff (1977). After just a few months, high quality

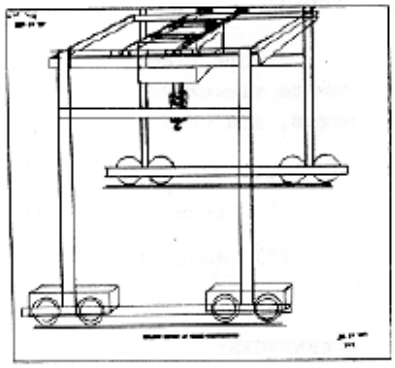
results were obtained; the complete transcription of Scanate sessions held during 1973 are now available in the Executive Summary of the Final Report of the second year. For example, a few days before the flyby of Pioneer 10 near to Jupiter (3 December 1973) Ingo Swann analyzed the planet by remote viewing, and described small rings around Jupiter, which are very difficult to see, and which were later discovered and photographed (Puthoff 1996).

The first rigorous test of the Scanate procedure was performed with the experiment known as "The West Virginia Site". The SRI team received geographical coordinates of a site which was unknown to experimenters as well as subjects. Coordinates were given as grades, minutes and seconds on a double-blind basis, that is, blind to experimenters as well as subjects. The purpose of the experiment was that of determining the utility of Scanate remote viewing under conditions approximating an operational scenario. Two subjects targeted on the site; one drew a detailed map of the layout of the building and grounds, the other provided information about the interior, including passwords which were subsequently verified. Details concerning the site's mission and the evaluation of the remote viewing test in particular, remain highly classified to this day, but the interest in this technique was increased considerably following this exercise.

- Operational remote viewing (Semipalatinsk USSR)

In July 1974 the first Soviet target of operational significance was analyzed using Scanate. It is not a "best-ever" example, but rather the very first operational Soviet target which was officially studied: "To determine the utility of remote viewing under operational conditions, a long-distance remote viewing experiment was carried out on a sponsor-designated target of current interest, an unidentified research center at Semipalatinsk, USSR". This operation was divided in three phases and it was under direct control of CIA. CIA gave coordinates in grades, minutes and seconds. The only other information was the designation of the target as a Research and Development facility.





The figure on the left shows the drawing of a construction crane as rendered by intelligence on the site (not available to experimenters until later), and the figure on the right shows the drawing made using Scanate. The description of the multistory crane, a relatively unusual item, was taken as indicative of possible target acquisition. The second phase started with a briefing by CIA relative to specific information of the target which could be verified by intelligence on site, providing the possibility of adjusting the procedure. The third phase was relative to information which could not be verified, but which was of interest.

Puthoff (1974) says that in a period of two weeks many hours of recording and several drawings were produced, but all this material is still classified. A number of specific large structural elements were correctly described. The results contained noise, but were clearly differentiated from the chance results generated by the control subjects.

- From research project to multi-client program

As a consequence of the high quality results produced with *Scanate* interest grew considerably and it led to an ever-increasing number of clients, contracts and tasking, and therefore expansion of the program to a multi-client base, and eventually to an integrated joint-service program under single agency (DIA, Defense Intelligence Agency) leadership.

Even though the details of the broad range of experiments have not yet been released, summaries of the overall characteristics of remote viewing learned in these studies were published, for example the apparent lack of attenuation of the signal due to seawater shielding (submersible experiments), the amplification of remote viewing performance by use of error-correcting coding techniques (Puthoff 1981, 1984, 1985).

At the end of his article *CIA-Initiated Remote Viewing Program at Stanford Research Institute*, Puthoff writes that "Regardless of one's a priori position, however, an unimpassioned observer cannot help but attest to the following fact. Despite the ambiguities inherent in the type of exploration covered in these programs, the integrated results appear to provide unequivocal evidence of a human capacity to access events remote in space and time, however falteringly, by some cognitive process not yet understood. My years of involvement as a research manager in these programs have left me with the conviction that this fact must be taken into account in any attempt to develop an unbiased picture of the structure of reality".

