

Set and Group Theories in the Transformation of Consciousness from an Ericksonian Hypnotherapeutic Perspective

The Roles and Integration of Set Theory and Group Theory in the Transformation of Consciousness from a Hypnotherapeutic Perspective: A Discussion of views of Penrose/Hameroff and Rossi/Rossi from the standpoints of the Erickson Resistance Protocol and the Implied Directive

Bruce Gregory¹

Abstract

As the roles and functions of consciousness have continued to be explored, a variety of views have been expressed, two of the more notable ones being the views of Penrose and Hameroff and Rossi and Rossi. These two views are compared from the perspectives of Cantor's set theory, Galois' group theory and the implied directive in the context of the evolving roles of consciousness and quantum physics in the area of mind-body hypnotherapy. Neuroscience and concepts from quantum physics are discussed and integrated with the application of Cantor's set theory to provide new perspectives to explore and understand consciousness, and how its role in treatment can be creatively employed. The implied directive is applied to clarify how creativity utilized in the context of patients'

¹ Dr. Bruce Gregory in achemical psychologist and hypnotherapist working at Ryokan , College, California, USA

qualia, and the permutations and inverse components of Galois' group theory can facilitate novelty, gene expression and new forms of comfort. Milton Erickson's work is discussed from the perspectives of its correspondence to quantum entanglement and the uncertainty principle in the facilitation of new consciousness within the unconscious.

Key words: Consciousness, set theory, group theory, creativity, implied directive.

Introduction

The origins, roles, and functions of consciousness have been explored and debated from a variety of perspectives that include philosophy, quantum theory, and the evolution of molecular biology and eastern philosophy (Chalmers, 1996, Joseph, 2011, King, 2011, Merrill-Wolff, 1973, Penrose and Hameroff, 2011, Rossi and Rossi, 2011, Tulku, 1979).

Depending upon the frame of reference, many distinctions, equivalences, and core contributions have been drawn during the quest to unlock the mysteries, secrets, and hidden aspects of Nature's design of life. From one perspective, there have been three basic hypothesis about the nature of consciousness; has consciousness been a natural evolutionary consequence of higher order complexity, is consciousness something more fundamental, or have there always been precursors of consciousness that through biological evolution facilitated actual consciousness (Clarke, 2011, Kafatos, et. al., 2011, King, 2011, Penrose and Hameroff, 2011). A second perspective has been the philosophical one of Chalmer's hard problem of consciousness, challenging the gap between functions and experience (Chalmers, 1996, Rossi and Rossi, 2011). Chalmers questioned why humans have subjective experiences, like color, sunsets, struggle, etc. which are called qualia. A third major perspective has been the role of the quantum world in the origins and facilitation of consciousness from the perspectives of computability or non-computability, the collapse of the wave function, superposition, and quantum entanglement (Clarke, 2011, King, 2011, Penrose and Hameroff, 2011).

Eastern philosophy has taken the position that consciousness is primary, preceding the the creative force (Kafatos et. al., 2011, Merrill-Wolff, 1973, Muktananda, 1969, Tulku, 1979). Nagarjuna,

living around 250 A.D., and considered to be the second Buddha and founder of the Mahayana school of Buddhism, used rigorous logic, primarily reduction ad absurdum to outline the doctrine of the empty self, demonstrating that as consciousness expanded through stages, the self or 'I' of the western world was replaced by the experience and consciousness of a no-self, and then at a later stage, the experience and consciousness of the empty self. These latter two experiences, which are subsets of a larger, more general set that contains all the different types of experience of the self, represented deeper levels of connection with Cantor's formulation of transfinite numbers (Cantor, 1874, Dunham, 1991).

The experiences and accompanying consciousness of the no-self and empty self implied molecular biological and genetic bridges and capacities that addressed Chalmer's challenge for a bridge to the hard problem of consciousness. Merrill Wolff, a mathematician from Stanford (Merrill Wolff, 1973) and Tulku, a Mahayanan Buddhist (Tulku, 1979) using similar logic, demonstrated that the self or I was not the center of the world as it viewed itself. Further, it was a product of space and time, both of which originated from a state of pure consciousness. A natural consequence of taking the position that consciousness was primary, fundamental, and the source, was the exploration and identification of levels of consciousness, whose deeper levels corresponded to the quantum world's aspects of superposition and quantum entanglement (Capra, 1975, Cox and Forshaw, 2011).

These states or levels of consciousness also reflected recognition of subsets of being states (King, 2001), and identified the subsets of qualia experiences relative to one's perception of reality. Regardless of the perspective, whether the various subsets of Hinduism, or the southern or northern Buddhist approaches, these levels of being states represented stages in the progression of consciousness from a state of pronounced alienation and disharmony to a state of consciousness reflecting integrated harmony and an experience of unified connectedness to both nature and the universe. Once again, these deeper states of consciousness reflected description of quantum states and presumably unknowingly a response to Chalmer's western philosophical challenge for explanatory 'bridges' for the qualia of consciousness. Recent research has demonstrated that some of the results of mindfulness training, a

subset of southern Buddhist practice utilizing present awareness without judgment, can be the alteration of affective processing and a reduction in chronic pain (Allen, et. al., 2012, Salomons & Kucyi, 2011). In addition, these deeper states or levels of consciousness implied that consciousness could be understood in terms of Cantor's set theory.

From an evolutionary perspective, one of the theories proposed concerned consciousness arising out of an adaptive need to anticipate and respond to survival threats (King, 2011, Wickramasingha, 2011). Current research strongly suggests that it was the unique sensing capacities of RNA and its role as a mediator between the environment and DNA that was one of the primary sources of consciousness (Culler, 2011, Wang, 2011).

From a philosophical perspective, consciousness has been divided into two categories, *quid*, which relates to doing, and *qualia* consciousness, which relates to being (Clarke, 2011, Dennett, 1991, Nagel, 1974). Observations of the WMAP satellite have identified quantum fluctuations during the period when the universe was 380,000 years old. While conventional theory suggests that these fluctuations were due to the influence of gravity, quantum theory asserts there can be no fluctuations without the presence of an observer, which points to the influence of consciousness as a primary source (King, 2011). These ideas were supported by the work of Hartle and Page. Hartle examined the probabilities of sets of outcomes for any collection of observations 'scattered throughout the universe in space and time' (Clarke, 2011, p. 266).

