

Quantum Holographic Critical Criminology

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Abstract Much of criminology rests on the fundamental framework laid out by Isaac Newton. Traditionally, criminology has often been examined in terms of the classical, neo-classical, positive school, on the one hand, or, on the other, consensus, pluralist, critical. We offer a more fundamental distinction: classical-materialist paradigm compared to a process-information paradigm. The former is rooted in Newtonian physics; the latter, in the findings of quantum and quantum holographic theory. It is not to say that there is not already some compatibility of the new paradigm with elements of thought from some theorizing in current criminology. Much of criminology, too, does not have a subject; rather, it relies on the determinism of Newtonian physics. Here, ultimately, everything is orderly, predictable and determinable. It is time for a Kuhnian scientific revolution, a paradigm shift at the ontological level. Accordingly, in this article, we provide: the differences between the two approaches, a reconceptualizing of the subject, and brief examples, snippets rather than a full theory, of a process-information paradigm at work.¹

Introduction

The legacy of Newtonian physics is ubiquitous. Originally developed to apply to the more materialistic sciences, it has been embraced as an unquestioned ontology by mainstream and a good part of critical criminology. We look far and wide in quickly concluding its failure in the contribution to understanding and ameliorating crime. Yet, theorizing in criminology clings to the fundamental ontology developed over three centuries ago, irrespective of the frontal assault by Einstein's relativity theory (1905, 1915) and quantum mechanics (mature form developed from 1924-1928). The resurgents of rational choice theory and its variants, located within the physics of old, and with questionable assumptions of agency, is a clear indicator that old theorizing insists, be it old wine in new bottles. It is time to rethink fundamental ontology to take into consideration the new sciences, especially quantum theory, which, to this day, has had none of its fundamental postulates disproven, even though it is seen as a "weird" science, and defying conventional logic. Nevertheless, quantum theory has contributed to much of contemporary electronics and to the current development of quantum computers. Holography theory, developed in the 1940s by Dennis Gabor and in the physics community by 't Hooft, Susskind, and Bekenstein in the 1990s, too, is leaving a major impact but has been conspicuously absent in the social sciences, outside the work of Pribram (1991), Wendt (2010), and Bradley (1998, 2006, 2010). Criminology is plainly out of it when it comes to recent developments in other disciplines.

There was a time that it was thought that the quantum realm only pertained to the very small, the world of the atomic and subatomic; the macro level was seen as quite adequately explained by Newtonian physics. This "Heisenberg cut" between the micro and macro is no longer viable. Quantum dynamics have macro effects and thus must be incorporated in any bonafied study in the social sciences.

There has been some sharing of ecological space between the physics of the quantum and philosophy and sociology. To suggest a few. Leibniz's notion of the nomad is often cited as compatible with aspects of quantum theory (Nakagomi, 2006, 2003; Globus, 2007; Wendt, 2010). Shimony's early article (1965) demonstrates a compatibility of Alfred Whitehead's (1925, 1929) writings with early quantum mechanics in his notion of an "actual

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occasion" and "concrecence," an appearing. Bergson, in 1896, anticipated by three decades some of the discoveries of the more mature quantum mechanics in his analysis of the vibratory nature of all entities, the process of instantiation of perceptions, and in holographic theory in his conceptualization of consciousness *in* things (see also Robbins, 2000, 2006; Capek, 1971). Deleuze and Guattari (1987) jointly, and Deleuze (1986, 1989) in his late two-volume books on *Cinema*, in their notions of "plane of immanence," becoming, assemblages, "blocs of space time," are accommodative. Jacques Lacan's (1977) work has offered much material suggestive of reinterpretation, a quantized version. Lacan, and Deleuze and Guattari on the retroactive appearance of an "I" are compatible with retrocausal effects stipulated in quantum mechanics. Pierre Bourdieu's (1990) notion of "habitus" has much play here. In short, much remains for an integration of these insightful points in developing a quantum holographic approach in the social sciences. Notably, two authors, Raymond Bradley and Alexander Wendt, have taken on the challenge. We will have occasion to reference each of these contributions.

This article outlines thoughts on the applicability of quantum and holography theory to the social sciences, and more specifically, to criminology. It is not by analogy or metaphor, but by way of an isomorphism. We want to develop three points. First, we will compare the conventional Newtonian based "paradigm," the classical-materialist paradigm, to a process-information paradigm rooted more in quantum and holography theory. These are ontological spheres, constellations of "images of thought," or noospheres (Chardin, 1961) replete with noosigns (expressive verbal and nonverbal forms), the former paradigm more akin to "organic regimes," the latter, "crystalline regimes (Deleuze, 1989). We polarize for didactic purposes, understanding full well that overlap certainly exists between the two as in a Venn diagram. Conventional, dominant criminology, we will argue, is squarely situated in the classical-materialist paradigm, and resists engagement with the process-information paradigm. Critical criminology has, to a degree, increasingly included process as an essential component in theorizing, but on the whole has not ventured forth into quantum and holographic theory. Critical law, which traditionally has followed a separate historical track, has had some applications of quantum theory, but quantum holographic theory, the core of an alternative paradigm, has not been engaged. Our position is that the process-information paradigm offers novel conceptual tools for critical analysis and for a transformative justice. It holds the promise for providing a better understanding of how information is constructed, stored, and communicated. And how social reality is constructed intra- and intersubjectively within a historically sedimented noosphere, a project given much impetus by Richard Quinney's *The Social Reality of Crime* (1970) that was one of the key treatises that revolutionized the development of critical criminology. Second, in response to the conspicuous lack of a bonafied statement of agency in criminological theorizing we will offer Schema QD, a non-transcendental, de-oedipalized, inter- and intrasubjective model of consciousness/agency. We move away from simplistic rational-choice theory and deterministic models. The new paradigm provides alternative intellectual tools for developing a better understanding of such things as responsibility, choice, cognition, and social reality constructions. It provides a physicality to otherwise abstractly constructed terms. It also offers suggestions for developing a transformative justice and a new *socius*. We will not develop the latter here due to space limitations (see Milovanovic, in progress). Third, we want to show how it works, how the new paradigm can be applied in several areas of criminology. Not to be construed as a thorough polemic on each, but rather, we want to offer snippets on the applicability of the emergent paradigm to indicate its usefulness and further development in criminology. Critical law has already engaged quantum theory, but not quantum holographic theory. There also still lacks a necessary dialogue between adherents of critical law and critical criminology. We must rise to the occasion and challenge the very ontological and epistemological assumptions upon which our thoughts are constructed. It is time for a rethinking.

We first turn to distinguishing a classical materialist paradigm (hereafter, CM paradigm) from a process-information paradigm (hereafter PI paradigm; see Figure 1). This is not an exhaustive list, but highlights some key distinguishing postulates found in the literature.

Commentary: Classical-materialist paradigm, Process-information paradigm

The classical-materialist paradigm is centrally rooted in Newtonian physics. At the time, it overthrew many irrational societal constructions. His *Principia* (1687) has laid the groundwork for incredible scientific achievements. The works of Rene Descarte and Euclid are reinforcing of a deterministic orderly universe fixed by fields and particles. It was a static, objective world where bounded essences can be situated in x,y,z coordinate systems, a world of "simple location." Time continued in a universal, linear, uniform, objective manner from the past to the present and into the future. All had their coordinates, all can be distinctively recognized, a fundamental, discoverable law governs their behavior. As Einstein quipped, "God does not play dice." Laplace's (1951)², the "French Newton," much rehearsed statement, the so-called "Laplace's demon," about inevitable predictability was but the logical extension of this world. Information in this paradigm is primarily digital, bits of information as in Shannon's (1998, originally, 1948) analysis of communication, a logic which has been incorporated in contemporary computers, DVDs, and cell phones. Binaries and Boolean logic, rooted in the axiomatics of Euclid by way of deductive logic was to assure that the unfolding logic of the universe would provide order, stability, and permanence. Our main vehicle of communication, language, privileged the static noun form; the structure of language was a subject-verb-object, inherently attributing some action to a subject in control, a determining, rational subject. Words were seen as neutral instruments, isolated and distinct, conveying the full embodied thoughts of the subjects who speak them. The processor of information was the brain with its neural networks, operating by bio-chemical dynamics. Memory images are stored within the enclosed brain of the person. What was perceived out there was accurately portrayed by the brain, a visual correspondence that assures further uniformity, stability, and permanence.

Let's look at contemporary criminological theorizing. Initially some basic information (data) needs to be collected. In empirical research this necessitates operationalizations of variables. Operationalizations are narrowly construed in time and place, a slice of what is otherwise a moving complex, dynamic event in process. Dominant thought opts for snapshot criminology, one picture, one slice in time and space, abstracted from ongoing processes. "Variances explained," traditionally are low, averaging less than 40% (Weisourd and Piquero, 2008) in the journal *Criminology*, but yet the variable(s) used are confidently said to somehow cause the phenomena under investigation. What of the 60% for which is unaccounted? Moreover, the first three or perhaps even four variables will provide most of the variance explained, and the rest are omitted "due to their low contributory value." Chaos theory, however, argues that some minor, seemingly insignificant factor can produce disproportionate effects. Take a $x^2 - 1$ key. Start with some initial value; iterate it, that is, recompute the results now as "x." Do it say 50 times, plotting each result. Now change the initial value ever so slightly, say by .0001 and redo the iterations and plotting. For a while the two graphs will be similar; but after several dozen iterations, the two diagrams diverge considerably. Take a school crossing guard working in a challenging environment developing some seemingly small interest, never within the radar of empiricist, in a 10 year old student crossing at her/his corner - "How did your class on ____ go today?" This may, with iteration

² "We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at any given moment knew all of the forces that animate nature and the mutual positions of the beings that compose it, if this intellect were vast enough to submit the data to analysis, could condense into a single formula the movement of the greatest bodies of the universe and that of the lightest atom; for such an intellect nothing could be uncertain and the future just like the past would be present before its eyes."

