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Ideas About a New Psychophysiology of Consciousness: The Syntergic Theory

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Series of ideas are presented about a new psychophysiology of consciousness called "The syntergic theory." The theory postulates that the human brain is able to create a hypercomplex field of interactions that are the result of the activation of all its neuronal elements. This interaction matrix is called the "neuronal field." One of the effects of its activation is the unification of neuronal activity. It is postulated that the neuronal field produces a distortion in the basic space–time structure and the reality of our percepts is the perception of this distortion. For the neuronal field to be activated a structure as complex as the brain is needed. This field is responsible for the interactions between brains produced in emphatic non-verbal communication. Consciousness is closely connected to the neuronal field. The postulates discussed are supported by the evidence from psychophysiology and the new physics.

I shall not attempt to offer a definition of consciousness here, but I will explain what I mean when I refer to a conscious experience and especially when I try to reflect on its quality. The question about the quality of conscious experience is not new and has perhaps been most clearly expressed by Dunne (1927) who criticized the attempts by physicists to explain qualitative experience. Dunne questioned how a physicist could explain the experience of light to a person blind from birth or that of sound to a congenitally deaf

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person. According to Dunne, the attempt was bound to fail since the quality of experience can only be accepted to exist when it is "felt" directly by its physiological correlates. In other words, the quality of light or sound cannot be found in the electromagnetic waves of photons that carry the information from the star, neither can it be found in the membrane of action potentials, nor in the potentials evoked by the brain nor in any neuronal pattern. The experience of light is exclusive to sentient beings and not to an energy structure, no matter how sophisticated it may be. In this way, when we see the countryside, all its colours, textures and ideas we experience as such *only* when a sentient being interacts with the structure and its characteristics. This means that the quality of experience appears when sentient beings appear in the universe and so it is we ourselves or rather some mysterious condition that we all share which is responsible for the quality of experience. This condition is none other than what we know as consciousness.

When a neurophysiologist tries to discover at which level of brain activity the conscious quality of experience appears, the need arises to postulate an anatomical location for it. Müller (1842) postulated that the quality of experience depended on the final place of activation (the cortical zone) to which a sensitive nerve was connected. However, this idea, known as the Müller doctrine, does not explain the different processes that occur in the final place of activation that make us experience sound as sound and light as light. Neither does it clearly identify the final place of activation in the brain. In the case of light, this place would seem to be the primary visual cortex or area 17 of Brodmann which, when stimulated, activates the appearance of phosphones. However, there are more than twenty visual zones in the human cortex (Kaas, 1989). Which one of them is the final place of activation?

The processes that take place in the primary visual cortex have neuro-electric, biomechanical and even electromagnetic characteristics but do not have the quality of light as we experience it. The same can be said of the "final place of activation" related to the quality of sound, the temporal cortex. It is also possible to record neuro-electric changes there (similar to those in the visual cortex) as well as biomechanical transformations etc. — but sounds as such are never found in this cortex.

The most recent studies about the primary visual cortex show, however, that the geometrical shape of a retinal representation is isomorphic with the cortical pattern activated in such a way that the shape or the geometry can be easily explained. Schwartz (1985), and Schwartz, Merker, Wolfson, and Shaw (1988), using computational neuroanatomy techniques, have been able to reproduce the cortical representation of an external stimulus. In Schwartz's studies (personal communication, June 1992), a curarized monkey is presented with a stimulus consisting of a group of concentric circles and convergent lines for a period of twenty minutes after having been injected with radioactive oxyglucose. At the end of the presentation, the animal is sacrificed, its brain frozen and histological cuts are subsequently made in its visual cortex and then coded. The cuts were used to obtain auto-radiographic impressions, and by means of computational techniques the cortical surface was reproduced. An image of the same concentric circles and lines originally represented was thus obtained. The representation of the outside world involves the simultaneous activation of huge populations of neurons with a particular pattern. The sentient being perceives this hypercomplex activation pattern as if it were located in the outside world, but perception is really internal, and the resulting representation can be subjected to analysis. With regard to this last point, Grinberg–Zilberbaum and John (1981) have shown that the geometrical representation of a stimulus is coded in the occipital cortex, but the analysis of its meaning is performed in another part of the brain: the parieto-occipital cortex.

