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Quantum psychotherapy: what prospects?

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Abstract. – From Freud's time to the present, various accounts of psychotherapists and psychoanalysts report episodes of certain phenomena – in particular of so-called 'telepathic' experiences – that, on the first impression of those who experienced them, appeared more akin to the world of the occult and the 'paranormal' than to what is typically perceived by the senses and corresponds to the physical laws established and verified over the centuries by the experimental scientific method. Today, however, thanks to the 'scientific revolutions' in physics over the last hundred years with the advent of the *Theory of Relativity* and *Quantum Theory*, and especially with the prospect of their possible complete integration, not only could these phenomena find new and convincing scientifically based explanations, but they could even help lay the foundations of a new model of *quantum psychotherapy* that could significantly contribute to current knowledge in this field.

Key words: field; entanglement; psychoanalysis; synchronicity; quantum theory.

From Copernicus to nuclear energy

Copernicus, Newton, and Einstein were 'classical' scientists (or, in other words, 'deterministic': for them, a cause – or 'force' – usually follows an effect, or 'movement'). The first significant scientific revolution was brought about by Copernicus when he changed the 'system of reference' in which to place his scientific theory: previously, the 'geocentric system' had been adopted, until then considered the best for observing the Cosmos. However, he understood that choosing instead a system 'external' to the earth, where one has a more comprehensive view of the movements of the celestial bodies, led to a more complete understanding of them. This made it easier to describe the motion of the planets, leading Newton to understand that the physics on Earth and the physics of the planets follow the same laws, thus enabling him to formulate the laws of dynamics and the theory of gravity.

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Given this progress, it proved essential to change the reference system. Einstein then went even further and extended Newton's theory, applying it to the great speeds and large gravitational fields of 'four-dimensional space-time' and formulating, even today it is believed correctly, first the theory of special relativity and then that of general relativity.

This further progress, with the discovery of the possibility of transforming mass into energy and vice versa, then led humanity to the possibility of using nuclear energy for military and civil purposes, and this was certainly one of the scientific innovations that most impacted and 'shook' the so-called 'collective imagination' of humanity throughout the 20th century. For the first time, or at least this is what we believe, with nuclear bombs, humans were given the means to destroy the planet on which they have always lived; no other living species on Earth had ever had this possibility, which to this day is still essential for the political-economic balance of governments in several countries. And the mere thought that this may happen at some point has certainly animated, and still today stirs, the deep fears and anxieties of millions of human beings.

We need only mention, for example, the words that the American poet and songwriter Bob Dylan, Nobel Prize winner for Literature in 2016, used in the text of his 1963 song '*Masters of War*':

"*You've thrown the worst fear*
That can ever be hurled
Fear to bring children
Into the world.
For threatening my baby
Unborn and unnamed
You ain't worth the blood
That runs in your veins"

On the subject of the atomic threat, various scholars in the field of psychology have made some extremely interesting contributions in the last century: to mention just one here, the Italian psychoanalyst Franco Fornari (1921-1985), who expressed himself on the matter as follows:

> "The first promise of the atomic age is that it can turn our nightmares into reality. The ability to distinguish objective reality from wakefulness, dream, delirium, and hallucination, which normal men have so painstakingly acquired, for the first time in human history seems to be seriously shaken" (Fornari, 1966, p. 136).

This is not the place to delve into the issue of the general activation of specters of anguish among human beings following the advent of the 'atomic age', with which the whole world inevitably had to deal, especially following the catastrophic destruction of hundreds of thousands of human

lives by the two nuclear bombs dropped on Hiroshima and Nagasaki in August 1945. Rather, here, I would like to highlight an interesting passage from Franco Fornari's aforementioned statement in which he effectively contrasts so-called 'objective reality' with subjective mental conditions, such as state of vigilance, dream, delirium, and hallucination.

Einstein's Theory of Relativity and Quantum Theory both appear to have significantly influenced many aspects of the reality of our daily lives, such as the perception of time (as Carlo Rovelli and Arnold Mindell, among others, highlighted in their respective books *The Order of Time* and *Quantum Mind at the Edge Between Physics and Psychology*) or the so-called *Hawthorne Observer effect* (also known as the *observer effect*, and also discussed by Jung and Pauli in their book *Psyche and Nature*). 'Objective reality' is the concept that emerges from all these innovations, and which has developed along a historical path that is partly parallel to and partly independent of the Theory of Relativity. The development of Quantum Theory compels us not only to take this concept seriously but also to examine it from a very different perspective to those generally adopted in past decades and centuries.

Thus, George Gamow, a famous Ukrainian physicist and writer – later naturalized in the United States – summarizes this parallel evolutionary path (1904-1968) in his 1966 work, whose title is still current today: *Thirty Years that Shook Physics*:

> "Two great revolutionary theories changed physics in the first decades of the twentieth century: the *Theory of Relativity* and *Quantum Theory*. The first was practically the creation of one man, Albert Einstein […] Quantum theory, on the other hand, is the result of the creative work of several great scientists, starting with Max Planck, who was the first to introduce the notion of quantum energy in physics. This theory has gone through many stages of development and enables us today to examine in depth both the structure of atomic atoms and nuclei and that of bodies of more familiar dimensions. Today, Quantum Theory is not yet complete, especially in relation to the Theory of Relativity and the problem of elementary particles, since it is blocked (temporarily) by the terrible difficulties that oppose its further development" (Gamow, 1966, p. 9).

It should also be noted that quantum theory, compared to 'classical' theories, introduced the concept of 'probability' into physics; no longer certainties and determinism as in Newton and Einstein's theories, but the probability that an object is in one place at a certain moment. This is all the truer when objects are small.

Thus, from 1966 to today, many important innovations have occurred in Quantum Theory, and indeed, significant ones had existed (but not always immediately recognized as such) even before Gamow published his fundamental work. However, let us proceed systematically.

The main repercussions of Quantum Theory on the daily lives of human beings

> "In 1925, a French physicist, Louis de Broglie, published a study in which he gave an unexpected interpretation of Bohr's quantum orbits. According to de Broglie, the motion of each electron is governed by certain mysterious 'pilot waves' whose propagation speed and wavelength depend on the speed of the electron in question. On the assumption that the length of these waves was inversely proportional to the speed of the electron, de Broglie could show that in the model of Bohr's hydrogen atom, the different quantum orbits could provide an *integer number of* 'pilot waves'. Thus, the model of an atom began to look similar to certain types of musical instruments with a fundamental note (the innermost orbit with the lowest energy) and various harmonics (the outer orbits with the highest energy)" (Gamow, 1966, cit. pp. 11-12).

The idea of wave-corpuscular dualism arose, whereby each body can exhibit both particulate and wave behaviour: electrons appear to behave like waves and electromagnetic waves appear to behave like particles.

The bond between the particle behaviour (expressed through mass and velocity) and the wave behaviour (expressed through wavelength) of each existing object is represented by the de Broglie relationship:

$$\lambda = \frac{h}{mv}$$

where λ is the wavelength (de Broglie's name), m and v are respectively the mass and velocity of the particle, and h $(6{,}6 \times 10^{-34}\, J\, s)$ is the so-called *Planck constant*. Since the value of this constant is very small, for a corpuscle to behave like an observable wave (in the form of gamma rays or X-rays), its mass must be extremely small. The undulatory nature of objects of gross magnitude is, in practice, not observable.

To quote Gamow again:

> "A year after their publication, de Broglie's ideas were developed and refined by the Austrian physicist Erwin Schrödinger; the theory then became known as *Wave Mechanics*. […] At the same time,[1] the young German physicist Werner Heisenberg, published a paper describing the development of a method for dealing with quantum problems using so-called 'non-commutative algebra', a mathematical discipline in which a x b is not necessarily equal to b x a. These two works seemed very different, yet they came to the same results on atomic structure and atomic spectra. But there was still a thorn in the path of Quantum Theory, and it caused some pain whenever one tried to quantify quantum systems that, given the high velocities involved (close to those of light), required that account be taken of the Theory of Relativity. Many unsuccessful attempts had been made to connect

[1] To be precise, Heisenberg's paper was published six months before the publication of Schrödinger's work on wave mechanics, so in this case it should be more correctly understood "almost simultaneously".

