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A Hearty Yes ... And!

Commentary on Marks-Tarlow's "A Fractal Epistemology for Transpersonal Psychology")

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With equal enthusiasm for how fractal geometry can enhance the social sciences in general (and psychology in particular), I hope to underscore and expand upon that theoretical utility in the context of the common *emotional biology* of living systems and its "self-regulatory" function (Peil, 2014). Through this lens, the profundity of fractals—and the fundamental self-organizing dynamics that undergird them—offer *ontological* utility that can also inform biology, evolutionary theory, the science of consciousness, and move the question of "values" themselves within the domain of science. To explain, I draw connections between several of the suggested epistemological principles on offer, and point out their role in emotional processes, and add a few of my own.

Fractal Geometry Advantages

Advantages that fractal geometry offers include quantitative methods for revealing patterns in nature, including elucidating the key structural features of subjective experience and modeling paradoxical [binary] logic.

The Experience, Structural Features, and Evolutionary Value of Emotional Qualia

A central "qualitative" pattern is the "subjective experience" of *emotional qualia*—a common *sensory* experience across all living systems, evidenced by common chemistry (Peil, 2012, 2014) as well as higher neural processes (Panksepp, 2005). The "structural features" of emotional qualia include: The binary nature of core affective feelings; the "self-relevant" (LeDoux, 1989) nature for their stimuli; the embedded cycles and iterative rhythms in the flow of consciousness; the biophysical and chemical signaling processes that undergird them; and the objective behaviors they yield. The "binary" nature of emotional qualia is twofold: Feelings not

only come in pleasurable or painful evaluative categories, they also trigger coupled approach-and-avoid behaviors respectively. Through the lens of fractal geometry, these binary features of emotional qualia provide an experiential inroad to a functional *self-regulatory logic*, driven by deeper physical (self-organizing) binary complements that give rise to many meaningful paradoxes in human experience, if not subjectively itself (Peil Kauffman, 2015).

In terms of evolution, emotional qualia are the first variety of subjective "sensory" experience to emerge in our single-celled ancestors (Peil, 2012), delivering a "protoself" awareness and the "feeling of what is happening" (Damasio, 1998) along with the ubiquitous "hedonic" pattern of behavior (Medicus, 1987)—toward that which is beneficial and away from that which is harmful. While we pretend that animals have neither subjective experience nor sense of self beyond "instinct," there would have been tremendous selection pressure for the ability of a living system to sense itself in its world, evaluate, and respond to its environment—functional "self-regulatory" services all provided by emotional qualia. Selfishness then is neither due to selfish genes nor original sin, but to a self-regulating genome constantly interacting within its local (physical and social) environment and adapting accordingly. The "self" is the fundamental unit of evolution, and the biophysics of emotional processes suggest the more accurate Cartesian cogito to be: "Sentio ergo sum!"—"I feel therefore I am!"

I'll note here that in ordinary parlance (Merriam-Webster, date), the root "quality" in the word qualitative connotes something's *essential character* as well as its *value* (degree of excellence)—both of which are offered within the evaluative (feel good, feel bad) and self-relevant nature of emotional qualia. The ultimate value is physical health and well-being—the universal value system across all living systems, and the only legitimate

source for evaluative words such as good, bad, right, or wrong. Emotional qualia inform us of right states of balance, how to right ourselves to winds of change, and how to stay upon an optimal “right track” of holistic personal well-being. Emotional qualia bring evolutionary theory to the here-and-now scale of time, honoring nonrandom deliberate actions of creatures themselves - and even Darwin’s original assertions the role of emotion, those that have long since been left out of the neoDarwinian paradigm (Diogo, 2017). They are the “felt needs” (Lamarck, 2011) that drive actively adaptive behavior, “adaptation” now running the body-mind gamut from adaptive immunity, to epigenetic inheritance systems, to neural development, deliberate learning, overt social behavior, cultural creation, and mindful personal growth. This is where the unique *mind* itself is an individual’s *epigenetic phenotype*, the oft ignored *developmental diversity* in the statistical tails of our Bell Curve statistics that privilege populations and survival of genotypes.