Some applications of remote viewing have been:

- NASA studies to determine if information in electronics could be acquired by remote viewing.
- Naval Electronic System Command studies to determine changes in remote viewer's brainwave.
- Special US spy plane crash in Zaire for which satellite search yielded no trace.
- American hostages localization in Iran.
- Dozier's localization in Padua after being kidnapped by the Red Brigades in 1981.
- Missile localization.

2. PEAR project

The Princeton Engineering Anomalies Research (PEAR) program was established at Princeton University in 1979 by Robert G. Jahn, then Dean of the School of Engineering and Applied Science, to pursue rigorous scientific study of the interaction of human consciousness with sensitive physical devices.

In the article "The PEAR Proposition" Robert Jahn and Brenda Dunne (2005) of the University of Princeton describe the broad range of experiments on consciousness-related physical anomalies developed in more than a quarter of a century at the Princeton Engineering Anomalies laboratory http://www.princeton.edu/~pear/.

The establishment of the PEAR program was stimulated by some rudimentary studies involving a microelectronic random event generator (REG) undertaken in an undergraduate independent project supervised by Robert Jahn over the period 1977-79. The aim of the study was to determine if the intentionality of mind could interfere with the Gaussian distribution produced by the REG device, moving the mean of the distribution towards lower values when the intention was that of producing lower values and moving the mean of the distribution towards higher values when the intention was that of producing higher values.

The effects which were observed had error margin (statistical significance) lower than 0.000001 ($p<10^{-6}$), and raised enigmatic questions about mind/matter relations and pragmatic questions about the implications for technological applications. These topics required more substantial investigation and the PEAR project was started.

In this first experiment the effects were:

- High intentionality→ deviation of mean values towards high values;
- Low intentionality → deviation of mean values towards low values.

These first results raised a huge list of questions:

1. could the same subjects continue to produce anomalous results with a high degree of replicability?
2. Could other subjects produce similar effects?
3. If so, how did their individual results differ?
4. Could structural features of their output distributions other than the means be affected?
5. What personal characteristics of the operators were relevant?
6. What operator strategies or protocol variants were most effective?
7. How important was the mode of feedback provided to the operators?
8. Were the details of the random source important to the occurrence or scale of the effects?
9. What were the spatial and temporal dependencies?
10. Could pseudorandom or other deterministic sources be similarly affected?
11. What forms of theoretical model could be posed to accommodate such effects?

Over many subsequent years of continuing REG experiments question 1 and 2 were answered affirmatively. The other questions have required subdivision of each of the questions into various subordinate queries, which required dedicated experimental protocols and equipment, which lead to the evolution from local mind/machine experiments to non-local experiments with regard to space and time, as the “off-time” experiments. These experiments have shown that it is possible to interact with physical objects which are far away or temporally distant. It has been proved that the quality of these interactions is independent from the distance of the object. The fact that the object could be temporally distant, up to several days in advance, lead to labeling these experiments as PRP (Precognitive Remote Perception).

The theoretical model proposed in order to accommodate the effects observed in the PEAR experiments have lead to the nonlocality properties of quantum mechanics (Jahn e Dunne 1986) and, until now, these properties have shown to be the only ones capable of interpreting in a satisfactory way the results produced with the PEAR experiments.

Jahn and Dunne underline that the PEAR experiments and the use of quantum physics have met grudging concession of academic freedom, uneasiness in public discussions, but, at the same time private interest by the same people who in public are embarrassed to acknowledge these results (Jahn e Dunne 2005).

Jahn and Dunne say that from time to time numerous individuals from various policy-level offices in the intelligence, defense, basic research, space, legislative, and executive branches have displayed interest in PEAR's work. But PEAR's inability to accommodate classified projects of information, and the commitment to maintain student access and free publication, have restricted these dialogues, and have precluded them as sources of funding. On several occasions high government officials visited the university President to assure him of the pertinence of this program to the nation's long-term interests.

