CONSCIOUSNESS, MIND AND SPIRIT[1]

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ABSTRACT: The explosion of interest in consciousness among scientists in recent decades has led to a revival of interest in the work of Whitehead. This has been associated with the challenge of biophysics to molecular biology in efforts to understand the nature of life. Some claim that it is only through quantum field theory that consciousness will be made intelligible. Most, although not all work in this area, focusses on the brain and how it could give rise to consciousness. In this paper, I will support this challenge, but I will suggest that the focus of work in this area reflects the failure to fully overcome the assumptions of Cartesian thought, associated above all with a defective understanding of consciousness as a 'thinking substance'. Firstly, as Bergson, Whitehead and Merleau-Ponty argued, consciousness is embodied. Secondly, as Jacob von Uexküll argued, consciousness is only comprehensible in relation to the organism's world defined as such by the organism. Thirdly, in the case of humans, this is a 'with-world', a world shared with others. The consequent social nature of human consciousness is better captured by the German word for mind: *Geist*, which also translates as 'Spirit'. And as Hegel argued, along with Subjective Spirit, there is also Objective Spirit, the realm of institutions, and Absolute Spirit, the realm of culture, with Subjective, Objective and Absolute Spirit being conditions, and even components, of each other. My argument is that this broader notion of mind as Spirit should be embraced, but without abandoning the work in biophysics. What is required is a further expansion of the notion of mind and Spirit as humanity comes to appreciate that it is part of nature and that it is through the development of institutions and culture that nature, through human subjects, is becoming conscious of itself and its significance. The development of process philosophy inspired by Whitehead, associated with the development of the concepts of field and ecology, should be seen as a development of the semiosphere and the advance of the Spirit of Gaia, essential for the creation of a global civilization able to augment the life of the current regime of the global ecosystem of which we are part. It is to orient humanity to create an ecologically sustainable civilization; an ecological civilization.

KEYWORDS: Process Philosophy; Philosophy of Mind; Quantum Field Theory; Neurophysics; Jacob von Uexküll; Hegel

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INTRODUCTION

There has been a spectacular growth in consciousness studies over the last two and a half decades. This follows the setting up of the *Journal for Consciousness Studies* in 1994, coinciding with the first of the *Toward a Science of Consciousness* conferences organized by the *Center for Consciousness Studies* of the University of Arizona. The cross-disciplinary nature of these initiatives brought into focus the massive problem of the unintelligibility of consciousness from the perspective of mainstream science, famously designated by David Chalmers (1995) as the hard problem of consciousness. Some of the impetus for this project came from the work of Roger Penrose, whose book *The Emperor's New Mind* published in 1989 attacked the computational model of consciousness and argued that quantum theory could play an essential role in human thought, a theory he further defended in *Shadows of the Mind* published in 1994. With Stuart Hammeroff, he aligned himself with Whitehead on the grounds that Whitehead's actual occasions can be identified with quantum events (Hammeroff and Penrose, 2000, 177). An interview with Penrose was included in the first edition of the *Journal of Consciousness Studies*. This growth has helped advance other work grappling with this problem. This has helped inspire the transnational interdisciplinary conferences devoted to explaining mind through quantum physics led by Seán Ó Nualláin, the proceedings of which have been published in *Cosmos & History*. Phenomenologists and post-phenomenologists, whose work had been focussed on characterizing consciousness, but who appeared to be a spent force, have revived with efforts to naturalize phenomenology (Kauffman and Gare, 2015). Given its original impetus through the work of Francisco Varela, it spawned the journal *Phenomenology and the Cognitive Sciences*, first published in 2002. Peircian semiotics has received a huge boost from the development of biosemiotics attempting to conceive nature in such a way that human thought can intelligible be conceived of as part of it. To advance this, the journal *Sign Systems Studies* was published in English in 1998 and the journal *Biosemiotics* established in 2008. More radical scientists such as David Bohm and Basil Hiley are again being looked at. And there has been such a renewed interest in the work of Alfred North Whitehead. Henry Stapp has used Whitehead to interpret quantum theory to show that what we experience are quantum mechanical processes (2017, 25f.). Mae-Wan Ho, who aligned her work in theoretical biology with the philosophy of Whitehead and Bergson, argued that organisms are quantum coherent liquid crystals, and this accounts

for their consciousness. Whitehead has been taken up within science so enthusiastically that someone complained in an email that now one only has to mention Whitehead in a scientific paper to get it accepted for publication.

To process philosophers, this looks like a welcome development. After all, the recognition that mainstream science had rendered consciousness unintelligible has always been central to the whole project of process philosophy, one of its defining features. Now, it appears, process philosophy might be taken seriously by mainstream philosophers. However, this attention to consciousness also raises suspicions. Why were consciousness studies taken up so vigorously at this particular time by mainstream philosophers when in the past concern with consciousness had been treated with suspicion; a sign of some form of soft-headedness associated with Idealism and continental philosophy? It is reminiscent of the development of complexity studies. This also was welcomed by radical thinkers who had been opposing the reductionism of scientific materialism, and many, such as C.H. Waddington and Brian Goodwin, aligned their work with the science of complexity. However, on examination, it was clear that Warren Weaver, who in a lecture in 1947 called for the study of complexity as the last frontier of science, really meant the last frontier of reductionist science. Norbert Wiener (1952, p.44), the founder of cybernetics, whose ideas were taken up by complexity theorists, in the first chapter of his famous book on cybernetics discussed the challenge to scientific materialism posed by Bergson, and concluded that cybernetics should really be seen as the triumph of scientific materialism. Cybernetics underpinned Pitts and McCulloch's work on neural networks which later became a major component of complexity science, particularly as this was applied to neuroscience, again, as a way of advancing scientific materialism. The turn to consciousness studies could be seen as a further effort to advance scientific materialism without abandoning the assumptions that underpinned the scientific revolution of the seventeenth century, that is, the Newtonian paradigm. It could be argued that it was for this reason that the work of Roger Penrose was embraced. As Penrose made clear in *The Road to Reality* (2004, 9ff.), he was defending the view that reality is essentially that which can be grasped through mathematics. He was merely defending more advanced forms of mathematics to achieve this. What becomes evident is that there is still a divide

between those theorists still working within the framework of deep assumptions of modern science and those struggling to overcome these assumptions, and the former still dominate science, and most scientists refuse to take seriously the work of those challenging these assumptions.