Of course, these studies do not solve the problem of the quality of conscious experience as posed above; neither do they say anything about the identity of the one who perceives. They say only that shape is represented isomorphically in huge neuronal populations and that this representation is analyzed. Different opinions exist as to how that analysis is carried out. For example, Pribram (1991) states that the brain has the capacity to perform Fourier analyses of the representations and that these explain the objectal invariance. Grinberg–Zylberbaum (1976) postulates that the analysis must imply the extraction of common patterns from a convergent coding in such a way that the cerebral system "decants" neuroalgorithms that represent (in a concentrated way in neuronal populations) the disperse, patterned activation of a large number of neurons. This idea has anatomical bases since a convergence analysis of this kind is carried out in the retinal circuits and possibly also in the cortex (Hubel and Wiesel, 1968).

Another possibility is that the representation itself — or rather the appearance of massive activity patterns in huge neuronal populations — is responsible for the conscious quality. In other words, the resultant pattern activation has the form of the resonant, autoreferential fields. John (1988) calls this type of massive self-coding activation the hyperneuron. A similar idea, discussed below, is the neuronal field postulated by Grinberg– Zylberbaum (1988). The idea of the neuronal field is that the result of the interactions between all neuronal elements in a living brain creates a hypercomplex field of interactions responsible for the unification of all brain activity. This field of interactions (neuronal field) includes in its macro structure the isomorphic representations described by Schwartz (1985).

Ideas about the Structure of Space

Schwartz's isomorphic neuronal representations, John's hyperneuron, Grinberg–Zylberbaum's neuronal field or any other brain pattern activated in the presence of a stimulus, appear when the nervous system interacts with the information contained in the pre-reflective structure of space. In the case of the visual image, the structure that interacts with the retina and from which the visual image is created contains neither objects nor space; nevertheless, space and objects are perceived as information. Thus, the original structure that interacts with the retina is pre-spacial.

The Syntergic Theory

In order to properly understand the syntergic theory, it is essential to understand the pre-space structure. I shall, therefore, present it here with the help of the phenomenology of visual perception.

The most striking characteristic of space is that it is perceived as a transparent (invisible) extension, even though it contains immense amounts of information in each of its parts. Transparency seems to be more a product of the brain's incapacity to decode information than a characteristic of space itself. The pre-space structure that is perceived as space has an organization that goes beyond (in complexity) the brain's neuroalgorithmic capacity. We are only able to decode information that our brain can neuroalgorthmize. The retina interacts with the pre-space structure and, as a result, the rest of the nervous system activates an image full of objects, space, colours, textures and a virtually infinite number of details. Our retina does not come directly into contact with the objects but with the information about them that is contained in the pre-space structure. Thus, one of the characteristics of the pre-space structure is the complexity and convergence of its information. If one night we see the firmament full of stars through a small hole in a piece of paper, the retina decodes the pre-space of the hole in which the information about the starry sky is inscribed. Constellations and clusters of stars separated by thousands and millions of light years converge on the area of "our" tiny hole. This convergent structure is continuous and can be found represented in all portions of the pre-space structure. The test of the absence of discontinuity in this structure is that wherever we move our hole in the paper, we shall go on seeing the starry sky. This means that all points of the pre-space structure concentrate information and that the structure that sustains this concentration must therefore be convergent in all its portions.

As to the quantity of information concentrated by each portion of the pre-space structure, we know nothing, but we do know that if we place a highly powerful telescope in any part of it, we will be able to see objects situated enormous distances away. Here, too, what we see are not objects but rather the information about them that interacts with the surface of the telescope's mirror, that is, with the same portion in which we can place our hole in the paper. Using a good telescope with impeccable optics and sufficient amplification, we could see the whole universe from the information concentrated and contained in one of its points. Therefore, one of the first characteristics of the pre-space structure is its capacity to contain all information in each point.

