Phylogenesis and the Nature of Mind

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Abstract: We have examined the presence of mind in phylogenetic primitive and evolved species using as criteria the objective presence of a nervous system that in man is strictly associated with mental capacities, and the likewise objective presence of sensory receptors that are strictly involved in the generation of mental images or *qualia*. The former criterion has indicated that mental capacities of progressively simpler nature are present in all vertebrate and invertebrate species, while the second criterion has further extended the mental domain to plants, protists and prokaryotes. Having reached the biological divide, the primitive mental capacities of prokaryotes appeared emerging from their mindless progenitors. This radical shifting was nonetheless analogous to that of systems which display different properties from their constituent subunits, as it occurs in molecules compared to their atoms. For instance, the different properties of water with regard to the constituent atoms are plainly due to the newly acquired configuration of electrons and nuclei. Accordingly, the primitive mental capacities of prokaryotes were attributed to the different 'configuration' acquired by the primordial mental aspects of their progenitors.

When the same reasoning was applied to progressively more elementary components (atoms, nuclei, quarks) the ultimate source of mental capacities appeared to reside in the elementary particles. Since they are likely to be the first entities of the universe and the ultimate constituents of all bodies, mind should be considered the only substance of the universe. Indeed, elementary particles and quantum entities are fields of energy and information that lack the *res extensa* qualities that have supported its role of additional material substance.

Keywords: Evolution, Mind, Consciousness, Matter, Qualia, *Res extensa*.

INTRODUCTION

We start from the premise that any truth may be modified by experience, and that tomorrow's truth may not be the same of today's truth. Modifications have occurred many times in the past, and they have also regarded relevant aspects of science. On those occasions, the new truth was often considered a threat to the prestige of people who defended the previous truth and disagreement degenerated into extreme contrast just as often. Only rarely people took notice that truth did not comply with their opinions and that the clash only regarded their contrasting models. All authors were presumably animated by the same desire to unveil truth but they remained unable to respect mutual attempts. We should try to avoid such regrettable oppositions by accepting that models of reality are liable to change with changing new inputs from ongoing research and meditation. To a certain extent, it might be helpful to acknowledge that truth is normally being approached by allowing a subconscious bit of faith to join rational logic. This premise is guiding me in presenting my views on the century-old problem of the nature and origin of human mind.

In this article 'mind' is used to indicate states and processes of non-material nature, irrespective of their being conscious or subconscious, since conscious operations are presumed not to be essentially different from unconscious operations. It follows that the subconscious mind appears much more pervasive than the conscious mind, presumably reaching the primordial roots of life, as we will try to suggest. The wide domain of the subconscious mind is partly due to our tendency to consider primitive minds subconscious by default, disregarding the possibility that within their own boundaries they could be conscious. After all, our conscious mind is a subjective privilege that we cannot share with other people. They can only assume it by inference.

METHODS

Features of mind have been described and discussed in all cultures, initially by theologians and philosophers, more recently by scientists who are studying brain capacities. Among them the mental ability to figure out the intentions of other people is called metalizing. As it has happened with a large multitude of other mental capacities, mentalizing is investigated by determining the distribution of the involved active brain regions by available technologies [1, 2].

From the several asserted values and often contrasting assumptions, most concepts produced by

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E-ISSN: 2409-3564/17

this virtual round-table have concerned mental states and processes proper to the adult man. Comparable trends are followed by science in its material approach to the meaning of the world that compels mental activities to be considered the equivalent of brain activities. Unfortunately, the study of the possible phylogenetic origin of mind has remained marginalized despite the great potential interest of independent evaluations based on criteria regarding mental features rather than their putative equivalence with brain activities. Indeed, in studies of the phylogenetic origin of mental capacities, adopted criteria were largely mimicking the mental capacities of the adult man, thus restricting identification to highly developed animal species [3]. Likewise, in studies of the phylogenetic origin of brain structures and functions, the corresponding mental capacities were of little or no concern in view of their assumed equivalence with brain capacities.

In my opinion, a more fruitful approach should be based on criteria making good use of the reliable correlations of human mental capacities with the corresponding anatomical structures. Since structures may objectively be identified, their phylogenetic presence would testify the corresponding presence of comparable mental capacities. Among anatomical structures, those displaying a sufficiently wide distribution regarded the brain or the nervous system which are linked to the overall mental capacities and, conversely, the structures of markedly smaller size which generate one of the most basic aspects of human mind, such as the mental images or *qualia*. Other anatomical features of intermediate size or less definite distribution, such as those required for swimming or singing, would correspond to less definite mental attributes. Conversely, anatomical features linked with presumably mental features, such as telepathy or remote viewing, would presumably fall short of displaying anatomical correspondence.