Figure 1 Classical-Materialistic Paradigm Process-Information Paradigm*

Key theorists

Newton, Descartes, Laplace, Euclid

Early quantum: Plank, Einstein, Bohr; post 1924: de Broglie, Born, Schroedinger, Heisenberg, Pauli, Diric, von Newmann; compatible philosophers - Leibniz, Spinoza, Whitehead, Bergson, Deleuze, Guattari; Quantum holography: 't Hooft, Susskind, Bekenstein, Maldacena, Witten, Bousso; Gabor

Objects

Enduring; fixed in absolute time and place; "simple location"; essences; static; essentialism; objective; clear boundaries; particles defined by location and momentum in x,y,z coordinates; set of instances

Process; events/occasions; vibratory; wave function; interconnectedness; wavicle; wave collapse; uncertainty; emergent; delocalized; entangled; quantum coherence; dynamic; nonlinear; assemblage; frequency, wave emitters/absorbers; dissipative structures; contingent; "smears/clouds of possibilities"(Ψ); actual/possible, actual/virtual; actual entities/occasions

Space/Fields

Euclidean; Cartesian, 3-D, x,y,z coordinates; empty; homogeneous; traditional four - electromagnetic, strong, and weak nuclear forces; gravitational; hological; void

Non-euclidean; fractal; multidimensional; spacetime; quantum fluctuations; 4D/8D sub-spaces; holofield; ZPF; QVI; A-field; in-formational; Higgs; network of nested holograms; torsion wavefield; implicate/explicate order; plane of immanence pre-hodological; holomonic; twister space; branes; light sheets; Minkowski space; Reimann; r-space; multiverse; singularities

Time

Linear; forward; objective; clock time; uniform; absolute; static/immobile cut

Relative; backward time referral; multiple time lines; timeless; flow; configuration time; duration/durée; mobile cuts; blocs of spacetime

Cause

Locality; deterministic; clockwork; linear; proportional effects; algorithmic; "God does not play dice"

Nonlocality; EPR ("spooky action at a distance"); non-linear; synchronicity; chance; probabilities; quantum tunneling; "Don't tell God what to do"; holomovement; pilot wave; non-computable; retrocausal; catalysis; QZE; quasi-causal; pilot wave

Information

Digital, bits (Shannon); binary; classical holographic; Boolean; two-logic; brain as receptacle; axioms-premise-syllogism-truth; reduce problems to solutions

Analog, logon (Gabor); Qubits; 2-D nested boundary surfaces; analog-digital; quantum holographic; 4-logic; topos; vortices; holographic principle; implicate order; pilot wave; noosphere; biocomputer; Wheeler, primacy of information;"in-formation field"; problematic approach/appropriate questions

Language

Static; categorical; noun privileged; subject-verb-object; neutral instrument/medium; words as isolated distinct, separate entities

Dynamic; language wave function; context/cues collapse wave function; polysemy; linguistic relativity; verb privileged; quantum lexicon; quantized mental lexicon; holographic lexicon; word entanglement; rhemod; genetic texts

Processor of information

Neural networks; bio-chemical; brain, neurons, synapsis, dendrites; visual correspondence; representational; neuronal subject; snapshot science

Quantum holography; holographic transducers (emitter/absorber of quantum holographic information – DNA, mitochondria, microtubules, liquid crystals, heart); frequency analyzer; imagemaker; phase conjugate adaptive resonance (Pcar); psychophysiological coherence; Fourier transforms; biophotons; holomonic; bioholography; quantum cognition

*References for concepts in following text.

produce disproportionate effect, e.g., to the puzzlement of the criminologist, no crime. Consider, too, the tendency to "subordinate problems to solutions" (Delanda, 2002, p.144) and the linearization bias: "if you decide that only linear equations are worth thinking about, self-censorship sets in. Your textbooks fill with triumphs of linear analysis..." (see Stewart cited in Delanda, 2002, p. 153). Pushed to their logical conclusions, most theories in criminology, including a good part of critical criminology, ultimately rest on a classical-materialist ontology of determinable fields and particles. The challenge, of course, is to recognize process, a becoming, a non-static conceptualization of multiple forces that converge at any moment in space. The Marxian notion of dialectics, for example, does suggest operationalizing variables in a way that reflects their internal contradictory states in dynamic tension. Concepts, too, undergo reification not only in daily activity, but also in activist's struggle. Embraced, for example, in identity politics are static conceptualizations rather than potentials for a "people yet to come" (Deleuze, 1989).

Not so with the process-information paradigm. Quantum mechanics and holography has ushered in a new ontology. Quantum mechanics had its early development with Max Planck in 1900 with the idea that light appears in quanta, an idea further reinforced by Albert Einstein's work in 1905 on the photoelectric effect for which he received a Nobel prize. Bohr, in 1913, followed with a model of an atom encircled by orbiting electrons that could jump from one orbit to another. But it was not until the years 1924-1928 that the more "mature" quantum mechanics was established. There were some major restatements on ontology: the work of Heisenberg posited the uncertainty principle – one cannot at the same time measure location and momentum; the work of de Broglie (1924) suggested a material wave notion of reality; Schroedinger's oft cited thought experiment of the cat in a box where a cyanide pill could be triggered by decaying uranium questioned what state the cat was in at any moment, alive? dead? – concluding, it was both, until a measurement/observation, the opening of the box; and the much cited "double-slit" experiment which clearly indicated the wave *and* particle aspects. In short, all this suggested that "reality" must be conceptualized as wave functions, probability functions. All entities emit and absorb energy or electromagnetic radiation. Essences are replaced by "smears or clouds of possibilities," an inherent indeterminacy; it was measurement/observation that "collapsed the wave function" providing one instantiation, e.g., in opening the box one will observe that the cat is either alive or dead. Instantiations are more like dissipative structures: emergents, momentary stable, and dissipating. Further, contrary to the classical-material paradigm and its privileging binaries as in an on-off switch of a computer, the two can remain simultaneously possibilities as "qubits," in states of quantum coherence until collapse of the wave function provides an instantiation.

All this, and more, resulted in the conclusion that the dichotomy of fields and particles was no longer viable. Fields were reconceptualized as non-euclidean, fractal, topological, multidimensional. Particles were events, or what Whitehead referred to as "actual occasions" or "actual entities" that are only defined in an instantiation of an otherwise complex dynamic state, in process. "Concrescence" is the process of instantiation. Einstein's special and general relativity reconceptualized homogeneous space in terms of spacetime, the idea that space and time were not separate entities.

Fields and our surrounding spaces were reconceptualized as not empty, but, at the atomic and subatomic level, teeming with energy fluctuations. "The ultimate elements of matter," Whitehead (1960, p. 40) tells us, "are in their essence vibratory." This was the zero point field, ZPF. At the lowest level, the Planck's scale, things were soupy, grainy, emerging and dissipating. The notion of a "particle" lost meaning. Rather, it was replaced with the idea of a probability wave, a quantum wave that only by collapse will provide an instantiation (actual) revealing one "reality" rather than a plurality of other possibilities (virtual). And at the quantum level, all was interconnected. Thus, the notion of nonlocality, or "action at a distance," a notion also introduced by Carl Jung as synchronicity,

contradicted the Newtonian schema of locality. Yes, our actions at one moment in time can have an immediate effect on some action quite distant from us, and vice versa, a "spooky action at a distance" according to a short, but much cited paper, the "EPR paper" (1935) by Einstein and two colleagues. Time in this paradigm is not unfolding, linear, and unidirectional; there is room for retrocausality, feedback loops going backward in time and forward. Von Neumann, in 1931 was to provide the mathematics of the emerging sciences, particularly as to one way of conceptualizing it, the pragmatically oriented Copenhagen interpretation that posited measuring or observing some state collapses the wave function, providing a momentary instantiation, what we perceive as "reality." In the more social science application, Shimony (1965) drew connections with the work of Whitehead. Stapp (2007) and Hameroff and Penrose (1996) also drew from Whitehead. Whitehead remains the key connecting link between quantum theory and philosophers. We shall return to both theories shortly.

More recently, for the PI paradigm, the discovery of the hologram and its integration with quantum theory, quantum holography, "the geometric encoding and decoding of information" (Marcer and Schempp, 1997a, p. 237), was to provide an even more substantial impetus for reconsidering the classical-materialist paradigm. This is currently producing an informational revolution within the physics community, best expressed by John Wheeler (1990) advocating the "physical world as mode of information, with energy and matter as incidental." "Information" can be defined as patterned, organized energy. Generally speaking, a hologram is created by two waves, an object beam representing information about an object, and a reference beam, or a non-object bearing beam, that meet creating an interference pattern that is recorded on some holographic "plate." Most unusual is that if one again makes use of the non-object bearing reference beam in illuminating any part of the surface, the whole initial 3-D image is recreated. Information is spread out across the whole "plate," in short, nonlocality. It has been estimated that one sugar cube sized hologram could store all the information of the U.S. Library of Congress.

Holography theory has developed from two directions. Dennis Gabor (1946), investigating optimal transmission of information (signals), postulated the minimal area in time and space that could encode information. He called it a "logon," a "quantum of information" which is a "space time constrained hologram." The logon is characterized as a "harmonic oscillation of any frequency with a pulse in the form of a probability function" (ibid. 435). It is analog in nature, a sinusoid: information is spectrally enfolded. Logons overlap with informational content thus producing indeterminacy. A contrasting view, more often embraced by the CM paradigm, and focused on the digital character of information, is from Shannon (1998). Here the digital code is composed of dualities: 1 or 0.

One of the early studies of applying holographic theory and the work of Gabor was from Karl Pribram (1991) on processes taking place in the brain. He also made use of the Fourier transforms which are encoding devices: movements in the external world are spectrally enfolded within the brain. Memories are spread all over the brain, not localized in particular neurons, as is the case with CM paradigm. A reverse Fourier transform reproduces 3-D images.

The second direction for understanding the hologram developed from studying the black hole. Many, including the much respected Stephen Hawking, had said that an object falling into the black hole would disintegrate and that was the end of it. 't Hooft, in 1993, and Susskind, in 1995, separately, showed, rather, that the information about the object is not lost but is retained on the event horizon. This was consistent with the second law of Thermodynamics and entropy theory. Bekenstein (2004) was to verify this and is credited with the notion of the "Bekenstein bound" showing the limits of information that can be encoded on the surface. Maldacena's (2005) work was a definitive mathematical statement that settled the so-called "black hole wars." Edwin Witten (1998), who many in the physics community consider one of its most prominent thinkers, separately contributed further to this insight particularly in string theory. In short, what was established is that "reality,"

unlike explanations offered by the CM paradigm, exists encoded, in holographic form on the boundary of that region. All events within the bounded area (the bulk, or spacetime) are encoded on the surface boundary. What appears inside these bounded regions are holograms derived from the information stored on the boundary surfaces. Thus we have networks of nested holograms; bounded holographic surfaces that exist within and overlap other bounded holographic surfaces. Within particular bounded regions, or "noospheres" arise "noosigns" (Deleuze, 1989) or "images of thought" by which each era thinks itself.