The second characteristic of the pre-space structure is that all its points or portions are interconnected one with the other. An example of this interconnectivity is the observation of an object in movement from a given location. Let us suppose that while we look at a mountainous countryside, we can make out an eagle in full flight. The fact that we can see at a distance obviously means that the area taken up by the eagle and that taken up by our retina are interconnected. If we then change places and can still see the eagle in flight, this means that the new portion is also interconnected. No matter where we move or how many times the eagle changes its position we shall still be able to see it. Therefore, all points in the pre-space structure are interconnected one to the other by means of a structure that must be able to attain total interconnection among all its parts. The informational convergence and spatial interconnectivity explain another fact: what happens in one portion affects the whole pre-space structure. Let us suppose that an astronaut is traveling toward Jupiter while I am writing this text. With an adequate telescope, the astronaut could see the movements of my fingers on the typewriter keys in my study in the small Mexican village where I live. My actions affect the location in which the astronaut is moving and the astronaut's actions affect my location. An observer on Pluto could see both of us. Thus what happens in one portion of the pre-space structure modifies the structure in each and every one of its points.

The following characteristic of the pre-space structure is more difficult to understand and to explain. It refers to the changes of informational coherence in the different areas of pre-space depending on the distribution of massive objects in these areas.

Let us suppose that we are traveling by night through a desert lit by the light of a full moon. Let us also suppose that the car we are traveling in is moving in a straight line at a 100 km an hour and that we can see the moon through the car window. We perceive a moon that is motionless or that "follows" our movement. The explanation of this is that at the distance between the moon and ourselves, the informational representations of the moon at each point of the pre-space structure we transect, are very similar. In other words, the informational representation of the moon in each successive portion of the pre-space in interaction with the retina is one of high coherence.

On the other hand, the desert sand beside the road (to our perception) is not constant. Again, this fact can only be explained if we consider that the informational coherence of the objects represented in the pre-space structure is minimal if the distance that separates the observer from the object is small. Thus in a part of space a long way away from any object, the coherence of the information contained in each point of the pre-space structure will be high; and in a section near objects, coherence will be low.

These last considerations bring to mind the postulates of the general theory of relativity about curvatures and distortions in the geometry of space in the proximity of massive objects. According to Einstein, these curvatures are tensional and appear as gravitational forces. Something similar occurs from the perspective I am discussing related to informational coherence: in a high coherence pre-space structure there is no gravity, while on the other hand, a low coherence pre-space structure is a distorted space full of gravitational changes. Furthermore, a high coherence pre-space structure is invisible space. Only when coherence decreases to a certain threshold (which no one has measured) can we observe objects and shapes as if they were the cerebrally decoded manifestation of an accessible pattern.

All the characteristics of the pre-space structure mentioned form part of an organization I have called "syntergic organization" (Grinberg–Zylberbaum, 1994; Grinberg–Zylberbaum, Attie, Cerezo, Schettino, Pérez, and Meraz, 1995). The term "syntergic" is a neologism derived from the words synthesis and energy. A pre-space structure with high coherence, a high degree of informational density and prominent interconnectivity in which there are no massive objects is a high syntergic pre-space. On the other hand, a pre-space structure with low coherence is a structure with decreased syntergy.

In conclusion, pre-space has a structure characterized by an enormous capacity to concentrate information in each of its points, a high degree of interconnectivity and a different degree of coherence. A high syntergic pre-space structure is perceived as space while a low syntergic pre-space is perceived as objects.

Ideas about the Neuronal Field

This century has been witness to a struggle between two positions found in the fields of neuro and psychophysiology: one can be called the elementarist or localizationist position (see for example, Hubel and Wiesel, 1968; Konorski, 1967; Mountcastle, 1957) versus the Gestaltist or statistics position (for example, John, 1972; Lashley, 1950; Lashley, Chow, and Semmens, 1951). I do not have enough space to trace a complete history of the magnificent confrontation between these two positions yet I cannot resist the temptation of presenting ideas on the subject. The elementarist position states that both external reality and the way in which the brain decodes it are based on the existence of separate objects that are independent both from one another and from the cerebral structure and neurons. In the field of perception, the most renowned proponents of this point of view are Hubel and Wiesel (1962, 1968) who, in an extraordinary series of experiments performed on cats and monkeys, located cells that could respond to specific stimuli. Hubel and Wiesel assumed that the visual image is built upon an assembly of features, each of which is recognized by unique cells. In the field of conscious perception, Konorski (1967) affirmed that the unified, conscious perception of an image is the result of the activation of a unique grandmother cell which receives highly convergent information from all the neuronal elements responsible for decoding the particular features of the image (see also Barlow, 1972).