Of Minds, Brains and Membranes

Hence, emotional qualia are also central to the autopoietic “self-making” and “enacted cognition” noted by Maturana and Varela (1980), the enacted “5E mind” (Peil Kauffman, 2017a), first instantiated on cellular membranes long before the emergence of neural structures and complex brains. All of these self-regulatory functions are evidenced by the chemistry instantiated on receptor complexes (the functional sensory organs) of cell membranes. They deliver a cybernetic sensorimotor control loop between the organism and its immediate environment in creatures are simple as the *E coli* bacterium (Peil, 2014). Specifically, this is a four-step iterative loop, driven by a coupling of functionally positive (amplifying/blocking) and negative (regulatory) feedback processes likened to a thermostat, the same cybernetic principles utilized by engineers to control everything from thermostats, to guided missiles, to AI robot minds: 1) The structure of the receptor complex has outside heads and inside tails that afford an ongoing *comparison* between self and not-self (outside world); 2) a *signal* is sent when imbalances occur, which; 3) triggers a *corrective response*; and 4) that response is also *fed back* into the next *comparison*—leaving a *memory*

trace—as the recursive cycle iterates on and on. The key point being that *hedonic qualia* provide the signal, the behavioral response, and the evaluative memory—three functions for the price of one. In short, emotional qualia emerged with life itself, its binary logic still central to cellular signaling and on/off switching in genetic, epigenetic and immune regulatory processes of all multicellular creatures. Feeling experiences are our inroad to these bottom-up (body-to-mind) regulatory processes, as well as the top-down (mind-to-body) information processing pathways, evident in conditioned attitudes, habits, immune responses, and placebo (Lidstone et al., 2005) and nocebo (Hahn, 1997) effects.

Our double-barreled emotional qualia speak the level-independent language of self-similar fractal structures, the binary self-organizing dance of parts and wholes, of chaos and order—the in-between realm modelled so elegantly by interpenetrating fractal boundaries. They call our immediate attention to moments of chaotic change, keeping us poised on the “edge-of-chaos” between rigid stability and chaotic change. They shout “Yes!” to the optimal kinds of creative chaos, and a resounding “No!” to changes that will degrade the stability of the physical form. Their binary logic showing up in: Bodily signaling, the “eustress and distress” in Selye’s (1957/1978) stress model; in all learning processes as the unconditioned stimulus-response pair in Pavlovian conditioning, in attitude formation, feed-forward motivation and social reward and punishment; in perceiving Gibson’s (1982) environmental “affordances” (things that are potentially harmful or beneficial—but highly relative to the subjective observer); still undergirding all “action impulses” (Frijda, 1988), animal drives, and human motivations (Bolles, 1991), as well as all evaluative semantic components of language. Indeed, Neils Bohr wondered if there were binary complements in biology like those in physics (Theise & Kafatos, 2013), and perhaps would have marveled at the new field of quantum biology (Lambert et al., 2013), and the self-regulatory versatility of emotional qualia.

Each of these binaries can be modelled via the paradoxical logic in fractal geometry, directly traceable to the iterative cyclic nature of

its equations, the functional logic of positive and negative feedback processes, and to the “edge-of-chaos” criticality notable in Power Laws. Yet, they remain confounded within unfounded assumptions of sin and virtue, if not good and evil forces.

Three Self-Regulatory Imperatives

Ultimately pleasure and pain undergird two right and good self-regulatory imperatives, attractors—purposes—if you will. Purposes implicit in the logic of natural selection yet never given their proper due. They are: 1) *Self-preservation* of the *body* proper in the immediate environment (Darwinian “survival” plus). The self-preservationary imperative is mediated largely by the *basic negative emotions*, our distress signals of *sadness, fear, disgust, and anger* and their coupled autopilot fight and flight defenses and competitive social behavior. Their appraisal themes (*loss, danger, contamination, and obstacles to agency*, respectively) link them directly to Maslow’s (1954) top-priority needs for physiological well-being and psychological safety, adding in the autonomy, liberty, personal empowerment and healthy social boundaries required of a self-regulating organism.

The second imperative is that of ongoing *self-development*, which largely concerns *adaptation*, of the *mind* and one’s social sphere. It is about building optimal schemata, empathic social connections, and participating in cooperative creative culture, and is largely mediated by *basic joy* and the complex positive emotions. Optimal self-development is about utilizing emotional sensory information to choose “right responses” of maintaining long-term balance and well-being by learning, communication, and creative self-expression as well as to understand when fight and flight defenses become necessary. Pleasure and pain work together, united in helping us to expand and contract our identity boundaries, connecting in optimally collective social wholes, yet disconnecting if our health, individuality or autonomy are compromised. When we mine the information within our emotional perceptions and respond accordingly, we stay on an optimal right track of ongoing development, fulfilling a third imperative of *self-actualization* of all innate genetic, if not quantum, potentials—which I turn to shortly.