Jung initiated a psychological perspective on consciousness, positing that it represented the relation of psychic contents to the ego, implying both a need and nature's support for consciousness (Edinger, 1984, Jung, 1923).

Jung asserted that consciousness was a fundamental process, saying:

Man's task is... to become conscious of the contents that press upward from the unconscious. Neither should he persist in his unconsciousness nor remain identical with the unconscious elements of his being, thus evading this destiny, which is to create more and more consciousness. As far as we can discern, the sole purpose of human existence is to kindle a light in the darkness of mere being. It may even be assumed that just as

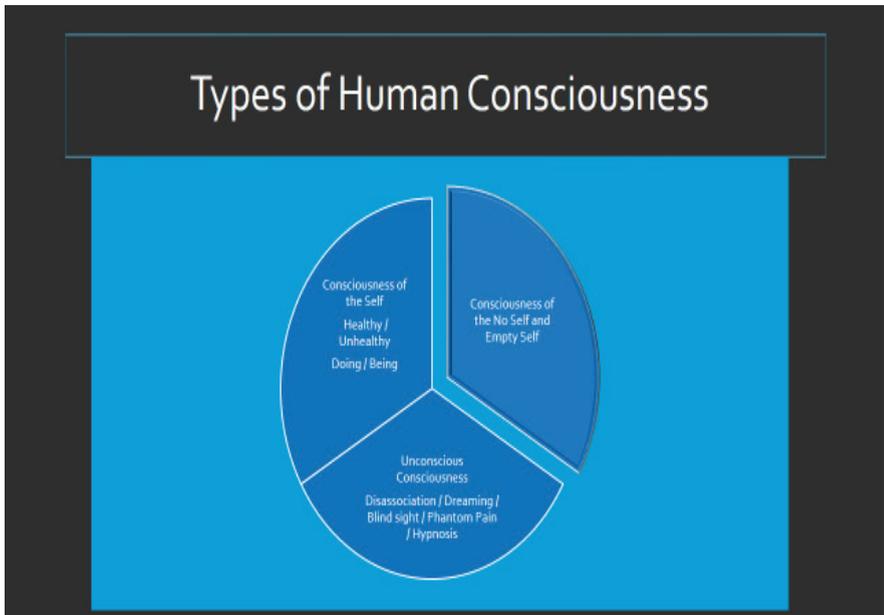
the unconscious affects us, so the increase in our consciousness affects the unconscious (Jung, 1960, p. 326).

Continuing the Jungian perspective, Neumann traced the evolution of human consciousness from the perspectives of different cultures. He asserted that consciousness was born when light was separated from darkness, and father sky was separated from mother earth, signifying the dawn of the world of opposites. Going further he stated that the experience of the world, meaning the experience of the self, was only possible through the dynamic of the opposites (Neumann, 1954). Edinger developed the themes Jung addressed in *Answer to Job*, (Edinger, 1984, Jung, 1945), addressing the spiritual components of consciousness in the individuation process.

Joseph (2011b, d, e) focused more on types of consciousness, which from an eastern perspective represented aspects or subsets of consciousness of the self, as opposed to Neumann's focus on the origins of consciousness. He pointed out that the mind is a multiplicity that is a function of specific brain areas that mediate different subsets of experience. The brainstem mediates the most reflexive, basic and unconscious aspects of the mind, while the limbic system is most analogous of Freud and Jung's conception of the unconscious overseeing basic motivational and emotional impulses, along with the desire of sex, and spiritual experiences. Joseph identified a variety of types of consciousness from the perspective of the self, from both functional biological processes to purely psychological types of consciousness. These types of consciousness were determined by what hemisphere of the brain they originated from. The left hemisphere of the brain is responsible for 'mathematical, analytical and linguistic aspects of consciousness' (Joseph, 2011, p. 109). In contrast, the right hemisphere is responsible for the perception, expression, and mediation of the predominant aspects of social and emotional functioning.

Further, Joseph identified that the left and right hemispheres of the brain were disconnected from each other, and were not aware of the other hemisphere's activity. Other examples of dissociated consciousness, which is a subset of consciousness, cited were blind sight, phantom limb pain and patients who reported separating from their bodies and still remaining conscious of the self. With regard to the experience of consciousness by the self, following

separation from the body, Joseph drew distinctions and parallels with quantum processes and dynamics, arguing that this state was a pure state of consciousness, a state of unity, reflecting a quantum state. Joseph (2011, d) drew distinctions between different subsets of dreams and different subsets of hallucinations, pointing out that sometimes dreams were more than just 'dreams', but represented an expanded type of consciousness that traversed temporal dimensions and also included archetypal components (Jung, 1945, 1964). In terms of hallucinations, Joseph argued that the hallucinations that accompanied some lsd experiences more represented alternate perceptual realities and states of consciousness that were mediated by the action of serotonin and 5HT than just being hallucinated states of reality. Figure 1 below summarizes some of the major types of human consciousness, a subset of the set of all consciousness.

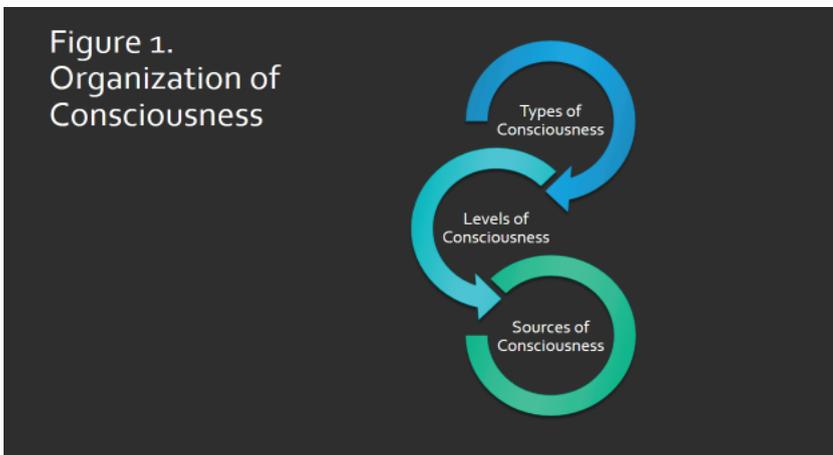


Although Descartes (Descartes, 1637(1984)) argued that animals have no consciousness, Darwin (Darwin, 1871) began to reverse that perspective by pointing out from the perspective of natural selection that the primary difference between man and animals was one of degree. The presence of consciousness in mammals has been corroborated by comparing the EEG signatures of different species

