Quantum Holography and Agency: Toward a Formalism of Schema QD

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ABSTRACT

This article provides a non-metaphorical model for the operation of a quantum holographically driven psychic apparatus. Schema QD offers an inter- and intra-subjectively constituted subject represented in a dynamic matrix, a basis for a QD signature wave that accesses and decodes holograms in the ZPF. We introduce both a qualitative and a formalism based on Hamiltonian quantum mechanics which includes time evolution. We use non-Hermitian Hamiltonians which can account for memory, learning and aging processes.

Key Words: Holography, quantum, Schema QD, consciousness, PCAR

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Introduction

Social sciences all too often lack a comprehensive notion of agency. Recently, the emergence of quantum holography (QH) has offered alternative concepts from which a quantized notion of agency may be constructed. We want to first review five models that make use of both quantum and holography theory, then offer an inter- and intra-subjectively construct, schema QD, to be followed by a formalism of its dynamic. We focus on one component, the wave collapse of our schema QD matrix, a model of agency and its development of perception images (gestalts). Insightful approaches have made use of only quantum theory, such as in Penrose and Hameroff (2011) and Henry Stapp (2007), but we see greater benefits by integrating the additional insights offered by those doing holographic theorizing. The work of David Bohm (1983) and Karl Pribram (1991) have paved the way. The greater benefits of QH stem from the suggested dynamic nature of information construction, storage, accessing, and dissemination.

Quantum theory suggests the wave-particle like nature of all entities. It is only by observation/measurement, an act of consciousness for example, that collapses the representative "wave function," that instantiates reality as we conventionally see. Holography theory, on the other hand, stipulates the idea that all entities are vibratory in nature, emitting wave fields. Embedded in the wave field is holographically encoded information in the form of frequency waves. It is in the interference patterns constructed between emitting wave fields within which distinct patterns of energy, a spectral domain, are produced.

Holography theory had its source with Dennis Gabor (1946) theorizing cable transmissions across the Atlantic Ocean. Investigating how to minimize uncertainty in the least space, he concluded that both quantum (Heisenberg's uncertainty principle) and holography (encoding of information) theory was necessary for explanation.

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His notion of a "logon" stands for a space-time constrained quanta of information that was essentially analog in form, unlike the more popular contemporary preference of digital (Boolean) information, traced to the work of Shannon and Weaver (1948 [1998]). Gabor's early article (1946) was concerned more with spectral information being transmitted. His following work (1948) was to be on image transmissions. Further developments were by Bohm (1983) particularly his notion of "pilot waves" and Pribram (1991) inspired by Gabor, with his idea of a holonomic brain.

Studies of agency/consciousness have often polarized into those more qualitative in orientation and those more mathematically inclined with formalistic descriptions and explanations. This article is an initial integration of the qualitative with a formalism.

Review of Literature

The literature on quantum holographic interaction between entities has produced fertile grounds from which to construct a viable notion of agency. There are, off course, a number of initiatives that focus only on the quantum possibilities (see, especially, Hameroff and Penrose, 2014). Five prominent approaches are reviewed which will prepare the way for the following section on a quantum holographic notion of agency.

The first significant contribution has been developed by Peter Marcer and Walter Schempp (1998), and Edgar Mitchell (2011). They call it PCAR, phase conjugate adaptive resonance. In this model (see figure 1), the "object" of attention (say a banana) emits a wave field that is received by an attentive brain.

"object" → → brain

← ←

conjugate wave

←←→→

(standing wave, information channel)

Figure 1. PCAR

The brain, in turn, generates "phase conjugate (mirror image) 'virtual' waves to identify the object" (Mitchell and Staretz, 2011: 5). This virtual wave decodes the holographic information embedded in the emitting wave. The two waves meet, one in a forward, one in a reverse direction, and create a "standing wave." This is an interference pattern. What distinguishes a "standing wave" is that it remains fixed in constant position. This is resonance. It is by this process of information exchange that the brain can construct a three-dimensional object "out there" from where it was emitted (Marcer and Schempp, 1997). This is phase conjugate adaptive resonance.

Mitchell and Staretz (2011: 13-14) considerably advance PCAR theory by a statement on how percipients (agents) conduct "evaluation" and hence meaning. In their model, once a standing wave is established (resonance, interference pattern, an information channel) and information is exchanged, accessed is the "information store" in the Zero Point Field (ZPF). This is a memory quantum hologram unique to each entity.[2] They (ibid., 11) suggest a matching process takes place during resonance by which "cognition and meaning require finding a relationship between the perceived information and the information percipient's beliefs and prior experience stored in its memory." With this process, attention is transformed into an intent and action (ibid.).

The second approach is by Irvin Laszlo (2007). He posits a vast "in-formation" field populated by frequency interference patterns embedding information. These patterns embed information about the characteristics of the respective ships. In this view, space is not "empty," but a vast storage repository of information. By altering ever so slightly the frequency patterns (amplitude, phase, wavelength) a tremendous amount of information is stored. One cube of sugar has been estimated to store all the information of the U.S. Library of Congress. Information stored, however, is nonlocal; it is distributed throughout the medium (ZPF).

The third approach, a "transactional interpretation," has been theorized by John Cramer (1986, 2016). Although not explicitly quantum holographic, it nevertheless has been influential for those who continue developing a PCAR model. There are four steps stipulated. The

2 "…every physical object (both living and nonliving) has its own unique resonant holographic memory and this holographic image is stored in the Zero Point Field (Marcer *et al*, 1997). Information in the ZPF is stored non-locally and cannot be attenuated. ..this information can be picked up via the mechanism of resonance…this information, its storage and its access is collectively called the Quantum Hologram (QH)" (Mitchell and Staretz, 2011: 6).

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first stage includes the idea that all entities emit waves that spread in all directions ("offer wave," or Ψ.) In the second stage, the absorber takes action on the received wave and re-emits a time reversal "confirmation wave." This is a complex conjugate of Ψ referred to now as Ψ*.[3] In the third stage, this conjugate wave arrives at the emitter now with an amplitude ΨΨ* at the exact time of emission. The fourth stage is repetition of the process during which time information is transferred until completion. It is "based on the strengths ψψ* of the advanced-wave 'echoes' it receives from the potential absorber." It is a "stochastic choice exercised by the source in selecting one from among possible transactions." The last stage, or completion, represents for Cramer, the collapse of the wave function. A real is instantiated from the many possibilities (the virtual realm) represented by the quantum wave of the emitter, Ψ. For Cramer, the collapse takes place at the emitter location and no consciousness (unlike our view) is necessary for the collapse of the wave function.

Ψ
Emitter →→ Absorber
ψψ* ←←
ψ*

Figure 2. Transactional Interpretation: Stages

The fourth approach is seen in the work of Raymond T. Bradley, initially in his collaboration with Karl Pribram (Bradley, 2011). He builds on Dennis Gabor in showing that two forms of holography exist. *Classical holography* is deterministic, and is more connected with Gabor's work of 1948. *Quantum holography* brings into play Heisenberg's uncertainty principle and hence is non deterministic (1946). His notion of space-time constrained quantum of information, or "logons," suggest that information construction always entails a degree of uncertainty. It is pattern matching between "Fourier descriptors" embedding information residing in the brain being matched with frequency interference patterns reflecting modes of organization in the ZPF that, in producing a match, create resonance. Bradley (2011: 339) sums this up as:

> …a thought or an intention is a distinct pattern of electrical activity in the brain, and that, as a unit of information, it is energetically encoded as a quantum hologram. The act of attention involves the generation of an out-going wave field of bio-emotional energy from an individual directed towards the object of interest. And, insofar as this act includes an intentional disposition (for example, a preference, a desire, a goal, or a plan) this intention is recorded as implicit information spectrally encoded as a quantum hologram in the outgoing wave field. The more passion (focused emotional arousal) with which the intention is held, the greater the activation of the individual's bio-emotional energy, and hence, the stronger the recording of the quantum hologram of intention in the outgoing wave field."