Envisioning a boundary demands overcoming some traditional thinking. Boundaries should be envisioned operative at the quantum level. More recently, Bousso (1999, 2002) has demonstrated that boundaries are "light sheets" and the logic extendable to all bounded surfaces.³ Susskind (2008, p. 294), from discussions with 'tHooft has suggested that the office we work in,⁴ and by implication, the classroom we teach in, the work environment within which we find ourselves – are all boundary surfaces. Boundaries encode 2-D information (recall Platos' cave parable of shadows) of 3-D entities within the bulk; if we include time, we have 4-D spacetime. Yet others (Barry, 2011) ask us to consider a "series of layers like the pages of a 'spherical' book." Examples of the bulk could be: interior of cells, neurons, the brain enclosed by the surface area of the neurons, the universe itself; so, too, the body, a room, a hall, etc. This logic can also be extended to commonly used sociological terms such as subcultures, communities, society, identities, etc., in so much as they imply an inside and an outside, an in-group and an out-group divided by some imaginary boundary. Another strange, but mathematically acceptable finding. Is it any stranger than when conventional criminology employs notions of boundaries? Subcultures suggest boundaries; Cloward and O'hlin's three types of delinquent subcultures suggest boundary regions; Miller's "lower class culture as a generating milieu of gang delinquency" suggests bounded regions. Consider the ethnographer entering the "world" (noosphere) of a subculture, immersed in its noosigns. Boundaries are also assumed in many concepts taken for granted: identities, family, gender, class, roles, insiders/outside, institutions, bureaucracies, etc., reified in their everyday taken-for-grantedness and use. Consider, for example, the much-heralded classic study by Erikson, *Wayward Puritans* (2004), where deviants and conflict are seen as functional in maintaining moral boundaries that can wax and wane, contract and dilate. Activists arguing against minority injustices, courts deciding on equal protection denial, denied groups engaging in identity politics – all embrace categorical boundaries, practices of repetition and reification. Even concepts such as rights have been questioned as to their static boundaries (Deleuze, 1988; Lefebvre, 2008, pp. 54-59). Implied, too, is a plurality of bounded regions within which we construct reality. A notion of "nested hierarchies of holographic surfaces" (Germine, 2008, p. 170; Wendt, 2010) has been offered in the social science literature. The dynamics of quantum tunneling, quantum entanglement, nonlocality, and topology account for how boundaries are crossed.

If we look at conventional criminology, take Sutherland's (1974) differential association theory, we could argue, following the notion of nested holographic surfaces, that the "definitions" referred to are encoded on the surface and are accessed as information for those within this bounded region. We will return to this in our final section. Similarly, take Matza's book *Delinquency and Drift* where he explains the wherewithal of the rationalizations available to the juveniles; these can be construed as encoded on the surface boundary of the regions within which the juvenile operates. Similarly with Cressey's (1956)

³ Consider Greene (2011, pp. 260-261): "think of any region of space, such as the room in which I'm writing or the one in which you're reading...whatever happens in the region amounts to information processing...since the information required to describe physical phenomena within *any* given region of space can be fully encoded by data on a surface that surrounds the region, then there's reason to think that the surface is where the fundamental physical processes actually happen."

⁴ A discussion with 't Hooft was recalled by Susskind (2008, p. 294): "he ['t Hooft] said that if we could look at the microscopic Planck-sized details on the walls of his office, in principle they would contain every bit of information about the interior of the room."

study of convicted embezzlers in *Other People's Money*. Rationalizations, one of the central elements in understanding embezzlement, exist on the bounded area of the workplace. We will return to this in our final section. Take also a lawyer arguing in court. This can be envisioned as situated within a bounded area, on whose surface is encoded, in 2-D form, all information on law. To this, too, we will return.

More generally, consider capital logic as an axiomatic system (Deleuze and Guattari, 1987). We could argue that axioms are encoded on the boundary regions of capitalist systems which, through syllogisms, lead to particular constructions by people's everyday actions in the "bulk." The continuous application would provide further reification of capital logic.

A third approach in holography is David Bohm's (1983) holistic oriented notion of the implicate order. Everything, in this view is interconnected and enfolded ("holonomic") in one vast implicate order. The quantum wave function represents all entities and enfolds information (Bohm and Peat, 1987, p. 93). But unlike the Copenhagen interpretation, there is no collapse of the wave function; all remains interconnected. The explicate order, the world of Cartesian grids and Newtonian physics, is an instantiation of this order. Instantiated are "relative autonomous sub-totalities" (Bohm, 1983, p. 189). Bohm (p. 207) argues that his approach has similarities with Leibniz's idea of the "monads" and Whitehead's notion of "actual occasions." Contrary to contemporary criminology's CM ontology, a focus on the interconnected nature of "reality" would demand new operationalizations of variables that reflect this character. A quantized constitutive criminology is in this direction, indicating "parts" and "wholes" being inseparable. Constitutive criminology, as presently formulated (Henry and Milovanovic, 1996), however, needs further reformulation reflecting the central insights of quantum holography.

A fourth area in the development of holographic information is the work of Ervin Laszlo (1995, 2007). He argues that we are immersed in an "in-formation" field. The quantum field within which we are but one component, is not a vacuum but enfolds all information of everything before us. Information is holographically embedded in this field. Bergson's *Matter and Memory* is remarkably compatible with some of Laszlo's insights about the nature of this field. Bergson envisions the cosmos as organized by images. All is image. Perceptions are *in* images and are not in the brain; they reside in this external field of images. Consciousness, too, is *in* the objects perceived. This certainly flies against the contemporary criminology's CM ontology which isolates "fields" and "particles." Consider rational choice theory: fields, defined as a reward/punishment structure; particles, human beings, as rational calculating machines.

Another critical component in the PI paradigm looks at the physicality of information transmission. Explained by David Pepper (1985) was the notion of phase conjugation, extended in a series of articles by Schempp (1992), Marcer and Schempp (1997a, 1997b, 1999; see also Mitchell, 2008; Mitchell and Staretz, 2011) and now referred to as "phase conjugate adaptive resonance," or Pcar. They begin with arguing that all entities vibrate and both emit and absorb energized electromagnetic radiation which carries information about these entities. In Pcar we start with a percipient, the receiver of some energized electromagnetic radiation emitted from some entity, and follow an interaction between the percipient and that entity's vibratory emissions. The incoming wave creates an interference pattern with the percipient's outgoing wave; in the process, producing a hologram, which is then returned to the sending entity and perceived there where it is. The example often given: snap your finger and ask where is the information being perceived. It is not in your head; it is out there.

Let's take Bergson's remarkable book *Matter and Memory* (2002) originally published in 1896 where he provides a much misunderstood analysis of how perception and consciousness are *in* things. He (ibid, p. 36) states, "everything thus happens for us as though we reflected back to the surfaces the light which emanates from them, the light which, had it passed on unopposed, would never have been revealed." This suggests that an

information carrying wave is emitted toward the percipient who selectively collapses its possibilities to one that is of immediate interest, which is then sent in wave form back to the sending entity with the appearance that the collapsed state is actually the entity. Thus, he insists, perception is *in* things; consciousness is *in* things. In 1896 Bergson was clueless about quantum mechanics and holographic theory. But he anticipated the logic of how perceptions are *in* things. Using Pcar we can see that Bergson's ideas make perfectly good sense. Given this, we could argue that in face-to-face interaction, between I and you, I is in the other (you), the other is in I. They have opened a channel of communication where resonance, phase conjugate adaptive resonance, is the operating principle. This provides a physicality to theoretical ideas such as "playing the role of the other," as in George Herbert Mead and symbolic interactionism. Further, since each is within the other, there also remains a permanent trace of the I in you and you in I. Similarly with all with which one interacts; some permanent holographic trace remains in both the subject and in the entity perceived.

For Marcer and Schempp (1999), the person's sensory apparatus acts as a "transducer," an emitter and absorber/translator of holographic information embedded in vibratory (wave) energy. Much research in wave genetics (for a review of this literature, see Rahnama *et al*, 2010; Grass and Kasper, 2004; Popp, 2000, 2012) indicates that the sensory apparatus is both receiver and generator of information, radiation, electromagnetic in form, such as biophotons. With Marcer and Schempp's model, Pcar accounts for how perceptions are constructed. Some (Bradley, 2007; Tiller *et al*, 1996; McCraty *et al*, 2004) have argued that the heart emits the most radiation. Emotionality is often connected with heart activity. It is also argued (Bradley, 2007, p. 83) "it is likely that the heart is instrumental in generating the outgoing wave of attentional energy directed to the object." Evidence indicates that the brain "sees" or senses things a split second after the heart does, as indicated by recorded ECG waves of the heart. Others have attributed this coding/decoding dynamic to the DNA (Gariaev *et al.*, 2011), the surfaces of neurons, to microtubules, and to liquid crystals that are ubiquitous in the body.

A PI paradigm would conceptualize language in terms of a wave function, a "language wave function" (Bruza *et al.*, 2009a, 2009b; Bruza and Kitto, 2008; Kitto and McEvoy, 2008; Kitto and Bruza, 2011; Neuman, 2008). Words remain entangled in memory; it is in context that they undergo a quantum collapse, a collapse of the wave function. Words, or signifiers are polysemous (Neuman, 2008). Using Dirac's notation, a word, or signifier, is conceptualized as a wave function $|\Psi\rangle$, or, $|\text{word}\rangle$; the "basis" would be symbolized as $|\psi_i\rangle$ where "i" stands for the possible instantiations of the word, that is, its meaning, or signified at any moment. The CM paradigm, on the other hand, would see a static word: separate, isolated and distinct. Consider jurists seeking support for their interpretations, who look to "original intent" of the "framers" of the U.S. Constitution. Consider, on the other hand, the "linguistic relativity principle" of Benjamin Whorf in his epic, *Language, Thought and Reality* (1964). He informs us that languages carve up "reality" in very different and distinct ways. Citing the Hopi Indian of southwestern U.S., he shows that: they privilege the verb form, not noun form; do not normally use the subject-verb-object construction, but employ structures that imply doing, eventing, and becoming without positing an entity that by itself causes the action; and do not conceptualize the world as "form plus formless" (i.e., cup of water) as in many languages, but in terms of interconnectedness. He insists that the use of language generally predisposes us to certain interpretations. This led Whorf to conclude that the Hopi Indian language is more in tune with quantum theory than with Newtonian physics. Bohm (1983, p. xii, chapter 2), too, has noted the static nature of a noun-oriented language and suggests a verb-oriented language, a "rheomode," a flowing, merging language that denies breaks, separation and stasis.

The emerging "quantum cognition" approach would therefore see words bound together, a "mental lexicon," where links and networks are established by ongoing experiences (Bruza *et al.*, 2009, p. 2). This is a holographic lexicon (Jones and Mewhort, 2007). Only in context

will one particular meaning of a word emerge. In an ambiguous, weak, and noninformative context, words remain in a superposed, quantum entangled state. But where context is unambiguous, strong, and informative what follows is a collapse of the quantum wave function of a word to a particular sense. For example, the word "bounce" (signifier), expressed as $|\psi_i\rangle$, where "i" may represent a bounced check, a child playing with a ball, laundry softener, being removed from a bar, a skydiver who dies. This superposition collapses to a particular sense, $|\text{bouncing a ball}\rangle$. As Bruza *et al* (2009, p. 13) inform us "a sufficiently strong context erases all information about the other senses." Consider the courts which insist on dualities and Boolean logic, i.e., yes or no answers, which then can be smoothly integrated into syllogism and through linear, deductive logic lead to clear conclusions in law. Context, in short, acts as a measuring device, an observation, that collapses the language wave function. This accords with Jacques Lacan's (1977) psychoanalytic semiotics. The nature of a signifier is that its meaning, the signified, perpetually "slides" under the signifier and it is a question of how a "punctuation," Lacan's $s(O)$, is attained, a collapse of the wave function. This argument has been extended to a holographic lexicon where temporal ordering based on historical experiences are encoded and stored (Jones and Mewhort, 2007). Mitchell (2008, p. 10) and Bradley (2007, p. 78) have also argued that icons and cues can activate the Pcar process. Thus icons, cues and signifiers can initiate the phase conjugate process. We can speculate that given a domain (noosphere) characterized by a distinct linguistic form (noosigns), signifiers are structural invariants (Gibson, 1979) and provide cues or "affordances" for phase conjugation. Here, a pacified subject is spoken by language.