(Covanna and Monaco, 2009). Activity in the thalamocortical system has been analyzed in mammals that reinforces the position that animals have consciousness (Baars, Banks, and Newman, 2003). Functional similarities have been detected between man and animal brains (Wada, Hagiwara, and Jarvis, 2001). Finally, from the perspective of the properties of consciousness (Seth, Baars and Edelman, 2005), monkeys have shown to be able to give non-verbal indications of their conscious experience by indirect methods (Cowey and Stoerig, 1995, Nani and Cavanna, 2011). Cetaceans (dolphins, porpoises and whales) have demonstrated highly evolved consciousness in a variety of areas that include; artificial language comprehension, concept formation, behavioral innovation, understanding of mathematical concepts and the ability to solve abstract problems (Hermann et al., 1993, Hermann et. al., 1994, Mercado, et. al., 2000).

Research in light harvesting and the intelligence utilized in navigation by birds has suggested significant roles being played by quantum dynamics (Ball, 2011, Fleming et. al., 2011). The primary quantum dynamic has been quantum coherence, which is utilized by excitons, energized electrons that are activated by photons after the photons are received by the receptors of plants.

Figure 1 below summarizes how consciousness can be organized from different frameworks.



Core aspects of the views of Penrose/Hameroff and Rossi/Rossi

At its core the Penrose/Hameroff model (Hameroff, 1998a, Penrose, 1994, Penrose and Hameroff, 2011) emphasizes the role of microtubules functioning deep within the cell structure as potentially representing the role of quantum processes in the facilitation of consciousness. Microtubules are self assembling protein polymers that are involved in a number of significant cellular processes that include architecture, growth and direction of function. They operate at the level of approximately 25 nanometers in time frames of 10 to the 15th operations per second and 25 milliseconds for each conscious thought. Penrose and Hameroff have compared the latter dynamic to ancient Buddhist texts that quantify thoughts around 20 milliseconds. This corresponds to the neuroscience concept of gamma synchrony. From a set theory perspective it should be noted that this is describing the subset of the consciousness of the self, as compared to Eastern perspectives on consciousness that prioritize consciousness that is connected to other perspectives, which function as essentially polarities to the western concept of self.

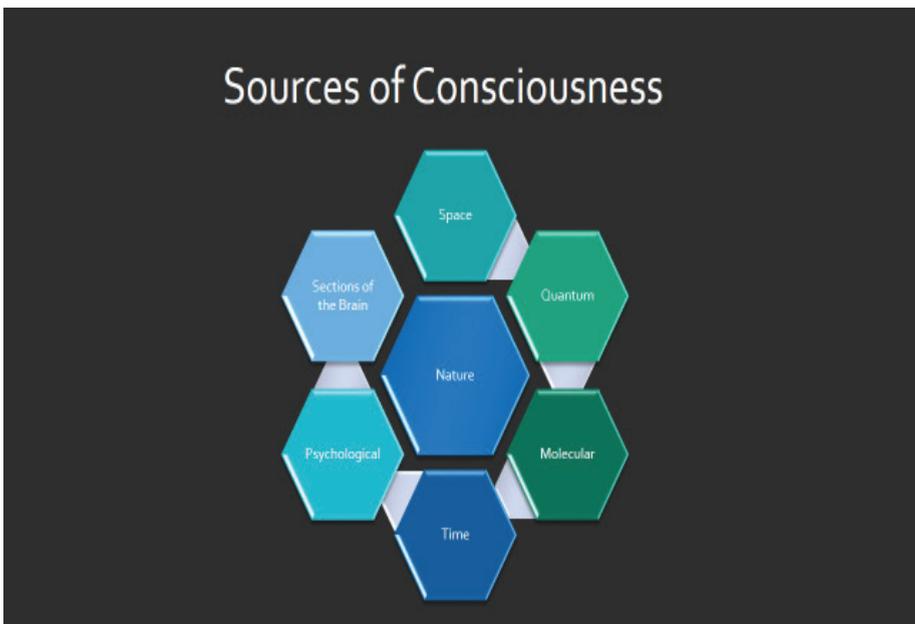
In addition it should be noted that microtubules are a subset of the larger subsets of *sources of consciousness*, in this case molecular biological ones. Penrose and Hameroff's argument reaches the quantum level as a subset source for consciousness when it addresses the role of the collapsing of the wave function as it relates to superposition. Penrose and Hameroff have proposed that there is a quantum gravity component operating at the Planck level of spacetime geometry that involves a mass displacement

of superimposed states consistent with Einstein's general relativity principles, and that this is the step at quantum level that facilitates consciousness.

Penrose and Hameroff noted that the switching mechanisms for the microtubules may depend on the van der Waals-London force operating in hydrophobic regions of the microtubules. They noted that the timing dynamics may be related to Frohlich's work on biological coherence and that the information capacity was 10 to the fifteenth operations per second per neuron, with there being ten to the eighth tubulins per neuron. In addition to the role of Planck level spacetime geometry, this capacity implied dependence

on the quantum level that further implied the roles of space and time as subsets of the sources for consciousness. In addition, the information capacity in the context of the roles of space and time implicitly pointed toward Rossi's proposal that the role of the numinosum was significant (Rank, 1923, Rossi, 2002, 2004, 2007).

The Rossi/Rossi model is responsive to Chalmer's challenge for an explanatory bridge or bridges to the 'hard problem', which he defines relative to the distinction between function and experience. In general the Rossi/Rossi model emphasizes the utilization of the appreciation of the molecular biological bridges in facilitating activity dependent gene expression that aligns and empowers individuals with their resources and nature's healing processes. One of the core aspects that the Rossi/Rossi orientation focused on was another molecular subset of the sources of consciousness both from an evolutionary and biological perspective. The Rossi/Rossi perspective noted the functioning of the RNA family of molecules as sensing activation devices, which simultaneously are a type, source and subset of consciousness (see figure 2).