In opposition to this position, Lashley (1950) spent half his life trying to locate the memory engram in one zone of the brain and instead came to the conclusion that memory is globally distributed, as expressed in his famous "law of mass action." Lashley, Chow, and Semmens (1951) were the first to mention the idea that information in the brain related to the appearance of energy fields. Along with Köhler and Held (1949), Köhler and O'Connell (1957) and Wertheimer (1912), Lashley was one of the founders of the Gestalt school and also a teacher of Karl Pribram, and indirectly of E. Roy John, the most important spokespersons of the neo-Gestaltist trend. In his book *Brain and Perception*, Pribram (1991) claims that perception is performed when the brain activates interference patterns between wave fronts produced by the setting in motion of millions of dendritic micropotentials brought together in huge neuronal populations and never as the result of the activation of grandmother neurons. That is, the coding processes involve the joint activity of the whole brain, and as Pribram's holonomic theory is described in this book, he leaves no doubt as to his position.

John (1972) has proposed a statistical theory of learning and memory in which he discusses the impossibility of unique neurons being responsible for coding processes and instead takes the position that gigantic populations of neurons decode by activating combined patterns. I have mentioned that John also proposes the existence of the hyperneuron which can be interpreted as similar to a self-referential global field. Grinberg–Zylberbaum's idea of the neuronal field derives from John's concept of the hyperneuron and is an extension of the same.

The hypothesis of the neuronal field states that each time a neuron changes its membrane potential or an axon activates a potential, there is a microdistortion in the syntergic pre-space structure. The interactions between all these microdistortions provoked by the neuronal changes create a hypercomplex macrodistortion in the pre-space structure. This macrodistortion is the neuronal field which unifies all brain activity in the dimension of the pre-space structure. This could solve one of the most intriguing problems of conscious experience: its unity. For example: How do we perceive a unifying visual image when we view a landscape and when at least twenty different regions of the brain (Kaas, 1989) are activated in the process? The question of what (or who) unifies all representations must involve the activation of a field of interactions between all the representations unifying their disperse patterns in neuronal fields.

The neuronal field is a distortion of the pre-space structure but it can also be said that the pre-space structure (the syntergic field) and the neuronal field interact giving rise to a hypercomplex interference pattern. The syntergic theory considers this interference pattern as the immediate antecedent of the appearance of conscious experience.

The neuronal field may be the real "place of final activation" postulated in the Müller doctrine and as such is directly associated with the appearance of the quality of experience. The morphology of the neuronal field must be extraordinarily complex considering the number of neuronal elements that are represented in it and all the interactions that take place among the elements — it is possible that the only structure that surpasses the complexity of the neuronal field produced by a human brain is the pre-space structure itself.

The changes in the morphology of the neuronal field depend on many factors such as inter and intrahemispheric coherence and correlation, the frequency of brain activity, the patterns activated in the cortex and processing times. With regard to processing times, a neuronal field associated with visual processing must possess greater informational density than a neuronal field derived from auditory processing, simply because the former involves a greater number of neuronal elements and requires more time for processing than the latter. This informational density together with cerebral coherence determines the appearance of neuronal fields of greater or lesser syntergy in a way similar to the different levels in the syntergy of the pre-space structure associated with the presence of massive objects.

A high syntergy neuronal field would be a high coherence field, with high informational density and greater frequency than a low syntergy neuronal field, and would appear in perception as empty space. A low syntergy neuronal field would be related to the perception of objects. The quality of the experience would depend on the syntergy of the neuronal field and on the interaction or connection with the pre-space structures; that is, on the specific distortion of the pre-space structure as a result of its interaction with a neuronal field. Since the neuronal field is part of the pre-space structure, it must follow the same laws, that is, laws of interconnectivity, representational continuity and convergence, in other words, a neuronal field must be represented throughout the whole pre-space structure; it must modify this structure in all its points and must be modified by it.