Two exemplary applications of quantum mechanics in the social sciences

Two noteworthy social science applications of quantum holography exist in the literature. Alexander Wendt (2006, 2010) has applied it to international relations, Bradley (1998, 2007; Bradley and Pribram, 1996, 1998) to sociological examination of organizational theory. More recently, Bradley (2010) has applied it to terrorist cells.

Raymond Bradley (1998) sets out to explain information processing in 57 communes at the psychosocial level. He identifies two critical intersecting axes that produce stability and order: flux (energy activation and expenditure) and control (social constraints). A system of common signifiers and references are said to characterize the constraint system, or control. Within any group, a "holographic prompt...informs the pathways of action" (*ibid.*, p. 143). This holographic prompt "encodes information about the specific system." This is order generating. The intersection through everyday interactions and communications between the two axes produces holographically encoded information, the logon, or information, that is spectrally encoded in the zero point field (ZPF). Each logon reflects the group's organizational logic. They are instantiated through forward and reverse Fourier transforms; the former spectrally unfolding information from the spacetime realm; the latter, recreating 3-D images from the spectral domain. This, then, informs everyday interactions and communications to reproduce an ongoing patterned, recurring socius.

Bradley offers an important start in quantum holographic analysis in the social sciences. It lends itself to a reconceptualization by way of Deleuze and Guattari's (1987) arguably quantum-based ontology. Rather than flux and control, we could use Deleuze and Guattari's notion of "assemblages" (see also Delanda, 2006); that is, out of a "plane of immanence," a primordial quantum flux (ZPF), assemblages, or dissipative structures are emergent phenomenon. These are constituted by two perpendicular, intersecting axes: the first, bounded at one end by territorialization, or forces of stability and closure, tends toward static, or "molar" expression and enclosed boundaries; at the other, deterritorialization, or forces of instability, tending toward more dynamic, more open, or "molecular" expression. The second axis is a material-expressive axis; where the former stands for bodies in relation to each other and various material with which it is oriented, the latter, the form of verbal

and nonverbal expressivity. Each assemblage can be distinguished by its "capacity to interact" (Delanda, *ibid.*, 10), and its power to effect and be affected (Deleuze, drawing from Spinoza, 1992). The quantum wave function incorporates these potentialities. Since an assemblage is always in process, its capacities will change and thus its threshold values to action will change; accordingly, significant is Delanda's idea (*ibid.*, p. 20) that rather than strict linear causation, we should consider "catalysis."

Bradley's discussion of "control" (territorialization) could be extended to Deleuze and Guattari's notion of the capitalist axiomatic and to Foucault's (1977, 1994) disciplinary mechanisms, technologies of the self, and governmentality. Alternatively, although Bradley entertains jazz music as an alternative he underplays the potential of improv jazz. For example, Holland (2011) explains how an alternative form, "nomad citizenship" could be a model. Deleuze and Guattari (1987), too, argue for a socius based on "permanent revolution," more akin to the logic of improv jazz and dissipative structures. Bradley could also make more room for uneven development. The employment of the holographic principle, suggesting the notion of nested, bounded surfaces on which is encoded all information from the bulk, and where quantum tunneling suggests interconnectedness, would provide new impetus to the model developed. And finally, even though Bradley posits the importance of a subject and even develops some rudiments, a bonafied statement is incomplete. Edgework literature, for example, suggests a seductive quality to engaging the edge – the adrenaline rush, excitement, sensual highs; this would seem to increase tensions but in a productive sense. It could, however, be a critical ingredient in crime, as "edgework" literature suggests (Katz, 1990), which has been recently incorporated in cultural criminology (Ferrell *et al.*, 2008). We need to explain intra- and intersubjective factors constitutive of the subject. Our final section offers one model.

Alexander Wendt (2006, 2010) has applied quantum holography to international relations theory. The state and international systems are seen as holographic projections. They only exist, as in a quantum wave, as potentiality. Their instantiation occurs in holographic coding and decoding of information by way of phase conjugate adaptive resonance (Marcer, 1995; Marcer and Schempp, 1997a; Mitchell, 2008; Mitchell and Staretz, 2011). The language we use to speak of the State and international relations must also be quantum holographic. It exists only in potentiality, with multiple understandings at any instant. Wendt argues (2010, p. 293) that "if language is a quantum phenomenon, then social objects like the state and international systems that are constituted by language will be quantum mechanical too." The State and international relations can only be "seen" in language, in its everyday usage. This collapses the wave function. He posits a "social wave function" in which citizens are constituted, and, in their activity, instantiate the notion of a State. He says (*ibid.*, p. 297), "because social wave functions entangle many individuals quantum mechanically, when a leader collapses the wave in a policy choice, that decision has non-local consequences for everyone else in the group." He also offers three forms of agency: active, passive and object. The person is "embedded" in a multiplicity of social wave functions. In the "the overwhelming majority of situations" s/he is in a passive mode at any given instant. However, the passive monads remain in a state of quantum entanglement within the "implicate order" (referencing Bohm). This provides them with "the capacity to become subjects (active) in their joint holographic reality if they choose to" (*ibid.*, 300). He embraces the notion of "attention" (Schwartz *et al.*, 2004) as being a critical ingredient in the collapse of the wave function. For those who share this wave function, it allows the monad to "purposefully [act] on the wave function" (*ibid.*, p. 300). The third form of agency, "objects," stands for those who are "not part of the system"; they are unaware, they do not share relevant information and thus they cannot become active monads in that situation, "because they are not entangled in the wave function that makes it possible" (*ibid.*). In any collapse of the wave function, "concepts, theories, and indeed levels of analysis are 'cuts' in a holistic sea of potentiality at the quantum level that helps produce a certain classical reality for participant-observers" (*ibid.*, p. 304). Thus researchers, because

of their articulated "cuts," "'see' the international system only by conjuring it into existence in their work" (ibid).

Wendt's research argues for the necessity of rethinking the CM paradigm. Criminology can benefit in that notions such as the State, criminal justice system, law, juridic (legal) subject, etc., can be seen, with Wendt, as wave functions that are instantiated in use. Legal language, too, can be conceptualized as a wave function with potentiality. It is the collapse of the language wave function that instantiates acceptable meanings, such as in courtroom narratives.

Although significant and path-breaking, and addressing some aspects of agency, neither Bradley, nor Wendt, however, has sufficiently offered a more substantive analysis of the "hard problem," the question of the subject itself.

The "Hard Problem": Consciousness/Agency

Traditional, and a good part of critical criminology, lacks a subject. We need to tackle what Chalmers (1995) has coined the "hard problem," the wherewithal of consciousness. Fortunately, quantum theory has been suggestive as to a possible direction. Here we want to: first, review two standouts in developing a quantum consciousness with commentary; and, second, provide an alternative quantized, de-oedipalized, inter- and intra-subjective framework that is neither in support of a transcendental subject nor does it advocate an inconsequential agent.

Exemplary models of quantum consciousness. There are two statements on quantum consciousness that have been much heralded and critiqued. The Hameroff-Penrose (1996, 2003) model provides for an "objective reduction." For Stapp (2007), on the other hand, consciousness collapses the wave function. Even though both approaches are highly suggestive as to a quantum consciousness and contribute important elements, neither offers a comprehensive psychosocial statement about agency itself.

Penrose, the highly acclaimed physicist and Hameroff, an anesthesiologist, combined their respective expertise in writing groundbreaking statements on a quantum consciousness (Hameroff and Penrose, 1996, 2003; Penrose and Hameroff, 2011; Hameroff, 2007a, 2007b). They posit that microtubules, the protein internal skeletal structure of nerves, are quantum processors. When faced with the requirements of interpretation of "reality" the microtubules undergo a quantum coherence. This quantum gravity approach works all the way down to the Planck's scale, whereby a separation, a "bubble" in spacetime is engendered. Picture two side-by-side sheets where a bubble appears in the middle, between the two. Each sheet represents a possible rendition of reality. This creates tension and at an objectively measurable threshold, there is a "collapse" (of the bubble between the sheets) into a unified spacetime: one version of what appears out there is rendered "reality," the other disappears from consideration. They also posit "hidden variables" at work embedded at the Planck's scale, "qualia" which make their presence felt in this process. According to Penrose, outcomes are "non-computable," neither probabilistic, nor determinable. This "objective reduction" is provided as an explanation for the periodic emergence of consciousness, as in a film with sequences of shots, but does not provide a convincing statement about the nature of the subject him/herself. It has also been critiqued in term of whether quantum coherence can be maintained in a warm, wet brain, to which they have responded.

Henry Stapp's (2007; see also his website) model differs. He applies a Copenhagen pragmatic interpretation developed in the mid 1920s by Bohr, Heisenberg, Pauli and Dirac which argues that it is the act of observation or measurement that "collapses" the wave function.

Von Neumann (1996), in 1931, developed mathematical equations for quantum mechanics. He refers to an "abstract ego" that is undefined, but nevertheless is the agency

that collapses the wave function in the act of observation or measurement. In Stapp's "process 1" the abstract ego is said to pose questions to nature. That is, out of the ongoing quantum fluctuations certain questions are selected. In Stapp's view (2011, p. 16), a person's "mental structure is continually probing the (awake or sleeping) brain for tiny clues that can alert it to the fact that something of interest might be going on." In further formulations (2011), he develops a Process 0 which is apparently initiated from a person's "reasons, motives, and aims."

Stapp, like von Neumann, admits there is no current compelling explanation as to how these probing questions initially materialize beyond his terse reference to the person's reasons, motives and aims. Nevertheless, this initial probing question is also the initial collapse, since a "choice" was made from all possibilities. This is followed by a "choice made by nature" (Dirac), or Process 3 that is indeterminate. In the interim Schroedinger's equations of evolution, Process 2, are said to be determinative. Process 3 is "nature's choice": the response is either a "yes" or a "no" to the probing question. This is the second "collapse." It provides feedback information to the abstract ego, who acts on this information in the everyday, macro world. Sensory motor schemas, or "templates for action" (Schwartz *et al.*, 2004), are activated at the more macro scale of the "Heisenberg cut." This is a continuous process. Stapp (see also Schwartz *et al.*, 2004) also posits the role of "attention" in activating desired responses. He draws from the quantum zeno effect (QZE). It is the focusing of the probing question (attention) and (nature's) response to which "templates for action" are likely activated.