These RNA subsets, which are sensing devices that utilize cues from the environment, and the qualia experience of the individual

to support the facilitation of new learning, activity dependent gene expression and new consciousness, were noted as a creative 'function' (Culler et al., 2011, Rossi and Rossi, 2011, Wang et al., 2011). The Rossi/ Rossi orientation proposed that RNA may satisfy Chalmer's challenge for a bridge on two levels, the first being their mediating role in supporting the development of DNA. The second level was its role from an evolutionary perspective in the design and creation of life, out of which a many types of consciousness emerged. In 2010 alone a class of 12,000 eRNAs was identified to support gene expression (Kim et al., 2010, Rossi and Rossi, 2011). Rossi and Rossi noted that the dopamine receptor D4 plays a significant role in one subset of the sources of consciousness in relation to novelty seeking behavior

(Matthews and Butler, 2011, Rossi and Rossi, 2014). In addition to the role of RNA molecules in the facilitation of consciousness, Rossi and Rossi noted a number of other factors relevant to the exploration of the sources of consciousness that included;

- The appreciation of time and natural time parameters (Rapparini, 2011, Rossi and Rossi, 2011).
- The qualia related to the BRAC, the four state creative process, and sleep and dreaming (Kleitman, 1969, Poincare, 1905, Ribiero, 2004, Rossi & Rossi, 2008).

Rossi and Rossi (Rossi and Rossi, 2014) have noted the value and relevance of the meta-consciousness subset of human consciousness in terms of mind gene connections.

This included, but was not limited to processes of self- reflection as wondering about wondering; thinking about thinking, the consciousness of creativity, the creativity of consciousness, the consciousness of connection, the connections of consciousness, etc.

In addition, the Rossi/Rossi approach highlighted the consciousness of integration subset by appreciating the roles of the hippocampus, frontal cortex, and the various groups of molecules operating within both areas of the brain that support the integration of new experiences, and in general the integration of the old and the new when new consciousness is facilitated through the creb cycle (Kandel and Squire, 1998, Ribiero, 2004, Rossi, 2002, Rossi and Rossi, 2008, Rossi and Rossi, 2011). This supported

other efforts expressing the consciousness of integration in physics (Greene, 1999, 2004), different psychological perspectives (Norcross and Newman, 1992, Wilber, 2008, Wolfe, 2008) different hypnotherapeutic theories (Lynn and Sherman, 2000), psychology with molecular biology, chronobiology, chaos theory (Rossi, 1986, 1996, 2002), and psychology with mathematics, physics, classical music composition theory, and tai chi (Gregory, 2010, 2011, 2012).

Rossi and Rossi utilized DNA microarray technology to address the relationship between the facilitation of new consciousness with gene expression in relation to the immune system and the handling of stress (Cozzolino, et. al, 2013, Rossi and Rossi, 2013)

In summary, both approaches recognize the role of nature, space, and time both in the origins/sources and the facilitation of consciousness. Both implicitly recognize *the need and capacity for connection* as a subset of the sources and types of consciousness, and implicitly value of the role of mathematical consciousness that is reflected by the quantum process of superposition and entanglement related to electrons (Cox and Forshaw, 2011, Greene, 1999, Gregory, 2011). The Penrose/Hameroff approach does this on a quantum and molecular level, and the Rossi/Rossi approach on just a molecular level. The major differences are;

- The emphasis on where and what (microtubules or RNA) in the cell is participating in the facilitation of consciousness
- The Penrose/Hameroff inclusion of the role of quantum dynamics.
- The Rossi/Rossi appreciation of the role of meta-consciousness in the facilitation of consciousness.
- The Penrose/Hameroff speculation about the role of quantum gravity in the facilitation of consciousness.
- The Rossi/Rossi appreciation and emphasis of the utilization of opposites in the transformation of consciousness
- The Rossi/Rossi valuing of the consciousness of integration subset.

The Utilization of Set Theory in the Exploration of Consciousness

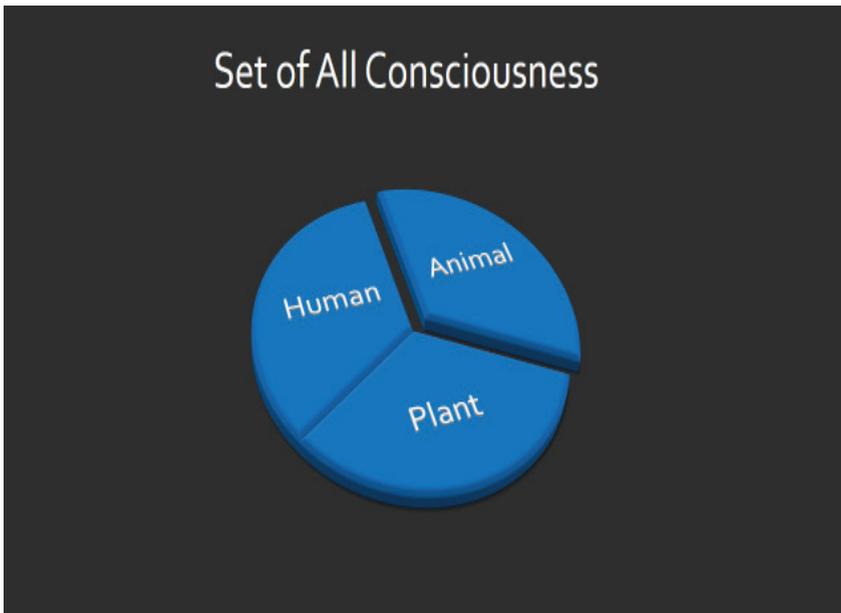
Set theory was developed and utilized by Cantor in 1873 (Dunham, 1991) in his proof of transfinite cardinals. The language of set theory relies on one fundamental relation, called membership. One result of set theory was that it became the basis for the definition of numbers, which included integers, real and complex numbers as well as functions, geometric and topological objects, and all objects studied in mathematics. As such set theory serves as a foundation of mathematics in that all questions of provability of mathematics are dependent on the axioms of set theory. One of the main tools utilized by Cantor in his proof was the principle of correspondence. The correspondence he utilized was between the sets of natural numbers and the set of real numbers of any finite interval;

For example $(0, 1)$. Through his use of power sets Cantor showed that there were many levels to infinity. The steps he utilized in his proof provided a series of bridges that implied a consciousness of infinity and a template for facilitating a consciousness of infinity through the holding of attention, which thereby created a yes set and a platform for activity dependent gene expression. Before this development, arguments using infinity, including Newton's calculus did not require the use of infinity. Even Gauss, one of the developers of non Euclidean geometry, had referred to infinity in a minimizing manner.