- FieldREG experiments and the role of emotions

Thanks to the evolution of low cost micro-electronics it has become possible to produce cheap and portable REG systems which allow to perform experiments in the most different environments. These experiments are named Field REG and have shown that the interaction mind-machine is much stronger in emotionally resonant environments, while it is weaker in anonymous environments as, for example, laboratory settings (Jahn e Dunne 2005).

FieldREG experiments have led to the discovery of the strong significance of emotions in amplifying the signal of anomalous information. This discovery has lead to the development of experiments in happy, relaxed, colorful environments showing that the signal is enhanced by emotionally positive environments, while anonymous environments tend to reduce the transmission of anomalous information.

Through the "International Consciousness Research Laboratories (ICRL: www.icrl.org) the PEAR project has started to recruit, organize, fund, and activate researchers which share a common interest in the role of consciousness in the establishment of physical reality.

Dunne and Jahn underline the fact that the principles of classical deterministic causality do not allow to explain the data obtained with the PEAR experiments and that it is necessary to introduce a new model of causality.

3. Experiments of the Cognitive Science Laboratory

The Cognitive Science Laboratory (http://www.lfr.org/LFR/csl/index.html) is a program sponsored by the US government which in the last 20 years has performed research activities known as Star Gate for intelligence applications. The Cognitive Science Laboratory uses competences from behavioral, psychological and physical sciences in order to:

- Determine which parapsychological phenomena can be validated under strict laboratory conditions.
- Understand their mechanisms.
- Examine the degree to which they might contribute to practical applications.

A library with articles which can be downloaded freely is available at the address http://www.lfr.org/LFR/csl/academic/library.html. Among these articles it is interesting to note “Skin conductance prestimulus response: analyses, artifacts and a pilot study” by James and Spottiswoode (2003) which shows a significant relation (p=0,00054) between anticipated skin conductance (3 seconds) and presentation of photographs with emotional content.

This research on skin conductance before stimuli was suggested by previous studies which showed that the autonomic nervous system responds to stimuli 2-3 seconds before presentation. While the autonomic nervous system response to emotional stimuli is long established, recent research by Radin and Bierman (1997) have shown that skin conductance and other autonomic measures can act as predictors of future experiences. These results

have attracted the interest of Parkhomtchouck (2002) and are being investigated by Bierman e Scholte (2002) using fMRI (functional magnetic resonance imaging).

The experiment performed at the Cognitive Science Laboratory had the purpose to control all the potential artifacts such as:

- Cueing. Subtle cues which could allow the participant to know the upcoming stimulus type.
- Expectations. The rate of skin conductance could increase due to stimulus hunger.
- Stimulus generator. Nonrandom anomalies in the stimulus generator which could allow the participant to infer the next stimulus type.
- Programming errors. As errors in data collection or programming codes.
- Participant or experiment fraud.

The conclusion of the authors is that all possible controls were performed and results continued to show a significant relation between pre-stimulus conductance and emotional content of the image.

4. Umberto Di Grazia

Umberto Di Grazia, President of the Consciousness Research Institute (www.coscienza.org) was involved in the US research projects of anomalous information acquisition. I had the pleasure to interview him on the 9th of January 2006.

How did your contact with the US projects start?

I was looking for an organization which was interested to use sensitive people for archeological researches. I had made important discoveries as for example:

- An ancient town, an Italic port, at Pratica di Mare. Professor Castagnoli had been looking for it for years and I found it thanks to sensations, images.
- The remains of ancient Rome between 40 and 105 meters beneath the ground level.

I had read that John Norman Emerson, father of Canadian anthropological archeology, had presented in a congress in the seventies the findings of MacMillan, a tourist guide, who discovered old Indian settlements at a distance, describing the colors, rites and costumes. Then digging on the spot, these old remains were discovered exactly in the point indicated by MacMillan.