> Quantum Theory with the Theory of Relativity, when finally, in 1929, a British physicist, p. A. M. Dirac, wrote the famous *relativistic wave equation*. The solutions of this equation perfectly described the motion of atomic electrons at speeds close to those of light and automatically explained also, unexpected reward, the amount of motion, the moment of momentum and the magnetic moment" (Gamow, 1966, cit. pp. 12-14).

To all these contributions by various scientists mentioned so far, we must add at least those of two Dutch physicists, Samuel Goudsmit and George Uhlenbeck, and of the Austrian Wolfgang Pauli, who together drafted the final version of the so-called *exclusion principle* (originally expressed by Pauli in an important form, which, however, proved not to be complete) according to which a quantum orbit cannot be occupied by two identical electrons (they must differ by a quantum number marking them, the *spin* characterizing the rotation on itself of a particle). The 'spin', using an easily understandable analogy even if not quite correct in physical terms, describes a rotational movement of the electron on itself, reminiscent of the Earth orbiting the Sun: in reality, the *spin* is a strange quantity that does not correspond exactly to a rotation in the classical sense, but this example provides a basic description not entirely foreign to the first impressions of the three scientists, at least in the initial stages of their research.

Two electrons can be on the same quantum orbit only if they have opposite *spins*, *i.e*., they are rotating on themselves in opposite directions. Figure 1 schematically depicts a beryllium atom, whose 4 orbiting electrons are placed in pairs with opposite *spins* on two orbitals, the outermost of which represents a higher energy level being farther from the nucleus.[2]

In the years immediately following all these innovative discoveries, the various scholars who contributed to them met regularly – sometimes informally, during specific 'official' congresses specially organized – to compare the theoretical and experimental data they had and to obtain an interpretation that was as consistent as possible. It was in Copenhagen, in 1927, that Niels Bohr and Werner Heisenberg made the first 'shared' exposition of the overall Quantum Theory (it was named the 'Copenhagen interpretation' by Heisenberg himself and is still the 'official' definition of this theory).

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[2] This figure is adapted to the Bohr model (1922). In fact, for some time now, after the introduction of the Schrödinger wave function, there has been no longer talk of 'orbits' in the scientific field, but more correctly of 'orbitals', which correspond to the areas where there is the greatest likelihood of finding an electron and which are obtained as stationary waves of the function itself, similar to the vibrations produced in a pinched guitar string or in a beaten drum skin. But the wave function is not a material wave, so the graphic representation above gives a basic idea of the Bohr atom, orbits, and spin that was probably true for scientists of the time, but has now undergone significant modifications based on both experimental studies and mathematical formulations.

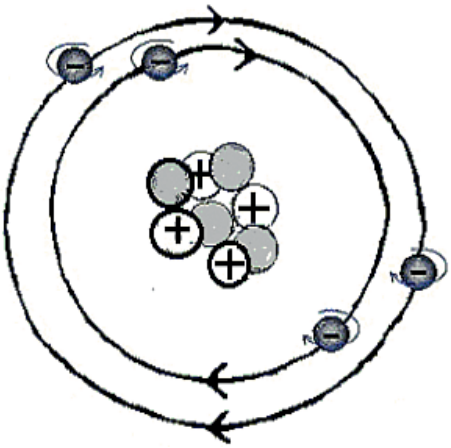

Figure 1. A representation of the Beryllium atom as described by the Bohr model, schematically represented according to the reformulated Pauli principle ('principle of indistinguishability of identical particles', also attributable to Pauli). In the center the nucleus (with positively charged protons and neutrons) and in quantum orbits the different pairs of electrons on opposite spins. Electrons, it is worth remembering here, have a mass about a thousand times lower than either protons or neutrons. On the same orbital, however, two opposite spin electrons are distinguishable by the action of electric or magnetic fields.

Specifically, according to that vision:

1) Since reality always has a 'dual' nature, that is, both corpuscular and undulatory, only what is measured at the very moment of its measurement can be taken into account in quantum mechanics, whereas before such an act, there is nothing 'real' in the material, corpuscular sense. Since quantum mechanics studies only observable quantities, that is, obtainable by measurement processes, it is the very act of measurement that forces what is observed to take one of the permitted values, according to a probability that can be verified only by several measurements. It is the very act of observation and possible measurement of what is observed that forces the wave to assume, at that precise moment and only for the time of observation, a nature that is perceivable by our senses (as it makes it 'corpuscular'). This process of acquiring a corpuscular form is referred to by physicists as the 'collapse of the wave function' because it is only then that what we are observing ceases to exist in the form of wave energy and instead assumes a corpuscular nature.
2) The claims of quantum mechanics are never absolute: the equations (or formulae) of quantum mechanics lead to very precise values, but today we know that such values are expressed only in the form of the probability that the measurement of an observable will take them, and not that it will inevitably take them. This is because we are observers who do not know with certainty what we will measure, we can only know with a certain probability. The 'cause-effect' principle, in other words, no longer

has as close a bond as it had in classical mechanics: it does not give a certain knowledge of the measurement but only a certain probability of obtaining a certain value. They are therefore defined as 'irreducible': on the one hand, they do not claim to give definite answers to every question, but express the possible solutions only in terms of greater or lesser probability, and on the other hand, they do not take into account – taking it for granted – the possibility of our not knowing, or our only partial knowledge, of some hidden variable.[3] Consequently, Quantum Theory (at least in its 'official' version, the so-called 'Copenhagen interpretation') argues that predictions of measurement outcomes of conjugate variables can always be expressed *only* in terms of greater or lesser *probability* and solely based on the knowledge currently available to us.

As can easily be inferred at this point, from the moment they first appeared, all these considerations sparked an evident commotion among the physicists of the time. For example, the provocation framed by the question Albert Einstein asked Niels Bohr ("*Do you believe the moon is not there when you are not looking at it?*") is famous in this regard, precisely to refute the Copenhagen interpretation as proposed by the latter.

These different views and interpretations, however, for some decades, had had little or no effect on those who are often generally referred to as 'the man in the street', and only interested 'insiders'. Among the latter were not only theoretical and experimental physicists but also highly regarded intellectuals from other disciplines who, nonetheless, were interested in understanding whether the developments in physics at the time could have significant implications for their fields of study, even if those fields were distinct from physics itself.

Among these intellectuals, the distinguished Swiss psychiatrist and psychoanalyst Carl Gustav Jung (1875-1961) deserves special mention. His deep interest in the connection between individual histories and the history of the human community had always been a key focus of his research. His engagement with quantum mechanics was particularly driven by his professional and personal relationship with one of the figures who contributed most to its birth and development, the aforementioned Wolfgang Pauli (1900-1958), who was also awarded the Nobel Prize in Physics in 1945.

[3] Here, too, the discourse for those without precise knowledge of the subject should be more articulated; the Schrödinger equation describes the wave function in deterministic terms, the interpretation of it (due to Bohr and Heisenberg and accepted by the majority but not by all contemporary physicists) is given in probabilistic terms. This means that, for example, the contemporary knowledge of the position and velocity of a particle cannot be known exactly both, which introduces uncertainty in the sense that, by making a measure on these variables, the more precisely we know one, the less we know the other, being constrained by the limit of uncertainty that is, that their product cannot exceed the Planck constant $h/4$.

Pauli was certainly a precocious and brilliant scholar. In 1923, he was appointed as a private lecturer in Hamburg, and, as we have already mentioned, in 1924, he proposed a new quantum 'spin' number for electrons, and in 1925, he formulated what is now known as the *Pauli exclusion principle*, which was later refined and reformulated thanks to contributions from Goudsmit and Uhlenbeck. In the same year, using the *matrix mechanics* recently developed by Werner Heisenberg, Max Born, and Pascual Jordan, he was the first to derive the spectrum of the hydrogen atom.

In 1928 he was appointed professor of theoretical physics at the Swiss Federal Institute of Technology in Zurich and, based on conservation laws, in the so-called *beta decay* (that is, in the atomic process in which radioactive chemical elements transform into others with a different atomic number, emitting β radiation), he later predicted the existence of a peculiar particle (which Enrico Fermi named the '*neutrino*'), first announced in 1931 at a conference in Pasadena and later more specifically defined in 1933 with the calculation of its mass.