Infinity becomes relevant in consciousness studies when one considers the subsets of the types, levels and sources of consciousness that are related to the experiences of connectivity/ quantum entanglement and superposition on quantum levels (Cox and Forshaw, 2011, Greene, 1999, Gregory, 2011). These subsets represent the opposite side of the polarity of the symptoms patients bring to treatment in terms of alienation, isolation, abandonment, etc. When this is considered alongside of the set, subsets, and power sets of the bridges to different types, sources and levels of consciousness, this leads to the recognition of the set of all consciousness, the set of all infinities, and the consciousness of infinity, which is referred to by a variety of terms in eastern philosophy. These include but are not limited to oneness, Samadhi, emptiness, sunyata. The consciousness of infinity can include, but

not be limited to, the valuing of the role of infinity and infinities, and the *implications* of the application of infinities to empowerment and creativity in therapeutic contexts. The primary application of the consciousness of infinity is that it serves as a deeper metaphor for the *consciousness of connection, the need for connection, and the capacity for connection*, at a level deeper than the quantum metaphors for connection.

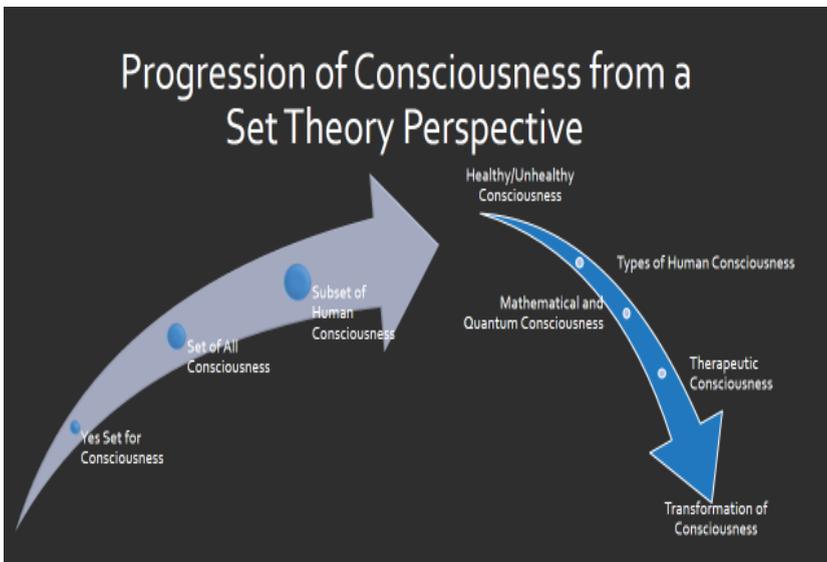
Figure 4 below provides a broad summary for the set of all consciousness.



Once Consciousness is considered as a set, a yes set for the consciousness of the therapist can be established (Erickson & Rossi, 1979). The following can occur; the *levels* of consciousness of the therapist, especially in terms of *trust, creativity, and appreciation*, and their relative subsets, can be put into a one to one correspondence with the set of numbers like Cantor did in his proof. These subsets, when integrated, represent the level of consciousness of the therapist. When this is considered in terms of the subsets of the sources of consciousness, and the subsets of the types of consciousness, *quantum dynamics and quantum consciousness being subsets of the sources and types of consciousness respectively*, the consciousness of quantum variables and processes (time, space, motion, position, momentum, uncertainty, entanglement,

superposition, the collapsing of the wave function), and their role in treatment, can be considered other *subsets of the sources, types and levels of consciousness*. Erickson’s resistance protocol (Erickson, 1964), with Erickson’s levels of trust and appreciation of the sources of consciousness, can then be considered in terms of the quantum variables, quantum processes and mathematical perspectives employed in the protocol, which will be discussed in the closing section.

Considering this in the context of the Langlands program of mathematics that seeks to integrate the different fields of mathematics, leads to the exploration of the correspondences and equivalences with other areas that utilize quantum processes, such as tai chi and classical music composition theory, and the implications of those correspondences, which will be addressed in the sections on group theory and the Erickson resistance protocol. In addition, this implies the need for an expansion of therapeutic consciousness to include an appreciation and utilization of both quantum and mathematical consciousness. (Frenkel, 2013, Gregory, 2010, 2012, Levitin, 2006, Man Ch’ing, 1985). Figure 5 below summarizes the progressions in terms of set theory.



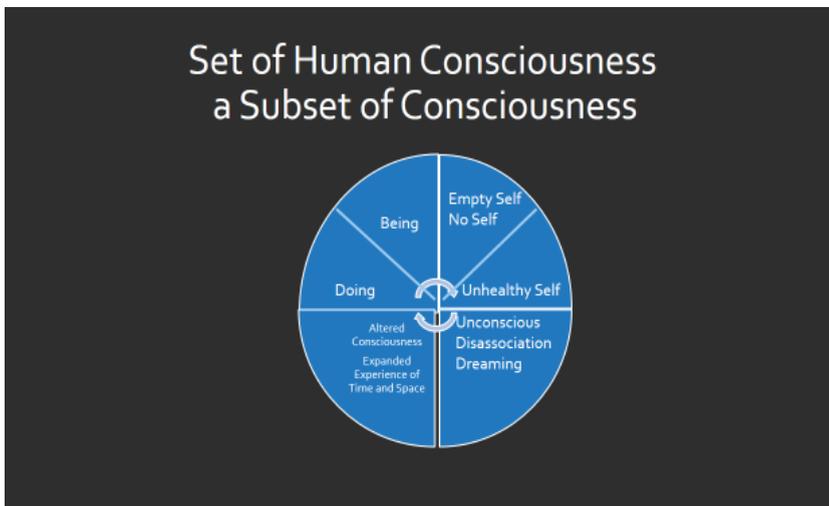
- Yes set for Consciousness (Consciousness has value and is a source of comfort). This yes set for consciousness can be

utilized comparable to the yes set Erickson facilitated with his patients with their unconscious.