Both Hameroff-Penrose and Stapp make reference to the work of Whitehead (1925, 1929) as being compatible with their respective approaches. Reviewing the literature, Whitehead has been consistently cited as being compatible with quantum mechanics, at least the early version (prior to 1924). Whitehead, even while acknowledging the influence by the early quantum mechanics, did not integrate the more mature quantum mechanics developed after 1924, although he was a contemporary of that time period. And, most importantly, in Whitehead, as is the case with Hameroff-Penrose and Stapp, there is no bonafied analysis of the percipient, the agent. We now turn to offering a path, not definitive, but a direction for further theorizing.

Schema QD. Our offered Schema QD is a de-oedipalized, quantized, inter- and intra-subjectively constituted entity that builds on the insights of quantum theory and the philosophy of Bergson, Whitehead and Deleuze. Its departing point is Jacques Lacan's Schema R (Lacan, 1977) in which an oedipalized structure of a decentered subject was offered driven by "lack." We acknowledge the worthy directions that Lacan suggested, as did Deleuze and Guattari, but his work is in need of revision, especially as to the notion of lack and the Oedipus. Deleuze and Guattari (1983), of course, explained the subject is not lacking at all; its driving force is production, much like in Bergson's "élan vital," Freud's libido/Eros, Nietzsche's affirmative activity, Spinoza's joyful passions. We present Schema QD as a macro-signature reference wave interacting in an in-formation field, a nested hierarchy of bounded regions on whose boundary surface all information is encoded of happenings in the enclosed bulk spacetime.

Deleuze's (1986, 1989) late 2-volume treatise on *Cinema*, drawing heavily from Bergson, is suggestive for a quantized reinterpretation. Henri Bergson's (2002) analysis of vibratory energy, the nature of memory, and perception are well in tune with quantum theory. Everything, Bergson (2002, p. 208) proclaims remains interconnected: "matter thus resolves itself into numberless vibrations, all linked together in uninterrupted continuity, all bound up with each other, and travelling like shivers through the immense body." Both Bergson and Deleuze, however, are dismissal of any notion of a transcendental subject.

In Deleuze and Guattari's *Anti-Oedipus*, the subject is an after-effect of three passive syntheses: connective (connections amongst emergents in the plane of immanence), disjunctive (recording of dissipative structures created), conjunctive (consummation-

consumption of the end results, including recognition as a subject). The recognition of an "I" is an after-effect of the process ("Oh, that's me!") (Massumi, 1992, pp. 75-76). In Deleuze's *Cinema* books, however, the subject is composed of the interplay and relatively stabilized configuration of three images, three "material moments of subjectivity" (1986, p. 66): perception-images (gestalts, or Lacan's "réalité, Deleuze's "blocs of spacetime"), affection-images (qualia – felt, emotional, lived experiences), and action-images (possible responses) always already implicit in the perception-image. In its active form, "attentive recognition" emerges in a "zone of indetermination," a temporal gap in an otherwise on-going, taken-for-granted, everyday "reality." Attentive recognition is triggered by problematics, an encounter, a question posed; most often, however, our behavior relies on habitual sensorimotor schemas, or "templates for action." The latter are more habitual adaptive responses to what Gibson (1979) called "affordances," action capabilities that reside as "invariant structures" within a particular "ecological niche," or bounded region. It is within this zone of indetermination that Bergson's "circuit" and "cone" diagrams (2002, pp. 105, 162) account for how perceptions (Deleuze's perception-image) arise; how an actual emerges from the virtual, a process by which an incoming object's rays stimulate leaps into the past store of memory-images for a match. Each temporal ordered "sheet of the past" (Deleuze, 1989), residing in tension, provides a virtual rendition of the real. Each circuit and plane, reconceptualizing along quantum lines, exists in quantum entangled and superposed states, reflecting various renditions of the possible (virtual).

Figure 2 provides a quantized Schema QD. We retain from Lacan some aspects of his Schema R and its underlying topological dynamic. Perceptions created and the instantiation of a subject follow a dynamic interplay amongst the various components of Schema QD. A person finds her/himself in relation with an immediate other, in the context of the standards of, and solidarity with, a more immediate group or community, which in turn is situated in a larger context of universal standards. These are three inter-relational others. The subject is not static; it is coming to be and passing away of temporary configured matrices, or, in Dirac's notation, $|QD_I\rangle$. Each component exists relationally; each must be viewed as entangled with others. We note a central quadrangle, perception-image, with corners: ego, ego-ideal, Other, and community generalized other. Indicated are intra- and inter-subjective relations and identifications. The ego, or view one has of oneself interacts and finds reflections of itself with the immediate, face-to-face Other. This is not merely about "taking the role of the other," with its implied distancing as in George Herbert Mead, but concerns the more penetrating "becoming other" as in Levinas (1969), Deleuze and Guattari (1987), Benhabib (1986), and in the "I-thou" of Martin Buber. The ego-ideal, or various conceptions that one has of oneself as an ideal interacts with the community generalized other (Levinas' "le tiers," the "third," 1969, p. 212) with whom one shares a common solidarity, an "ethic of solidarity" (Fraser, 1986). We also see a second form of the "third." The abstract generalized other (revising Mead, 1967; Benhabib, 1986) represents universal, societal-specific identification categories and normative order always already existing in background assumptions, standards, and in less visible metanarratives. The "third," Levinas tells us, implies an ethics and justice. In a more dynamic version, these relations become interconnected by way of a twist, conceptualized by the unilateral surface of the Moebius band, which, we shall see, is but a "cut" of the subject. (Take a strip of paper, make one twist and glue the ends. You have a unilateral Moebius band).

With the twist and reconnection, we see a relation between ego—community generalized other, and ego-ideal—Other. With Lacan (1977), the subject is spread out over all four corners simultaneously. Thus a variety of possible interactions and identifications (virtual) exist in potentiality, $|QD_I\rangle$, instantiated in context as a dissipative matrix (real). Operationalizations in traditional (snapshot) criminological approaches all too often reflect a static "cut" as totally representative of the subject, reifying it to the status of continuous identity, overlooking the many possible instantiations, $|I_i\rangle$, of the speaking subject. Lacan (see Dor, 1992, p. 27) refers to these possible instantiations as "d'assujet," Massumi (1992,

p. 73), as "larval selves." I_i represents the speaking subject (Lacan, 1977), a shifter (Benveniste, 1971) that takes up residence in discourse. It is a momentary coalescence of the matrix of inter- and intra-subjective relations in context.

This schema, following the suggestions of Lacan, is but a flattened version of a 3-D topological construct known as a cross-cap (See figure 3). Intriguing and suggestive with a figure-8 cut in the cross-cap (see figure 3a) is that one enters the "inside" (1), emerges from the "outside" (2), re-enters the inside (3), and re-emerges on the outside (4), never encountering a boundary. From Schema QD, the ego-ideal connects with the Other, the ego with the community generalized other, an ongoing "becoming-other" (see also Figure 3c). At the moment of connection we have resonance, a communication channel, where interconnectedness remains the operative principle.

The dynamic cross-cap, revealing the perception-image and the subject, includes three moments. First, within the enclosed sphere Schrodinger's equations of motion can be portrayed as operative (Stapp's Process 2); it is a plane (sphere) of immanence. Rather than distinct particles, recall, we have clouds of possibilities/potentialities and the Schrodinger wave function "determines the shape of the cloud, how it moves through space, and how it responds to other clouds" (Blood, 2009, p. 304). Here, inattentive recognition (Bergson, 2002), passive syntheses (Deleuze and Guattari, 1983) and habitual activity predominate given the affordances and "structural invariants" available (Gibson, 1979). Here "direct experiences" (ibid) are more likely at work. Deleuze (1986, 1989) would add, it is the "organic" noosphere or paradigm that is efficacious. Its central postulates and axioms are rooted in the CM paradigm.

Consider Lefebvre's (2008) Bergsonian-Deleuzian application to law of how most cases, over 90%, are determined. The work is by "subsumption," a form of reducing problems to solutions. The judge finds the appropriate rule that can fit the event before her/him. Once selected, the judge makes use of syllogistic reasoning and adjudicates the event, the event now rendered a "case" with legal "standing." The "hard cases," however are problematic. Given legally construed discursive structural invariants do not offer appropriate "fits."

This ambiguity necessarily produces a moment of reflection in deciding how this event can be reconceptualized into a case before the law with legal "standing." Only a case conceptualized as having legal standing is litigable in law. This often entails *ex post facto* constructions of the "what happened" to fit a principle that has been already chosen by some idiosyncratic, extra-legal manner, and in some cases with prejudice as "legal realists" remind us. Various identifications also have effects, as Kennedy (1997) explains. Three kinds of judges, he informs us, adjudicate cases to maintain an imaginary conception of themselves as ethical justice-rendering agents. It is only with an "encounter," the "hard cases" in law, that the continuity of life is suspended; a break appears, a "zone of indetermination," within which real thinking takes place. The process begins in the second moment and reaches fruition in the third.

The second moment opens up the cross-cap revealing its constitutive elements (See Figure 3b). It's the moment where "fledging selves" (Massumi, 1992, pp. 75-76) begin to take form shaped by the constitutive disciplinary forces and "technologies of the self" (Foucault, 1997, 1994) within a socius. As Massumi (ibid., p. 76) states, "a full-fledged self only takes wing after the grid of value judgment has been successfully applied to the body, incorporeally transforming it into its assigned categories." The "full-fledged self" only takes form at the third moment with the completion of the figure-8 cut (figure 3c). The second moment only allows for fledging selves; the first, habitual selves. In the second moment, a question is posed to nature as pointed out by: Lacan (1977), in his notion of "che vuoi?" or "que veux-tu" (what does it want of me?); Stapp (2007) in his notion of Process 1 (see also Wheeler, 1990, p. 311); and Bergson (2002, p. 46) in his notion of interruption and question posed. This opening of the cross-cap is accommodative to the notion of the "zone of indetermination" (Bergson, 2002) or to Hameroff and Penrose's (1996, 2003) notion of a bubble created in the spacetime fabric offering possible (competing) superposed

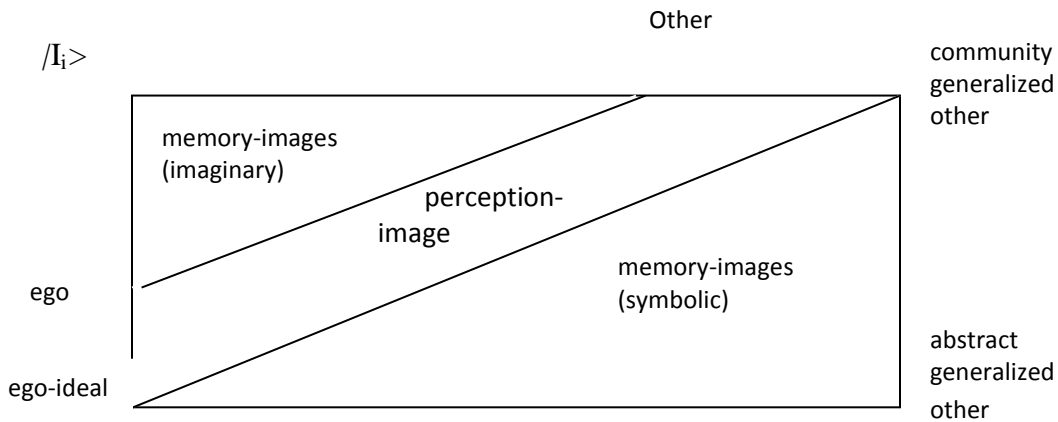
conceptualizations of reality. Deleuze (1989), too, incorporates this idea of an opening in the "crystalline regime" of signs, an operative noosphere in which continuity is shaken in our everyday world. Here, in the zone of indetermination, immediate response does not take place; rather, Bergson's (2002, pp. 105, 162, 152) "circuit" and "cone" diagrams" depicts how perceptions eventually are instantiated within which a direction of action is a component.