In sum, all of these functions attest to the “self-regulatory” function of emotional processes, and how they emerge from the self-organizing dynamics of matter in motion. A function now ranging from the early auto-poetic self-making to the now complex functions of balancing, unification, preservation, development and actualization of all aspects and potentials of a human self-identity—body, mind, spirit, and soul. Complex human emotional perceptions (trust, mistrust, confidence, shame, admiration, envy, gratitude, resentment, compassion, contempt, love, and hate) now encode three levels of self-regulatory information, a complexity commensurate with the triune structure of the vertebrate brain, yet still evidenced in the whole body chemistry—including neuropeptides and endocrine hormones—known as the “molecules of emotion” (Pert, 1998). In terms of complex systems, feelings pull triple duty: Their binary qualia and basic appraisals serve as *intrapersonal* evaluative feedback signals (bottom-up internal messages from body to mind about the body in the world and the mind’s adaptive schemata). Their complex blends and shades, their empathic resonance and social contagion provide an *interpersonal* level of feedback, a language of social judgment, punishment and reward. Together, these two levels of feedback provide the personal and the nearest neighbor information, which provide the “simple rules” that give rise to complex human behavior.

But their source may go deeper still. This is where the infinite depth of fractal structures—and the concept of “the Self” (with a capital S)—become the most intriguing, where we encounter the hard problem of consciousness, the nature of “the self,” and new ways to think about identity components such as spirit and soul. While highly speculative, this line of thinking goes straight to the heart of what it means to be “trans-personal.”

Fractal Measurement Illuminates

Fractal measurement illuminates observer dependence, fuzzy boundless borders across realms with full interpenetration between them, and the deepest, transpersonal, vital roots of Self-identity.

The thermostatic function in the chemical loop of mind is more than mere metaphor, for it is ultimately rooted in the laws of thermodynamics

(the conservation, transformations and flows of energy), as well as the electroweak and gravitational forces. Indeed, all of chemistry is driven by the orderly behaviors of electrons, behavior governed by quantum mechanics. Might the binary language within hedonic qualia, the dynamic balancing act between chaos and stability, go all the way down? Might it be that the dynamical behavior of networks, with “attractors” and “repellers” and “edge of chaos” criticality have something to do with electromagnetic attraction and repulsion, positive and negative charge, constructive and destructive interference patterns? While physicists do not yet know how to reconcile classical relativity with quantum mechanics, binary complements are common across both, and edge-of-chaos criticality has been suggested to be where computation—*information processing*—occur (Langton, 1990; Wolfram, 2002).

Indeed, the complements in physics that made Neil’s Bohr wonder about others in biology are known as *conjugate variables*. These are the mathematical commonalities across all of physics that undergird irreversible processes (evident in gravity, fluid dynamics, electromagnetism, and quantum mechanics). They are inseparably paired opposites, superpositioned Q-bits with Heisenberg uncertainty relationships, wherein only one can be observed at a time, but imbalances in one drive changes in the other—including the very conjugate of energy and time in quantum mechanics. But conceptually, they all boil down to one grandfather duality: How “derivatives of action” reciprocally create “events of differentiation”—the in-forming process of creative change itself. Here we encounter Gregory Bateson’s (1972) definition of in-formation: The difference that makes a difference—a creative informing process not unlike the never-ending dance of yin/yang opposites known as the Tao.

Perhaps not coincidentally and mathematically, both fractal geometry and quantum mechanics draw upon the *complex plane*—which includes “imaginary numbers,” the equation for the Mandelbrot Set itself, (Mandelbrot & Mandelbrot, 1982), forging the exquisite fractal structures by feeding back into itself, squaring its own output solutions, adding with each iteration a new factor (C) that contains both

a real and an imaginary component. What if the complex plane somehow captures the still mysterious process, force or mechanism that unites quantum and classical worlds? Might this suggest that the ubiquitous dance of complementary opposites might all flow from a deeper interactive dance between quantum and classical realms themselves? Might it be that the infinity in fractals connotes a realm of ontologically real “quantum possibles” (Kastner, Kauffman, & Epperson, 2017), a fully interpenetrating, unifying, nonlocal realm, tucked everywhere within the fractal boundaries of the classical realm—like the glorious fractal image of Newton’s method?

Self, Not-Yet-Self Potentials, and Self-Actualization Within a Participatory Universe

What then of the role of “the self” in all this self-organizing dynamism? What then of the enigmatic role of “the observer”? Indeed, upon closer examination of the chemical machinery, the ongoing *comparison* in the thermostatic loop of mind relies upon the fundamental *capacity to observe*—lest we be devoid of genuine free will, with subjective experiences only empty reflections of deterministic processes.