- **Set of All Consciousness**

- Subset of Human Consciousness (The Set of Human Consciousness)
- Subsets of Human Consciousness (healthy vs. unhealthy/ therapeutic consciousness/ quantum consciousness/ mathematical consciousness)
- Transformation of Consciousness

Figure 6 below summarizes many of the subsets of the set of human consciousness, which *implies* the subsets of the consciousness of bridges and the bridges of consciousness.



Role of Implied Directive in the Exploration, Valuing and Transformation of Consciousness

The implied directive utilizes the recognition of the implications of facts and relationships, which makes it primarily a cognitive process. It is the cornerstone of mathematical proofs and Erickson's indirect, utilization approach. Erickson originally used it in the context of indirect contingency suggestions. It had three components; a time binding introduction; a suggestion that takes place within the patient; and a behavioral response that indicates when the suggestion has been internalized (Erickson and Rossi, 1976). A few examples are:

- Would you like to go into a trance now or later?
- Would you like to go into a mind-body state lying down or sitting up?
- Would you like your mind-body experience to be a familiar form of comfort or a new experience that contains a measure of fascination?

The concept had wider applications, which were expanded by Erickson and Rossi in the following statement:

An understanding of how Erickson uses implication will provide us with the clearest model of his indirect approach to hypnotic suggestion. Since his use of 'implication' may involve something more than the typical dictionary definition of the term, we will assume that he may be developing a special form of 'psychological implication' in his work. For Erickson, psychological implication is a key that automatically turns the tumbled pieces of a patient's associative processes into predictable patterns without awareness of how it happened. The implied thought or response seems to come up autonomously within patients, as if it were their own response rather than a suggestion initiated by the therapist. Psychological implication is thus a way for structuring and directing a patient's associative processes when they cannot do it for themselves. The therapeutic use of this approach is obvious. If patients have problems because of the limitations of their ability to utilize their own resources, then implications are a way of bypassing these limitations. (Erickson & Rossi, 1976, pp.59-60).

In terms of the exploration and transformation of consciousness, the implied directive has many applications which include:

Consciousness of infinity implies capacity and metaphors for connection that complement the metaphors for connection of the quantum processes of superposition and entanglement.

- Consciousness of infinity implies the need for bridges.
- The need for bridges implies sets, subsets, and power sets for bridges, and a need for both the consciousness and appreciation of bridges.
- Consciousness of opposites implies capacity for separation and integration, needs for containment, creativity and time.

- Sources of consciousness imply needs, needs for containment, attention, validation, the need to appreciate opposites, and the need to appreciate quantum variables.
- The need to appreciate and develop levels of consciousness of therapists.
- RNA and microtubules imply need for time and space, opposites, and capacity to deal with abandonment issues.
- Sources of consciousness imply that one of the subsets of consciousness is quantum consciousness, which implies the value of quantum variables and quantum dynamics.
- The consciousness of infinity implies the infinity of creativity, since creativity is a subset of a type of consciousness.

The Role of Group Theory in the Transformation of Consciousness

Group theory was originally discovered by Evariste Galois and later developed by Lie, Klein, and others (Du Sautoy, 2010, Livio, 2005). Group theory was discovered in the context of addressing the solution of the quintic equation, a problem that had been eluding and frustrating mathematicians since the mid sixteenth century when Tartaglia, Cardano and Ferrari came up with the solutions for the cubic and quartic equations (footnote here) and identified four main characteristics of any group which include:

The axioms (basic rules) for a group are:

1. **CLOSURE:** If **a** and **b** are in the group then **a • b** is also in the group.
2. **ASSOCIATIVITY:** If **a**, **b** and **c** are in the group then **(a • b) • c = a • (b • c)**.
3. **IDENTITY:** There is an element **e** of the group such that for any element **a** of the group **a • e = e • a = a**.
4. **INVERSES:** For any element **a** of the group there is an element **a⁻¹** such that
 - **a • a⁻¹ = e**
and
 - **a⁻¹ • a = e**

Any mathematical system that obeys those four rules is a group. The study of systems that obey these four rules is the basis of **GROUP THEORY**.

Group theory involves hidden patterns of structure and numbers and an appreciation of opposites. It is the language that describes the interactions of symmetries, actions between elements of a group that preserve its structure. Galois recognized that was an active process, which altered and expanded its original understanding that viewed it only as static, reflecting a balance between sides, without an appreciation of the hidden patterns and structure within. Galois also recognized that every equation had a unique composition of permutations which maintained the laws of the solution, and by analyzing them one could discover the secrets of the equation. In addition, what would be found inside the solution of an equation would be certain geometric structures. For quartic equations, equations containing exponents to the fourth power, often either a tetrahedron, the simplest of the Platonic solids, or a square would be found inside the symmetries, but for the quintic equation, it was a more complex structure; it was the icosahedron that was found. The different possible symmetries for groups are glide, reflection, and translational. Group theory was instrumental in the development of quantum physics, the solving of complex mathematical equations, and the Lorentz transformation which was an essential ingredient in the formulation of Einstein's equation of special relativity (Ash and Gross, 2006, Du Sautoy, 2010).

By thinking in terms of group theory, a subset of utilizing cognitive processes mathematically, Galois' core realization that the interactions between the symmetries of a group determines and reflects its essential structure can be creatively applied to orient consciousness toward the core of the healthy side of the polarity within the patient. This is done by an *appreciation of the permutations* which is what Erickson creatively utilized in his resistance protocol.

Group theory is an expression of a type and level of consciousness that appreciates harmony and balance, a particular subset of consciousness whose implications can be applied creatively in the transformation of resistance and consciousness itself as we will discuss in the next section.