In this view, each agent is the source of "attentional bio-emotional energy" which interacts with a wave field of energy vibrations emitted from other objects/entities. It is the interacting and interference wave fields that produce standing waves. This is the basis of "matching" and information exchange, culminating with meaning attributions to perception-images. Thus, a modified model of figure 1 and 2 above would substitute two human beings in interaction, each a source of bio-emotional energy. Understanding takes place along two inseparable interconnected dimensions: verbal dialogue (more cognitive, rational) and based on a particular language, and socioaffective dialogue (emotionality, passions, nonverbal). Nonlocal information is accessed by the attentional wave field, and once resonance is established, the brain decodes holograms by way of a reverse Fourier transform producing "mental imagery, feelings, and other sensations…" (ibid., 336).

The fifth statement on the workings of the brain and consciousness via QH has been developed by Stephen Robbins (2012). He draws from Gibson (1969), notably his idea of "direct perception," suggesting an immediate match between "affordances" (what a particular environment affords as possibilities, encoded in ambient light arrays or optic arrays) often more stabilized in the form of "invariance structures," and the perception images constructed in the percipient's brain. He posits the brain as a decoder, a "modulated frequency wave"

[3] This quantum event thus involves an exchange of specific quantities such as energy, momentum and energetic, geometric configural forms.

traversing and accessing the holographic field. The brain is a "reconstructive wave that is unpacking the 'code' in the holographic field" (2006: 373). The brain is a "modulated reconstructive wave," meaning that it is in continuous variation. It is what is accessing invariance structures embedded in optic arrays and decoding their informational basis. In our view, invariance structures can be reconceptualized as relatively stabilized frequency interference patterns that populate a particular niche or locale.

In sum, five approaches have pointed to a potentially productive direction for further research. Our Schema QD builds on these models in developing an alternative QH driven notion of agency.

Schema QD

Schema QD builds on the aforementioned integrated with a revised and adapted de-oedipalized Schema R of psychoanalyst Jacques Lacan (1977). It is an inter- and intra-subjective, dynamic notion of agency (see figure 3). It can also be depicted by way of a topological construct called a cross-cap[4] (see figure 4) which has the unusual features of incorporating and revealing, with an appropriate "cuts," an infinite number of unilaterally sided Möbius bands.

Figure 3 provides a "flattened" version of the Möbius band. The key components (located on each corner) on this unilateral band can be identified as: ego, an imaginary construction one has of oneself as a unified self, gained through the eyes of the immediate Other; ideal-ego, identification with desirable traits one has internalized; Other, the person either real or imaginary with whom one is in face-to-face interaction; and generalized community other, the more immediate significant group with whom one finds attachments. These components frame a middle region the locus of a perception-image or gestalt. We also locate discursive subject positions (a discursively structured role within which a person may take temporary residence from which to speak as a speaking subject), and an abstract generalized other (societal normative order).

[4] For the construction of the cross-cap and its enclosed Möbius bands, see: http://web1.kcn.jp/hp28ah77/index.html#chapters . For the cross-cap, see: http://web1.kcn.jp/hp28ah77/us27g_crsp.htm .

Each of the four components of the Möbius band may vary along the dimensions of intensity, saliency, priority, frequency. Each is in relation with the others. Together these represent a matrix.

Each component can be seen in the form of a quantum basis, thus, for example, |ego>; meaning that they remain in virtual states of possibilities in relation to each of the other. The matrix therefore changes in its various relational forms, and the totality at any instance is captured by a signature wave reflecting these mixtures of different wave functions.

A certain characteristic attractor state (an "idling speed") characterizes schema QD at rest. That is, a degree of stability in the form of an attractor state persists with the relations amongst the four key components. Plikynas's work (2010, 2015) is suggestive of modalities of attractor states ("basic mind states," BMS), amongst which he identifies sleeping, wakefulness, resting, and thinking.

Each BMS has a distinct wave frequency and exists as an attractor state within the brain, with wandering between points modeled much like a strange attractor and its sensitivity to even slight changes in initial conditions. He also describes a "mind-field" associated with each BMS, which is defined as "coherently radiated energy" which is consistent with the notion of a modulated schema QD matrix signature wave. We would hasten to add that this "mind-field" is holographic in nature, encoding geometric, energetic information. We also take note of Bradley's (2011) recent work which identifies two additional states, "psychophysiological coherence," and a hyper emotional form referred to as "emotional quiescence," in which state the phenomena of intuition can be explained. In sum, suggestive is that discrete basic mind states exist.

It is with perturbation (e.g., incoming wave fronts that represent novel encounters) of the four components of the Möbius that these are relationally re-aligned whereby a modulated signature wave takes form that encodes all information about the entity in-process (a constant becoming).

Measuring or observing by a person, then, collapses a quantum wave that otherwise reflects the distinct idling speed with its embedded information about the entity. We call this idling speed a modulated schema QD matrix frequency wave. Here, we build on Robbin's (2006) notion of the brain as a modulated frequency wave that traverses the holographic field. We suggest that the modulated frequency wave is constituted by distinct instantiated matrices of schema QD.

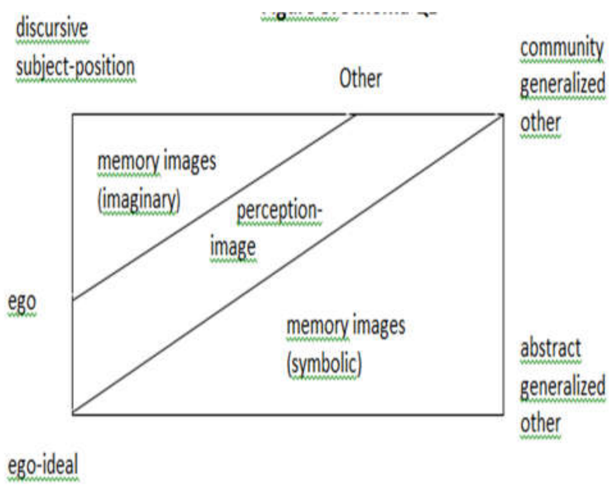

Figure 3. Schema QD*

*Adopted from Lacan (1977: 197)

Moving to Figure 4, what is depicted is that doing a figure-8 cut (see Lacan, 1977) on the cross-cap identifies a Möbius band which depicts a relationally constituted identity and instantiated perception-images, or gestalts. Closing the cross-cap also finds the appearance of a vertical "line of intersection" where the Möbius band crosses from the "inside" to the "outside" of the cross-cap. When closed the four components of the Möbius band coincide. The Möbius band is immersed in a sea of symbolic and imaginary memory images.[5] Thus each "cut," or collapse of the wave function, produces a distinct matrix, along with a modulated signature frequency wave that both interacts with incoming frequency waves, and is, at the same time, modified by these very same waves.