I was looking for someone with whom I could do this kind of research, when a friend told me of an Italian, Brando Crespi, who, with Stephan Schwartz, had founded the Mobius. Mobius (http://www.stephanaschwartz.com/home.htm) had already found a Trident submarine which had disappeared.

Your first day at Mobius

At the beginning of the eighties, I took a plane from New York to Los Angeles. I had little knowledge of English and it was a miracle that I managed to arrive at Los Angeles. As soon as I entered the Mobius small building, I was asked to undergo a test which consisted in a list of names to which I had to answer instinctively. Later I was informed that among these names there were Senators and the directors of CIA and DIA. This test consisted in assessing if I could guess their physical traits, if they were married or not, their habits, and other information of the kind. My descriptions were wrong only in 2 cases out of 200. I guessed 99% of the descriptions, in those conditions, and having just arrived from Italy.

And after that?

It was a good start. Schwartz involved me in all the experiments that Mobius was performing. For example, someone was killed, I received a personal object, and something similar was

sent to the other 8-11 persons involved in the project, which I did not know. The team was of 8-11 subjects, referred with labels as R6, R9. Each subject gave the information following a questionnaire, and Mobius analyzed these answers. After years of activity they had discovered that each one of us had the right information, but in giving it we distorted it. The work of Mobius consisted in studying and eliminating the distortions in the information. Distortions could be spotted thanks to the use of particular words, particular signs in the drawings. Thanks to these correction techniques the information produced by Mobius was very accurate and reliable. Questionnaires were similar for all the subjects. For example, in the case of a ship, built with special materials, which had disappeared, the questionnaire asked the names of the people involved, the location of the ship, the new name, the ports in which it could be found and the exact dates.

Was this program different from the one directed by Puthoff?

Totally different. Puthoff was interested in reaching statistically significant results. Between 1978 and 1988 all the military operations supervised by CIA were followed by Targ which started the Star Gate project. One thing is saying what everyone says, and another thing is to be involved in real operations. For example operations, now public, in which we found Russian spy planes and biochemical facilities.

When you receive a map, in a sealed envelop, with no reference to a part of the world, with no names of towns, but only with the outline of the border, and you are asked to indicate a point, which means making a hole in the map using a needle, and then they go there and find what they were searching for, I do not think someone can say that it was just a joke. From here, from this table, I spotted a relict in the Bermudas, and the error was of just 6 meters. Then when I became conscious again I was the first to wonder how it was possible.

These experiments are extremely demanding: you see information, dates, shapes, you draw, you try to understand and locate the information: sea, lake, mountain, railway, signals.

Which is the role of emotions?

What brings attention to a place are the emotions which people felt or will feel in that place. I have been studied by many scientists: Servadio, Massimo Inardi, Piero Calcioli. Many reached the conclusion that I feel quakes because my grandmother was involved in the sea-quake of Messina; she lost everything and she remained buried for 15 days. It was a miracle. What takes you to an event are emotions, the suffering of people in the past or in the future. Suddenly I find myself in the event, not knowing what it is, but just knowing that something is going to happen, but not knowing what. If I see the sea I know that the event is relative to an earthquake. Emotions, feelings, attract me in a place and then images start to appear. If during one of these experiences I see a town which I know, for example Pisa, Genoa, or other places I know, I can immediately say where the event will occur. If I do not know the city or the place, I then have to get information that I am now used to remember as soon as I come out from this anomalous state. I have always allowed researchers to study me. For example professor Maciotti studied me for 3 years and has published a book which is now used in the faculty of sociology. I have been studied by psychiatrists, for example Iovine, and specialists.

Which technique do you use?