There are a number of effects of this discrimination against more radical scientists. Often it means their achievements are ignored, to the detriment of science. Even among these radicals, because of the conditions they work under (their academic positions are less secure and they have more difficulty obtaining funding for their research) they are often unaware of work done elsewhere that complements and could advance their own work. There is a bigger problem particularly relevant to process philosophers; science continues to impose a fundamentally defective view of what humans are and what is their place in nature, reinforcing a defective culture that is maintaining the trajectory of humanity to global ecological destruction. This is particularly evident when it comes to conceiving of consciousness, or more broadly, the mind. While acknowledging the deficiencies of both mechanistic accounts of consciousness as computing with algorithms and Cartesian dualism, the enormous amount of work of philosophers and anti-reductionist psychologists in developing our understanding of mind, from Leibniz's critique of Locke through the work of Vico, Kant and Herder, neo-Kantian and post-Kantianism, Idealism, process philosophy, pragmatism, phenomenology and post-phenomenology, has largely been ignored by most of these new scientists of consciousness, with some notable exceptions (see Kauffman and Gare, 2015). This does not mean that the work of these scientists is of no importance, but from the perspective of process philosophy, not only does their work appear to be distorted by their assumptions, but there is a distortion in which work is embraced and integrated and which marginalized.

I believe the best way to understand this situation, which I will try to show in this paper, is to appreciate the fundamentally different research programs involved in consciousness research. One still grounded in Newtonian assumptions, strives to explain more and more through these assumptions with minor modifications, extending this research program from physics to chemistry, and then to biology, and now, meeting the greatest challenge of all, to neuroscience to make consciousness intelligible. The other research program

developed through the focus on the mind. Problematized by the development of the mechanistic world-view and the impoverished conception of mind that accommodated itself to mechanistic thought, developed by first ignoring the advances in the natural sciences or denying their significance in order to do full justice to the reality of the mind. The full development of this research program involved challenging the natural sciences and demanding a radical reformulation of these to accord with advances in our understanding of mind. This I believe is the essence of process philosophy, and it is this research program which I will focus upon, not only because this is necessary to understand advances in our understanding of mind that many neuroscientists are overlooking, but it is necessary to understand the main advances in the natural sciences relevant to neuroscience.

MIND AND SPIRIT

While Descartes dealt with mind by treating it as a thinking thing, it was Hobbes who extended the mechanistic world-view to characterized humans and their minds mechanistically, arguing for an atomistic view of society and treating people as calculating machines moved by appetites and aversions and thinking as a mechanical organization of images, a view embraced and elaborated by John Locke. Thought was characterized by Hobbes as a mechanical process of adding and subtracting in the service of controlling the world, with language and science also characterized from this perspective as means for gaining and communicating instrumental knowledge (Hobbes, chap.5). It is surprising how little mainstream reductionist psychology has advances since then.

Reactions against this have involved efforts to recover the superior ideas about humanity developed by the ancient Greeks and Romans, medieval and Renaissance philosophers, but also involved creative efforts to deal with phenomena revealed by the inadequacy of mechanistic thinking. There were two inter-related aspects to this. One involved developing an appreciation of the creative imagination, the other, appreciating that humans are essential social beings largely formed by their cultures. While the English and to some extent the French developed mechanistic models of the mind under Locke's influence and developed their understanding of the mind as an association of

ideas understood as images, Giambattista Vico, who died in 1744, reacted against Descartes' and Hobbes' philosophies by portrayed the imagination as essentially creative and central to all aspects of human life, including the formation of civilization (Vico, p.18ff.). Imagination, he argued, is essentially social, as are people. On this basis he defended the primacy of the study of human history over the study of nature because, as he argued, we are the creators of history and we can only truly understand what we have made. It is for this reason that mathematics is comprehensible. Nature, on the other hand, was made by God, and only God can fully understand it. What the weak influence of Vico at the time shows is how difficult it was to break through the orthodoxies of the time.

Through most of its history although not all of it, Germany has been far more receptive to such ideas than Anglophone countries. Virtually any history of social thought reveals the bias towards mechanistic and atomistic thinking about society in Anglophone countries, and the challenges to this primarily although not always from German thought. This is evident in the place accorded imagination, as shown by James Engell's magisterial study, *The Creative Imagination: Enlightenment to Romanticism* (1981). Descartes regarded imagination as of no importance in gaining knowledge except as an obstacle to clear thinking. Hobbes gave imagination a place in the mechanics of calculative thinking. Locke conceived thought as an essentially mechanical or chemical interaction of ideas understood as sense-impressions and their copies, a view that inspired the associationist theory of thought, taken up by a number of philosophers in Britain and France, most importantly, David Hume. While various English and French philosophers came to appreciate that the imagination was far more important than this, it was only in Germany that this view came to dominate.

The crucial figure here was Kant, although Kant can only be fully understood in relation to Hume. Hume was also influenced by the associationists, but saw a role for imagination. He argued that our perception of the world is fleeting, partial, constantly changing, and yet what we experience is a stable, clear, constant image of the world. How is this possible? Hume, while strongly influenced by Locke, reluctantly concluded that this crucial role at the very foundation of our mind's functioning was performed by the imagination.

Kant, influenced by Leibniz's criticisms of Locke, had taken this argument further, arguing that "impressions" are perceived as already organized and structured by the imagination. We do not need to see the imagination as somehow creating coherent images out of incoherent perceptions. Imagination is pushed to perform the even more fundamental task of providing the prior structuring of our perceptions. That is, what we can perceive, and know, is predetermined by our imagination. Consequently, we cannot know the world as it is in itself, the noumenal realm, independently of any cognition. In making judgements, this experience is further organized by the forms: space and time, and concepts or categories of understanding. These concepts are schematized and applied through imagination to objects of sensibility, and then the rule for doing this applied to other objects. The objects of sensibility become symbols of the latter objects. This is all anchored by the soul (*Gemüt*), a corporeal awareness of sensation and self-affection, which is both the recipient of representations and that which gains knowledge through these representations. However, while the soul in this sense is central to Kant's philosophy, he was not sure of the grounds for accepting its reality. As he wrote in the the *Criticism of the third paralogism of transcendental psychology* of the first *Critique,* 'in the soul we encounter no persisting appearance other than the representation "I," which accompanies and connects all of them, we can never make out whether this I (a mere thought) does not flow as well as all the other thoughts that are linked to one another through it (Kant 1998, p.424 (A364)).