Our model is in accordance with Bergson's early insight (2002, originally 1896) that consciousness is said to be *in* objects. Thus the image is constituted where it is, "out there," not in the brain. This is consistent with Laszlo's model, that we are immersed in an "in-formation" field.

Passions and affections are often overlooked in standard analysis of the development of consciousness and agency. We also note work by Bradley (2011), Katz (1999) and Denzin (2007) who suggest emotionality has an intra-subjective dimension. Bradley, for example, argues that it ("socioaffective dialogue") is central in understanding meaningful communication along with the rational, verbal dialogue with which we engage. Thus he recognizes two components to an emitted

"intentional bio-emotional wave": (1) a cognitive component of reason and logic, and (2) a "purely passionate component" that relates to the "individual's passionate connection to the object of interest" (Bradley and Tomasino, 2011: 334, 341).[6] Let us build on this.

The "cognitive component" has more to do with the dynamics of schema QD which is shaped by the more primordial heart wave fields into further composite form emerging as distinct modulated signature waves. We posit the possibility of distinguishing two forms of this wave field: a more primordial, free floating, unadulterated form of the heart's bio-emotional field[7]; and a more captured form (encoded in the subsequent spectra of an entity) and constitutive of the schema QD signature wave. The latter, in other words, is a result of operators such as disciplinary forces; the former remains, however, in *potentia*, a basis of disruption of any fixed forms (a transverse wave). This also suggests that the interference patterns established by the further workings of PCAR are also continuously traversed by a ubiquitous, potentially further

[5] Imaginary memory images are spectra, frequency interference patterns encoding information often in constellations or associations of images; symbolic memory images are signs, icons, and symbols, or signifiers, which compose a holographic lexicon.

[6] He further suggests that the heart plays a primary role in generating these waves. And it has been shown that the heart's energetic emissions are associated with emotionality and feelings (Bradley, 2014: 24). "The heart also communicates information to the brain and throughout the body via electromagnetic field interactions" (2014: 9; see also the empirical support by McCraty *et al* 2009). The heart, as a sensory apparatus, has been shown to emit 60 times the force field than the brain's. Thus, posited is a two-way information exchange (Bradley, ibid.). Further, "the signals the heart continuously sends to the brain not only affect physiological activity but also influence the function of higher brain centers involved in perception, cognition, and emotional processing" (citing McCraty *et al*, 2009).

[7] This idea could conceivably be associated with (but not fully developed in this paper) Sigmund Freud's idea, modified by Jung's somewhat desexualized emphasis, of a "libido," or life force of psychic energy (the latter nowhere precisely defined by Freud). This was also related to "Eros," love. This, too, has compatibilities with Henri Bergson's notion of "élan vital," and in Gilles Deleuze's subsequent modification (building, too, on Nietzsche's active/reactive forces, and Spinoza's joyful and sad passions), which is closer to our view. It is a "virtual multiplicity," a vital impulse that places entities in continuous variation producing continuous differences and variation with only evolving dissipative unities (see Deleuze, 1989). Deleuze and Guattari's work (1987), for example, show that "sad" passions or "reactive forces" are the basis of more static "molar" assemblages (e.g., rigid bureaucracies), whereas joyful passions, active forces are the basis of "molecular" assemblages that resemble more dissipative structures (e.g., organizations based more on improvisational jazz) – in the other words, for the latter, free energy, élan vital, a Deleuzian vitalism is more actively at work.

energizing or a more destabilizing, transverse bio-emotional wave field.

In our appropriation, we suggest that the bio-emotional wave originating from the heart may traverse superpositioned images through a form of "quantum tunneling." Thus, instantiated perception-images always have a quanta of passions embedded in the first instance, and possibly are subject to subsequent energizing effects of a more primordial transverse bio-emotional energy wave field. Each "cut" of the subject (see Figure 4), then, is an embedding of qualia as it plays itself out in inter- and intra-subjective interactions. Each "cut" is a "bloc of spacetime," a quantized sectioning, or more appropriately, given its basis on Heisenberg's uncertainty principle and on the Schrödinger equations of evolution of entities, a logon, a spacetime constrained quantum of information, or a quantum hologram.

The vertical "line of intersection," which appears when Figure 4 is closed, is also the basis of the emergence of an "I," a placeholder in discursive production. It has multiple forms of expression from the virtual possibilities, or $|I_i>$. In other words, a distinct materialized "I" takes up temporary residence in distinct (discrete) discursive subject positions from where it can speak as a speaking subject. As so, it accesses distinct signs and symbols characteristic of the discursive subject position. This accessing entails mobilizing the dynamics of PCAR. We become in-tune (and therefore attuned) to relatively stabilized word-associations, as the literature in quantum cognition suggests (see Busemeyer and Bruza, 2012). Said in another way, the modulated schema QD matrix signature wave collapses represented by a distinct "I" which becomes the basis of authorship in narrative constructions.

Dynamics of Schema QD

Our model extends on fundamental insights of Cramer's transactional interpretation, and the literature on PCAR by Marcer, Schempp, and Mitchell in showing that an object's emitting waves are absorbed by a percipient whose characteristic signature wave is now perturbed. The four-cornered subject (ego, ego-ideal, other, generalized community other), we have argued, can be conceptualized as a matrix, with each component ranging in value in relation to each of the other. A composite interactional pattern generates a distinct signature wave, or a modulated schema QD matrix signature wave. Whereas at everyday unperturbed idling speed an attractor state is generated, upon perturbation, the matrix values change and a new modulated frequency pattern is established reflecting the percipient's state of being at that moment. More specifically, immediate response is suspended while the PCAR condition is mobilized. During this mobilization, various memory images remain in a superposition state; that is, many possibilities exist in virtual form, side by side. An always ubiquitous, more primordial bio-emotional transverse wave, via quantum tunneling, may further energize each possibility with a quanta of emotionality/passion.

At this point, drawing from Mitchell and Staretz's (2011) notion of "evaluation" and from Bradley's (2011) notion of "matching," memory images are checked for closeness of fit. This is shaped not only by the bioemotional/socioaffective wave, but also by the various possible configurations of values in schema QD. In other words, the gestalt, or perception image that eventually is instantiated is shaped by the interactional patterns of the four corners, further possible hypercathexis by a more primordial transverse bio-emotional wave, the intensity of the incoming wave of an object, as well as other operators such as context. The superposition state of possible images generated collapses to one which then becomes the basis of transforming attention to intention, as Mitchell and Staretz (2011) argue. Suggestive is Penrose and Hameroff's (2011) "Orch-OR" model as to thresholds of intensity that account for the collapse of a superposition state to one image.

To draw from and extend on Bradley's insights (dialogue includes both a verbal discourse and a bio-emotional discourse), a verbal discourse now includes a representative of the percipient in the form of an "I" that takes up temporary residence in a discursive subject-position within a particular context marked by a distinct dominant language regime. This is the basis for the speaking subject. Finding oneself within particular milieu also provides a particular dominant discourse in use: an associative lexicon of the milieu is accessed. With the "cut" of the subject, depicted as the figure-8 cut, a particular perception image, a gestalt is instantiated by the collapse of the superposition state of recollected memory images that are constantly being traversed by a further, more primordial transverse bio-emotional wave.

In the next section, we want to turn to a possible formalism of schema QD.