Consider Young's (2011) analysis of "post modernity" or Bauman's (2000) "liquid modernity," emerging from mid to late 1960s to present. This is a time of uncertainty in employment, economy, family, identity. Consider, too, Beck's (1992, 2008) characterization of a world-wide emergence of a "risk society." An emerging response was to re-establish a new sense of security, order, stability. For Young (2011) it is also the fermenter of conservative and liberal othering which separates, distances, reduces the other; the former more directly, the latter by subterfuge in seemingly benevolent responses to social problems, one form of which is in the rise of actuarial justice and rational choice theory (see O'Malley, 2009, 2010). Deleuze, however, argues this time period was one in which "thinking" can really begin. Disruptions themselves activate zones of indetermination. Unlike Young's more dire prognosis, we view the contemporary times as both: potentially exponentially liberatory (Deleuze and Guattari's "permanent revolution" populated by dissipative structures, molecular assemblages, 1987; Holland's, improv jazz players, nomad citizens, 2011; Hardt and Negri's revolutionary force, the multitude, 2005); and also the potential harbinger of harms of reduction and repression (Milovanovic and Henry, 2001). The dialectic is upon us; we must rise to the occasion to seek affirmative practices.

The third phase, the completion of a scissor-like figure-8 cut, "la coupure en double boucle," reveals a unilateral Moebius band and a center piece that falls out, a non-Moebius disc (figures 3c,d). The Moebius band represents the bilateral movements from the interior of the body to the surface (see also Grosz, 1994, pp. 116-120). The subject is a figure-8 "cut" introduced in the cross-cap. From Deleuze's view this "cut" is a "bloc of spacetime," a relatively autonomous spatiotemporal sub totality (Bohm, 1983), or, from Hardt's (1993, p. 94), a "temporarily stable assemblage of coordinated elements." In our reconceptualization, this "cut" is the collapse of the wave function transforming the virtual into an actual, Whitehead's actual occasion. The Moebius band represents the momentary perception instantiated and the subject that appears, a "full-fledged self" (Massumi, 1992, p. 76). There is no prioritizing of one or the other; they happen simultaneously.

Quantum theory, too, allows for retrocausality. Penrose and Hameroff (2011, p. 17; Hameroff, 2007a, p. 1040) suggest that consciousness emerges as a result of quantum information returning to an earlier phase in the process with effects on the final product (see also Libet *et al.*, 1970). In agreement, we argue that an integrated dissipative matrix (QD) takes form early in the perception-imaging process that influences what appears to have already happened. Unlike Huxley's (1986) pessimism - "We are merely spectators"—and others (Dennett, 1991; Wegner, 2002) who argue that conscious decision-making is an illusion, our model shows the potential creativity that each human being can engender. Thus, not only anticipatory factors structure concrescence, but a "retrograde" - as in Lacan's (1977) explanation of speech production where time reverse effects occur at any punctuation in narrative constructions - accounts for the final product. Only after the result, does a reconstructed notion of self emerge seemingly in control, providing the appearance of a centered, static, authoring subject. Said in another way, a person finds herself in an encounter receiving wave emissions which are subjected to reflection by the percipient and return to the emitting object but now with an admixture of an emerging QD dissipating matrix; it is with the perception created *in* the emitting object and its re-emission back to the percipient which provides the more complete instantiation of the dissipating QD matrix. Thus, as the object becomes clearer, quantum information is being sent backward in time to influence the emerging QD matrix which then influences the final instantiation, the

Figure 2. Schema QD*



|I_i> Multiple possible forms of expression; the “I,” the “speaking subject,” the one who is speaking; inherently a “shifter”; a place marker taking up residence in a particular socially constructed discursive location (e.g., discursive subject-position) (Benveniste, 1971; Lacan, 1977, 1981, p. 271; Lyotard, 1985); appearing (instantiated) along the line of identification in the cross-cap (Lacan, 1962; Granon-Lafont, 1985, p. 88); a momentary, probabilistic coalescence within discursive subject-positions from which to speak; manifestation of image of unity; a subject of enunciation, imaginary objectification of the subject (Dor, 1997).

Ego Imaginary construction one has of oneself through the eyes of the Other as an unitary subject (Lacan, 1977, 1981, pp. 144-46); via various cultural and historical modalities of appearance and “scripting of the self” (Foucault, 1983, 1990, 1997); appearing more passively as [quantumly superposed] “larval selves,” progressing to molecular [superposed] “fledging selves,” (Massumi, 1992, pp. 64-72), manifest more statically as “collapsed” molar forms.

Ego-ideal Identification with desirable traits, collective ideals (Lacan, 1977; 1981, pp. 144, 272); desirable social imagery (Goffman, 1959, 1966, 1982); historical/cultural forms of likeability, an ethical subject (Foucault, 1994, pp. 24-32); good-me, bad-me, not-me (Sullivan, 1991, p. 161); orchestra performer/ improv jazz play.

Memory-images (imaginary) Quantum holographic virtual memory images (Bergson, 2002; Lacan, 1977) ; “shining points” (Bergson, 2002, p. 171); attractor states/“dense points” (Massumi, 1992, pp. 64-72).

Memory-images (symbolic) Quantum holographic lexicon structure; expressive forms; totality of signifiers in virtual memory; including master signifiers and “order words” (Deleuze and Guattari, 1987) at the core (“shining points”) of the subject (Bergson, 2002; Lacan, 1977); attractor states or dense points; inherently connected with semiotic regimes, phrase regimes, or linguistic coordinate systems (Deleuze and Guattari, 1987; Lyotard, 1988).

Perception-image Gestalt, unified image (Bergson, 2002; Lacan’s (1977) “réalité; “cut” of Schema QD, collapse of the quantum wave function; “cut” from the flow of matter/energy or “plane of immanence,” “bloc of space time” (Deleuze, 1986); a “cut” from the stream-of-consciousness; “event,” “occasions of experience”(Whitehead, 1929).

Other Person with whom one is in face-to-face interaction; infinite Other (Levinas, 1987); concrete other (Benhabib, 1986).

Community generalized other Specifying from G.H. Mead, the group, community, some larger but more immediate significant group; the “third” (Levinas, 1969; Benhabib, 1986); “collective concrete other,” or group identity with which one develops an “ethic of solidarity”(Fraser, 1986); “multitude” (Hardt and Negri, 2005).

Abstract generalized other Universal categories such as the legal subject (i.e., “reasonable man in law”); abstract, distant “third”; social identificatory categories (i.e., race, gender, ethnicity, etc.); oedipally induced social roles (e.g., father, mother, child); law, societal rules/standards; normative order (point attractor v. “permanent revolution” (Deleuze and Guattari, 1987) and “people yet to come” (Deleuze, 1986), “nomad citizenship” (Holland, 2011).

*Adopted and revised, Schema R, from Lacan (1977, p. 197)

perception-image.⁵ The causal arrow is in both directions. It is how an "I" is instantiated, a placemaker in narrative construction, the so-called speaking subject which can now take up residence within a discourse in which it may speak. There are many instantiations of an "I" in context. This can be depicted in the cross-cap as the "line of intersection," the vertical "line" (see Figure 3a, $|I_i\rangle$) along which the various Moebius bands cross, along which various instantiations of the "I" momentarily appear reflecting inter- and intrasubjective identifications. This provides the means for narrative construction and social action. Each instantiated "I" also appears with a unique quantum signature wave. Which "I" is "chosen," as Dirac would say, is "nature's choice," an unknowable, "non-computable" (Penrose, 1994), much in line with the unpredictable final "I" in Mead's (1967) analysis of the "I-me" dynamic constitutive of the self.

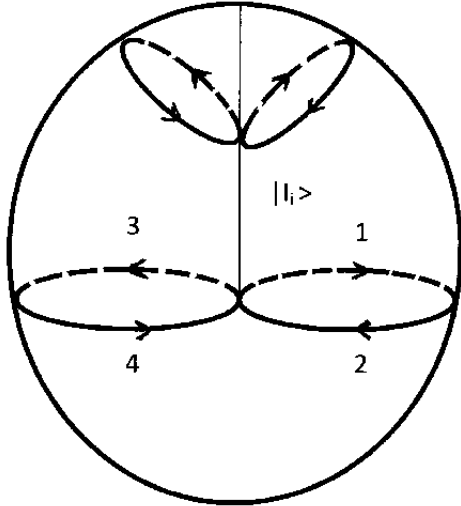
Consider Schema QD in relation to quantized Lacan's (1977) "graphs of desire" explaining speech production. For Lacan there are two time dimensions. A forward, anticipatory time, whereby each word (signifier, or S) is anticipated (consistent with Gabor's notion of overlapping logons); with each being completed, yet new ones are anticipated, whereby each "signifier represents the subject for another signifier," until a pause. Each signifier's meaning (signified, or s) remains in flux, S/s-s-s-s, until the pause, at which time a "retrograde" to the beginning of the statement produces particular signifieds [Lacan's punctuation, s(O)] and meaning all at once with a "fading subject" as an after-effect. In our appropriation, each signifier anticipates by way of the intrinsic properties of logons ("overlap with the future," Gabor, 1946) the next signifier with a communication channel opened by way of Pcar dynamics. One draws from one's particular quantum lexicon, where signifieds remain in quantum entangled/superposed states, with the subject represented by a signifier infused with a quantum wave of information carrying the dissipative matrix of Schema QD in a particular context. The reverse time effect consists of the emerging dissipative matrix, $|QD_i\rangle$, returning to the beginning of the sequence of signifiers infusing all as finished product, or collapse of the wave function, S/s, along with a final collapse of the wave function representing the momentary instantiated dissipative matrix of QD. This provides meaning and an instantiated speaking subject, an apparently centered "I" guiding the process. The Moebius band portrays how "reality," the actual (perception, gestalt, *réalité*, bloc of spacetime) emerges from the interaction of all four corners of Schema QD (ego, ego-ideal, Other, community generalized other) immersed in a bounded sea of entangled virtual memory images, a quantum lexical structure (Jones and Mewhort, 2007) with non-local properties. For Lacan, the remaining disc which falls represents the objects of desire, and its spiraling to a singular point (looks like a seashell), the phallus that colors all thought, language and action. We offer, instead, a quantized notion of the spiraling disc (see Figure 3d) as a loci of: recollection-images, $|R-I_i\rangle$, in a state of quantum coherence indicating where a "general idea oscillates," climaxing in a "bodily attitude or an uttered word"⁶; and affection-images mobilized with the particular encounter, always intertwined with expressive forms. It also contains a singularity, the portal for non-locality and quantum tunneling, "patrolled" by the form of abstract generalized other from which the Moebius "cut" of the subject is constituted. Registered affections reside in the body (Bergson, 2002, pp. 57-58, 61), for Hameroff and Penrose (1998), encoded at the Planck's scale as a