It is impossible to understand subsequent philosophy except in relation to Kant's work, beginning with his students, Herder and Fichte (Gare, 2017a, ch2.). While Herder was an early student of Kant, Fichte was his student while Kant was expounding his critical philosophy. Fichte's ideas were a direct development of Kant's mature work, and departed from Kant in three ways. To begin with, Fichte rejected any reference to the noumenal realm of things in themselves, and embraced Idealism. Secondly, he argued that we can understand how concepts emerge through the dialectical development of consciousness, arguing that we are first of all active agents, and concepts emerge in the process of meeting and attempting to overcome felt resistances to our wills. Thirdly, he argued that the enduring self-conscious ego develops as such through relations to others whereby we look at ourselves from the

perspective of others. We, as conscious beings are essentially social. This is the basis of the dialectic of recognition central to the ethical and political order of society.

An older student of Kant, Herder had argued that we are essentially cultural beings, the products of history, defending ideas similar to those of Vico. Building on Fichte's work, but also influenced by Herder, Hegel argued that there are three dialectics through which people transcend the immediacy of their engagement in the world and participate in mind or Spirit (*Geist*), the dialectic of recognition that operates through ethical forms, the dialectic of representation that operates through language, and the dialectic of labour that operates through tools (Gare, 2017a, p.163 & 167ff.). It is through such participation that the subject takes the perspective of the universal, transcending its egocentricity, and becomes an 'I' among other 'I's', achieving self-conscious as a participant in society and history. Subsequently, Hegel argued that Spirit has a further three dimensions, Subjective Spirit associated with the development of individuals, Objective Spirit consisting of institutions, and Absolute Spirit through which people come to comprehend the world and themselves through art, religion and philosophy, which for Hegel, included what we now call science.

Influenced by Herder and Goethe as well as Fichte and while originally aligned with Hegel, Schelling rejected Fichte's and Hegel's Idealism and argued that we are part of nature, the beings through which nature is becoming conscious of itself. In doing so, he rejected Fichte's assumption that our concepts of nature emerge simply as means to enable us to impose our will upon it (Gare 2017a, 59ff.) and Hegel's claim that nature is posited by Spirit as its Other. The process of understanding the development of cognition through which the concepts by which we understand the world, defended by Fichte against Kant's strictures on what we can know, was extended by Schelling to include the whole of nature. On this basis, Schelling challenged Newtonian physics, arguing for a speculative physics that could make intelligible the process by which nature had evolved and humanity had evolved within nature with all the characteristics ascribed to humanity by Fichte and Hegel (Schelling, 2004, 193ff.). Nature was thus conceived as unconscious mind and mind, conscious nature, with nature as activity constructing itself, evolving through

successive limiting of this activity (Schelling, 2004, 17). While this was not fully developed by him, Schelling built on the dynamism that Kant had defended, and argued that nature must be essentially active and productive, that is, it must consist of 'productivity/products' with these being indissociable since without productivity, there could be no products, and without products, productivity would be unintelligible. The most basic units of this productivity are actants, corresponding to Whitehead's actual occasions. These are not in space but prior to space (Schelling, 2004, 22) and are able to combine by prehending each other (p.24). Such productivity of actants engenders opposing forces that limit activity, leading to products the forms of which are a consequence of the balance between opposing forces. However, with life, there is no such balance and living organisms while being products of their environments have to actively maintain their form against the forces in their environments through engaging with their environments. It is by virtue of this duplicity that their environments become meaningful worlds for them (p.112n*). Humans develop through further limiting their activity in recognizing the freedom of each other, and holding each other responsible for their actions. Allowing for evolution and the development of cognition through successive limiting of activity and the possibility of comprehending this evolution involved rejecting the claim of Kant that nature must be completely comprehensible through mathematics. However, this did not involve rejecting mathematics but a call for new developments in mathematics adequate to a dynamic nature and life (Gare, 2013). On the basis of all this, Schelling was able to defend and develop the conception of humanity and of Spirit that had been developed by Herder, Fichte and Hegel.

THE SCHELLINGIAN TRADITION, PROCESS METAPHYSICS AND SCIENCE

Schelling began what I have argued is the modern tradition of process philosophy through this strategy of focussing on life, consciousness, mind or Spirit, attempting to do full justice to them, and then demanding of the natural sciences that they be transformed to make intelligible the existence of life and human consciousness within nature (Gare, 2011). The same approach was embraced by the leading figures of process philosophy at the end of the

nineteenth century and the beginning of the twentieth century, including C.S. Peirce, William James, Henri Bergson, Aleksandr Bogdanov, John Dewey, George Herbert Mead and Alfred North Whitehead, and with the development of phenomenology, by the philosophical biologists and philosophical anthropologists inspired by Max Scheler. This was continued through the efforts to naturalize phenomenology following Merleau-Ponty and Varela. It was also the strategy of thinkers who began as neo-Kantians, but who could be thought of as contributing to the tradition of process thought, most importantly, Ernst Cassirer with his work on the philosophy of science and mathematics, and Jean Piaget with his work on developmental psychology, ethology and his genetic structuralism. The development of biosemiotics and biohermeneutics exemplifies a more recent application of this approach. Having such a common approach constitutes these thinkers as a tradition, although influences of different thinkers in this tradition on each other was often indirect. What has not been appreciated, even by Alfred North Whitehead, is the enormous influence this tradition had on the development of science and mathematics as well as the arts and humanities.