Despite these significant professional achievements, which undoubtedly establish Pauli as one of the foremost 'fathers' of Quantum Theory, he was a person of complex character and not always easy to approach. In 1927, in particular, a very unhappy period had begun for him on a personal level, with the suicide of his mother and the remarriage of his father (a Jewish doctor who converted to Catholicism who had left the profession to become a university professor of chemistry and physics) to a woman whom his son did not appreciate. Moreover, in 1929, he – who had been baptised in the Catholic rite by his father at birth – left the Roman Catholic Church and married a cabaret dancer, though he divorced her just a year later.

Although he regularly attended Blegdamsvej, the Copenhagen street where Bohr's Institute of Quantum Mechanics was located, Pauli spent most of his life in Zurich, where he continued to teach at the University of Zurich. And it was in Zurich, in 1932, that, having begun to drink excessively (probably also as a result of his first disastrous marriage), he sought the advice of the already renowned psychotherapist Carl Gustav Jung, who initially entrusted Pauli's therapy to one of his most brilliant collaborators, Erna Rosenbaum (Pauli reportedly recounted at least a thousand dreams during his analysis). Meanwhile, he maintained a relationship of mutual scientific collaboration with Jung.

In 1934, Pauli remarried, and this second marriage proved much more stable and fulfilling than his first. That same year, Jung himself took over Pauli's psychoanalytic therapy, and the two continued to correspond, developing the ideas that emerged from their discussions, until 1957 – the year before Pauli's death.

With Jung, Pauli began exploring the connection between depth psychology and quantum mechanics. Central to this exploration was the analogy between the Jungian concept of '*synchronicity*' and the quantum concept of '*entanglement*'.

From *Synchronicity* to *Entanglement*

Jung coined the term *synchronicity* between 1928 and 1930 "to describe circumstances that appear significantly related but lack a causal connection" (Kerr, 2013).

Originally, like most of the scientists of his time (generally materialist and positivist), Jung based his research methodology on the same three factors used in classical Newtonian physics, namely:

1) space;
2) time;
3) causality.

Then, with the advent of relativistic physics and the resulting new perspective in which space and time had to be considered jointly, leading to the inevitable transcendence of traditional forms of 'linear causality', the aforementioned three-element model (referred to in classical physics as the 'Triad') had already proven insufficient in the first two decades of the 20th century for addressing the new problems that contemporary studies sought to resolve. Jung, therefore, turned to the concept of *synchronicity* primarily to find the necessary explanatory elements for two ideas of which he was deeply convinced but that had not been sufficiently accepted by the international psychoanalytic community, particularly those aligned with Sigmund Freud. These two interconnected concepts are, in particular, 'archetypes' and the 'collective unconscious'.

By 'archetypes', a term he borrowed from Greek philosophy, particularly from Plato, Jung refers to specific mental content universal to all human beings. He places these archetypes in the deepest layer of the psyche, which he identifies as the 'collective unconscious', and considers them to be 'models of innate behaviour' for all people (Jung, 1947-1954, p. 185) and 'organizers of representations' (*idem*, p. 247). Jung wrote that such mental content "is created from the primordial material of revelation and represents the eternal experience of divinity, which has always evoked in humans a premonition of it, while at the same time shielding them from direct contact with it." (Jung, 1934-1954, p. 8), because "since the stars have fallen from the sky and our highest symbols have become pale, a secret life now dominates in the unconscious. This is why we have psychology today, why we speak of the unconscious" (*ibid.*, p. 22).

Jung's exploration of archetypes also aimed to provide the scientific community with insights into the deep connection between humans and religion, the beliefs and faiths intertwined with them, as well as the intangible realm of the transcendent and the absolute:

> "To the ephemeral world of our consciousness they communicate an unknown psychic life, belonging to a distant past; they communicate the spirit of our unknown ancestors, their way of thinking and feeling, their way of experiencing life and the

> world, men and gods. The existence of these archaic States supposedly constitutes the source of belief in reincarnation and belief in 'earlier lives'" (*idem*, p. 278).

Moreover, among Jung's long-standing interests, dating back to his youth, was the study of so-called paranormal phenomena. He first encountered these directly while analysing the case of a young cousin who was a medium. He always approached these fields of research with a rigorous scientific methodology. In his specialisation thesis in Psychiatry, he proposed for the first time a hypothesis that remains the most widely accepted today – namely, that in the trance state often achieved by psychics during occult sessions, one or more unconscious personalities emerge, that were already present within them (in the language of Jungian analytical psychology, this would be considered an 'external projection' of autonomous complexes already present in a person's unconscious. Through the attenuation of ordinary consciousness, which typically characterizes the trance state, these complexes can thus manifest more freely). Jung himself conducted several parapsychological experiments and became convinced that he possessed psychic abilities.

In 1897, at the age of 22, Jung delivered a lecture proposing the existence of a 'life force' – the soul – that extends beyond human consciousness, sparking a wealth of literature exploring phenomena such as materialisation, telekinesis, bilocation, telepathy, clairvoyance, and prophetic dreams.

Jung also became convinced that paranormal phenomena were indicators of the collective unconscious, just as dreams are signals of the individual unconscious. When he began a psychoanalytic exploration of himself – an approach that, much like it had been for his great mentor Sigmund Freud, became one of the fundamental foundations of his studies and research – he meticulously recorded his dreams and fantasies, illustrating them in what would later become his famous *Red Book*. He never published it, but his heirs eventually authorized its publication in 2008.

Thus, when Jung came into contact with Pauli, a mutual intellectual exchange began between them, leading to a unique joint study of a specific and, until then, largely obscure 'object of research', sometimes referred to today as 'The excluded fourth'. This term aptly represented, both in physics and in psychoanalysis, the missing 'fourth element' that could resolve lingering doubts about the validity of what had been understood, verified, and accepted by science up to that point, thereby completing the existing 'triad' in both disciplines.

In 1948, Jung came to the following conclusion:

> "After collecting psychological experiences from many individuals across different countries over the course of half a century, I am no longer certain […] that an exclusively psychological methodology and reflection can fully explain the phenomena in question. Not only do the findings of parapsychology support this, but my own theoretical reflections have also led me to certain postulates that intersect

> with the realm of atomic physics – specifically, the space-time continuum. This raises the problem of transpsychic reality, which serves as the direct foundation of the psyche" (Jung, 1920-1948).

Jung then gave this 'fourth element', which he had pursued for many years, the specific name of *synchronicity*. In particular, *synchronicity* represented for him a possible solution to this problem, at least from the perspective of psychoanalysis, as he believed it could serve as a highly explanatory tool, especially in relation to his concepts of 'archetypes' and the 'collective unconscious'. Moreover, in his vision of the human being, it could also represent a very useful key to interpreting what lies at the foundation of the entire social, emotional, psychological, and spiritual experience of all Humanity.

Jung meant by *synchronicity*, in this holistic interpretation, a temporal correlation that eludes any causal explanation between psychic, subjective events, and external, subjective facts: for him, it was a strictly scientific concept (and therefore with no direct derivation from the world of occultism and parapsychology). Any connection with events classifiable as 'paranormal' could, according to Jung, be only indirect, that is, based on the common derivation of both types of phenomena from a universal and harmonious 'whole' in which not only human beings but the entire physical reality surrounding us is embedded.

This conception of a cosmic and harmonious 'whole', moreover (which Jung had always shared not only with Western authors such as Leibniz, particularly through the construct of 'Pre-established Harmony' proposed by the latter, but also with the Eastern tradition of *I-Ching* and the main reference contents of the medieval alchemical world) was substantially compatible with another mysterious concept strictly belonging to quantum physics and more specifically within Pauli's domain of expertise – namely the concept of *entanglement*.