Grinberg–Zylberbaum's hypothesis of the neuronal field, John's of the hyperneuron, and Pribram's of the holonomic wave fronts reflect some of the characteristics of conscious experience (unity, fluidity and subtleness, non-concrete location, etc.) more closely than other postulates. These hypotheses, however, cannot explain conscious experience since, as with any other energy field, they belong to an order of reality that can in no way be compared with consciousness. However, it is possible to think that consciousness in its purest stratum exists at the base or at the origin of reality of which the pre-space structure is one of the primary emanations; in this way, the neuronal field would be a complex distortion of basic consciousness. Thus, the human brain, which can make manifest a sufficiently complex neuronal field, produces human experience.

In summary, the neuronal field is a macrodistortion of the pre-space structure and arises as a result of the activation of all the neuronal elements in a living brain. Each elementary activation as a macrodistortion of the pre-space structure joins with another giving rise to a real field of interactions of extraordinary complexity.

Ideas about the Syntergic Theory

The principal postulate of the syntergic theory is that there is an interaction between the neuronal field and the pre-space structure, and the resulting interference pattern is experienced by us as an image. From this point of view, a visual image would, metaphorically speaking, be the internal wall of the interactions between the neuronal field and the pre-space structure.

The informational density of the neuronal field, or better said, its neurosyntergy, must be able to vary in analogical shape through a continuum. Something similar can be postulated to happen with the variations of syntergy in the pre-space structure. However, the interaction between the neuronal field and the pre-space structure would seem to adjust itself in a discrete or quantum mode. Auditory consciousness is, for example, discretely different from visual consciousness not only because of its qualitative differences but also because the former needs less neuronal processing time to be activated. We would speak of a duration of the visual present and of a duration of the auditory present associated with the processing time (Grinberg–Zylberbaum, 1994; Grinberg–Zylberbaum et al., 1995). A visual image is experienced without time (in the present) but nevertheless time is involved in its activation. This duration of time sensed as "no time" is the duration of the present for the visual image. Each modality of consciousness involves a different duration of the present, and the discrete jumps from level to level of consciousness also occur in time. The duration of the present for each modality varies depending on (among other things) the EEG (Varela, Toro, John, and Schwartz, 1981). The duration of the present of a modality of consciousness is the greater the more complex the modality is. The foregoing indicates that the interaction between the neuronal field and the pre-space structure congruence is probably only achieved in defined syntergic bands. In other words, an interference pattern resulting from the interaction between the neuronal field and the pre-space structure is only congruent at certain levels of syntergic connection which we experience as the levels of consciousness of the modalities of qualitative experience.

I mentioned before that the condition for external reality to be perceived would seem to require the information contained in the pre-space structure to be represented (internalized) in a biological cerebral structure and there analyzed. The first studies on the physiological correlates of the state of consciousness vigil (Moruzzi and Magoun, 1949) demonstrated that the integrity of the reticular formation was indispensable for guaranteeing vigilance and maintaining it. The reticular formation receives afferent (incoming) information from all the sensory modalities and there they carry out the work of interconnections and centralization of information. The reticular formation in turn maintains the cortical tone by sending efferent (outgoing) signals to the cortex. Recent studies carried out by Harmony et al. (1991) show that adequate development of the nervous system implies a strengthening of electrophysiological coherence in central regions of the brain as if the centralization of unified convergence of cerebral information were a basic condition in the conscious representation of reality (Grinberg–Zylberbaum, 1976). The great French thinker Theilhard de Chardin (1965) expressed similar ideas, considering consciousness to imply an optimal degree of centrality.

This centralized interconnectivity must be represented in the organization of the neuronal field and in its interaction with the pre-space structure. In the development and evolution of consciousness, the neuronal fields of living beings could be placed on a syntergically ascending axis characterized by greater centrality, coherence, information density, complexity and frequency. An organization like the human neuronal field must possess these parameters to a high degree. Furthermore, one of the most interesting repercussion of the syntergic theory is the possibility of direct interactions (in the pre-space structure) among different neuronal fields. If a neuronal field enjoys the same characteristics as the pre-space structure, it is possible to think that the neuronal fields interact and mutually influence one another. This possibility will be the subject of the following section.

Ideas about Interconnectivity

Before the dawn of quantum mechanics, the prevailing paradigm in the science of physics was classic Newtonian cosmology in which the universe was seen as being built of autonomous, absolute objects separated one from the other. Interaction between objects was only possible through an exchange of signals in the form of material particles of physical forces (fields). This view of reality was common (and still is) since it was derived from the way in which we perceived the world.