Biostimulation. When I started doing these works I had a group named “Dimensione Uomo”, joined by the director of the synchrotron of Frascati, the director of the astronomical observatory of Monte Mario. In all we were almost 200 very motivated people. With Mario Bruschi, professor of physics at the University of Rome, we tested biostimulation working on more than 3,000 people. We obtained results, which reached high statistical significance, and which tell that each person receives “anomalous” information.

Which is the difference between remote viewing and out of body experiences (OBE)?

Remote viewing is a technique during which you remain conscious, and you try not to deform with logic what you feel. OBE, instead, requires the separation of the energy from the body. During OBE my body is paralyzed, collapses, and then I travel. This trip is like moving in the

dark, extremely fast. Then I slow down and stop. When I stop I see like at night time, I do not see colors or shapes. When I identify myself I start seeing the colors and I can start telling where I am. When this energy expands and goes away from me, my heart slows, my body becomes cold, and my heart beats are nearly imperceptible. For years I used to wear a medal with written on “If I look dead I am still alive”. These situations are dramatic, they are not games.

When OBE are done under command “go and see this…, what will happen…, where are the American hostages in Teheran held?…” it is a different thing. I first need to work on my motivations. When an OBE is ordered a conflict always arises. Therefore the first part of the technique is aimed to bring motivation and energy. Each one of us, I am talking of these 11 persons in the world, uses different techniques to persuade himself that it is possible and necessary to receive this information.

How do you recognize an OBE from a dream?

OBE is usually programmed. When it happens during a dream there is a jump: I feel the emotions of the people. In the dream I feel only my emotions. If I feel scared during a dream I can stop dreaming, during OBE it is impossible. Until the message is acquired I am forced in the situation.

Why was the project terminated in 1995?

The reason for these projects comes from Russian. Since Stalin, Russia spent huge sums in this field which they named psychotronic, in order to avoid any reference to religion, parapsychology or philosophy.

In the States the biggest projects were given to Mobius and Targ. These projects led to a technology which no longer requires the presence of gifted humans.

I have been invited by KGB to go to Moscow to see the technologies which the Soviets developed in order to amplify the signal.

When projects are ended it means that the goal has been reached, and that they continue under other forms and that they do not want any publicity. In the seventies we witnessed what we all know, now they just do not want other people intruding in these projects.

What annoys me most, apart from those people who just talk without knowing anything about these projects, is that in the seventies all these things had been well defined at all levels: physical, anthropological, sociological. Then something happened, and the attention of people has been moved down, somewhere else, and now we are starting back to what had already been said 30 years ago. It seems as if we are always starting again, while other people are moving away from these mechanisms, like Brian Josephson (Nobel prize 1973 for physics: http://www.tcm.phy.cam.ac.uk/~bdj10/), and carrying on silent research works. Who do we have to convince?

Does a conflict exist between two paradigms?

Yes, more than ever. I don't like the term "holistic" for the new paradigm, I much more prefer the expression "science of consciousness" which Brian Josephson has coined in his studies, and which implies the integration of mind and matter, which was proved by the experiments of the University of Princeton (http://www.princeton.edu/~pear/). What has been discovered is that nothing is fixed. The new paradigm does not see matter as an objective, fixed entity, but as an aggregation of energy, which is in constant transformation, with no separation between matter, consciousness and spirituality. The new paradigm sees consciousness everywhere.

5. The role of emotions

In the previous paragraphs the role of emotions in the anomalous flow of information was underlined by:

- Umberto Di Grazia who stated that "*what brings my attention to a place are the emotions which people felt or will feel in that place*".
- Jahn and Dunne of the PEAR project of the University of Princeton found that FieldREG experiments are affected by the emotional resonance of the place which amplifies the anomalous transmission of information. For example in PRP (Precognitive Remote Perception) experiments in which information move backwards from the future to the past.
- James and Spottiswoode in "Skin conductance prestimulus response: analyses, artifacts and a pilot study" of the Cognitive Science Laboratory show that the autonomic nervous system responds to emotional stimuli 2-3 seconds before the presentation.
- Puthoff (1985) shows that it is possible to produce predictive information which moves backward in time.