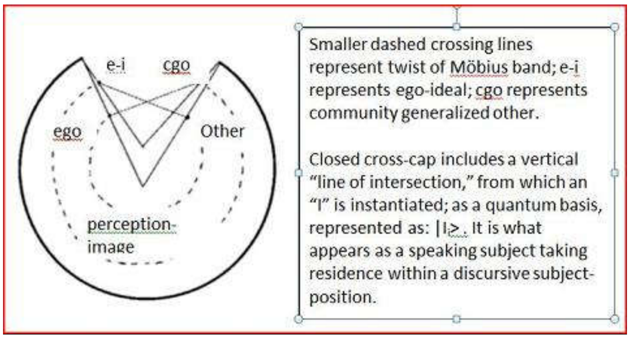

Figure 4. Schema QD and Figure-8 Cut on the Cross Cap.

Formalism

In this section we want to begin the development of a formalism for the dynamics of schema QD. Our model builds on Cramer, Marcer, Schempp, Mitchell and on the work of Raymond Bradley. Recent work by Darius Plikynas (2015) though focused on only quantum mechanics, lends itself to an incorporation of holographic principles. All entities emit and absorb wave fronts. Wave fronts are carriers of holographically encoded information about that entity, which can be conceptualized as wave functions. Ours is a first approximation of a simplified dynamic model. A more complex model is suggested at the end of this section.

In order to provide a complete formalism of the hologram formation properly, several things are needed that a single article cannot accommodate. First, we need to study the collapse of the QD matrix of the receiver. For this we must also give a description of the mathematical ingredients, as quantum mechanics, linear algebra, and some differential equations. Next, we have to describe how the reflected wave (which is proportional to the new QD matrix) will affect the emitting entity. This involves more complex differential equations that are coupled, and in order to do that, one must make use of nonlinear dynamics, and this must be also adequately explained to the scholarly reader. Most of these issues can only be solved by numerical programming, which we must also duly explain. After the numerical examples we give, the next step would be some statistical analysis (which must be accurately explained too) of the available observational (experimental) data, in order to fully interpret our results and provide more versatile models. Quantum rather than classical logic/probability would underlie this statistical analysis. Therefore this article has a limited scope, namely, the collapse of the QD matrix, while we also give a sketch of the following steps, as a possible direction for future work.

A Brief Summary of Concepts and Definitions. In quantum mechanics, a wave function corresponds to any physical state. The QD matrix describes the state of the observed person, therefore, if we are to give a quantum description, it is necessary to conclude that the QD matrix can be represented by a wave function (ψ). Emitted waves from each person represent geometric and energetic patterns which are holographic in nature and imbed all information about that person. A wave function is an element of a linear space, called Hilbert space. A linear or vector space is a set of elements whose sum is another element, and whose product with a scalar (real or complex number) is also an element. For example,| ideal ego> and |Other> are states, therefore *|ideal ego>+|Other>* and *2.53*|ideal ego>* are also states. Combining these states into one composite state can be represented by the state of the QD matrix at that moment in time; its signature wave represented as $|QD_w>$. Mathematically this means that a linear combination of two vectors is another vector, or more precisely, if *a, b* are scalars, and *u, v* are vectors, $av + bu$ is also a vector of the very same space. In our context, to give an example, this means that *1.66*|ideal ego>+3.88*|Other>* is also a state. Linear spaces are always defined over some set of scalars, such as the reals numbers (ℝ) or the complex numbers (ℂ). In quantum mechanics (QM), while measurements always yield real results, the linear space is defined over the body of the complex numbers (ℂ). In Cramer's (1986) model (figure 2), the returning wave from the absorber/percipient is a complex conjugate wave, Ψ* of the initially emitted wave of the object, Ψ. A complex number is any of the following: $z = a + ib$, where a is its real part, b is its imaginary parts, both are real numbers and i is the imaginary unit ($i^2 = -1$) The simplest signature wave is e^{ikx}, where k is the wave number and x is the position. Later we will use this. Wave number means the spatial frequency of the wave and is analogous to the angular frequency (also called pulsation).

To every state there corresponds a wave function (which satisfies the definition of a vector). Consider, again, Plikynas *et al*'s (2014) basic mind states (BMS). And to every observable (measurable quantity/entity, such as energy, momentum, angular momentum, position, etc.) there is a corresponding operator. Operators are linear vector-vector functions (describing well-defined specific operations, hence the name). For example, Deleuze and Guattari (1987) have offered the notion of "abstract machines," which is an operator producing transformations in a person's orientations to others and to him/herself. Language, too, can act as an operator as in "speech act theory." Say the word "Fire!" in a movie theater produces distinct changes in one's orientation (fear, desire to escape, etc.). Say the words "I do" in a marriage ceremony, or a police officer saying "Hey you!" produces distinct changes in the person. Eigenvalues of the respective operators are the possible results for measurements. Eigenvalues are the end results of an operator at work. An "abstract machine" Deleuze and Guattari, 1987) produces particular bodies in social space. Each of the four key components of schema QD, both individually and in relation to each of the other, with the work of an operator, will tend toward a particular eigenvalue. The eigenvalue problem is defined as such: if Q is an operator, u is a vector and $\boldsymbol{\lambda}$ is a scalar, and they satisfy the following equation: $Qu = \lambda u$, it is said that $\boldsymbol{\lambda}$ is an eigenvalue of Q, and u is an eigenvector corresponding to Q. Qu means the result of applying the operator Q to vector u. For example, the effect of the operator "abstract machine," panopticism, or speech act theory (Q) on the ego produces a particular result, or eigenvalue (u). Each of the four components of schema QD can, then be seen as vectors, in so much as they have degrees of intensity, but also a directionality. For example, take the ego-Other relation. The ego may be less directed (sympathetic, empathetic) toward the Other for self- understanding; or, the Other may be the more dominant forces directing its impact on the ego in its self-understanding.

Operators can be represented by matrices. Matrices can be represented by tables, such as $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$. This is a 2 by 2 matrix, but one can have 3 by 3, n by n, etc. Schema QD, with the four key components (ego, Other, ego-ideal, community generalized other) represented as corners of a Möbius band immersed in a cross-cap, can be seen as a 2 by 2 matrix. Measurement results are always real, therefore we can only make use of those operators whose eigenvalues are always real. These are the so-called Hermitian operators, meaning that the conjugate of transpose of the corresponding matrix is equal to the original matrix itself. In other words, the conjugate of a complex number $z = a + ib$ is $\overline{z} = a - ib$. Transposing the matrix means that one exchanges the rows and columns, in other words, the horizontal and the vertical lines (Mathematically this is represented as follows: $Q^{+} = Q$.) In our context, in the simplest cases this means that the mixing of the states is symmetrical, for example, that ideal ego influences Other exactly the same way Other influences ideal ego.

Any operator corresponding to observables is represented by a Hermitian matrix. (Here we will deviate from quantum mechanics (QM) in the case of the Hamiltonian, which is the operator corresponding to the energy, and we will justify this at the right time.) Now, not every matrix is Hermitian, but it can be uniquely decomposed as a sum of a Hermitian and an anti-Hermitian part. Q is an anti-Hermitian if $Q^{+} = -Q$. Any anti-Hermitian matrix A is equal to a Hermitian matrix B multiplied by i: $A = iB$. The eigenvalues of an anti-Hermitian operator are purely imaginary, i.e. $\lambda = i\alpha$, where $\boldsymbol{\alpha}$ is real. [8]

In mathematics, the multiplication of two operators A and B is not always commutative, meaning that the order counts, in other words AB does not always equal BA, or symbolically, in most of the cases $AB \neq BA$. Whenever they happened to be equal, it is said that their commutator (defined as $[A, B] = AB - BA$) is zero. In more simple terms, it means that if operators commute, the order they are displayed does not count. A simple example would be that if one determines the height of some entity, and later the position, the results would be the same as if one had done this in the reverse order, since the operators related to these quantities commute.