Having adopted these two criteria, a backward-going phylogenetic journey was started that covered the entire evolutionary history of living organisms. Subsequently, as we reached the biological threshold separating them from inanimate bodies, we faced the problem of how primordial mental capacities could have originated from mindless precursors. The problem proved analogous to the emergence of new qualities in a system that acquired them from components that did not display them, as it occurs with water and, more generally, with all molecules compared to the constituent atoms. In all instances, the new qualities stem from the modified configuration attained by the assembled subunits. Accordingly, the primordial mental qualities of the first organisms were assumed to originate from the different mental configuration of the progenitor subunits. As an analogous reasoning could be applied to all systems made of subunits, mental aspects of progressively simpler nature were assigned to molecules, atoms, nuclei, quarks, and finally to the elementary particles that are the ultimate components of all bodies, and the first to appear in the dense, hot domain that started the universe [4-6].

RESULTS

Vertebrates and Invertebrates

Somewhat ironically, the backward journey in phylogenetic time was prompted by the accepted correlation between mind and brain that presently supports the equivalence of mental activities with brain activities. We reasoned that if the correlation was valid for man given his subjective mental experience and his objectively demonstrated brain, every organism objectively harboring a brain or a nervous system should likewise hold a subjective mind. Since mind capacities correlated with simpler brains, by inference they had to be considered proportionately less developed. Hence, mind capacities of a proportionate less complex nature were assumed to be present in all vertebrate and invertebrate species since they are well known to have a brain or a nervous system. Notably, their phylogenetic lines appeared in periods that long preceded the birth of man.

Plants and Unicellular Organisms

To further proceed in our phylogenetic quest of mental capacities in simpler organisms, the identifying criterion appeared to gain resolving power if based on anatomical structures corresponding to elementary mental qualities rather than those of man and higher species. Among them, what seemed a most basic capacity regarded the generation of mental images or *qualia*, a subjective product that may hardly be communicated as such. The structures responsible for their generation appeared to be the sensory receptors activated by incoming stimuli rather than the associated neural signals that presumably modify the quality of mental images but are also elicited by the activated receptors.

It should not be forgotten that the human capacity to generate *qualia* is never doubted by other men, presumably in view of their similar features, but also

irrespective of the subjective nature of *qualia* that prevents any objective validation. Consequently, comparable inferences may be extended to organisms exhibiting sensory receptors. It follows that, since sensory receptors are present in all organisms, including those lacking a brain, they all display reliable evidence of their capacity to generate mental images. The quality of these images is obviously to be considered very primitive in less developed species, but this does not detract from the conclusion that plants and unicellular organisms, such as prokaryotes and protists, do generate mental images. Hence, it may be concluded that mental capacities ranging in degree from the most primitive kind to the high capacities of man are present in every species, presumably in direct proportion with the complexity of their lives and needs, experiences and physiological/behavioral endowments. In other words, mental capacities existed since the earliest phylogenetic periods, a long time before the appearance of nerve cells or eukaryotic cells. Their presence in species lacking a nervous system underlines the conclusion that mental capacities cannot be equated to brain capacities.

Mental images are also generated by memories and memory processing [7]. Notably, learning capacities are present in all species, including those that lack a nervous system, such as plants, protists and prokaryotes. Indeed, bacteria exposed to different temperatures and oxygen levels may learn to express genes promoting aerobic or anaerobic metabolism according to the values of environmental variables [8, 9]. More generally, plants, unicellular organisms, and primitive multicellular organisms are capable of processing information [10-12] comparable to the algorithms underlying the transfer of DNA from the micronucleus to the macronucleus in ciliates protists [13]. Since memories and learning generate mental images in man, the comparable operations present in organisms lacking a nervous system confirm their capacities to generate mental images.

One may wonder if primitive mental images are conscious or not. The question is relevant but may hardly be properly answered. We have already noted that information processing may also occur in subconscious states. In addition, it may be added: i) that conscious activity is supported by subconscious processes [14]; ii) that memory processing of complex tasks requires periods of slow wave sleep in which consciousness is absent [15]; and iii) that problem solving is 3-fold more easily attained after a period of slow wave sleep than a period of waking [16].