This term was introduced by the famous quantum scientist Erwin Schrödinger in his review of the paper by Einstein, Podolsky, and Rosen on the so-called *EPR paradox*, which in 1935 analysed its theoretical implications in an attempt to invalidate its scientific legitimacy, arguing that the phenomenon of *entanglement* could not exist as it was incompatible with the principle of localisation or, more precisely, with the principle of 'locality'. This principle states that the action of one body on another cannot occur 'magically' at a distance instantaneously, as was the case, for example, with gravitational action according to Newton's law. Instead, it requires a local interaction through some medium that transmits the action from one point to another – for instance, in electromagnetism, through electromagnetic waves, which in the 19th century were thought to be oscillations of a medium called the ether. After the Theory of Relativity, the ether is no longer mentioned, and instead, the concept of the 'field' is used. However, this concept must be

understood as a *sui generis* physical reality, as it is not directly detectable but only inferred based on the effects that are presumed to arise from its action.[4]

However, the EPR hypothesis was definitively disproven in 1964 by the Northern Irish physicist John Stewart Bell (1928-1990). Through the so-called Bell's Theorem, which he mathematically formulated, he demonstrated that if quantum mechanics is valid (and all physics experiments conducted for at least the past hundred years have so far not been able to prove otherwise), measurements performed on two particles will always be correlated, regardless of the distance separating them.[5]

According to some 'insiders', Wolfgang Pauli was not only a distinguished physicist (even Nobel Prize laureate) who certainly knew the theoretical value of the concept of 'entanglement', but (similarly to Carl Gustav Jung, at least in this respect), he was also a human being who had repeatedly experienced first-hand, throughout his life, the reality of 'temporal correlations that elude any causal explanation between psychic, subjective events and external occurrences'. This is what Jung meant by the concept of *synchronicity*, whereas quantum physics attributed it to the analogous concept of *entanglement*. For example, the renowned scientist and science communicator George Gamow discusses this in a tone that is also somewhat lighthearted and humorous, in his 1966 work *Thirty Years That Shook Physics*, already mentioned here.

> "Pauli began his scientific career at an early age, and at twenty-one he wrote a book on the Theory of Relativity which is still today (in the revised edition) one of the best books on the subject. He is renowned in physics for three reasons:
> 1. The *Pauli principle,* which he preferred to call the *exclusion principle.*
> 2. *Pauli's neutrino,* whose existence he hypothesised in the early 1920s and which eluded experimental verification for thirty years.
> 3. The *Pauli effect*, a mysterious phenomenon that has not been, and probably never will be, understood on a purely materialistic basis"[6] (Gamow, 1966, pp. 68-69).

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4 In a quantum reformulation (so-called quantum electrodynamics or QED) charged particles interact with 'virtual' photons. With regard to the gravitational field, the theory of general relativity deduces the existence of oscillations of space-time known as 'gravitational waves'; however, any attempt to give a convincing quantum version of the latter by introducing the 'gravitational field quantum' (called 'gravitons') has not yet been exhaustively made, despite many attempts so far.

5 In this regard, however, it must be stressed that two particles, in order to be 'intertwined' through an effective 'entanglement' process, must be generated together in an appropriate process, or otherwise have interacted for some time in order to become a kind of single entity represented by a single wave function that 'intertwines' them even if they are separated from each other light-years, so that the fate of one measurement on one affects the other.

6 The 'Pauli effect', of course, should not be placed among the scientific discoveries of this scientist, but refers to an anecdote relating to the character, which circulated among physicists and was frequently accompanied by an ironic smile: even though it appears

In light of our current knowledge, everything suggests that the 'mysterious phenomenon' Gamow refers to as the 'Pauli effect' is nothing more than an expression of the *synchronicity* that Jung (1980) regarded as a *principle of acausal connections*. Possible confirmation of this hypothesis can be found, for example, under the entry 'Pauli effect' in the Italian version of the online encyclopedia *Wikipedia*, where it is described with the following words:

"Pauli was a theoretical physicist, and following a series of unfortunate events that occurred from 1924, he was credited with spoiling any experiment with his presence." So, for fear of the 'Pauli effect', physicist Otto Stern warned Pauli not to enter his laboratory.

If it were real, the Pauli effect could be classified as a *macro-psychokinetic* phenomenon. Wolfgang Pauli, however, according to his biographer Enz, was convinced that the effect that bore his name was real. Markus Fierz, a colleague and collaborator, said:

> "Even specialists in experimental physics – objective and realistic people – shared the view that it was Pauli who emanated these strange effects. For example, it was believed that his mere presence in a laboratory caused numerous problems in conducting an experiment – let's say, it revealed the 'malice' of things. This was the *Pauli effect*. For this reason, his friend Otto Stern, famed 'artist of molecular beams', never let him enter his Institute. It's not a legend at all – I knew Stern as well as Pauli! Pauli himself believed in his effect. He told me that he sensed impending misfortunes as a feeling of unpleasant tension and that if the anticipated mishap actually occurred, he would feel strangely free and relieved. In short, the Pauli effect can be considered a synchronic phenomenon" (*Wikipedia*, the free encyclopedia, Pauli Effect, 2022).

Further significant indications of Pauli's unusual personal characteristics can also be found in various other texts. Among them, it seems appropriate to mention at least the recent book by physicist, Italian writer, actress, and science communicator Gabriella Greison, *Everything is Connected: Pauli, Jung, Quantum Physics, Synchronicity, Love, and Everything Else*, published by Mondadori in 2022. In this volume, the author – besides delving deeper into the specific theme of the personal and scientific relationship between Pauli and Jung – also seeks to highlight, particularly in light of the knowledge introduced by quantum physics, the reciprocal and multiple relationships between the concepts of *synchronicity,* mind, and *entanglement*.

The existence of quantum entanglement (also referred to as *quantum correlation* by some authors), following its theoretical proof by Bell, has been definitively proven on several occasions, starting with the experiment conducted between 1981 and 1982 by the French physicist Alain Aspect together

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permissible today, from an 'alternative' perspective compared to its traditional narrative, to seriously consider it as an indication of the presence of phenomena that are still not interpretable in a sufficiently shared manner.

with the two researchers of the Institute of Optics of the University of Paris, Jean Dalibard and Gérard Roger. This team of scientists, who in later years were awarded countless international awards, through the use of a series of sophisticated instruments, was able to observe the immediate inversion of the *spin* of an electron placed at a very great distance from the electron previously connected to it in the same quantum orbit (even though the two electrons had been physically separated and completely isolated) simply by reversing the *spin* of the latter through the action of powerful magnets. (The two electrons had therefore been initially connected; without this prior entanglement the phenomenon would not have been observed).

In this way, Aspect and his collaborators provided compelling evidence in favour of the reality of entanglement and the underlying Quantum Theory, thereby resolving a long-standing dispute. For more than half a century, this debate had prevented 'classical' physicists from acknowledging the possibility of distant interactions in quantum mechanics without the involvement of possible hidden or unknown local variables. Subsequent experiments conducted by various research *equipes* across Europe and beyond – including the Netherlands, Denmark, China, and Scotland – have repeatedly confirmed the now undeniable reality of distant interactions and quantum entanglement. These findings carry inevitable implications for our overall understanding of the universe in which we are immersed, extending to philosophical, psychological, and even psychotherapeutic perspectives.

For example, the renowned Italian physicist Franco Selleri (1936-2013) in his book *Paradoxes and Reality. Essay on the foundations of microphysics* reflected on the inevitable cultural consequences of the overall Quantum Theory and the repeated scientific proof of the existence of entanglement for our overall conception of the world:

> "Quantum mechanics is not philosophically neutral and … its mathematical structure, together with the rules that give empirical meaning to its symbols, cannot be compatible with the idea that atomic objects exist in space and time and that any two of them are practically independent of each other if separated by a great distance" (Selleri, 1987, p. 4).

The collaboration between Jung and Pauli ended in 1957. Jung was nearly eighty-two when he passed away, about a year before the untimely death of the discoverer of the *neutrino* on December 15, 1958, in a Zurich hospital where the renowned physicist was hospitalised. Their extensive correspondence, spanning from 1932 to 1957, was meticulously retrieved by the German psychoanalyst Carl Alfred Meier (1905-1995) and is now also available in Italian in the volume *Jung e Pauli. Il carteggio originale: l'incontro tra psiche e materia* published in 2022, edited by Antonio Sparzani and Anna Panepucci,

The dimension of the *Unknown* in psychology and psychotherapy

Even before Jung, through his long collaboration with physicist Pauli, attempted to scientifically address the questions raised by his direct experience with the *Unknown* and the immaterial, other important figures in psychology and psychoanalysis had already sought to look beyond the limits of our ordinary sensory perception.