In QM, if the commutator of two operators is zero, in principle they can be measured simultaneously with an arbitrary precision, otherwise not. The nicest example to this is the Heisenberg's relation of uncertainty. The commutator of a coordinate (for example, x) and the linear momentum (quantity of motion)

[8] Since this approach is novel, the very first example one can provide is the collapse of the QD matrix.

related to the same dimension (that would be p_x) is $[x, p_x] = i\hbar$, where $\hbar$ is the rationalized constant of Planck (approximatively $1.054571726(47) * 10^{-34} Js$). The consequence of this commutation relation is the Heisenberg´s principle of uncertainty: the product of the uncertainties of the position and of the momentum is always greater or equal than $\hbar/2$. In Newtonian physics, in principle, the uncertainties can be reduced to zero, but not in QM, in case of entities whose operators do not commute. As an example applied to our study, this uncertainty principle means that determining the position of the entity we study, perturbs its movement. There is, however, a more important aspect of this uncertainty principle: that we cannot determine time and frequency (hence the energy) with an arbitrary resolution[9]. So this is how Gabor´s logon (space-time constrained information) comes in: as time analysis and Fourier analysis are extreme cases, we need a "mixture", thus we get the so-called wavelets (or wave packets). These wavelets might be also determined by the size and density of neurons in the brain, so it is to be seen which of these factors affects the resolution more severely. The interpretation of the interference pattern is the one described by Mitchell and Staretz (2011: 13-14).

In addition, in QM, if the commutator of an operator A with the Hamiltonian (the operator corresponding to the energy) H is zero ($[A, H] = 0$), the quantity signified by the operator A is conserved, i.e. its value is constant in time. Thus, in QM, the Hamiltonian is indeed a fundamentally important entity. As we have said, it is the operator associated to the energy, therefore its eigenvalues E_i are the only possible results of energy measurements. In Terms of the QD matrix this implies that to every state, such as ego, ideal ego, Other, community generalized there is a corresponding energy of oscillation. Now, according to the discovery of Planck, there is an angular frequency $\omega_i = E_i/\hbar$. The angular frequency is the frequency divided by 2π. This frequency we associate to the vibrations described in the previous section. (Moreover, according to de Broglie, to every particle one must associate a wave, whose frequency is the one found by Planck, with the wave length equal to $\frac{2\pi\hbar}{p}$, where p is the linear momentum.) Therefore, every particular signature wave transports some energy which propagates in quanta, and the energy of every quantum (for example, biophoton) is proportional to its angular frequency $E = \hbar\omega$.

Calculations in QM can be mainly done in three distinct, but equivalent ways (meaning different descriptions that yield the same observable results, as no one measures a wave function or an operator directly). They are the so-called Schrödinger picture, the Heisenberg picture and the interaction picture. (The third possibility also means several different things as we shall see shortly.) In the Schrödinger picture the wave functions are "rotating" in time, but not the operators (meaning that they are time independent). The time dependence of the wave function $\boldsymbol{\psi}$ obeys the Schrödinger equation:

$$H\psi = i\hbar \frac{\partial \psi}{\partial t},$$

where $\partial\psi/\partial t$ means the partial derivative of the wave function with respect of time (all other parameters kept constant). The time derivative of the operators is zero. A relevant example to this is the description of the BMS based on the Schrödinger equation, as in the article of Plikynas (2010) and Plikynas *et al* 2014), although more concentrated on thermodynamics.

In the Heisenberg picture, where the wave function is constant (i.e. their time derivative is zero), the operators are rotating, their evolution in time being given by the Heisenberg equation:

$i\hbar \frac{dA}{dt} = [A, H]$. Here $\frac{dA}{dt}$ is the full time derivative of the operator A, which means that the other parameters do not have to be kept constant. (In most cases, this is equal to the partial derivative in the Heisenberg picture.) This picture is the least relevant for our calculation. We presented it merely for completeness. Some confuse this picture with the matrix mechanics of Heisenberg, which is equivalent to the differential formulation of Schrödinger, since there is a one-to-one correspondence between operators and matrices, therefore even to the operations of differentiation one can attach a matrix.

The most interesting description is the interaction picture, which is the mixture of these two. We divide the Hamiltonian H in two components: $H = H_0 + H_1$. This is convenient when we know the eigenvalues and eigenvectors of H_0. (Since this division is not always unique, it

[9] The uncertainty in the energy multiplied by the uncertainty of the frequency is greater or equal than $\hbar/2$, therefore the product of the uncertainities of the frequency and time would be greater or equal than π.

means several possible descriptions as mentioned before.) In our context, in most cases this means that the total Hamiltonian is decomposed as the sum of H_0, related to the oscillations of our absorbing entity, while H_1 describes the absorbtion process. One example is the absorbtion mechanism we will first provide. Another example to this which we will discuss later is the sleeping cycle of an individual.

In this picture operators obey a Heisenberg-type of equation:

$i\hbar \frac{dA}{dt} = [A, H_0]$, while wave functions a Schrödinger-type:

$H_1' \psi = i\hbar \frac{\partial \psi}{\partial t}$, where $H_1' = exp(iH_0 t/\hbar) H_1 exp(-iH_0 t/\hbar)$. If $[H_0, H_1] = 0$ then $H_1' = H_1$, as we will consider in our most simplest case. In the context of the QD matrix, this commutation means that the radiation is unaffected during the process of absorption. This is possible if the distance between the emitter and absorber is big enough.

We can now make a more precise connection with the verbal part of our analysis, as given in the former paragraph. H_0 will be the Hamiltonian of the observed individual (related to its vibrations/oscillations/signature wave before and after the interaction). Recall, each manifestation of a schema QD matrix signature wave can be represented by a distinct wave function, and, from Hameroff and Penrose's (2014) recent article connecting microtubule quantum vibrations to specific EEG patterns in the notion of "beat frequencies," and from Bradley (2014: 26-29) which argues these beat frequencies can be identified as sequences of Gabor's overlapping logons, together with Plikynas' notion of basic mind states (BMS), we can see that emitting waves from a person characterize specific states (eiganstates) that holographically encode information about that person at that moment in time, making for a degree of uncertainty, following Heisenberg. H_1, on the other hand, is the Hamiltonian associated to the interaction between the observer and the observed and will depend on the wave emitted by the observer.

This is the crucial point where we decided to deviate from the pure QM. In QM it is known that observations/measurements perturb the system, so the wave function is going to collapse. However, QM does not give a deterministic description of this collapse, only a probabilistic picture, predicting the probability of each possible result. (Of course, some tried to speculate that there are some hidden parameters that guide the collapse, but these trials have led to no result.) Now, since our collapse of the wave function (which reflects the QD matrix) is deterministic, in terms of following the Schrödinger equation of the evolution of a system, we have to devise a different collapse mechanism. We need a controlled collapse, determined by the signature wave emitted by the observer. The signature wave and the wave function are proportional.