The failure to appreciate the influence of this tradition on science and mathematics is due to the distortion of the history of science by the heirs of the Seventeenth Century scientific revolution, the scientific materialists. The Romantics called for a mathematics adequate to the fluidity of nature (Heuser, 2016). Their influence can be traced through Hermann Grassmann's extension theory that anticipated most of the mathematics of modern physics, through his influence on Alfred North Whitehead's effort to develop a universal algebra, and then to category theory that is at present challenging set theory as the foundation for mathematics (Gare, 2013). Schelling's characterization of being as essentially activity contributed to the development of thermodynamics. As Thomas Kuhn (1977) showed, those who postulated the conservation of energy, including Hermann von Helmholz who helped found neo-Kantianism to oppose the influence of Schellingian thought, were influenced by Schelling. It was the Romantics who believed that light, electricity and magnetism would be shown to be related in a science that could displace Newtonian science, and the development of field theory by Faraday and Maxwell was really the triumph of this project. Faraday's ideas were developed in Schelling's lifetime, and were enthusiastically endorsed by him as the realization of his philosophy of nature

(Mainzer, 1996, 269f.). The idea that different chemicals were not substances but only relatively stable structures maintained through a balance of opposing forces derived from Schelling. Karl Ernst von Baer's work on embryology was a development of the tradition of *Naturphilosophie*. Jacob von Uexküll's argument that organisms can only be understood within their environments defined through function circles as having meaning for them, drew upon Kant rather than Schelling, but going beyond Kant to acknowledge that all organisms, not only humans, constitute their environments as worlds, had already been argued by Schelling (2004, p.106ff.). Despite Darwin's efforts to make evolutionary theory accord with Newtonian science, the notion of evolution was really a revival of the Romantic notion of evolution promoted by Schelling (Richards, 2002, chap.14) and as Whitehead pointed out, evolution is unintelligible from the perspective of scientific materialism. While mainstream evolutionary theory aligned with biochemistry and molecular biology continued this project, the more important advances in biology, that is, the advances that actually made the reality of life more intelligible, came from those reacting against reductionist thought such as von Bertalanffy and C.H. Waddington and those they influenced. This involved not only giving a place to epigenesis, but also to organisms defining their environments as their worlds, in interaction with each other to cooperatively augment their environments, creating ecosystems with their own dynamics. Only in this context, these theorists argued, could evolution and the struggle for survival be understood.

The influence of the Romantics permeated the work of many of those who established psychology as a science. The later work of Darwin on humans manifest the influence on him of the Romantic tradition of thought. Helmholtz who called for a return to Kant to uphold the Newtonian tradition of the natural sciences, and his student Wilhelm Wundt, sometimes claimed to be the founder of the science of psychology in Germany, were also strongly influenced by the Romantic tradition. Wundt was influenced by Herder, Hegel and Wilhelm von Humboldt and gave a central place to consciousness, and wrote on cultural psychology, understood in a very broad sense to include all facets of social life. C.S. Peirce's work in psychology and William James' *Principles of Psychology* (1990) were very much in the tradition of Schellingian thought. Even Freud's notion of the unconscious can be traced back to the influence of

Schelling. The phenomenological tradition founded by Edmund Husserl is usually taken to have originated in the descriptive psychology of Franz Brentano based on a return to Aristotle rather than to Kant. However, Husserl was also influenced by William James, Henri Bergson and the neo-Kantians, and his work facilitated a revival of interest in the work of those philosophers influenced by Schelling, such as Kierkegaard and Nietzsche. His characterization of the development of cognition echoed the work of Fichte, as has been noted.

Gestalt psychology founded by Carl Stumpf, rejecting atomistic thinking, arguing that in perception the whole is more than the sum of its parts and concerned with the mind as self-organizing, was also seen as influenced by Brentano. But this movement also was influenced by a wider range of thinkers. Stumpf's grandfather had studied the philosophies of Kant and Schelling, and this background clearly influenced Stumpf's work. The Gestalt psychologists ascribed this self-organizing tendency to the brain, and following the use of the concept of field in physics, Wolfgang Köhler characterized the wholes they studied as fields. Kurt Goldstein extended Gestalt psychology to neuroscience. Jean Piaget objected to the focus of the Gestalt psychologists on achieving equilibrium to the exclusion of development, and to overcome this, developed his genetic structuralist theory of cognitive development to show how cognition develops from babies to adults. His later work on ethology was influence by von Uexküll. Piaget's theory of cognitive development has also been compared to Fichte's, and his extension of this to animals, along with efforts to characterize mathematics, again echoes Schelling (Gare 2017a, 84). Merleau-Ponty, who late in his career revived natural philosophy, turning to the work of Bergson, Schelling and Whitehead as well as to developments in the physics (Merleau-Ponty, 2003), work that inspired later efforts to naturalize phenomenology, from the beginning of his career drew upon the work of the Gestalt psychologists, including Goldstein and von Uexküll, and also Piaget.

In all cases, humans were portrayed as being essentially social, not only through being part of societies, but only becoming human through being socialized or encultured into historically formed and historically developing communities, defining themselves through mutual recognition in the context of institutions, communicating through socially formed languages and controlling

their situations through tools, technologies and built-up environments. That is, they were understood as Hegel had characterized humans. Social sciences that conceived humans in this way were defended against the atomic individualism promoted by mainstream economists and psychologists. Sociologists, following Pitirim Sorokin, analysed societies into through three dimensions of personality, society and culture, each being essential to and a condition of the other two. This corresponded to Hegel's philosophy of Spirit or *Geist* according to which there is Subjective Spirit, Objective Spirit and Absolute Spirit. By developing these as sciences they should be seen as justifying Schelling's naturalism and seen humanity as part of nature. On this basis, it could be argued that if the human sciences are to advance, human ecology should become the central human science through which all other human sciences can be related to each other and put into perspective.