Group theory functions as a subset for the consciousness of appreciation, itself a subset of therapeutic consciousness. The consciousness of appreciation functions as a platform for the expansion of the consciousness subsets of trust and creativity, which are the core variables in the integration of quantum variables in treatment. Group theory's mathematical validation of the role and need for opposites complements the mathematics of Dirac's creation and destruction operators. This serves as support for metaphors for depth and safety, and for facilitating the interaction of opposites; such as between fused object relation units, healthy and unhealthy parts of the self, and resources vs. issues of inadequacy/ emptiness (Gregory, 2011, Rossi, 2002).

Group theory and the symmetries contained therein imply, validate and can function as bridges to;

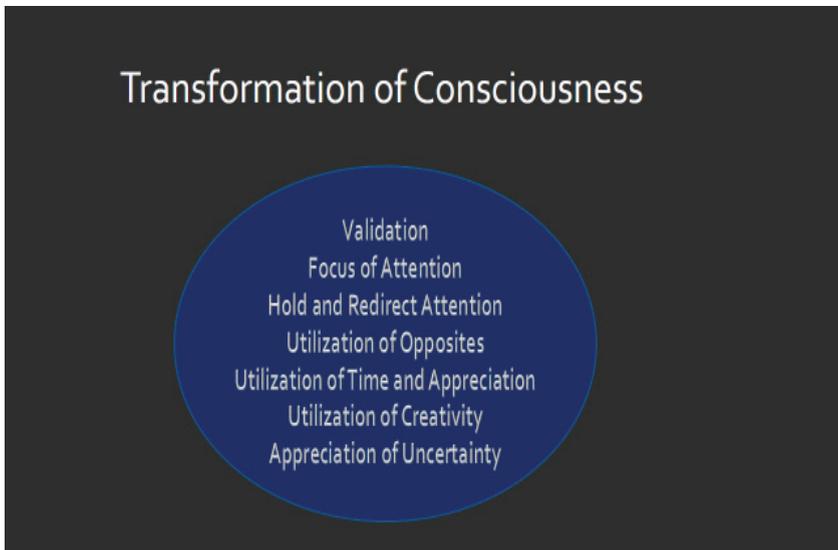
- Mathematical Consciousness (awareness and appreciation of time, space, position, rates of change, creativity, intuition, logic, etc.)
- Quantum processes and variables
- Consciousness of the appreciation of opposites
- Creative application of structure and hidden design

In terms of the exploration of meta-consciousness, what emerges is a group of subsets of consciousness that reflect permutations of meta-mind processes that can be creatively utilized as metaphors for focusing and redirecting attention. Some examples include;

- The Consciousness of Symmetry
- The Symmetry of Consciousness
- The Mathematics of Consciousness
- The Consciousness of Mathematics
- The Harmony of Consciousness
- The Consciousness of Harmony
- The Nature of Consciousness
- The Consciousness of Nature

The role of the Erickson resistance protocol as a template for the transformation of consciousness

The Erickson resistance protocol (Erickson, 1964) was designed to serve as a template for the treatment and transformation of resistance, which is a subset of human consciousness, and an opposite of receptivity. The protocol recognized and appreciated nature's consciousness in developing mind-gene algorithms for the transformation of consciousness, while simultaneously validating the role of quantum variables in the transformation of consciousness. In addition it implied the need for a sufficient level and type of therapeutic consciousness to appreciate the role of quantum variables (Gregory, 2011). The core stages of the protocol are identified in figure 7 below.



The primary aspects of therapeutic consciousness employed were an appreciation of creativity, trust, appreciation, the role of opposites, the role and dynamics surrounding attention, needs of patients in the context of their uncertainties surrounding the transformation of their anxieties, and the quantum variables of momentum, position, time, space, and motion. Erickson's deep *appreciation* of the dynamics and variables involved in the getting, holding and redirecting of attention corresponded to the quantum processes of tai chi, and classical music composition theory (Gregory, 2011, Levitin, 2007, Man Ch'ing, 1985).

Erickson demonstrated that the consciousness of the therapist could correspond to the measurement component in quantum mechanics that was responsible for collapsing the wave function. In mathematical terms, Erickson's level of consciousness allowed him to implicitly integrate quantum and mathematical consciousness in creatively permuting various aspects of trust, appreciation, creativity and validation in the focusing and redirecting of attention. The core guiding principles of this process were the trust and appreciation of opposites, and the appreciation of uncertainty, fundamental aspect of both the consciousness of group theory and quantum physics. The two primary sets of opposites Erickson utilized were conscious/unconscious and knowing/not knowing. Corresponding processes are utilized in classical music composition theory and tai chi (Campbell, 1997, Gregory, 2010, Levitin, 2007, Man Ch'ing, 1985).

Examples of the level of Erickson's consciousness are below;

Erickson's consciousness of the need to appreciate failure was an accompanying component of the treatment plan. Previous failures in treatment or in resolving the stated problem were identified and acknowledged a number of times in order to discharge hostility and provide a bridge to utilize motivation to redirect the patient's resistance through the utilization of the implied directive. Erickson's interventions at this stage are below.

"You have come for therapy, you have requested hypnosis, and the history you have given of your problem leads me to believe strongly that hypnosis will help you. However, you state more convincingly that you are a resistant hypnotic subject that others have failed despite prolonged efforts to induce a trance, that various techniques have been of no avail, and that reputable men have discredited hypnosis for you and as a therapeutic aid in and of itself. You have frankly expressed your conviction that I cannot induce a trance in you, and with equal frankness you have stated that you are convinced that you will resist all attempts at hypnosis and that this resistance will be despite your earnest desire and effort to cooperate." (Erickson, 1958/ 1980, p. 302)

Once Erickson had sufficiently validated the resistance and its momentum and time components (consciousness of quantum variables) he proceeded to the next stage of treatment applying his

consciousness of appreciation around the focusing of attention.

“Since you have come for therapy and you state that you are a fault-finding, uncooperative patient, let me explain some things before we begin. So that I can have your attention, just sit with your feet flat on the floor with your hands on your thighs, just don’t let your hands touch each other in any way (Erickson, 1958, 1980, p. 302).”