In classical physics, a nice example for a controlled collapse is dissipation. For example, a damped harmonic oscillator will have complex frequencies. The real part of this frequency is responsible for the oscillations, while the imaginary part for the damping. In Cramer's (1986) emitter-absorber model ("transaction interpretation"), the returning wave from the absorber is a complex conjugate wave, ψ*; the standing wave established where the two waves meets is the basis of a communication channel, and it is by repetition of the forward and quantum backward time referral that eventually the emitter is constituted as a finished product at its location, "out there."[10] This model is atemporal; no classical time passes during these circuits. This completed cycle, for Cramer, is the collapse of the wave function. He neglects the play of consciousness, to which we offer schema QD as the operator. Returning to the mathematics of this damping, one can give a nice phenomenological description of the collapse of the QD matrix. The most clean-cut collapse, as we will show in our first example is realized this way, meaning that the QD matrix will collapse to a single composite state whereby each of the four components take on particular eiganstates/eiganvalues in the context of their inter-relations; a collapsed state can manifest as a "basic mind state," and also reflects a signature wave.

We therefore need complex frequencies in our model. Here is how we get them. Since the frequencies are proportional to the energies (due to Planck, as mentioned before) and energies are the eigenvalues of the Hamiltonian, it is easy to see that the Hamiltonian must have complex eigenvalues. (In our case this implies that energy measurements are meaningless during the

[10] Our approach considerably advances this, since we are able to describe reflected waves that can be completely different from the absorbed wave.

absorption process, since the imaginary part is the inverse of the transition time. Recall that measurements give real values.) However, Hermitian operators can only have real eigenvalues, we must have a Hamiltonian that is non-Hermitian. As stated before, any non-Hermitian operator can be uniquely decomposed as a sum of a Hermitian and anti-Hermitian part. We consider the Hamiltonian of the individual H_0 purely Hermitian: real frequencies, that means an unperturbed personality, or a basic mind state that is in an unperturbed state,[11] or philosophically, in an "everyday taken for granted" state whereby all is seen as unproblematic, more along the lines of Bergson's (2002) notion of "inattentive recognition" whereby habitual sensorimotor schemas are employed. This is also characterized by a unique "idling speed" reflected by the ongoing emission of a schema QD matrix signature wave. Therefore the non-Hermitian part must come from the interaction (which causes the QD matrix to collapse). The collapse of the QD matrix can be envisioned in Figure 8 as the "cut" of the subject which produces both a distinct visual gestalt/perception image and a subject. This is also a logon (Gabor, 1946), since we need to take into consideration both location and time (evolution) whereby information constructed is a spacetime constrained quantum of information.

There is a wide variety of possible interactions, since not every person reacts the same way to every single stimulus (i.e., wave front emissions of objects, entities, or encounters). The variations of personalities[12] might be studied in a future work, where one can model different personalities via this matrix of the interaction Hamiltonian, H_1. In the simplest example we give, we will make the interaction Hamiltonian purely anti-Hermitian.

After this brief review we are ready to further discuss our formalism[13]. Our system, schema QD, is, recall, comprised of four key components visualized as corners on a Möbius band. These are not only individual states, but relational; thus each component can be expressed in terms of eiganvalues, but so too the various relations (*simple* and *complex*). Schema QD, then, can be represented by a matrix which can take a collectivist form of expression in terms of a distinct signature wave. Let's take the more *simple* forms of dyadic relations. The possible states of our system are made up as linear combinations of the following states: ego ($|1>$), ideal ego ($|2>$), other ($|3>$), generalized community other ($|4>$), which can be labeled by $|j>$, where j can be 1,2,3 or 4. Therefore to restate item 2 (see earlier section, "Summary: Dynamics of Schema QD"), we represent the QD matrix of as $|\psi>=\alpha_1(t)|1>+\alpha_2(t)|2>+\alpha_3(t)|3>+\alpha_1(t)|4>=\sum_{i=1}^{4}\alpha_j(t)|j>$, the last equality being the compact notation of the sum. Alternatively, the QD matrix can be represented as a column vector:

$$|\psi>=\begin{bmatrix}\alpha_1(t)\\ \alpha_2(t)\\ \alpha_3(t)\\ \alpha_4(t)\end{bmatrix}.$$ These coefficients depend on time via a Schrödinger-type equation as we discussed earlier.

One of the simplest possible[14] interaction Hamiltonian, that is anti-Hermition, as stated before, is:

$$H_1=i\begin{bmatrix}a_1b_1^2 & 0 & 0 & 0\\ 0 & a_2b_2^2 & 0 & 0\\ 0 & 0 & a_3b_3^2 & 0\\ 0 & 0 & 0 & a_4b_4^2\end{bmatrix},$$ where a_1, a_2, a_3, a_4 are parameters of the absorber, while b_1, b_2, b_3, b_4 are the external stimuli belonging to the signature wave of the emitting entity[15], which can be represented as

$$|b>=\begin{bmatrix}b_1\\ b_2\\ b_3\\ b_4\end{bmatrix}.$$

The Schrödinger equation describing the time evolution of the QD matrix is

$$H_1\psi=i\hbar\frac{\partial\psi}{\partial t},$$

which with the former notations will become

[11] Recall that an anti-Hermitian matrix A is equal to a Hermitian matrix B multiplied by i: $A=iB$, and the eigenvalues of an anti-Hermitian operator are purely imaginary, i.e. $\lambda=i\alpha$, where $\boldsymbol{\alpha}$ is real.

[12] Perhaps this could build on Plikynas' (2015) and Plikynas et al's (2014) notion of "basic mind states" to indicate that a distinct attractor state remains relatively stable and recognizable by distinct EEG patterns, manifesting as a characteristic type of personality.

[13] There are other attempts to use a Hamiltonian description of the state of mind. Plikynas *et al* (2014) uses the Hamiltonian formalism, but differently, he concentrates mainly on the thermodynamical aspects. Marcer and Schempp (1998, 1991) also make use of a QM description, but do not focus on the Hamiltonian. We go beyond these works in providing specific examples.

[14] In physics this kind of simple systems are called toy models. Some other example for toy models are the Gedanken-experiments of QM, including Schrödinger's cat.

[15] We assume that these quantities do not change during the interaction, which is possible if the observer is far enough. Otherwise we would obtain some coupled differential equations, which are too complicated as a first example.

$$i\begin{bmatrix} a_1b_1^2 & 0 & 0 & 0 \\ 0 & a_2b_2^2 & 0 & 0 \\ 0 & 0 & a_3b_3^2 & 0 \\ 0 & 0 & 0 & a_4b_4^2 \end{bmatrix}\begin{bmatrix}\alpha_1(t)\\ \alpha_2(t)\\ \alpha_3(t)\\ \alpha_4(t)\end{bmatrix} = i\hbar\frac{\partial}{\partial t}\begin{bmatrix}\alpha_1(t)\\ \alpha_2(t)\\ \alpha_3(t)\\ \alpha_4(t)\end{bmatrix}.$$

This equation can be decomposed into a system of four uncoupled differential equations

$a_jb_j^2\alpha_j(t) = \hbar\frac{\partial\alpha_j(t)}{\partial t}$, where j goes from 1 to 4. This kind of an equation is trivially solved:

$\alpha_j(t) = \alpha_{j0}e^{a_jb_j^2t/\hbar}$, where α_{j0} are the initial values of the coefficients. However the reader unfamiliar with these technicalities should not be disheartened, since there are softwares that can perform this task[16].