Inanimate Bodies

At the uncertain threshold separating living bodies from material bodies, the backward journey in the quest of mind seemed to have reached a stop since the primitive mental qualities of the early prokaryotes were not overtly present in their material progenitors. In a way, those mental qualities looked like they had inexplicably emerged. However, the word ‘emerged’ not only described an impasse but also indicated a possible solution. Indeed, it made us note that the appearance of mental qualities from mindless progenitors was analogous to the appearance of new qualities in molecules and other systems emerging from the assembly of subunits that lacked them. One of the best examples regards the properties of water that are markedly different from those of water constituent atoms. By common knowledge, water properties have not been attributed to inexplicable processes but to the newly acquired different configuration of electrons and nuclei contributed by hydrogen and oxygen atoms. More generally, the properties of every molecule owe their new qualities to the different configuration attained by the electrons and nuclei contributed by their constituent atoms. The analogy suggested that the emerging mental qualities of the early prokaryotes were not due to inexplicable processes but more profitably could be attributed to the new ‘configuration’ attained by the mental features of their progenitors. Clearly, mental configurations may not be properly defined since mind is assumed to be an immaterial entity lacking subunits. Nonetheless, mental qualities are well known to markedly diverge in going from prokaryotes to man. In addition, some encouragement comes from the quantum nature of electrons and nuclei that is also facing uncertainties. Hence, we may presently hold at bay our ignorance by assuming that differences in mental configurations may stand for states of hiding, potential capacity, or inadequate detection by the adopted identifying criterion.

The logic that suggested that different mental ‘configurations’ or potential assets could be present in subunits of complex entities was also applied to molecules, atoms, nuclei, nuclear subunits and the subunits of subunits. Accordingly, mental capacities of progressive primordial nature were associated with simpler components until we reached elementary particles, the ultimate components of material and living bodies. Being quantum entities they are considered energy and information fields of uncertain identity that is with properties that are basically different from the material bodies studied by classical

physics. In the present context, it may be worth noting that they fail to conform to the notion of *res extensa*, whose spatial qualities raised material bodies to the status of substance.

In view of the pervasive presence of elementary particles and related quantum entities in the universe, their association with primordial mind suggests that cosmic phylogenesis was involved more in mental development than in promoting the evolution of material bodies [5]. This hypothesis would require educated attention to be focused on the properties of entities well below the cellular level. Accordingly, the crucial interaction of stimuli with sensory receptors should be properly analyzed after freeing it of redundant attributes that might prevent unbiased analyses of comparable effects occurring in the latter domain.

From this point of view, it is worth mentioning that material bodies have been in a persistent state of motion since the beginning of the universe and have mutually interacted to generate evolutionary changes. These interactions are not substantially different from those of stimuli impinging on sensory receptors to generate mental images but also biological changes. The analogy suggests that interacting material objects might also elicit flashes of primordial mental configuration especially when interacting suitable partners produced evolutionary changes. These events initially occurred with elementary particles, and at later times with atoms, molecules, cells, and organisms. Given these basic similarities, could the subjective essential experience of interacting human beings turn out not to be different from the putative primordial mental flashes of interacting material objects? No substantial reason compels elementary particles and quantum entities to be non-sentient [17]. Indeed, the changes produced by interacting *suitable* partners imply their mutual capacity to concretely identify and select each other. With elementary particles, such capacity regards their interacting fields that might be viewed as the primordial sensors, the Ur-perceiving units.

From Simple to Complex: a Putative Principle

The evolution of complex systems is likely to have followed a general principle from prebiotic to present times. Elementary particles built atoms and molecules, and eventually cells and organisms. At every level, subunits assembled in more complex entities that thus acquired novel properties. An interesting example is offered by the aromatic carbon compounds in which a fraction of the electrons that were previously associated with carbon atoms delocalized over the entire aromatic ring [4]. These electrons are known as the π electrons. This behavior suggests that the integration of subunits in a new entity requires a fraction of the total energy to become associated with the whole new entity, thus supporting its existence and contributing to its emerging properties.