When all such scientific work is considered together, it is should be evident that the quest to overcome scientific materialism that began with the Early Romantics has been the driving force of both the natural and the human sciences from the early nineteenth century onwards. Reductionist thinking has proceeded by attempting to account for the observations and insights of the Schellingian challenge to scientific materialism by interpreting these in terms commensurate with Newtonian science, and generally, have failed. In some cases this has been productive, as when Heinrich Hertz, Helmholtz's student, in his effort to reformulate physics from a neo-Kantian/Newtonian perspective to oppose the work of Faraday and Maxwell, set out to refute Maxwell by showing that the implications of his work were mistaken, and discovered radio waves. While orthodox reductionist biology, by effectively explaining away life rendered itself incoherent, understanding the struggle for survival and the study of the chemistry of life did advance biology. However, the effect of the continued domination of assumptions deriving from Cartesian and Newtonian science fragmented the advances in post-Cartesian, post-Newtonian science. The development of field theory in physics has been hindered by a constant tendency to privilege particles. Rodney Brooks in a recent book, *Fields of Color* (2016) in which he defended the quantum field theory of Julian Schwinger and Hideki Yukawa against Feynman, Schrödinger and de Broglie against Born, Heisenberg and Dirac, and Lorenz against Einstein, noted that in each case

those defending the primacy of particles prevailed over those defending fields. This constant tendency to translate field theories in terms of particles, he argued, is responsible for the apparent incomprehensibility of quantum theory. Thermodynamics has been hindered by the assumption that ultimately its laws will be explained by statistical mechanics despite the impossibility of explaining phase transitions in this way. Advances in quantum chemistry have been limited because of the assumption of chemists that they are dealing with nothing but particles and the bonds between them. Post-reductionist biologists are hindered by not being able to take full advantage of the advances in the physical sciences. And the human sciences, even when anti-reductionist, have a tendency to privilege objectifying forms of thought that render the notion of humans as subjects creating themselves though history, unintelligible.

EXPLAINING CONSCIOUSNESS THROUGH PROCESS PHILOSOPHY

With this background it should become evident that developing science in a way that makes consciousness intelligible will require us to not only reject reductionist scientific materialism as incapable of comprehending consciousness. It will involve a radical transformation of what we take the sciences to be. It means rejecting the tacitly held assumption of those who take the reality of consciousness seriously that it is a Cartesian thinking thing or thinking subject. It means embracing the German notion *Geist* for mind and conceiving of the mind as Spirit as characterized by Hegel and Schelling, and conceiving consciousness in relation to this. Thinking of consciousness in this way involves first of all seeing human consciousness as integrally related to culturally formed communities and their histories, and involves multiple levels of feeling and awareness as well as focal consciousness. Spirit (*Geist*) is the moving force of humanity advancing humanity's understanding of itself as central to its own self-creation, while following Schelling, seeing humanity as part of nature and therefore part of the self-formation of nature. It is through human Spirit, which includes culture, institutions and technology as well as the embodied, conscious subjects who undertake research and develop ideas, that nature is reaching higher levels of self-understanding.

It is also necessary to understand what is involved in consciousness being embodied as part of nature. As Schelling, then von Uexküll and the phenomenologists argued, it involves being an organism that defines its

environment as its world, and acts on the basis of how this world is defined. In the case of humans with their capacity to see the world from the perspective of others, this world is a with-world, a world shared with others, and it is by virtue of this that it is an historical world transcending the lives of any particular individual. This also facilitates the capacity of humans to reflect upon themselves and their understanding of themselves, developing a self-world. As the semioticians have argued, all these processes are semiotic processes; that is, forms of semiosis, with the most thoroughly worked out characterization of semiosis having been provided by C.S. Peirce, who characterized himself as a Schellingian of some stripe (Gare, 2009). What made Peirce's theory of semiosis superior is that he understood semiosis as triadic, involving a sign, an object and an interpretant in a way that can be interpreted as involving the limiting of activity. This very general characterization of signs enabled the growth of organisms and their actions as well as thoughts to be understood as semiotic processes, with vegetative growth, actions and ideas being conceived of as interpretants, with thoughts presupposing the capacity to act and action presupposing vegetative semiosis (Kull, 2009). Semiotics is also central to ecosystems. As Kalevi Kull argued, the bonds of ecosystems, including the global ecosystem, are semiotic bonds (Kull, 2010). From this perspective, the development of human culture associated with the development of human Spirit, including the institutional, architectural and technological forms and infrastructure that cultures sustain, is part of the development of the semiosphere as characterized by Jesper Hoffmeyer.

For orthodox Peircians, this theory of semiotics solves all problems of science and philosophy since we can regard semiosis as ubiquitous and the whole of reality as nothing but semiosis. Since natural processes always involve semiosis and interpretants, all of nature involves different degrees of consciousness. This has been contested by other semioticians, such as Marcello Barbieri (2008), who argue that semiosis originates with life, and there can be semiosis at a basic level of life without anything like consciousness. To reveal where consciousness comes in, it is necessary to unpack what has been enfolded from Kantian and post-Kantian philosophy into Peirce's notion of interpretant. It is here that Piaget's work is relevant, since his notion of structures assimilating and accommodating to their environments, based on Kant's notion

of schema, provides a better appreciation of what is consciousness. This is especially the case when Piaget's notions are further developed through Merleau-Ponty's post-phenomenology and Mark Johnson's (1987) and George Lakoff's (1987) work in cognitive science, which also facilitate an appreciation of the role of body schema, metaphors and narratives in cognition, the development of culture and individual consciousness.

The problem then becomes how to explain the possibility of these semiotic and cognitive processes through the physical sciences. Here it is important to keep in mind what has been argued above, that that most of the major advances in science since the middle of the nineteenth century have been inspired by efforts, following Schelling, to conceive nature is a way that would make consciousness intelligible. To put these advances in science in perspective from a Schellingian perspective it is best to work from the reality of self-conscious Spirit down. Consciousness must be acknowledged as part of nature by science because to deny it is a performative contradiction. And as Robert Rosen noted, whenever biology has come into conflict with physics, it is physics that has turned out to be wrong and has had to give ground. So, discussing consciousness, it is better to look at Spirit before biology and biology before chemistry and physics. Along with work in biosemiotics, the developments in theoretical biology that can grant a place to Spirit are those inspired by Whitehead, most importantly, the work of the mathematico-physico-chemical morphologists led by C.H. Waddington and Joseph Needham. Under the influence of Whitehead's notion of concrescence, Waddington developed the concept of 'chreod', or necessary path, along with the concept of homeorhesis, the process by which a developing system returns to its path of development after perturbations. There are hierarchies of paths, as with an embryo as a whole and its differentiated parts, and there are possibilities of taking different paths, with various degrees of difficulty in shifting from one path to another. Waddington modelled these paths as landscapes with paths represented as valleys and the difficulty of shifting from one path to another as ridges between the valleys. René Thom formalized these representations through differential geometry, introducing the notion of catastrophe into mathematics to characterize moving from one path to another. These concepts were utilized to characterize the development of embryos, but proved useful in diverse

disciplines. As both Waddington and Piaget realized, these concepts were applicable to comprehending cognitive development and cognitive activities, and Thom applied them to developing a theory of semiotics that influenced Barbieri.