From here one can easily see that, in case of this kind of a Hamiltonian, and if one could strictly follow the rules of conventional QM, then with no stimulus b_i that affects only the state $|j>$, or the object is insensitive to that stimulus, the coefficient would not be modified. (I.e. one stimulus enhances/ inhibits only one component, such as ego, ideal ego, etc.) However, due to the non-Hermitian Hamiltonian, we deviated from conventional QM. In order to be able to interpret the result, one must know that in QM the "direction" is the relevant feature of the wave function, and not its norm (meaning "length"), that, unlike in conventional QM, has changed due to the non-Hermitian Hamiltonian. Therefore we normalize the wave function, i.e. reduce its norm to one. (In layman's terms this means that we reduce the "length" of every state-which is a vector-to the same standard "length".) This is done by computing the norm of the wave function[17], and then divide the wave function by the number that we found. The result will be the new wave function, we can interpret more easily. The squares of the new coefficients are the probabilities of finding the system in the respective states. An example of this will be the first case numerical calculation, where the probability of the state $|4>$ will be unity.

Before discussing other types of Hamiltonians, we will give an example of such a system, *to illustrate the collapse of the wave function*, using the formulae given in the footnote. In our example, we choose $\alpha_{10} = 0.316228$, $\alpha_{20} = 0.632456$, $\alpha_{30} = 0.316228$, $\alpha_{40} = 0.632456$, (so the initial state is already normalized, and since the ratio of the first and second coefficient is 1/2, the ratio of their probabilities will be 1/4, and we can say the same about the third and the fourth states), the stimuli $b_1 = 2$, $b_2 = 3$, $b_3 = 1$, $b_4 = 7$ and the interaction coefficients $a_1 = 0.5$, $a_2 = 0.8$, $a_3 = 0.1$, $a_4 = 0.4$. We choose to do the calculations in natural units, i.e. $\hbar = 1$. We will also make some approximations, which are instructive. We calculate each function, as stated. The functions are found to be: $\alpha_1(t) = 0.316228 * e^{2t}$,

$\alpha_2(t) = 0.632456e^{7.2t}$,

$\alpha_3 = 0.316228e^{0.1t}$, $\alpha_4 = 0.632456e^{19.6t}$. The norm will become N=

$$\sqrt{\begin{matrix}0.100000147984e^{0.2t} + 0.100000147984e^{4.t} \\ +0.400000591936e^{14.4t} + 0.400000591936e^{39.2t}\end{matrix}}.$$

This, with a very good approximation is

$N \approx \sqrt{0.400000591936e^{39.2t}} = 0.632456 * e^{19.6t}$, which is equal to the absolute value of the function that has the highest exponent, i.e. whose absolute value is the fastest growing one.

In order to find the new functions (which are the components of the normalized wave function) we divide the alphas with the norm:

$\alpha_1(t) \to \frac{\alpha_1(t)}{N} = 0.5 * e^{-17.6t}$, and this is going to decay[18] in a time $t = \frac{1}{17.6} = 0.051$ units,

$\alpha_2(t) \to \frac{\alpha_2(t)}{N} = 1.0 * e^{-12.4t}$, and this is going to decay in a time $t = \frac{1}{12.4} = 0.081$ units (and this is the maximum decay time, which is considered to be the time in which the system reaches its equilibrium, called relaxation time)

$\alpha_3(t) \to \frac{\alpha_3(t)}{N} = 0.5 * e^{-19.5t}$, and this is going to decay in a time $t = \frac{1}{19.5} = 0.051$ units.

$\alpha_4(t) \to \frac{\alpha_4(t)}{N} = 1.0$, and this is *not going to decay*, but is the asymptotic value of the fourth

[16] Mathematica, by Stephen Wolfram. This software does the task as follows: In1 := DSolve$[a_jb_j^2\alpha_j[t] == \hbar\frac{\partial\alpha_j[t]}{\partial t}, \alpha_j[t], t]$ this is the input, and the output is Out1:= $\left\{\left\{\alpha_j[t] \to e^{\frac{ta_jb_j^2}{\hbar}}C[1]\right\}\right\}$. Here C[1] is interpreted as the value of the solution when $t = 0$, i.e. α_{j0} This software can solve even more complex differential equations, even those one cannot solve by hand, if not always symbolically, at least numerically.

[17] The norm of the wave function is $N = \sqrt{|\alpha_1(t)|^2 + |\alpha_2(t)|^2 + |\alpha_3(t)|^2 + |\alpha_4(t)|^2}$

[18] For a function proportional to e^{-kt}, where $k > 0$, the decay time is estimated as $1/k$.

coefficient. The example provides us a conclusion: the system is going to collapse to the state for which the product $a_j * b_j^2$ is the greatest, provided that its initial coefficient is non-zero.[19] Therefore, this kind of a system can only collapse to a state that was originally part of its signature wave[20]. At this point, as a conclusion of this calculation we are able to give a description of an experiment, clarifying the behavior of such a system. This system is the absorber, whose interaction parameters and initial QD matrix was given at the beginning of our numerical calculations. The emitting entity starts emitting a wave of stimuli (whose components we also gave) at the time $t = 0$, and this interaction lasts for a time substantially greater than the relaxation time (0.081 units). At the end of this interaction, the new QD matrix of the object [absorber/percipient] will be $|4>$. During and after the interaction the absorber will also emit its signature wave, proportional to the QD matrix. This wave will also reach the emitting and modify its signature wave. To understand how, one must know its interaction Hamiltonian. This is the way the "decoding" mentioned by Marcer and Schempp happens: the modified signature wave returns from the percipient and interferes with the wave of the emitting entity, modifying it. This is going to be our decoded image. This is a direction for some future work.

As we have stated, there are several kinds of possible non-Hermitian Hamiltonians. For example, one can imagine the following:

$$H_1 = i\begin{bmatrix} a_1 b_1^2 & a_2 b_2^2 & a_3 b_3^2 & a_4 b_4^2 \\ a_5 b_1^2 & a_6 b_2^2 & a_7 b_3^2 & a_8 b_4^2 \\ a_9 b_1^2 & a_{10} b_2^2 & a_{11} b_3^2 & a_{12} b_4^2 \\ a_{13} b_1^2 & a_{14} b_2^2 & a_{15} b_3^2 & a_{16} b_4^2 \end{bmatrix}.$$

The equation describing the time evolution of the coefficient $\alpha_1(t)$ becomes:

$$\hbar \frac{d\alpha_1(t)}{dt} = a_1 b_1^2 \alpha_1(t) + a_2 b_2^2 \alpha_2(t) + a_3 b_3^2 \alpha_3(t) + a_4 b_4^2 \alpha_4(t).$$

The equations for the other coefficients are similar. These types of differential equations are called coupled, meaning that we cannot solve them for each coefficient separately. They have the advantage that they are mixing the states, so if one of the states was not part of the original QD matrix, it can still show up in the end. These equations admit solutions that are not pure states; therefore the collapse of the wave function is not deterministic, as in the former case.

The most general interaction Hamiltonian, however, can be given as

$$H_1 = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix},$$

where the parameters a_{jk} are functions (real or complex, as long as the Hamiltonian is non-Hermitian) of all the stimuli b_j. Unlike before, we might even have more than four stimuli (which can be of an electromagnetic, mechanical, chemical or other nature). An example of such a case is $a_{jk} = cb_1 + db_2^3 + mb_3^2 + nb_4^4 + qb_5 + rb_6$, where c, d, m, n, q, r are (real or complex) numbers. These a_{jk} parameters, can be, for example some logit functions used in economy or even politics[21]. These functions can be determined by quantitative analysis of some data[22], or failing that, one can devise some other toy models (i.e. oversimplified models, with hypothetical numbers) which exhibit the desired qualitative behavior.