Are comparable processes regarding other types and levels of integration, from the most simple to the most complex? It seems obvious that any system made of subunits does require an energy structure holding the dynamic association of components. In addition, any system may interact with entities belonging to lower, similar, and higher levels of complexity. Accordingly, in a system of systems such as man, an energetic scaffolding safeguards all layers and the entities of each layer. Even the upper layer is part of the whole energy structure and contributes to it. It follows that we are involved in an overall energy structure created by all layers including the ultimate quantum layer. Conversely, we are likewise contributing energy for the maintenance of the upper systems we belong to, such as family, society, biosphere and universe.

DISCUSSION

How could we envisage the nature of our mind? If it originated from the elementary particles, as I tried to show, their primordial mind should be deemed present in all entities that progressively evolved from that starting point, our own mind included. This view implies that the substance of the universe is a mental substance, notwithstanding the material appearance we perceive. The material vision of the world that science has adopted limits understanding to phenomena, cannot explain the nature of quantum particles, and marginalizes or negates our primary knowledge of being mental subjects. Several converging considerations support this conclusion.

Let me start with the thoughts expressed by the patriarchs of quantum physics. They are reproduced from a more extensive list [18], and are presented according to the time of publication:

The nature of the physical world [...] is something that is fashioned by the mind of the observer himself [19].

Is there something in the nature of man, some inner realm, that science cannot touch? [19).

Science cannot solve the ultimate mystery of nature. And that is because, in the last analysis, we ourselves are part of nature and therefore part of the mystery we are trying to solve [19].

To my mind, the laws which the nature obeys are less suggestive of those which a machine obeys in its motion than those of which a musician obeys in writing a fugue, or a poet in composing a sonnet. […] If all this is so, then the universe can be best pictured, although still very imperfectly and inadequately, as consisting of pure thought of what, for want of a wider word, we must describe as a mathematical thinker [20].

If the universe is a universe of thought, then its creation must have been an act of thought [20].

It would be most satisfactory of all if physics and psyche could be seen as complementary aspects of the same reality [21].

Consciousness is that by which this world first becomes manifest [22].

The same elements go to make up both the Self and the external world [22].

The external world and consciousness are one and the same thing [22].

The material world has only been constructed at the price of taking the self, that is, mind out of it, removing it; mind is not part of it; obviously, therefore, it can neither act on it nor be acted upon by any of its parts [23].

The content of consciousness is an ultimate reality [24].

'Values' are created by the mind [25].

To put the conclusion crudely – stuff of the world is mind-stuff [25].

We have found a strange foot-print on the shores of the unknown. We have devised profound theories, one after another, to account for its origin. At last, we have succeeded in reconstructing the creature that made the foot-print. And Lo! It is our own [25].

Consciousness and matter are different aspects of the same reality [26].

Long before them, in the fifth century before Christ, the Sicilian philosopher Empedocles proclaimed:

all beings […] enjoy, suffer and think [27].

Several centuries later, in 1848, the German psychophysicist GT Fechner published his thoughts on the pervasive mind in 'Nanna, oder, über das seelenleben der pflanzen', a book that has recently been translated in Italian [28]. Thirty years later, the English mathematician WK Clifford concluded:

Mind is the only basic reality of the simplest elements composing man's sensitivity and thought […]. The presumed basic atom of the mental substance coincides with that of matter. It represents the basic entity of which the material atom is the phenomenon [29].

During the last century, the Jesuit paleontologist PT de Chardin described the progressive evolution of mind on earth from the biosphere to the noosphere and beyond [30].

Other scientists have strived to explain how our mental capacities could have raised from matter. Significant contributions were provided by M Delbrück [31], S Hameroff [32-34] and R Penrose [35, 36], but their attempts have fallen short of a satisfactory solution. Nonetheless, mainstream science postulates that mental capacities derive from brain activities. The world is perceived as a material domain and needs to be investigated as such to preserve objectivity. Much has been said of the epistemological limits of this approach. One of the most devastating comments is expressed by an ancient Russian monk in one of the most appreciated Dostoevskij's book [37]:

[…] having attained powerful strength, mundane science has dismantled piece by piece, chiefly during last century, everything of heavenly nature that had been promised us by the Holy Scriptures; following their ferocious analysis nothing remained for world scholars of what previously had been sacred. Yet they have proceeded with their analysis piece by piece, and the whole they have not been able to discern; it is astounding to what degree they have been blind.