LIFE, THERMODYNAMICS AND QUANTUM FIELD THEORY

The question such work raises is how chreods and homeorhesis are possible. Various efforts to explain these have been made, but a common feature of them is that they accord a central role to oscillations and their entrainment. It is by virtue of oscillations in a developing embryo that cells recognize their position and role. Oscillations are functioning as signs. Oscillations in turn involve energy and its transformations. Ilya Prigogine, who used his work on dissipative systems engendered by far from thermodynamically equilibrium systems to explain life, showed that oscillations, that is, fluctuations in concentrations of the chemical acrasin, can explain the transformation of the slime mould from a collection of individual cells into a differentiated organism with a foot, stalk and spore pod (Prigogine, 1976). Oscillations developing as components of dissipative structures account for vegetative semiosis. Those developing these ideas are generally seen to be challenging the work of the biochemists and molecular biologists with their reductionist program, but Candace Pert, examining the nature and role of chemicals in the relationship between ligands and receptors, has shown that these can only be understood through frequencies of oscillation and entrainment of oscillations. On this basis she showed that polypeptides are able to account for memory and emotion in organisms (Pert, 2003).

What is crucial for understanding how these oscillations can effect significant changes is work on how systems organize to a state of criticality such that a very small input can trigger major transformations. This involves storing usable energy, and one of the pioneers of biophysics, Herbert Fröhlich (1977), showed how such storage can take place through various kinds of oscillations, that these oscillations could account for the coherence of organisms, and electric dipole oscillations associated with water could be propagated as coherent waves along filaments within cells without thermal loss. Building on this work, Mae-Wan Ho (2008; 2012) pointed out that organized heterogeneity can involve the creation of a hierarchy of near-equilibrium regimes despite the

whole being far from equilibrium, thus maximizing the efficiency of energy transformations. Organisms are excitable media poised to respond to specific signals disproportionately because large amounts of energy are available to amplify small, weak signals, often into macroscopic action.

Thermodynamics and chemistry are not enough by themselves to explain how these oscillations engender consciousness, however. This requires recourse to further developments in physics. I have already noted that the development of electro-magnetic field theory explaining light emerged out of the research program of the Early Romantics, and particularly Schelling, to replace Newtonian physics that made consciousness unintelligible, with a form of physics compatible with the reality of mind and consciousness. Claiming that electro-magnetic fields are somehow involved in consciousness can facilitate an explanation of consciousness should not be seen as surprising. However, later developments in physics stood in the way of this conclusion. One was the reconceptualization of fields in a way that denied any reality to temporal becoming, the other was the development of quantum mechanics and the reinstatement of particles to the centre of theoretical physics. As I noted above, particles tend to be privileged over fields in physics despite the continued use of the language of fields. We speak of elementary particle physics, not elementary field physics. However, there is no reason to accept this way of interpreting advances in physics, and quantum field theorists have reasserted the primary reality of fields, with so-called particles seen as perturbations of fields. This is really how Whitehead, whose first work was a study of Maxwell's equations, was interpreting fields, with his notion of actual occasions being quanta of fields conceived in such a way as to grant a place to subjectivity and choice as well as objectivity.

A number of theorists have invoked quantum theory to account for consciousness. The most well known of these are Roger Penrose and Stuart Hammeroff, drawing upon Penrose's own work in physics, Henry Stapp who has interpreted John von Neumann's interpretation of quantum theory through Whitehead's philosophy to explain experience as it was described by William James (Stapp, 2009, 9ff.), and David Bohm, whose early work and later work have influenced different theorists in neuroscience, most importantly in my view, Paavo Pylkkänen (2007). However, here I want to draw on the work of

Hiroomi Umezawa (the successor to Yukawa as Japan's leading theoretical physicist), and those he influenced. This includes Mari Jibu and Kunio Yasue, and the Italian theoretical physicist, Giuseppe Vitiello (Globus, Pribram and Vitiello, 2004). Umezawa was concerned to advance quantum field theory by incorporating thermodynamics, and Vitiello continued this project. Umezawa, Jibu and Yasue applied these advances in quantum field theory to neuroscience, developing quantum brain dynamics. This work was embraced by Karl Pribram and his student, Walter Freeman, both concerned to overcome the limitations of brain science based on the assumption that all important brain activity is associated with the electro-chemical activity of neurons and neural nets. Vitiello went on to develop a dissipative quantum model of the brain (Vitiello, 2001). This work has influenced Gordon Globus (2009) who has attempted to interpret their work through Whitehead's and Heidegger's philosophies.

Quantum theory has been invoked by neuroscientists not only because it might make the reality of consciousness more intelligible, but also because the brain and the body generally has an enduring coherence in its functioning that cannot be accounted for through the chemistry of nerve impulses. These are too slow. Nor can mainstream neuroscience account for long term memory, given that biomolecules are continually being broken down and reconstructed every few weeks. However, those drawing on quantum theory have been vigorously opposed, and this opposition was consolidated by an influential paper by Max Tegmark (2000) claiming that at body temperature the quantum coherence required to explain this neural coherence could not last anywhere near long enough to do so. Thermal noise would lead very rapidly to decoherence. While Penrose and Hammeroff claimed that the water bound up in microtubules is insulated from thermal noise, Umezawa pointed out the argument was invalid against quantum fields achieving this integration. As he pointed out, neither neurons nor other brain cells are treated as quantum objects, and the quantum variables are basic field variables (Vitiello, 2001, 86). Tegmark has revealed the limits of quantum mechanics, and thereby why it is necessary to use quantum field theory to understand the brain, Vitiello argued.