For example, Sigmund Freud, in a way that, in my opinion, is similar to what William James had already pointed out on the matter (whom he also personally met in the USA in 1909, when accepting an invitation from Clark University Freud he traveled to the USA from Europe with Carl Gustav Jung, Sannor Ferenczi and Ernest Jones, some of his closest collaborators of that period) repeatedly emphasises in these writings the need to approach these phenomena maintaining a healthy interest in the new that can become the object of fruitful intellectual research and maintaining an extremely rigorous scientific method.

Freud's most accomplished position on these issues is probably what he expresses in his 1932 essay, *Lesson 30: Dream and Occultism,* contained in his broader text *Introduction to Psychoanalysis (New Series of Lessons)* (1932b) and expressed in the following words:

> "We must insist and not underestimate the precautionary and control measures with which we have recently begun to protect ourselves against the unreliability of mediums. Unfortunately, this modern security technique puts an end to any possibility of easy access to occultist observations. The study of occultism becomes a particular and difficult profession, an activity that cannot be exercised like any other activity. As long as the scholars who deal with it fail to draw their conclusions, we will remain at the mercy of doubt and subjective conjecture. The most likely of these conjectures is certainly that in the case of occultism, it is a real core of unknown facts, which deception and fantasy have wrapped in a blanket that is difficult to penetrate. But how, in what way, do we get close to this core, and at what point do we attack the problem? Here I think that dreams come to our aid, giving us an indication that in this case what matters is the theme of telepathy" (Freud, 1932b, pp. 149-150).

Marianna Bolko and Alberto Merini, in their work published firstly as Chapter 10, entitled *Sogno e telepatia: continuità e discontinuità della ricerca psicoanalitica (Dream and telepathy: Continuity and Discontinuity of Psychoanalytic Research)* in the volume, *Sogni, figli di un cervello ozioso (Dreams, Children of an Idle Brain)* edited by Marino Bosinelli and Piercarla Cicogna (and later republished in the column *Traces,* Volume 52, no 1, 2018, in the journal entitled *Psicoterapia e scienze umane [Psychotherapy and Human Sciences])* wonder whether the telepathic communications witnessed in four dreams cited by as many psychoanalysts, as

well as in other similar dreams reported in writings on telepathy found in Sigmund Freud's works *Psychoanalysis and Telepathy* (1921a) and *The Occult Meaning of Dreams* (1925), are due to a 'unidirectional communication' from the analyst to the patient or vice versa, or whether they should be considered as the product of a 'bidirectional communication' between the two protagonists of the psychoanalytic encounter. The authors appear decidedly and resolutely oriented toward this second possibility:

> "In case P. [one of the dreams reported by Freud, N.A.] Freud attributes the telepathic event to the patient's transference: the analyst is, so to speak, foreign to the event. This unidirectionality was questioned as early as 1933 […] This bidirectional hypothesis will be accepted, only many years later, in the transference-countertransference ratio and, more recently, in the projective identification-projective counter identification ratio" (Bolko and Merini, 1988, 1989).

The question then arises: to whom do these dreams properly belong? Is it legitimate to consider the telepathic message as the conscious, or even subliminal, perceptions that are part of the diurnal remnants *around* which the dreamer's unconscious material builds the dream? Or rather does the telepathic message *become* an *integral* part of the unconscious material itself?

Freud's articles *Psychoanalysis and Telepathy* (1921a) and, above all, *The Occult Meaning of Dreams* (1925) had already raised this issue: from the seer's ability to 'read' the repressed desire of the person consulting them, Freud moves to the general consideration that "an intense unconscious desire, along with the thoughts and notions derived from it" (Freud, 1921a, p. 357), as well as "memories endowed with a strong affective hue" (Freud, 1925, p. 164), can easily be transmitted (*ibid.*, 2018, p. 112).

Regarding this, Bolko and Merini conclude: "The problem of the transmission of mental contents can rightfully be definitively included among the categories of clinical psychoanalytic theory" (*ibid.*, p. 113).

Finding myself in complete agreement with this conclusion by Bolko and Merini, the following question immediately arises: given that, in an intense context of transference-countertransference, this phenomenon can frequently occur in a psychotherapeutic (and not only psychoanalytic) relationship and, albeit more rarely, within the emotional life of any human being, *how* does the telepathic phenomenon that Bolko and Merini define as a "passage of mental contents" actually take place? In my view, there are essentially two possible hypotheses in this regard: either it occurs through conscious or even subliminal 'physical' messages (for example, eye contact, body posture, vocal intonations, *etc.*), or one may resort, as an explanatory possibility, to the principle of 'non-locality', characteristic of entanglement, which is now widely accepted—at least in

its reality—by that branch of contemporary physics based on quantum mechanics.[7]

In attempting to address this dilemma, I must first make an important clarification. In the three-dimensional space in which human beings typically live and act – where the dimensional scales of objects range from centimeters to meters, or at most kilometers – the laws of Newtonian mechanics function sufficiently well, and quantum phenomena do not play a fundamentally interpretative role.

However, these phenomena – and the laws governing them – become crucial when dealing with extremely small physical dimensions, generally below 20 nanometers (or 20 billionths of a meter, since one nanometer equals one billionth of a meter), meaning 20 millionths of a millimeter.

Even though these measurements are so minimal as to almost entirely escape any possibility of mental representation, we must nonetheless be aware that in human body cells – including the neurons of the brain and the central and peripheral nervous system – there are at least two biological structures smaller than this scale, and we cannot rule out the possibility that they are the site of quantum phenomena; in other words, the '*microtubules*' and their fundamental building blocks, the '*tubulins*'.[8]

With this basic consideration, the answer to the above-mentioned question on how the telepathic phenomena reported by Bolko and Merini, as well as Sigmund Freud and various other well-known psychoanalysts occur in

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[7] It is worth reiterating, at this point, that entanglement is a phenomenon that concerns microphysics, not macrophysics (even the point of separation between these two areas of physics is still uncertain); how applicable this is to psychic reality is not an entirely trivial problem, and there has been much debate on this issue for a long time. What we can say about this at the moment is that:

1) in the microworld, seemingly anti-intuitive rules apply that make less surprising the exceptional nature of so-called paranormal phenomena;
2) there are also laudable attempts to give extensive versions of quantum physics that can at least partly justify such phenomena, and this is a feasible but very complex path that requires wider considerations and that cannot yet be taken for granted, also to avoid the risk of easy generalisations;
3) it should also be noted that the bizarre quantum rules also have a possible transcription in psychological and linguistic terms, regardless of physical entanglement, but this subject requires much broader treatment. For a first possible deepening of this theme see, for example, Teodorani, M.: Entanglement. The intertwining in the quantum world: From particles to consciousness, 2015.

[8] A hypothesis that was formulated years ago by Hameroff and Penrose, that of the so-called 'OCRH-OR model' (Orchestrated Objective Reduction), is mentioned here quickly. This is a hypothesis about the functioning of the mind whose central idea is that consciousness in the brain originates from a process that occurs within neurons, rather than in the interaction between them. This original theory will be taken up and better specified later within this same paper.

humans, and what biological structures may be involved, remains extremely open to both of the above hypotheses. On the one hand, it should be noted in this regard that none of the experiments on telepathy and ESP under conditions of maximum possible control of variables conducted for more than a century in specially equipped laboratories has ever experimentally confirmed the objective reality of telepathy, so this fact reinforces, in my opinion, the hypothesis that the phenomena considered telepathic that occurred and were amply described within the analyst-patient setting during multiple psychotherapy sessions could have been induced not by a distance transfer of thought but by other variables that were not opportunely controlled in the *psychoanalytic setting*.