Nevertheless, our concepts of reality began to change radically during the early decades of this century when the universe came to be seen as a unified whole made up of interconnected parts. This new view of reality appeared principally as a result of the work of Einstein which gave rise to the theory of relativity and quantum mechanics.

It is not my intention to dwell on the changes in our view of reality brought about by the discoveries of the new physics, but in order to provide a broader theoretical framework to the following discussion of interconnectivity, I shall present an outline of the Einstein–Podolsky–Rosen (1935) gedanken-experiment, also known as the EPR paradox, followed by a discussion of some subsequent developments. The experiment mathematically demonstrated that if a system (a particle, for example) was measured, another with which it had interacted would be instantaneously altered regardless of the distance separating them (the existence of a signal traveling faster than the speed of light). Bell (1964) used a mathematical argument, based on the EPR paradox, to prove that the predictions of quantum mechanics contradicted the idea that the measurements of a system can be only determined considering the system's local state. In other words, the properties of the particles in a region of space must be influenced by what happens in far away regions. Bell (1966) subsequently suggested that non-local interdependencies exist between distant systems.

For almost half a century, the EPR paradox could not be subjected to experimentation for technological reasons (there were no gauges with sufficient precision and speed). But Aspect, Dalibard, and Roger (1982) built an apparatus that made it possible to measure distant, non-local particles after they had interacted, which demonstrated that non-local interactions do in fact take place. Things that have interacted are interconnected, and interaction cannot be attributed to intercession of messengers traveling at the speed of light.

Experimental Evidence

Over the past two decades, studies in neurophysiology have shown that interactions also take place between brains. I shall mention just a few of these studies by way of evidence. In Mexico, Grinberg–Zylberbaum, Cueli, and Szydio (1978) demonstrated that during human communication there is a high correlation between the coherence of the brains of the participants in the communication. Millay (1981) found similar results. In the same year that Aspect published his experiment, two international journals published original studies using human subjects that indicated the existence of interactions between brains (Grinberg–Zylberbaum, 1982; Orme–Johnson, Dillbeck, Wallace, and Landrith III, 1982).

Studies on the electrophysiology of human communication (Grinberg–Zylberbaum and Ramos, 1987; Orme–Johnson et al., 1982) have shown that there are intercerebral interactions that cannot be explained as the result of habituation, fatigue or conditioning and that these interactions occur even when the subjects involved are separated by a distance with each one sitting inside different Faraday chambers, that is, without any possibility of sensory exchanges (Duane and Behrendt, 1965; Targ and Puthoff, 1974).

Some researchers have tried to explain the instances in which a psychotherapist experiences an intense emphatic union with his or her patients, as measured by a resonance mechanism (Larson, 1987) or as an exchange of brain coherences (Grinberg–Zylberbaum, Cueli, Riefkhol, and Szydio, 1981), and there have even been attempts to increase communication through interhemispheric correlation modification techniques (Millay, 1981). Over the last few years we have attempted to determine if it is possible to prove that when a brain is stimulated, other brains, located at a distance and that are not stimulated, are modified. The first experiment of this series (Grinberg–Zylberbaum, 1982) consisted in making two subjects interact inside an isolated Faraday chamber, then separating the subjects by placing them in two independent chambers with no possibility of exchanges of any type and stimulating one of the subjects without the other knowing. When a clear evoked potential is present in the subject who has been stimulated, the average of the EEG activity of both subjects (synchronized with the presentation of the stimulus in one of them) reveals that a potential with a similar morphology can be observed in the non-stimulated subject. We have called the potential recorded in the non-stimulated subject a transferred potential (Grinberg–Zylberbaum, Attie, Cerezo, Schettino, Pérez, and Meraz, 1995; Grinberg–Zylberbaum, Delaflor, Attie, and Goswami, 1994; Grinberg–Zylberbaum, Delaflor, and Sánchez, 1989; Grinberg–Zylberbaum, Delaflor, Sánchez, Guevara, and Pérez, 1992). According to our results, transferred potentials occur if and only if several conditions are fulfilled: (1) the subjects have interacted and established powerful non-verbal empathy, determined by means of the verbal reports of the subjects and their self-qualification on a scale of empathic communication from 0 (lack of empathy) to 10 (total empathy); (2) the subject stimulated presents evident evoked potentials; and (3) outside stimuli and situations do not interfere with subject-to-subject communication (Attie, 1996). I believe the transferred potential to be a manifestation of the existence of neuronal fields and their mutual interactions.