⁵ Penrose and Hameroff (2011, p. 17) and Hameroff (2007a, p. 1040), building on Libet et al's experiments (1979), demonstrate how "backward time referral" is responsible for the movement of (unconscious) quantum information, and suggest that "conscious sensation actually occurs in transit between the two locations." Thus, an integrated perception-image ("visual gestalt") results "early in the integration process." For example, "tennis and baseball players consciously see and recognize the ball's shape, color and motion early enough to respond successfully." It would seem that they first see the spin, speed, and direction then hit; rather, they are responding before the actual conscious perception of these attributes.

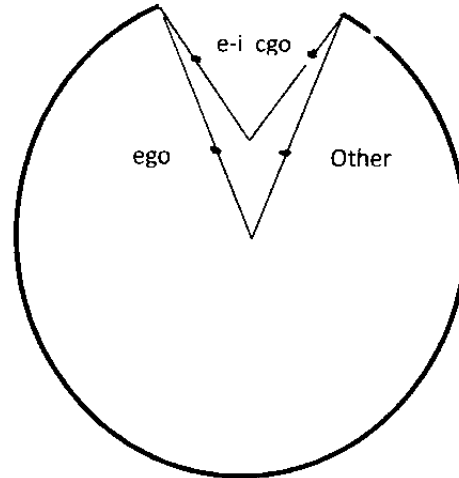
⁶ See Bergson (2002, pp. 161-163). His "cone diagram" can be reconceptualized as reflecting the dynamics of quantum coherence or quantum entanglement. From the "oscillations," one perception-image arises which equates with the collapse of the wave function. From the virtual multiplicity, a real is instantiated.

Figure 3. Cross-Cap and Schema QD*

a. Closed Cross-Cap (dashed line = inside)

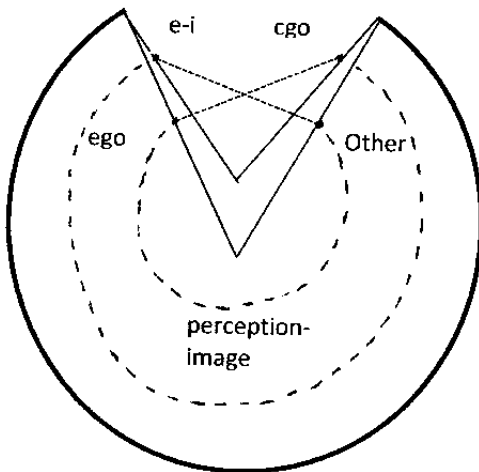


b. Opening of Cross-Cap

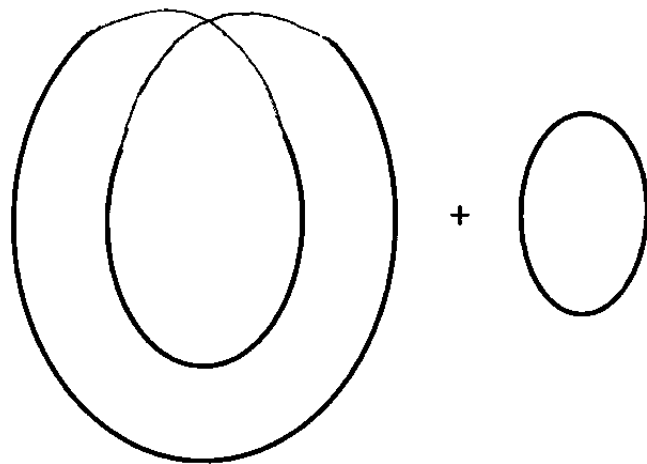


c. Figure-8 Cut

(dashed lines = twist; e-i, ego-ideal;
cgo = community generalized other)



d. Mobius Band and Disc



*Adapted from Granon-Lafont (1985) and Dor (1992)

geometry of "spin networks."⁷ Affection-images, emotionality, interpenetrates emerging perception-images, the form and expression of which are inter- and intrasubjectively constituted in-process requiring, as Denzin (2007, pp. 3, 48, 93) argues, an implied or imagined Other (see also Katz, 1999; Sartre, 1972).

Schema QD reflects, in a more static (flattened) form, a complex wave function constituted by various contributing wave functions in producing the "cut" of the subject and instantiated perception. In the more dynamic cross-cap, it traces a movement from the virtual realm of possibilities, to the actual; in Dirac's notation, $|\text{perception}_i + I_i\rangle$. The constitutive effects arise from the interplay of the four main corners of the Moebius band. Each possible relational dyad can be depicted as being represented by a wave function, together operating in a larger representative complex wave function reflecting the dynamics of Schema QD. This "assemblage" (Delanda, 2006) or what Whitehead (1925, p. 71) referred to as "spatiotemporal unity," is again immersed within virtual memory-images (imaginary, symbolic) with shaping effects from the societal-wide other, the abstract generalized other. Out of the flux of quantum flow, the plane of immanence, political economies "capture" (name, categorize, classify, cross reference, normalize, and hierarchize) these flows in axiomatics, "abstract machines" (logics) tending to produce more static "molar assemblages" (Deleuze and Guattari, 1987; Patton, 2000). With Gibson (1979) and Deleuze and Guattari (1987), we could argue that abstract machines produce structural invariants, providing limiting affordances, emanating as "lines of flight," or information-bearing quantum waves.

Memory-images are spectrally encoded holographic information activated through P_{car} ; a reverse Fourier transform reproduces a 3-D image, but interpenetrated by a contextually induced altered signature wave reflecting a dissipative matrix of QD. Recollection-images in quantum coherence $|R-I_i\rangle$ will collapse to one perception-image providing a gestalt or meaning in the situation. Thus memory-images undergo ever so slight modification as they are interpenetrated by the signature wave activated in context. With iteration, differences in repetition are ongoing. A repeated traumatic memory-image can be seen as a resistant memory-images. Recently, a "holographic reprocessing" form of therapy (Katz, 2005) has been developed in which traumatic events can be reconstituted.

In sum, our composite characterization of Schema QD can be restated: Schema QD, as a quantum wave function, $|QD_i\rangle$, represents a complex dissipative matrix composed of intertwined inter-relational dyads distinguished by attractor state forms, represented in context as an instantiated speaking subject, an "I," an agent of indetermination, information-processing, and becoming, characterized with a distinct quantum holographic spectral wave signature, an information-bearing quantum holographic signature wave unique to that person. Much research from prominent cosmologists argues for a hierarchy of nested, imbedded boundary regions on whose boundaries are encoded all information from the bulk. With Marcer and Schempp (1997a, 1997b, 1999), Mitchell (2008), Mitchell and Staretz (2011), and Laszlo (2007), it is phase conjugate adaptive resonance that creates resonating channels to this information from which instantiations emerge. Necessarily, then, to do genuine holistic political economic, socio-psychological investigation, we must recognize the holographic principle as necessary for incorporation in theorizing in criminology. As a working hypothesis, we assume 't Hooft-Susskind's Holographic Principle, although our analysis can with some modification be equally applied to Laszlo's "information" field model.⁸

⁷ For a clear explication of the geometry of "spin networks," a relational view of spacetime, see Smolin (2001). Qualia, or "raw feelings," in the Penrose-Hameroff model ultimately are encoded at the Planck's scale, the smallest level that physicists can conceptualize. Hameroff (1998, p. 12) argues since Whitehead (1929) has also said each occasion of experience is encoded with feelings then spin networks can be its basic structure.

⁸ A reasonable hypothesis is that there is a double inscription, where perhaps the boundary surface contains the "diagram" of virtual forces. Here the work of Deleuze and Guattari (1987) on assemblage theory, diagrams, abstract machines, and lines of flight would be essential elements for integration (see Milovanovic, 2014).

Contrary to the holographic determinism implied by Bohm (1983) and the earlier Laszlo (1995), a quantum holographic model, following Bradley (1998, 2006, 2007), provides at least three moments of indeterminacy to which we will add three: first, following Gabor (1946), logons are intrinsically overlapping in form, that is, spectrally enfolded information in one logon is already partly encoded in adjoining logons, for Gabor, an "overlap with the future" (*ibid.*, p. 437). Second, drawing from Heisenberg's uncertainty principle – one cannot simultaneously measure momentum and location – Gabor argues that time and frequency, essential constitutive elements of logon constructions, cannot both be measured at the same time. This also entails critical timing as a factor. Thirdly, the apparatus that energizes the frequencies of logons in context have differential effects and hence provide for moments of indetermination. And we add, fourth, with Schema QD, operative within the "zone of indetermination," there are always differences within repetition in constituting the perception-image and the instantiated "I" of the occasion. From dynamic systems theory, iteration produces disproportional effects. Fifth, following Delanda's (2006) notion of "catalysis" rather than linear causation, there are shifting threshold values unique to the person (Schema QD) which increase or decrease the capacities of the associated assemblage. Thus, even similar environments (ecological niches) impact differentially on a human being. Finally, sixth, with Robbins (2000, p. 36), since each person has a unique signature bearing QD, then its access to the holographic field and affordances are differentially operative.

Toward Applying Quantum Holographic Concepts In Criminology

This final section provides further applications of the PI paradigm. We will consider Sutherland's differential association theory and "Cease Fire Chicago," recently renamed, "Cure Violence."