While Umezawa was concerned primarily with showing how the quantum vacuum in quantum field theory could serve memory, Mari Jibu and Kunio

Yasue (1995) characterized quantum brain dynamics as the quantum electrodynamics of the electric dipole field of dipolar solitons and water molecules bound within the cytoskeletons of cells, postulating a 'cortical field' and 'corticons' as cortical field bosons. Asking "What is mind?" and "What is Life?" they proclaimed, 'We will address these two issue from the new point of view that *water is the fundamental constituent of both life and consciousness'* (p.158). Building on this work, Freeman and Vitiello argued:

> The common belief is that, if physics has to be involved in the description of brain dynamics, classical tools such as non-linear dynamics and statistical mechanics should suffice. However, many-body field theory appears to us as the only existing theoretical tool capable to explain the dynamic origin of long-range correlations, their rapid and efficient formation and dissolution, their interim stability in ground states, the multiplicity of coexisting and possibly non-interfering ground states, their degree of ordering, and their rich textures. It is historical fact that many-body quantum field theory has been devised and constructed in past decades exactly to understand features like ordered pattern formation and phase transitions in condensed matter physics, similar to those in the brains, that could not be understood in classical physics. (Freeman and Vitiello, 2006, 96)

Freeman and Vitiello continued their collaboration to develop these ideas to show the relationship between mind and quantized fields (Freeman and Vitiello, 2016a and 2016b).

Apparently independently of this school of thought, Mae-Wan Ho also defended a central role quantum coherence and for the role of water in facilitating this. She also claimed that quantum coherence associated with water is central to consciousness. Her work has been ignored by mainstream scientists, partly because of the boldness of her claims for the role of quantum coherence in biological organization and in the emergence of consciousness. If the claims of Penrose and Hammeroff can be challenged, then Ho's speculations about quantum coherence place her outside what can be taken seriously.

However, Ho's views differed from those of the proponents of quantum brain dynamics (see Gare, 2017b). Her work manifest her commitment to Whiteheadian and Bergsonian process ontology. She characterized her own work as 'a Whiteheadian "process" view in which organisms are seen not as the consequence of natural selection of past random mutations but as dynamic

structures which are immanent and simultaneous with process.' On this view, 'The organism, as well as the human observer as organism, are firmly located within nature where they are empowered to shape their own evolution and destiny' (Ho and Fox, 1988, 14). She also embraced Henri Bergson's 'intuition of inner organic time of "pure duration" as a dynamic heterogeneous multiplicity of succession without separateness' which, she argued, 'the advances in neuroscience over the last two decades have borne out' (Ho, 2008, 320). On the basis of these ontological commitments, she argued that too much emphasis had been placed on the brain and the central nervous system and argued that consciousness should be seen in relation to the whole body of organisms, which she characterized as quantum coherent liquid crystals. As she put it:

> Body consciousness possessing all the hallmarks of consciousness – sentience, intercommunication and memory – is distributed throughout the entire liquid crystalline matrix that connects each single cell to every other. Brain consciousness associated with the nervous system is embedded in body consciousness and is coupled to it. (Ho, 2008, 237).

The work of Umezawa and those he influenced provides strong support for such conjectures. While focusing on the brain, Umezawa, Jibu, Yasue and Vitiello acknowledged that there was no reason for not acknowledging that the whole body could function as a coherent quantum field, although except in rare asides, they did not develop this insight (Vitiello, 2001, 92).

While Ho did not attempt this, the importance of this approach is that it can be embraced and used by proponents of the microgenetic theory of consciousness. Building on the work of the Leipzig school of Gestalt psychology and examining the actual genesis of the various forms of differentiation of experience into separate sensations, perceptions, distinct acts of remembering, distinct thoughts, and so on, they argue and have provided a great deal of evidence for their claim that such differentiation culminating in the higher forms of self-reflexive consciousness are built on and presuppose the more primitive and immediate forms of cognition as inchoate, pre-conscious felt dispositions (Bachmann, 2000, chap.1). Each act of cognition up to and including language and reflective self-consciousness, unfolds through moulding the more basic and more global forms of cognition to achieve greater specificity to achieve these more advanced, focussed and more detached forms of

cognition. Jason Brown (2015, 49) concluded that it is necessary to invoke Whitehead's notion of causation in which what comes later in a sense incorporates what comes earlier (as for instance the meaning of a sentence understood at the end of the sentence incorporates the earlier parts of the sentence) to explain such cognition.

RETHINKING THE SCIENCE OF CONSCIOUSNESS THROUGH ROBERT ROSEN

Does this mean we should accept the identification of consciousness with coherent quantum fields of liquid crystals? What is the relationship between such physical processes and Spirit as characterized by Hegel? Those defending quantum theory have shown that tranquilizers work by interfering with the quantum coherent fields associated with water in microtubules, so it is reasonable to believe that these fields are inseparable from consciousness, but to claim that these fields are consciousness is like claiming that since cars cannot function without sparkplugs, the life of cars must be in its sparkplugs. It is best to interpret work on the role of quantum coherent liquid crystals in terms of the whole tradition of process metaphysics and corresponding advances in science as these have developed since Schelling wrote his major work on the philosophy of nature in 1799 (Gare, 2013).

One of the most important insights of Schelling was that the evolution of nature, involving emergence of higher and higher levels of organization leading up to human consciousness and the development of Spirit, as noted above, involved, counter-intuitively, limiting activity (Schelling, 2004, 17). Once postulated, this is obvious. Atoms limit the components of their nuclei and their electrons to reproduce themselves, and it is by virtue of these limitations that neutrons are stable and atoms have their valency and powers and liabilities. The activities of chemicals in a living organism are similarly limited to serve the maintenance, development and reproduction of the organism. This insight was rediscovered by Howard Pattee in the 1960s and 70s (Pattee, 1973; Pattee, 2012), who referred to constrains rather than limits. Pattee was primarily concerned to explain how molecules become messages, and his work on this was initially associated with dealing with the measurement problem in quantum theory before being generalized to theoretical biology and social theory. Pattee's work

was taken up and further developed by the theoretical ecologist Tim Allen (Allen and Starr, 1982) and the theoretical biologist Stan Salthe (1993). Generally, hierarchy theory was developed as a means to advance general systems theory and complexity theory. However, if we relate this work on constraints back to the Schellingian tradition of process thought, it would be more fruitful to think in terms of emergent fields rather than systems, immediately focusing attention on balances or imbalances of opposing forces in producing, maintaining and developing fields.