In this section Erickson creatively utilized language to facilitate the patient following him, creatively validating, creatively dealing with time, pressure, and the fear of failure.

This had the effect of setting the foundation for the creative depotentiation of the conscious mind. As in classical music composition theory, Erickson would then creatively replay various aspects of the conscious/ unconscious polarity, while simultaneously creatively utilizing different aspects of time. Some examples of how he did this were;

“Now I don’t really care if you listen to me with your conscious mind, because it doesn’t understand your problem anyway, or you wouldn’t be here, so I just want to talk to your unconscious mind because it’s here and close enough to hear me, so you can let your conscious mind listen to the street noises or the plane’s overhead or the typing in the next room. Or you can think about any thought that come into your conscious mind, systematic thoughts, random thought because all I want to do is talk to your unconscious mind, and it will listen to me, because it is within hearing distance even if your conscious mind does get bored. Just be comfortable while I am talking to your unconscious mind, since I don’t care what your conscious mind does (Erickson, 1958/ 1980, p. 302).”

The next component that Erickson employed in his treatment and transformation of resistance was an appreciation and respect for patients’ anxieties with respect to the uncertainties around the reduction of their defenses. This was done through the creative use of language for multilevel communication to the conscious and unconscious minds, and the creative repetition of the themes of not knowing, and waiting comfortably. Examples of interventions Erickson used in this stage include;

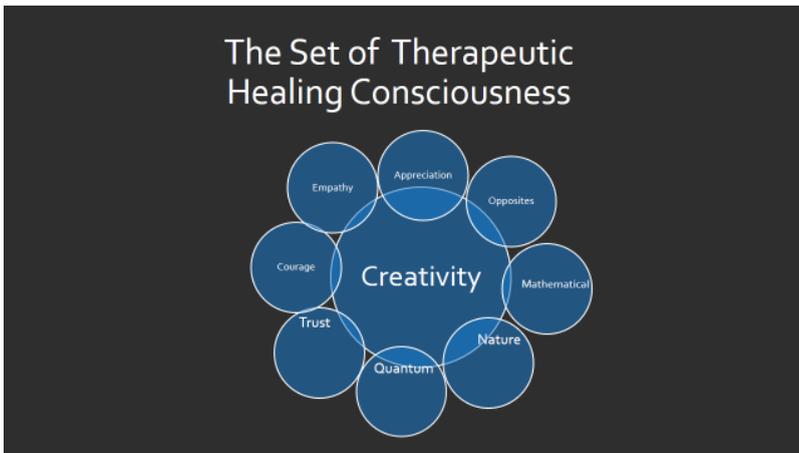
“In other words, I will ask a question to which only your unconscious mind can give the answer, and concerning which your conscious mind can only guess if it does at all; maybe correctly, maybe wrongly, or maybe have only some kind of opinion, but if so, only an opinion, not an answer.

Before I ask that question, I would like to suggest two possibilities. (1) Your conscious mind might want to know the answer. (2) Your unconscious mind might not want you to know the answer. My feeling, and I think you will agree, is that you came here for therapy for reasons out of the reach of your conscious mind. Therefore I think that we should approach this matter of the question I am going to put to your unconscious mind for its own answer in such a way that your own deep unconscious wishes to withhold the answer or to share the answer with your conscious mind are adequately protected and respected.

Now, to meet your needs, I am going to ask that yes or no question, and be prepared to be pleased to let your unconscious mind answer, and in doing so either to share the answer with your conscious mind or to withhold it, whatever your unconscious mind thinks to be the better course. The essential thing, of course, is the answer, not the sharing nor the withholding. This is because any withholding will actually be only for the immediate present, since the therapeutic gains you will make will eventually disclose the answer to you at the time your unconscious minds regards as most suitable and helpful to you. Thus you can look forward to knowing the answer sooner or later, and your conscious desires, and well as your unconscious desires, are the seeking of therapy and the meeting of your needs in the right way at the right time.” (Erickson, 1958/ 1980, p.304)

“An unconscious mind response is different, because you do not know what it is to be. You have to wait for it to happen, and consciously you cannot know whether it will be ‘yes’ or ‘no’. It does not need to be in accord with the conscious answer that can be present simultaneously in accord with your conscious mind’s thinking. You will have to wait, and perhaps wait and wait, to let it happen. And it will happen in its own time and at its own speed.” (Erickson, 1958/ 1980, p.305)

In this last section Erickson was creatively permuting the polarity between the conscious and unconscious, knowing and not knowing, and the quantum variables (time, space, motion, momentum, position, uncertainty) operating in the treatment process. Throughout the process Erickson maintained connection with the patient, metaphorically being in harmony with the principle of quantum entanglement through his appreciating the power of focusing attention, one of the core aspects of eastern philosophy's approach to increasing and transforming consciousness that is found in almost all forms of meditation. The purpose of Erickson's interventions was to facilitate yes sets (Erickson & Rossi, 1979, or response sets (Lynn & Sherman, 2000) in the patient in order to facilitate the transformation of the patient's consciousness from one of resistance to one of receptivity. These series of interventions corresponded to the quantum processes of Dirac's creation and destruction operators (Farmelo, 2006, Gregory, 2011). Overall Erickson's interventions may reflect an expansion beyond what is normally considered therapeutic consciousness that primarily emphasizes a combination of empathy and logical thinking. This expansion is summarized in figure 8 below.



Summary

When consciousness is considered from the perspective of Cantor's set theory, and the appreciation of the permutation component of group theory, and a yes set for the value of consciousness is integrated within the therapist, treatment can be guided by the appreciation and integration of two of its subsets,

mathematical and quantum consciousness. When this occurs, the distinctions between types, levels, and sources of consciousness become significant in the context of the quality of therapeutic consciousness of the person providing treatment. Without explicitly acknowledging this, Erickson demonstrated this level of consciousness in his resistance protocol, utilizing a deep integration of trust, creativity, and appreciation to transform resistance, focus and redirect attention, and focus the treatment process around work with pairs of opposites. This was done consistent with appreciating the role of quantum variables and the principles of group theory.

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