Might it be instead that our subjectivity itself is part of this creative self-organizing in-forming process? That consciousness plays a mediating role in the interactive dance between quantum and classical realms (Kauffman, 2016; Peil Kauffman, 2015)? Might it be that when living systems sample, sense, or otherwise perceive their environment this might be the “measurement” that collapses the wave function? Quite literally enacting, collapsing, singular classical events from infinite quantum possibilities? Might it be that the self-corrective responses may include some energetic resonance that somehow feeds back upon the deepest physical levels of scale, tweaking quantum probabilities up or down in the “adjacent possible” (Kauffman, 2000), or leaving the deepest kinds of memory traces? Or that the feedback loop is a self-reflexive “gravitational self-collapse” from whence consciousness itself emerges, bubbling up and resonating within the microtubules proteins of all physical structures (Hameroff, 2016)?

Indeed, many have suggested that sentience goes all the way down—down to something akin to a Leibnizian (1710) or Whiteheadian (1927)

panpsychic universe (Skrbina, 2017), where consciousness—including feeling—is inherent in all matter. Whatever the ultimate source of emotional sentience may be, in living creatures, emotional processes are the mechanism that provides both the animation and guidance that the old Vitalists associated with *spirit* and *soul*. And indeed, the most complex human emotions—wonder, awe, compassion, oceanic unity, universal love, utter faith—hint of much deeper aspects of personal identity. Through this new lens, emotional feelings provide the voice of “spirit,” any identity component that participates within the creative process itself, guiding us in how to best utilize our apportionment of causal creativity (whatever that may be). The term “soul” would capture any energetic memory traces the living experience may yield, all quantum identity potentials, any genuinely enduring identity components, or those that ultimately reside within one nonlocal unified whole.

My favorite of these panpsychic views has been set forth by Theise and Kafatos (2013, 2016). In their model everything occurs within a fundamental monistic (“nondual”) awareness; what I might call the Self with a capital S—and others may call God. They describe a mathematical symmetry-breaking dynamic wherein the unbounded Self, can parcel itself into infinitely many local subject/object subdivisions, but forging local and relative self/not-self boundaries. Best of all, their model notes three universal components that occur on all levels of scale: 1) *Interactivity*, between parts and wholes; 2) *Complementarity*, (our dance of Yin/Yang opposites), and 3) ongoing, *Recursion*—the iterative, self-reflexive, cyclic nature of feedback—the engine driving the creation of fractal structures. In such a scenario the deepest fundamental *comparison* in the loop of mind, might actually be the Self/ Not-Yet-Self possibilities—giving quite literal meaning to the imperative of Self-actualization. Indeed, beneath the level of the living system, the imperative for stable self-preservation is meaningless, as form itself emerges from the deeper creative dance of change. All that remains is the *developmental regime* and the *positive emotional spectrum*, a possible source of ecstatic bliss of “nonbeing” or of the God as Love metaphor.

Conclusion

Fractal geometry does indeed provide a holistic, flexible meta-framework for transpersonal psychology. And, to note its recursive processes, its binary complementarity, and its direct link to the chemistry of subjective hedonic qualia, also underscore how the biology of emotional processes can inform the muddled field of emotion theory across the social sciences. It provides the broader evolutionary paradigm of Emo-Eco-Evo-Devo (Peil Kauffman, 2017b), one that honors our active participatory role in our own evolution—liberating psychology from the shackles of genetic determinism, “mismatch” theory (Tooby & Cosmides, 2000), and the ongoing paradoxes that leave emotion undefined. While based on solid science, it allows us to transcend the strictly emergent “epiphenomenal” consciousness born of brain processes, lacking in genuine free will, wherein subjective experience itself meaningless, and even our most insightful thoughts, experiences, and complex pleasures serve little more than sexual reproduction. And, they honor the bodies of ancient philosophy (e.g., from China, India, Africa, and Indigenous populations) missing from Western philosophy, while tethering cleanly to Grof’s (2008) ontological realism for the transpersonal phenomena.

And, if the deeper speculations reflect similar mathematical elegance in terms of the deeper physics—that they reflect Wigner’s (1960) “unreasonable effectiveness of mathematics in the natural sciences”—there are quite profound implications for what it means to be human in a fully participatory, self-actualizing, universe. And that we not only have an apportionment of creative capacity as individuals and en masse, but also the innate guidance to use it optimally.

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Katherine Peil Kauffman, M.A., is an affiliate of Northeastern University and the Harvard Divinity School. As Founding Director of non-profit EFS International, whose mission is to foster global emotional wisdom, she is especially interested in an evolutionary perspective on how the new biology of "emotion" can shed light on various mind-body conundrums. In her commentary, entitled "A Hearty Yes... And!" Peil Kauffman relates the epistemological and ontological utility of fractal processes to the "still mysterious, yet deeply personal and meaningful, experience of human emotion, which remains mired in religious assumption, functionally enigmatic and largely missing from our scientific cannon."

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