This not only aligns this idea with the theoretical biology of Waddington and the notion of chreod which presupposed the notion or the biofield (originating with Alexander Gurwitsch), but also makes it easier to relate biology to advances in physics. The fruitfulness of the notion of field has been demonstrated by Alexander Gurwitsch with his notion of the biofield, by Brian Goodwin with his notion of the morphogenetic fields developed in his work on embryology, by Mari Jibu and Kunio Yasue in developing the notion of the cortical field, by Gestalt psychologists with their notion of the perceptual field, and by Kurt Lewin and Pierre Bourdieu in their social theory based on the notion of social and cultural fields. As I have shown elsewhere, it provides the means for integrating Piaget's genetic structuralism and Peircian semiotics, and for understanding the nature of human culture and social dynamics (Gare, 2017a). And as Joseph Bracken has argued, the notion of fields is required to overcome the atomistic tendencies of Whitehead's formulation of process philosophy in *Process and Reality* (Bracken, 1994).

However, field theory and hierarchy theory are not enough by themselves to comprehend life and mind. Robert Rosen, who initially worked with Pattee in developing hierarchy theory, found this inadequate to do full justice to the reality of life itself. Through his work on mathematical modelling using category theory according to which what is being modelled is causal entailments, he realized that anticipatory systems, which must have models of themselves in their environment, must be seen to consist of a number of processes that are components of each other but are not reducible to each other (2012). Consequently, there is no largest model of such systems through which models of its components can be deduced. Multiple models, each being components of and presupposed by the others, are required. This work had far

reaching implications because it reveals the impossibility of identifying the functions into which an anticipatory system can be analysed with their fractionated components, for instance, the electromagnetic and chemical processes and transformations that make up an organism. From this it should be evident that it is impossible to identify consciousness with quantum coherent fields of liquid crystals (Rosen, 2000).

This does not mean that quantum coherent liquid crystals are not essential to there being consciousness. Just as the chemical structures that give strength to bones are essential to these bones, quantum coherent liquid crystals organized at multiple levels are essential to organizational and psychological memory, coordinating growth, maintaining coherence in organisms, and enabling them to interpret their environments and then actively engage in their worlds, that is, to be aware and then conscious.

To begin with, the quantum coherent fields of liquid crystals are involved in consciousness because they encode memory in a way that they are able to trigger and coordinate cascades of energetic transformations, as when organisms leap into action in response to sensed danger. They are able to serve their role because of the complexity with which they can be modulated while at the same time preserving stability, while interacting with other fields, such as those associated with polypeptides formed in cytoskeletons, particularly those of neurons. It appears that the quantum field vacuum states and polypeptides, situated within dissipative systems constantly exchanging energy with their environments, serve the development of memory. However, memory is not merely recordings but the capacity to relate the past to present circumstances and to respond to these and to anticipated futures. Following Peirce and the biosemioticians, it is best to think of this as semiosis, including vegetative, animal and symbolic semiosis through which environments come to be sensed or experienced as meaningful worlds. Semiosis operates in these transformations at multiple levels. In serving to make memory possible, these quantum coherent fields should be seen not simply in relation to the whole organism rather than just the brain, but to the organism in its environment.

The development of a proprioceptive sense is crucial to animals, that unlike plants, can move in their environments. This is associated with differentiating the organism from its ambience with which it is engaged, which then become

the world of the organism. While in the case of most organisms that are capable of consciousness, this does not involve recognition that their world is independent of their perspectives on it. However, organisms have co-evolved with other organisms and what they are sensitive to and can respond to is largely determined by the ecosystems within which they have evolved. Ecosystems have evolved through the evolution of semiotic bonds between organisms and these are major components of the worlds of each organism. Humans also have the capacity to view the world from the perspective of others, developing their with-worlds. Their ambience or environment is an environment transformed by humans over their history into a shared, transformed world; a built-up environment. Memory and anticipation are augmented by the capacity to participate in linguistically mediated communication, whether speaking and listening, or reading and writing, and joint projects, sometimes organized over many generations, such as building a city, advancing science, building a nation, or building a global civilization. These are represented by shared narratives which being embraced function as facilitative or enabling constraints, making heroic actions and endeavors and new achievements possible. That is, civilized living involves participating in Objective and Absolute Spirit in a grand narrative as characterized by Hegel, constraining oneself in the quest for beauty, justice and truth. Rethinking Hegel through Schelling, Whitehead and Peirce, Objective and Absolute Spirit can be situated within the global ecosystem, and seen as a development of the global semiosphere whereby nature through us is reaching higher and higher levels of self-understanding. At the same time, this is an advance of process philosophy, the humanities and science.

CONCLUSION

Understanding the relationship between quantum coherent liquid crystals and human consciousness understood within the context of ecosystems is facilitated by Rosen's work, showing that processes can be components of each other while being irreducible to each other. This is how Hegel understood the relationship between the dialectics of representation, recognition and labour, and the relationship between Objective Spirit, Absolute Spirit and Subjective Spirit. Clearly, consciousness is associated with Subjective Spirit, but Objective

Spirit (institutions and their material supports) and Absolute Spirit (culture, pre-eminently the dialectic of representation whereby humans develop their understanding of themselves and their world) are components of Subjective Spirit, and central to human consciousness. By being inspired by participation in these, people are constrained to play roles in institutions and to participate in appropriating and advancing their understanding of themselves, other people, societies and the rest of nature. This can be characterized as the constraints associated with semiosis, evident when people accept the constraints of grammar to communicate, or the more severe constraints to speak only when appropriate, taking into account the dynamics of cultural fields in which they are situated. These constraints in turn are built on more basic constraints associated with biological existence and the maintenance of the ecosystems of which humans are part and within which they are participating. The advance of civilization is the development of consciousness and thereby Spirit, embracing the enabling constraints associated with having broader and broader perspectives, acknowledging through the dialectic of recognition crystalized in Objective Spirit, the significance of ever greater numbers of others, including other communities, societies and civilizations, and of ecosystems and their diverse species and members, moving towards the creation of a global ecological civilization, each person constraining their activities and productions, acting and living accordingly. This global Spirit, forging a new grand narrative, is slowly being incorporated by individuals, and is made possible by the quantum coherent fields of liquid crystals and protein molecules that are essential components of them.

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