On the other hand, however, to return to the more strictly psychoanalytic area, it is also true that in the period when Freud was professionally active, the advances of Quantum Theory had not yet spread and expanded to the point of providing a convincing scientific interpretative model for such 'psi phenomena'. This occurred later, after the death of the founder of Psychoanalysis (Freud died in London on the night of September 23, 1939) through the work of Jung, Pauli, and other psychotherapists, both Freudian and Jungian as well as those from other theoretical orientations, roughly from 1940 onward. This, thus reinforces the hypothesis that not only may telepathy actually exist, but that the *psychoanalytic setting* itself may facilitate its emergence, or, at the very least, its increased frequency, though not yet its control.

These subsequent developments in the relationship between physics and psychology advocated by Freud, however, were not realised only through the concepts of *synchronicity* and *entanglement* already highlighted above, but also, and perhaps most importantly in my opinion, through the use of the concept – typical of physics – of the *field*.

From the *field* of classical physics to the *psychological field theory* in psychotherapy

In physics, a *classical field* is a function of spatial coordinates and time. Some examples are the gravitational field of Newtonian theory and the electric field and magnetic field in classical electromagnetism as defined in the four fundamental *Maxwell Equations* (published by James Clerk Maxwell in 1865).

Each 'field', according to the classical physics setting, is characterised by a number (actually called a 'vector') that highlights the areas of space where a specific body can propagate within it.

A 'classical' field can be thought of as a set of numerical quantities assigned to each point in space that is variable in time and within which a body or mass can move freely: the value of each of these numerical quantities

determines the so-called *degrees of freedom* of the mass or body considered. In physics, the number of degrees of freedom of a point or material body is the number of independent variables needed to uniquely determine its position in space. For example:

- a mass lying on a plane and bound to an inextensible wire bound to a fixed point in the plane has 1 degree of freedom, because it can only move along a circumference;
- a pendulum, that is, a mass bound to an inextensible wire which is itself bound to a fixed point in space, has 2 degrees of freedom, because it can only move along the surface of a sphere;
- a two-dimensional rigid body on a plane has 3 degrees of freedom since it can shift along two reference directions and rotate about an axis perpendicular to the surface;
- a person, a human body, if not chained to a chair or locked in a cell, can move in any direction of the earth's surface and, through the use of special lifting machines such as flying vehicles, can ascend to the upper limits of the atmosphere and even beyond, in space: therefore, under normal conditions it has infinite degrees of freedom, whereas if it is locked in a cell it has only three degrees of freedom and if it is chained to a chair, practically zero.

In classical physics, therefore, the field is a representation of the situation of the degrees of freedom of a mass or body (including human bodies) at a specific time point.

The first scholar to systematically use the concept of *field* in psychology was probably, at least in Europe, German (later American) Kurt Lewin (1890-1947). His *Psychological Field Theory* was initially based on a model from classical physics, namely the Maxwell electromagnetic field (1860-70).

Lewin's field theory posits the existence of a psychological space where behaviours are always somehow originated from the individual's *life spaces*, the latter being formed – in turn – by the individuals themselves and the physical and human environments in which they live.

Lewin primarily argued that the individual's perception of themselves and the surrounding world is fundamental to defining human behaviour and that such perception is always influenced by the *field* in which the individual finds themselves. For Lewin, the *field* is defined as a totality of facts coexisting in their mutual interdependence; the field theory he proposed thus underlies a method of analysis and understanding of psychological phenomena, both individual and social, viewed in their interdependence.

According to this theory, every human individual exists within a *field* that represents the life space of the individual themselves, where the latter interacts with the social and environmental events surrounding them; in other words, each person is immersed in a field of forces acting simultaneously, pushing them in different directions. The *psychological field* presents

a set of interdependent facts (past, present, and future), that coexist, and can affect the individual, and which are: 1) the life space of the person; 2) the people who are present and act within that space; 3) the events that occur within that space.

Lewin also provided a mathematical formulation of his theory, through the equation:

$$C = f\,(P,A)$$

where *C* stands for behaviours, which are a function of the life spaces, in turn made up of people *P* and environments *A*.

The interaction between the individual and the environment thus determines, according to Lewin, the behaviour of people, and the behaviour, in turn, acts in their determination and characterisation. Every psychological field, according to Lewin, is also always, albeit to a different extent from one situation to another, an *interpersonal field*.

Moreover, according to Lewin, every 'Object' (by this term, I mean not only material things but primarily the individuals who are emotionally significant for each subject) has a positive or negative value for the subject itself. These values are psychological forces that push us in one direction rather than another: we are therefore attracted to people that we feel have forces and energies that we consider 'positive' for ourselves and our lives, and we tend to distance ourselves from those that we perceive as having energies that we subjectively consider 'negative' for ourselves and the people closest to us.

Kurt Lewin, among his many and varied perspectives, uses the analogy of the *field* which he applies in the same way with the classic concept of the *field* in physics (such as Maxwell's electromagnetism). Coming from Gestalt psychology and being particularly interested in social psychology, he found it useful to express the conception of social relations – through the famous formula $C = f\,(P,A)$ – as a system of interacting charged particles.

However, apart from this analogy, which Lewin developed in psychological terms and also applied in group psychology, his field theory (even in its later developments) does not seem particularly enlightening either with regard to parapsychological or quantum phenomena.

Lewin's field theory thus seeks to describe and understand human behaviour in relation to the situation in which it occurs. In contrast to what was primarily emphasised by original Freudian psychoanalysis, Lewin considers that the motives for a person's behaviour should not primarily be sought in their distant emotional past, but rather that current interrelationships between the person and the environment in which he or she lives should be examined first.

Today, this position is certainly not the most widely shared in the field of psychology and psychotherapy, but importance is often given to both childhood and current events, and the aspect chosen to focus on is based on the specific needs of the subject. However, the external environment, both natural

and human, having value, can always significantly influence the behaviour of the person who, within it, interacts with others.

Today, therefore, more than ever, as Arnold Mindell also notes in his book *Quantum Mind: The Edge Between Physics and Psychology*, "The human being needs to rediscover a genuine sense of reality, through a knowledge of oneself (experiencing one's unity, body-mind-emotion) that places one in a deep bond with nature, of which one is a part and with which one shares strength, energy, fragility, and delicacy". However, it must be specified in this regard that for Mindell, reality is not only that which is generally 'shared' by human beings as perceived by them through their sensory organs (and that Mindell labels with the acronym 'CR', denoting 'Consensus Reality'): but there is also another reality, no less important, which the author refers to with the acronym 'NCR' denoting 'Non-Consensus Reality'.

> "I would suggest introducing two new terms to distinguish and evaluate two fundamentally different realities: The consensus reality (CR), which has the general consensus; and the non-consensus reality (NCR), which has been neglected by the world's current scientific view. […] CR is impersonal, has a consensus and is considered fundamental in a given culture and time. The NCR is another reality, one that, in the CR's view, seems to be more 'individual', subjective, and less important; it has less consensus and less approval from the cultural mainstream. […] We must remember that consensus and non-consensus perceptions are not one more real than the other. […] neither of the two realities, CR or CNR, is absolute" (Mindell, op. cit., pp. 21-22).

Mindell continues:

> "Before the sixteenth century, physics and psychology were one and the same 'science': Alchemy. […] Native peoples have always associated with each other the fields of psychology, physics, work in groups and with the body, in shamanism or in what some now call indigenous science. […] Through shamanism, or popular wisdom, psychology and physics were one indigenous science" (*idem*, pp. 22-23).

The author concludes in this regard:

> "Physics traditionally focuses primarily on CR and real numbers as it defines itself as the study of shared perceptions. However, this definition is self-limiting and inadvertently overlooks the importance of psychological experience. Physics tends to avoid studying non-consensual aspects of observation, such as the personality of the observer and the feelings evoked by the observed object. Physics, in exchange for CR, loses track of its mathematics, its real numbers, its wave function, and the realm of dreams. However, the dream world is not lost. Traditional shamanism and psychology begin where physics ends" (*ibid*., p. 103).