These examples of space and time nonlocality added to EPR experiments and to the big variety of evidence of anomalous phenomena in quantum physics prove the necessity of a different model of causation which requires the negative solution of Dirac's equation.

It is interesting to note the relation between these anomalous phenomena, negative energy, anticipated information, living systems and emotions. Luigi Fantappiè had already underlined these relations in 1942 when he noted that the mathematics of Dirac's negative solutions led to state that "syntropy" is felt as emotions: *"Let us conclude by looking at what we can say about life. What makes life different is the presence of syntropic qualities: finalities, goals, and attractors. Now as we consider causality the essence of the entropic world, it is natural to consider finality the essence of the syntropic world. It is therefore possible to say that the essence of life are the final causes, the attractors. Living means tending towards. But how are these attractors experienced in human life? When a man is attracted by money we say he*

loves money. The attraction towards a goal is felt as love. We now see that the fundamental law of life is this: the law of love. I am not trying to be sentimental; I am just describing results which have been logically deducted from premises which are sure. It is incredible and touching that, having arrived at this point, mathematical theorems start speaking to our heart!" (Fantappiè 1942).

A duality arises among:

- Rationality, which is the consequence of information arriving from the past: memory, past causes;
- Emotions, which are the consequence of information arriving from the future: finalities, attractors, motivations.

Blaise Pascal (1623-1662), one of the greatest scientists of his time, underlined that "*the heart has its reasons of which reason knows nothing*". Now, with the discovery of negative energy and of the causes located in the future it is possible to understand, under a new light, this quotation from Pascal: information from the future talks to the heart (emotions), and therefore rationality which is based on past information is not capable to investigate the reasons of the heart.

In 1928 Dirac, with his famous equation, suggested the existence of a universe, for us invisible, made of antimatter and waves which flow backwards (Coughlan e Dodd 1984). The discovery of this negative energy and of a form of causation which for us is invisible because it is placed in the future (attractors), opens the way to a radical change of paradigm.

Changes of paradigm have always been opposed as they require the evolution from intuitive knowledge, based on everyday experience, to counter-intuitive knowledge based on a more profound knowledge of the laws which govern the universe.

For example, the conflict which opposed in the XVI century the Aristotelians and Galileo who proposed the new paradigm based on scientific observation is famous. The old paradigm was based on the intuitive everyday experience that the Sun moves around the Earth. This intuitive knowledge led to a dramatic refusal of the new paradigm which showed facts which could not be accepted for their implications. For example the fact that Earth rotates around the Sun and that the Sun shows dark spots. Today we are facing a similar situation. Everyday experience leads to refuse Dirac's negative energy solution, but facts show that this solution is correct.

The new paradigm that is now taking shape starts from a new understanding of time, which overcomes the intuitive experience of absolute moments which flow from the past to the future. This new paradigm which is rooted in the dual solution of Dirac's equation, and is proved by the anomalous finding discussed in this paper, implies the passage from:

1. deterministic causality to supercausality;
2. a mechanical universe to a universe which is based on free will, where this constant process of choice plays a key role in the evolution of the universe;
3. from a universe limited by the speed of light to a universe in which information can travel instantaneously through space and time;
4. from an analytical science to an holistic science.

Although Newtonian physics apply to objects moving at modest speeds on the surface of the Earth, the framework has now shifted radically. Today "quanta" are known to be intrinsically and instantly "entangled" with each other, creating subtle strands of connection that span the cosmos. The idea of instant and intrinsic connection goes back to the concept of entanglement advanced by Erwin Schrödinger in the 1930s. Physicists have accepted the strange fact that all quanta in the universe, in particular those that share, or have ever shared, the same quantum state, are intrinsically entangled with each other. This means that in its totality the physical universe is an intrinsically and instantaneously interconnected whole—a far cry from the Newtonian universe and laws.

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