The Concept of Unity

A few months after the original article on the EPR paradox appeared, Bohr criticized Einstein for maintaining a mistaken vision of reality in which objects were seen as independent from the process by means of which they were measured. Spasskii and Moskovkii (1984) offer an excellent account of this discussion between Einstein and Bohr. A further criticism of Einstein's interpretation of reality came from the Copenhagen school and its interpretation of quantum mechanics. According to that perspective, it is impossible to speak of an interaction between two separate particles for the simple reason that before an observation (a measurement) no particle or event can be located in space because its localization is simultaneously in all places since its wave function is distributed throughout space. For this reason, it is nonsense to say that two objects are separate because, before an observation is made, only pre-space exists, so there is no distance between objects. This interpretation has given rise to the "idealistic interpretation of quantum mechanics" in which Goswami (1989) holds that not only must the act of observation be taken into account to define the state of an object, but that consciousness is responsible for the collapse of the wave function. Furthermore, that interpretation holds that consciousness is unitary and unitive; that a measurement is not complete without the participation of a sentient being; and that consciousness is not local. Wigner (1962, 1967) had already proposed the necessity of taking consciousness into account in physics as had von Neumann (1955) before him, but it was Goswami (1990) who clearly posed the participation of consciousness.

Ouspensky (1970) performed an analysis of the effects and interactions between spaces of different dimensions. Later we presented the singular idea that what is found to be separate in a space of n dimensions forms a unitary body in a space of n plus 1 dimensions (the fingers of a unified three-dimensional hand supported on a bidimensional plane form five separate circles). The idea that consciousness is unitive implies that all particles are united in it or that from it everything is perceived in unity. Something similar has been proposed for the properties of the observer (Grinberg–Zylberbaum, 1987). Since the neuronal field is a non-physical matrix that contains all the neuronal interactions unified in its structure, it is possible to postulate that the evidence mentioned above in support of intercerebral interactions could be mediated by means of the action of neuronal fields. Fock and Aleksandrof (cited in Spasskii and Moskovkii, 1984) mentioned as early as 1956 the possibility of nonforce interactions between quantum objects to explain the EPR paradox. In summary, there is physical and neurophisiological evidence which demonstrates that non-local relationships exist between systems that have interacted, seemingly without the need for interceding messengers. It is possible to explain these interactions if we assume the existence of unified levels such as the neuronal field.

Conclusion

The brain has solved the problem of the resistance put up by conductors by using real biological superconductors: the sodium–potassium pump is an active recovery mechanism where an action potential maintains the same voltage all along the axon. The brain then has a hypercomplex network of biological superconductors pressed together in a small volume and the information that passes through that together with all the informational and energy modifications that occur in the synapses and in the neuronal bodies, the fluctuations of the membrane potentials as a result of ion flows etc., form part of the structure of the neuronal field. The brain mimics the pre-space organization because the stimulus that has interacted most constantly with the brain structure since it appeared at the dawn of evolution has been, precisely, the pre-space structure. For this reason, it is tempting to think that the brain has mimicked this structure in its neuronal wiring, and its result, the activation of the neuronal field, would be the neuro–spatial mechanism that is activated to transform this mimicry into fact. It is also possible that the limit to brain capacity is related to the possibility that the human brain can activate a neuronal field of the same syntergy as the pre-space structure. Perhaps there we could perceive the high syntergic structure of pre-space, and at that level our consciousness could reach unity. Be that as it may, the distortion that the neuronal field exercises on the pre-space structure is perhaps the mechanism that explains the relationships between brain, mind and matter. The closer the neurosyntergy of the neuronal field to the syntergy of pre-space, the greater will be these relationships. The new psychophysiology of consciousness, called the syntergic theory, postulates the existence of the neuronal field interacting with the fundamental pre-space structure. This interaction creates a hypercomplex pre-space distortion that is the nearest correlate of our conscious experience and is responsible for its unity.

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