Perhaps, the strongest support to the pervasive existence of mind has come from the often marginalized efforts of scientists that started to investigate the anomalous properties of mind, those that bypass space and time. The available literature covers more than a century and a half of investigations, but mention will be limited to the long work done at Princeton University by R Jahn and B Dunne [38], and to the experiments made in 1907 by F Bottazzi of the

Royal University of Naples with the medium Eusapia Palladino whose telekinetic capacities were instrumentally recorded [39]. His report was concluded with the following statement:

Mediumistic phenomena are not mere hallucinations of those attending sessions known as spiritualistic sittings. They are biological phenomena depending on the MEDIUM's organism. If they are such, they occur AS IF they are operated by the extensions of natural limbs or by additional limbs stemming out of the MEDIUM's body, and returning and dissolving into it after variable times. During those periods, they reveal themselves by the sensations they elicit in us as limbs in no essential way different from natural limbs.

The hypothesis that telekinetic events are biological phenomena was confirmed a century later [40]. Additional more relevant data regard the demonstration of the conditioning effect of human intentions on the outcome of the particle/wave alternative [41, 42]. In one of the two experiments the intentions came from people living far away from the recording instrument. Let me also mention the Manifesto for a post-materialist science [43] that was signed by a group of qualified scientists to remind colleagues all over the world that an open minded approach to the study of nature might help envisaging spiritual hints.

The last paragraphs of the Manifesto read as follows:

16. Post-materialist science does not reject the empirical observations and great value of scientific achievements realized up until now. It seeks to expand the human capacity to better understand the wonders of nature and, in the process, rediscover the importance of mind and spirit as being part of the core fabric of the universe. Post-materialism is inclusive of matter, which is seen as a basic constituent of the universe.

17. The post-materialist paradigm has far-reaching implications. It fundamentally alters the vision we have of ourselves, giving us back our dignity and power, as humans and as scientists. This paradigm fosters positive values such as compassion, respect, and peace. By emphasizing a deep connection between us and nature at large, the post-materialist paradigm also promotes environmental awareness and the preservation of our biosphere. In addition, it is not new, but only forgotten for 400 years, that a lived transmaterial understanding may be the cornerstone of health and wellness, as it has been held and preserved in ancient mind–body–spirit practices, religious traditions, and contemplative approaches.

18. The shift from materialist science to post-materialist science may be of vital importance to the evolution of the human civilization. It may be even more pivotal than the transition from Geocentrism to Heliocentrism.

The correlations of objective neural structures with mental capacities demonstrate their presence in all organisms, including those lacking a nervous system. On the other hand, the presence of a primordial mind in material objects, including quantum entities, is resting on logical considerations and analogies. The latter hypothesis might be validated by the scientific demonstration that, during paradoxical sleep, the newly acquired brain information is transferred to the quantum level from the provisional synaptic storage. Experiments examining this possibility have been suggested [15].

CONCLUSION

These thoughts on the nature of mind may appear, even to me, as ephemeral as the images designed by birds that fly over cities. Those living clouds break down and reassemble according to unknown logics of freedom. The little poem posted below suggests that those images are allegories of our wandering thoughts.

They fly the sky in charming multitudes
Free to be together or suddenly divide.
Thoughts also turn in the valley of mind
Never longing to rest.
They play with air and fire
Water and land.
They try to guide
The wanderings of life
They attempt to perceive
With shameless insolence
Through the veil of Maya.

Thoughts on mind, rather than be guided by dogmas, should take advantage of the precious humility that may stem from being free to be wrong when attempting to attain truth. Mind is the beloved child of spirit, and spirit may blow where he likes. How could we attempt to understand the nature of mind by accepting rigid formulations, accurate definitions and subtle distinctions? Would we trust preconceived ideas and get entangled as birds in a net?

Perhaps, a real knowledge of the nature of mind is unattainable given that mind is the subject and the object of the inquiry. Perhaps, its origin from elementary particles might have made the use of mental capacities allowed to us but their ultimate nature a mystery not to be unveiled. Back in the 15th century, Niccolò Cusano reached a similar conclusion with regard to the ultimate truth. In any event, since elementary particles must have joined each other an indefinite large number of times to attain our mental capacities, we might still expect that when we will join the unfathomable mystery of the universe, the long journey of the primordial mind will finally reach its target feeling as little droplets of water presumably do when they join the big ocean.

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Received on 23-03-2017 Accepted on 11-04-2017 Published on 28-04-2017

http://dx.doi.org/10.15379/2409-3564.2017.04.01.01