Sutherland's (1974) much cited and integrated "differential association theory," implicit or explicit in much contemporary theorizing, has one of its main principles that "a person becomes delinquent because of an excess of definitions favorable to violation of law over definitions unfavorable to violation of law" (proposition 6). An implied determinism is mitigated by his proposition 7, which states definitions may "vary in frequency, duration, priority and intensity." We hasten to add, critical timing and differentials in threshold values for activation are further qualifiers. If we accept the quantum holographic postulate concerning boundary surfaces, and if this surface, following Bousso's refinement (2002; see also Susskind and Lindesay, 2010), is made up of "light sheets" beams of which are informationally encoded with, following Gibson (1986), "affordances," a set of which makes up one's "ecological niche" within which one's lives (*ibid.*, p. 128) – then, suggestive is that "definitions" can be seen as information holographically stored on the boundary surface. Bradley's previously summarized theory was groundbreaking to note how information in the form of logons are created and constantly reconstructed in producing a social order. Wendt's work, too, is suggestive as to how certain linguistic usages instantiate a distinct "reality." A person enters this bulk area, or ecological niche, or subcultural domain in traditional criminology parlance, and negotiates the various probability waves and "affordances" ("excess of definitions") embedded within it. S/he interacts with others, existing narrative forms, power differentials and given architecture. Similarly with Matza's drift theory (1960) in his identifying "techniques of neutralizations" and in Cressey's (1956) notion of rationalizations existing at the work place justifying embezzlement. These rationalizations/neutralizations can be envisioned as encoded on the boundary region but act as quantized affordances within the bulk. They are logons that provide the elements out of which social reality is constructed.

Sutherland did not acknowledge a viable entity (agency) that interacts within a context. Our previous short summary of Stapp's and Penrose and Hameroff's work indicated that both approaches do not sufficiently integrate the intra- and inter-subjective elements of

agency. Bradley's initiative can be augmented. Wendt's work did begin to look at the active and passive forms of subjectivity, but needs further development. Schema QD would indicate how various constructions (elements of the Moebius band: ego, ego-ideal, Other, community generalized other), perceptions, and a speaking subject crystallize in a particular dissipating matrix in movement through various locations. A snapshot, or a static "cut" of the subject professed to be "reality," heralded in the classical-materialist paradigm, is not consistent with Heisenberg's uncertainty principle. In the passive recognition form, the Schroedinger equations and an "organic regime" (Deleuze, 1986), here sedimented affordances and structural invariants, will be efficacious, but subject to the six nonlinear effects previously developed. In problematic encounters, the first cut opens the subject and its "zone of indetermination," after which, according to Bergson (2002), various leaps to the past's recollection-images take place in search of congruence with the object encountered. Here there is indeterminism and the opening for creative alternatives. It is with this insight that alternative intervention policies may be constructed. Intervention (gang) workers must focus on establishing phase conjugation with potential youth in trouble in order to develop a resonating communication channel. The completed figure-8 cut stands for the collapse of the wave function, an "occasion of experience" (Whitehead, 1925), an instantiation from the virtual to the real, where both the perception-image (gestalt, *réalité*) and an "I" momentary appear as the centers of subsequent action. Of course, with "pacification" and being "objectified" (Matza, 1969), effects of repressive political economies (harms of reduction and repression, Milovanovic and Henry, 2001), a subject tends to perceive affordances and structural invariants as direct experiences and to enact the script and templates for action assigned in that ecological niche. What is offered here is not a full-fledged theory. It is suggestive of the usefulness of concepts from the process-information paradigm in thinking how reality is constructed within bounded spheres, or ecological niches. Traditional theory does not sufficiently explain how information is constructed, stored, and communicated. And how it becomes reified. Quantum holography provides a physicality to much of extant process-oriented theories in criminology.

This leads to a related example. Take "Cure Violence" an NGO in Chicago that makes use of "interrupters," previously involved offenders who now counsel at-risk youth away from crime. Notwithstanding is the questionable recent change to a medical model ("infectious disease," "disease control workers"), squarely reflecting the CM paradigm. Space limitations do not allow us to critique this model. We focus only on the "interrupters" since their currently defined work philosophy does not conform to "disease control workers."

Consider the signature quantum wave (QD) of the interrupters. Their ego, ego-ideal, Other, and community generalized other are framed with indigenous elements reflective of the context within which they are engaged. Consider, too, the identified at-risk youth's signature quantum wave, more in tune with the context within which s/he operates. This context or ecological niche can be contextualized as a bounded area, a noosphere within which distinct noosigns prevail, such as definitions for Sutherland (1974), neutralizations for Matza (1960), rationalizations for Cressey (1954), instrumental rhetoric for Schwendinger and Schwendinger (1985); and narratives of self - "redemption" and "condemnation" scripts for Maruna (2006). For at-risk youth, there develops resonance, phase conjugation, with that of the interrupter's signature quantum wave while immersed in resonance with holographically encoded affordances prevailing in the ZPF, the primordial source of which is informationally encoded on the boundary surface. Consider, too, the emerging speaking being, an instantiated "I" in this context. When "interrupters" engage the Other, the gang member's ongoing inattentive recognition is actively challenged, transforming it into attentive recognition. Here the interrupter is a catalyst for an alternative understanding of a previous situation which normally would have escalated into violence. A channel for alternative information exchange and the basis of an alternative construction of reality follows Pcar dynamics. The interrupter, in a collaborative "dialogical pedagogical" form (Freire, 2005), is a catalyst in the collapse of the ongoing wave function in a form already

embedded as a possibility in the at-risk youth's wave function, but not played out, not the one normally collapsed within that bounded sphere of action, the bulk space which often leads to heightened probabilities of law infraction. S/he also provides the possibility for an alternative construction outside of those habitual possibilities in the at-risk youth's quantum lexicon by offering new elements in the construction of perception-images and an "I." Consider Maruna's (2006) insightful study of how a "redemption script" offers a more active notion of the subject, a "rebiographing" conducive to more productive story-telling of self, others, and the socius. The potentials for an indigenous understanding to evolve, a replacement discourse, is but one possible direction of development that could enlighten the public as to a better understanding of the nature of crime and its attenuation. A concerned criminologist would take note of these potential developments and seek not to provide static snapshots, but a portrayal of this dynamic unfolding. Empirical researchers and organizational heads of Cure Chicago, I fear, in their wish or pressure to provide statistics for funding and public receptivity can easily fall within a snapshot criminology stance, leaving the more subtle dynamics involved in interrupter's dialogical encounters with at-risk youth misunderstood. The further danger is for the noosigns to take on the form of a master or university discourse (Lacan, 1991; Milovanovic 2004) whereby more static signifiers and lexical structures tend to collapse the wave function of possibilities into more static, categorical, non-dynamic form, more in the form of "order words" of Deleuze and Guattari's description (1987), overriding the dialogical encounter and their possible novel forms of instantiations. That is, static understandings replay themselves and become habitual templates for action. Indeed, it would seem that the tendency would be to straddle interrupters with the basic duties of categorizing otherwise dynamic events into the framework of bureaucratic imperatives. In so doing a "particle-like" orientation becomes dominant over a "wave-like" orientation (Kuttner, 2010). Nevertheless, left alone, identified at-risk youth play out their activities within the constraining factors, narrative constructs, "affordances," and structural invariants of the bounded region (ecological niches) and loci of relatively stabilized logons available in more passive forms of recognition. This is not to say their actions are "mindless" and robotic in form; it is to say that the instantiation of perception-images and an "I" follow a more patterned form (i.e., templates for action, sensorimotor schema) always already embedded in the subculture.

Limitations of space disallow us to more fully develop the use of quantum theory in critical legal studies (See Milovanovic, 2014), but a few words on its use. Deleuze, who has admitted if he didn't study philosophy he would have studied law, has advocated a more dynamic form of law, an alternative version he calls "jurisprudence," by which he means more case law orientation without static categories (Lefebvre, 2008). Lefebvre (ibid.) has drawn from Bergson and Deleuze to develop an alternative picture of how judges reason in law. In both, implicit is a quantum holographic orientation, or alternatively, material that lends itself to a quantum holographic rethinking including the insertion of a bonafied agent. There have been many more articles on a quantum approach in critical legal studies than in criminology (see for example, Goldberg, 2002; Kelsey, 2013; Kuttner, 2010; Levin, 2001; Powell and Menendian, 2010; Mootz, 1993; Tribe, 1989; Winter, 1991; Wright, 1991). Rejected is a traditional Newtonian-based model more fully articulated and much followed by Langdell, Dean of Harvard Law School in 1870. Langdell insisted that the study of law is scientific and should follow the same principles as the physical sciences. It was a form of reductionism and atomizing (Powell and Menendian, 2010) that separated wholes into parts. Legal decision-making more often narrows contexts and reduces what is seen as "relevant knowledge" (ibid., p. 18). There has also been some suggestions that the work of Gadamer, particularly his *Truth and Method*, which is more in the hermeneutics approach in discerning the text, is compatible or converges with conceptualizations of quantum theory (Kelsey, 2013; Mootz, 1993). There has been some suggestion that a "post-Newtonian" approach is already sporadically employed in lower court decisions as well as with individual Supreme Court justices (Powell and Menendian (2010, pp. 25-28). These are consistent with the

process-information paradigm here being developed. What remains, however, is application of holographic principles in quantum theorizing applied to critical legal studies. This would lead to a new understanding, if not just explaining the physicality, of how information is constructed, stored and communicated in process. In addition, much of the literature in critical legal studies, although advocating an alternative to an individualistic, reductionist notion of agency, does not provide a fuller examination of the agent her/himself. Queer theory, however, is offering insightful directions for the nature of agency itself. Theorists in this tradition would surely benefit from engaging quantum holographic theory.

Conclusion

Contemporary criminology rests on ontological assumptions of the classical-materialist paradigm. We have offered an alternative ontology rooted in the new physics of quantum and holographic theory. Primacy here is with process and information exchange. Much of quantum theory is still not well understood. It has been called a weird science. Nevertheless, since its inception in the 1920s, no major experiment has contradicted its core propositions. There was a time where the Heisenberg "cut" would distinguish between a subatomic and macro-world, with the exact separation open to debate. For all intents and purposes, it was argued, the classical-materialist paradigm explained things good enough. We now see, however, that quantum theory has macroscopic effects. We have ventured forth to propose a Kuhnian paradigm shift in criminology. Einstein once explained his development of relativity theory. He (1995) proposed that normal science is a self-enclosed universe with key postulates acting as axiomatic. The key for innovative change is a jump, perhaps even appearing somewhat irrational, to a new set of postulates from which an alternative *verstehen* could develop. Deleuze and Guattari, too, have argued that the key for discovery is in offering well-posed questions. Ours has been an effort to resituate discourse and questions posed in criminology. Included is the "hard problem," the question of agency, or the subject. Criminology is missing a subject. It is time to consider new tools for inquiry. We don't look far to see the failures of our criminal justice system. We need to move forward with a new sense of urgency and conviction. Quantum holographic theory is offering novel understandings well understood in other disciplines. It is time for the process-information paradigm to be addressed in criminology and the social sciences.

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