Moreover, since an individual's social environment is often shaped by specific groups (*e.g.*, family, circle of friends, *etc.*), in addition to the *individual*

psychological field and the *interpersonal field* where the individual interacts as an independent subject within their environment, Lewin emphasises the significance of the so-called *social field*, which encompasses each group and its environment. He makes the point and repeatedly highlights that a group is always more than just the sum of its parts.

This latter rule, highlighted by Lewin, is of central importance to the subject we are discussing here, because it also applies to every psychotherapeutic group, whether it is one consisting of two or more people within a specific couple or group therapy setting or one consisting of the patient-therapist couple, typical of individual psychotherapy. In the context of the current psychological and psychotherapeutic work, both the psychodynamic/psychoanalytic fields (which both the Freudian and Jungian schools refer to as an example) and the Gestalt/phenomenological fields of which Lewin was one of the leading exponents, there is usually a tendency to distinguish three different fields of action: the *individual* one, the *couple* one and the *group* one. In all three of these areas, the concept of the '*field*' is now regarded as fundamental, and it is also present – after Lewin's initial contribution – in the philosophical writings, also of a purely phenomenological nature, of Maurice Merleau-Ponty.

A further particularly significant impetus to the use of this construct in psychotherapy was given in the early 1960s by the publication of Willy and Madeleine Baranger (at the time both didactic psychoanalysts, members of the Argentine Psychoanalytic Society) of a text that specifically introduced the concept of 'analytical field', that is, a dynamic field that characterises the analytical situation as one in which two persons are deeply connected and complementary so that one member of the couple cannot be understood without the other. By combining the concept of field (derived from phenomenology, in particular from Merleau-Ponty) with some 'defense mechanisms' introduced by the Kleinian approach, Willy and Madeleine Baranger further clarify the situation of the analysis by describing it as a 'bipersonal field', that is, a real dynamic structure resulting from the encounter of the two mental lives and the 'crossed projective identifications' that develop between analyst and patient.

Particularly evident in this regard is the strong analogy between the description of the unconscious functioning of the 'analytical bipersonal field' proposed by the Baranger spouses in their text and the interpretation of unconscious interpersonal dynamics described by Bolko and Merini in their aforementioned paper on telepathic phenomena observed during various psychoanalytic therapies. These latter two authors explicitly relate them to the 'transference-countertransference relationship' between patient and analyst and, even more specifically, to the 'projective identification-counterprojective identification relationship' (Bolko and Merini, 2018, p. 112).

These particular archaic and early 'defense mechanisms', not yet present in Freud's texts, first appeared in the psychoanalytic writings of Edward Weiss (1925) and Marjorie Brierley (1945), but attracted particular interest

among psychoanalysts after being described in Melanie Klein's work *Notes on Some Schizoid Mechanisms* (1946). Since there are various types of descriptions of these defense mechanisms in the literature, and some of them can only be clearly understood if properly linked to others, we will consider them here as follows:

1. *Introjection*: extremely early mental functioning mechanism, already present in very young children. It is also called *incorporation* because, in psychoanalysis, it denotes the unconscious incorporation into the individual's own ego structure, values, attitudes, and qualities. In other words, it is the mechanism by which we internalise both the desirable and undesirable aspects of the outside world – the former to assimilate and possess them, and the latter to neutralise them by making them disappear within oneself.
2. *Projection*: the attribution to another person – generally experienced unconsciously as negative – of those characteristics that are instead present in one's *ego* structure.
3. *Splitting:* the tendency of the subject, by inclination or necessity, to make a sharp division of external objects into 'all good' or 'all bad'.
4. *Identification*: when one takes on the traits and aspects of another person.
5. *Projective identification*: this consists of the combined action of two of the mechanisms described above (*projection* and *introjection*), integrated with the action of *splitting*. Split parts of the subject are projected into the object, and the subject identifies with them by reintrojecting them.
6. *Introjective identification*: this also consists of the combined action of the two mechanisms of projection and introjection, supplemented by the action of *splitting*, but in a manner opposite to what occurs in projective identification. Split parts of the object are introjected by the subject, who can then project outward their own corresponding parts.
7. *Projective counter-identification*: "the concept of 'projective counter-identification' introduced by Grinberg refers to the analyst's response to excessive use of projective identification, often by patients who, as children, were subject to heavy parental projections" (Zuccarino, 2015).

The inescapable connection between the defensive mechanisms illustrated here and the concept of the field could be even more evident through the use of the concept of 'complementarity' that Arnold Mindell speaks of in his book *Quantum Mind. The Quantum mind at the border between physics and psychology* (2017). The author says:

> "The uncertainty principle of physics states that we cannot know all the details of the state of a system: we can accurately measure the amount of motion of a particle, but the energy required to make the measurement disturbs the particle by changing its position in space. […] In short, the more precisely we know position *x* and the less we know the amount of motion *p*. Conversely, the more precisely we know the amount of motion *p* and the less we know about the position *x*" (Mindell, op. cit., p. 194).

Mindell also points out:

> "Niels Bohr, observing the principle of uncertainty, realised the existence of a second principle, which he called the principle of 'complementarity'. Bohr realised that *p* and *x* were two 'complementary variables' […] in the sense that if you have a lot of information about one of the two you know little about the other. It is like a seesaw swing: if one goes up, the other goes down" (*idem*, p. 195).

Related to this, Mindell also observes, returning to the fundamental concepts of quantum physics to enhance our understanding of what typically occurs within a 'psychotherapeutic field' that is complementarily created between the therapist and the patient: "Pauli further extended Bohr's principle of complementarity by adding other types of complementary variables, such as the magnetic field and the electric field, and the tools needed to measure them. Object and observer are complementary".

Even in psychology as in physics therefore, Mindell seems to conclude, "one can make assumptions and perform measurements in CR, but the more one does, the less one remains in contact with CNR, and the experience of the flow of what is being measured. My formulation of the uncertainty principle is that CR and CNR are complementary. We could also say that the more you focus on consensual reality, the less you are in contact with the dream process; the more you focus on the dream, the less you know about CR. This lack of contact with one of the two aspects of reality makes us feel uncertain" (*ibid.*, p. 197).

In light of all these considerations, as well as what we have seen so far of the contributions of Bolko and Merini, Jung, Freud and the various other authors mentioned above, it does not appear to the writer to be excessive to consider the hypothesis that, in a particularly intense emotional context such as that which can certainly occur between analyst and patient within a psychotherapeutic relationship, crossed actions of unconscious and archaic mental mechanisms may be established, involving, on a physiological level, human cellular structures – neuronal and possibly others – such as microtubules and tubulins (structures, as previously mentioned, having physical dimensions very close to those of atoms and therefore subject to the laws of quantum mechanics rather than Newtonian mechanics) able to activate quantum entanglement phenomena capable of establishing a 'remote' 'instantaneous', and 'acausal' psychic communication between the two individuals involved, exhibiting all the characteristics of phenomena that can be considered 'telepathic'.

This hypothesis, moreover, could find its theoretical framework even within that branch of quantum mechanics that, from Dirac onwards, has been specifically dedicated to the study of those particular types of fields that (unlike the 'classical' electromagnetic fields) are known by contemporary

scholars as *quantum fields* (Italian has two terms for quantum fields: *campi quantistici* and *campi quantici)*, since they no longer adhere to the spatiotemporal limits imposed on physical phenomena by the traditional laws established by Newton, Maxwell, and other scientists of their time or immediately thereafter. Instead, they operate within the new spatiotemporal horizons, where Einstein's General Theory of Relativity and the original Quantum Theory of Bohr, Heisenberg, Schrödinger, Dirac, Pauli, and many others are currently in a phase of mutual integration.

And it is precisely because, at the current state of our knowledge – though with a clear and fundamental distinction from the previous theories on electric and magnetic fields – *Quantum Field Theory* does not impose *a priori* restrictions on the number of dimensions or the geometry of spacetime. As a result, it may offer a convincing and shared scientific explanation for the psychophysiological mechanisms implicated in apparently illogical and inexplicable phenomena that psychoanalysts have been observing empirically for at least a decade.

One could then speak, provided this was indeed the case, of a true 'quantum psychotherapy', which could review existing methodologies and techniques to deepen our understanding of their mechanisms and specific areas of application. It might also equip practitioners with new instruments capable of further optimizing potential outcomes.

The scientific instrument so far judged most significant in this regard appears to be, according to many authors (Andrzej Brodziak, William Bishop, Vincenzo Fanelli, Giuseppe Fulco, Arnold Mindell, Małgorzata MUC-Wierzgoń and Alicja Różyk-Myrta, to name but a few), the *Penrose-Hameroff hypothesis* on quantum effects in neurobiology, also called *Orchestrated Objective Reduction* (Orch-OR), already mentioned briefly above. It is a theory advanced some decades ago by the British physicist Roger Penrose (who, with the well-known cosmologist and astrophysicist Stephen Hawking won the Wolf Prize for Physics in 1988, and then the Nobel Prize for Physics in 2020) and the American physician Stuart Hameroff, who hypothesised that some typical phenomena of quantum mechanics (in particular *wave function collapse* and *entanglement*) influence the neurochemical processes that generate human consciousness "through a process occuring *within* neurons, rather than in interactions *between* them" (Segre, 2019).

According to Roger Penrose and Stuart Hameroff's 'Orch-OR' hypothesis, consciousness is, in essence, 'emerging property' due to the quantum effects present within neurons and in particular microtubules (for details see: 'Roger Penrose' and 'Stuart Hameroff', in *Wikipedia*). Specifically, in presenting this theory, Penrose and Hameroff suggested that quantum vibrational calculations in microtubules were 'orchestrated' ('Orch') by synaptic inputs and memory stored in microtubules, and terminated according to Penrose with 'objective reduction' ('OR'), hence 'Orch-OR'. Microtubules are the

main components of the structural skeleton of the cell, of such a size that they are not subject to the laws of Newtonian mechanics but to those of quantum mechanics.

Furthermore, in his book *The Emperor's New Mind* (1989), Penrose put forward the hypothesis that the human brain operates through 'non-algorithmic functions' and that, consequently, its processes and activities are 'non-formalizable' and 'non-computable' (and therefore 'not reproducible through computing'). He also presented some of his hypotheses regarding the quantum effects of gravity, particularly concerning the phenomenon of so-called *state superposition* (Segre, 2019, cit.; 'Orch-Or,' in *Wikipedia*).

Thus, after discussing with Hameroff the physical processes inherent in the functioning of neurons, in the book *Shadows of the Mind* (1994), Penrose himself took up these themes adding that in his view it may be possible that quantum effects play an important role in neurochemical processes, since the superimposed states between electrons (according to his view of quantum gravity) are associated with a relative curvature of space-time and when the reciprocal distance exceeds the 'Planck length' (the measure of the radius of the horizon that defines the maximum possible energy for a photon before it 'collapses' into mass, which corresponds to less than 200 micrometers – specifically $1.616 \times 10-35$m – and is 10^{-20} times smaller than a proton), they begin to collapse (Segre, 2019, cit.). It is important to note that, according to various current interpretations of Quantum Theory, it is precisely at dimensions smaller than approximately 200 micrometers that the laws of Newtonian mechanics lose their applicability and must be replaced by those of quantum mechanics.

Hameroff also proposed, in this regard, that these processes could occur in microtubules composed of tubulin protein subunits, in particular in the non-polar regions of these, consisting of 8 tryptophans each (which therefore may contain 'π-binding electrons'. For further information on this topic see: 'π-binding' in *Wikipedia*) and, thus, in his opinion, close enough to become *entangled*.

The Orch-OR hypothesis faced sharp criticism from the outset, as the brain was initially thought to be too 'hot, humid, and noisy' for the quantum processes involved. However, later studies have explored, albeit with mixed conclusions, the possibility of quantum phenomena occurring both within the human brain (for example, in our sense of smell and in neuron microtubules) and in other living organisms, such as birds and plants.

Particularly relevant in this regard is certainly the contribution of the Swedish cosmologist and naturalised American Max Tegmark, who – in a paper published in 2000 in the journal *Physical Review* – hypothesised that microtubules constitute brain structures complex enough to contain 'self-conscious substructures' ('SASs', acronym for 'self-aware substructures') that can perceive themselves as existing in a real physical world. This idea was

supported by the author in his book *The Mathematical Universe,* in which he also formulated a theory whose fundamental postulate is that '*all structures that exist mathematically also exist physically*' ('Max Tegmark' in *Wikipedia*).

Furthermore, in the context of this debate, Tegmark "pointed out to Penrose that the time of *decoherence* (*i.e.*, the transition from the superposition of wave function states to a statistical mixture, which always occurs within a characteristic time variation that allows it to desynchronise) is much shorter than the time it takes for neuronal processes to interact within the microtubules" (Aureus, 2018). Especially in this respect, Tegmark strongly criticised Penrose's theory, arguing that the time scale for the activation and excitation of a neuron in the microtubules is actually much slower than the decoherence time, by a factor that he calculates could be as much as 10,000,000,000 times slower.

Silvia Di Stefano, in her article *Il Gatto di Schrödinger – Schrödinger*'s *Cat* (2020), specifies:

> "*Decoherence* is the dispersion into the environment of the quantum nature of the original particle. The 'piece' that allows the transition from quantum to classical is called *decoherence* and has to do with *entanglement*. When an object exists in a superposition of states, that superposition spreads as the object interacts with its environment and becomes increasingly *entangled* with it. But if you want to observe the superposition, you need to account for the quantum behaviour of all the *entangled* particles. This quickly becomes impossible, in much the same way that it becomes impossible to trace all atoms in a drop of ink as it spreads into a pool. Through its interaction with the environment, the quantum nature of the original particle is dispersed. This is *decoherence*."

Thus, it would be precisely the extreme speed at which the phenomenon of decoherence occurs within individual neurons, according to the 'Orch-OR' hypothesis, that makes it possible to activate in humans phenomena that seem to be inexplicable by the laws of traditional physics but are instead based on those of quantum mechanics, and at the same time, are generally uncontrollable by the action of individual will.

Following the debate generated by all these contributions, neither Penrose, nor Tegmark, nor Hameroff were able to propose a theory capable of unifying them, so "Hameroff decided to go ahead alone, planning to write a book entitled *Quantum Soul*, in which he specified, however, that Professor Penrose dissociated himself from the content presented in it" (Aureus, 2018, cit.). In fact, to this day, Hameroff has not yet published a complete book entitled *Quantum Soul'*, but only a chapter (written together with Deepak Chopra, entitled *The 'Quantum Soul': A Scientific Hypothesis)* in the volume edited by Alexander Moreira-Almeida and Franklin Santana Santos, *Exploring Frontiers of the Mind-Brain Relationship (Mindfulness in Behavioural Health)*. However, it appears that he has not completely ended his scientific

collaboration with Penrose, with whom, in 2014 he published a paper entitled *Reply to Seven Commentaries on "Consciousness in the Universe: Review of the 'Orch-OR' Theory"*.

Despite this still incomplete attempt at revision, the 'Orch-OR' hypothesis is considered scientifically acceptable by most of the scientific community today as it seems to be 'verifiable' (or, possibly, 'falsifiable'), "however, it presents some ambiguities in its theoretical formulation: unproven concepts of quantum gravity are used (at present, no theory unifying general relativity with the quantum mechanics of the Standard Model has been experimentally verified) and even assuming they were effective, such mechanisms would still not be relevant on the scale of magnitude of classical mechanics, especially given the high temperatures that define neurochemical processes" (comment by Thomas Aureus, 2018).

For all these reasons, the hypothesis of a quantum basis for mental functioning – and consequently the theoretical development of a true scientifically-based 'quantum psychotherapy' – is a fascinating prospect, but it has not yet been concretely established, except as a framework for further exploration and research. However, the general notion that the psychotherapeutic *setting* is a context in which psychic and relational phenomena may certainly arise – phenomena that are not always explainable within the bounds of generally accepted and shared scientific notions – should not, for this reason, be disregarded, minimised, or even denied. On the contrary, every psychotherapist should be able to recognise, assess, and, if necessary, utilise these phenomena in relation to the goals of psychological well-being and personal growth that every truly psychotherapeutic process must always aim to achieve.

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