We will present one last example, before finishing this section. In the first approximation[23], one can model the sleeping cycle of a person with the following (Hermitian) Hamiltonian (since we do not investigate a collapse here, but a cycle, this is not H_1, however, but H_0):

$H_0 = g\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$, where the coupling constant g depends of the frequency and strength of the external stimuli (such as the effect of the day-night cycle, since we know that without

[19] The relaxation time is evaluated like this: we calculate the highest value of $a_j * b_j^2$ and the next-to the highest, and the relaxation time will be estimated as unity divided by the absolute value of their difference.

[20] These systems cannot be "corrected", meaning to be externally enforced into a state, which was not part of its original makeup, so, in criminology these systems are the difficult individuals. Luckily this is not the only possibility, therefore we must consider other possible Hamiltonians.

[21] An example: suppose that we are interested in the factors that influence whether a political candidate wins an election. The outcome (response, our a parameters) variable is binary (0/1); win or lose. The predictor variables (our b parameters) of interest are the amount of money spent on the campaign, the amount of time spent campaigning negatively and whether or not the candidate is an incumbent. This case is merely one of the many possibilities.

[22] Hamiltonians might be modelled with the quantitative method of Plikynas *et al* (2014; see also Plikynas, 2010, 2015); they did this for some other parameters, but unfortunately not for the Hamiltonian.

[23] This is a rough approximation. Because the permanent dilemma of a scientist is this: whatever is mathematically simple, is not always realistic, and whatever is realistic, does not always have an easy mathematical description, and in many cases, not even a rigorous one.

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external stimuli the sleeping cycle is destroyed, but other parameters might be incorporated as well).

The possible states for such an object are $|awake>=|1>$ and $|asleep>=|2>$, so any wave function can be given as $|\psi>=\alpha_1|1> +\alpha_2|2>$. The time evolution operator, as defined in QM[24] belonging to this Hamiltonian is (and we do the calculations in the Schrödinger picture) $U(t) = exp\left(-\frac{iH_0t}{\hbar}\right) = \begin{bmatrix}1 & 0\\0 & 1\end{bmatrix} cos\left(\frac{gt}{\hbar}\right) - i\begin{bmatrix}0 & -i\\i & 0\end{bmatrix} sin\left(\frac{gt}{\hbar}\right)$. Therefore the time dependence of the wave function is $\begin{bmatrix}\alpha_1(t)\\\alpha_2(t)\end{bmatrix} = \begin{bmatrix}\alpha_1(0)\,cos\left(\frac{gt}{\hbar}\right) - \alpha_2\,(0)sin\left(\frac{gt}{\hbar}\right)\\ \alpha_1\,(0)sin\left(\frac{gt}{\hbar}\right) + \alpha_2\,(0)cos\left(\frac{gt}{\hbar}\right)\end{bmatrix}$. If the object was asleep originally, it can wake up and go to sleep again. The angular frequency of this cycle is $\omega = \frac{g}{\hbar}$, so its period is $\frac{2\pi\hbar}{g}$. To this kind of a Hamiltonian one might add some non-Hermitian perturbation H_1, that helps the wave function collapse (for example, a wake-up signal). One might even extend this model by including other states (attentive, inattentive, etc.) as the subspace for "awake", and this would be a nice alternative to complement the work of Plikynas on consciousness (2015). An example of our wave function components would be: |wakefulness > = |1>, |sleeping>=|2>, to which we could add the other basic mind states (BMS), such as|thinking>=|3>, |resting>=|4>", |attentive recognition>=|5>, |emotional coherence>=6>, |emotional quiescence>=|7>, etc. One could even order them differently. But this extension would significantly complicate our description. With a properly modeled Hamiltonian, one can describe basically any kind of behavior. This description is very versatile. As we have stated, in the most general case one has a system of coupled differential equations which are not always linear. The possibilities are virtually unlimited: such systems can exhibit chaotic behavior (bifurcation, quasi-periodical motion as in the case of attractors[25], etc.).

Conclusion and Outlook

In sum, we have offered a more simplified first approximation of the dynamics of schema QD. We must cautiously proceed in steps in our formalism. A more complex, dynamic model would consider several possible operators at play that have been alternatively conceptualized in philosophy and sociology; for example, "abstract machines," panopticism, "speech act theory," "order words," the legal system itself, as we have previously mentioned. Further work on a transverse bio-emotional wave is needed. Research should take into consideration Hameroff and Penrose's (2014) recent statement on "beat frequencies," which Bradley (2014) has already begun to integrate into a quantum holographic model. Quantum cognition theorists focused on decision-making should be more receptive to the idea that the brain is a quantum holographic structure, not by analogy, nor prefaced with "like." Work, too, in the human lexicon using QH could benefit from our Schema QD. The conscious agent must find a place in any *bona fide* social science research.

[24] Meaning that the time evolution of the wave function can be given as $|\psi(t)>=U(t)|\psi(0)>$, if the initial state $|\psi(0)>$ is known.
[25] As stated by Plikynas (2015). We claim that his statements we can reproduce via our Hamiltonian formalism, with a properly modelled Hamiltonian.

References

Batiz Z, Chauhan, B. Holographic principle and quantum physics. NeuroQuantology 2009; 7(4): 665-676.

Bergson H. Matter and Memory. NY: Zone Books, 2002.

Bohm D. Wholeness and the Implicate Order. NY: Routledge, 1983.

Bradley RT. Communication of collective identity in secret social groups. Behavioral Sciences of Terrorism and Political Aggression 2011; 3(3): 198-224.

Bradley RT. and Tomasino D. A quantum-holographic approach to the psychophysiology of intuitive action. In L-P Dana (ed.) World Encyclopedia of Entrepreneurship. Northampton, MA: Edward Elgar, 2011.

Bradley RT. Consciousness and the Eye of Love. Auckland, NZ. First Light Ebook (forthcoming).

Busemeyer J and Bruza P. Quantum Models of Cognition and Decision. Cambridge: Cambridge University Press, 2012.

Cramer J. The Transactional Interpretation of Quantum Mechanics. Review of Modern Physics 1986; 58: 647-88.

Cramer J. The Quantum Handshake. NY: Springer Publishing Co, 2016.

Delanda M. A New Philosophy of Society. N.Y: Continuum, 2006.

Deleuze G and Guattari F. A Thousand Plateaus. Minneapolis: University of Minnesota Press, 1987.

Deleuze G. Cinema 2: The Time Image. Minneapolis: University of Minnesota Press, 1989.

Denzin N. On Understanding Emotions. Piscataway: Transaction Publication, 2007.

Gabor D. Theory of communication. Journal of the Institute of Electrical Engineers 1946; 93: 429-41.

Gabor D. A new microscopic principle 1948; Nature 161: 777-778.

Gibson J. The Ecological Approach to Perception. Hillsdale: Lawrence Erlbaum, 1969.

Granon-Lafont J. La Topologier Ordinaire de Jacques Lacan. Paris: Point Hors Lignes, 1985.

Hameroff S. and Penrose P. Orchestral reduction of quantum coherence in the brain. Journal of Consciousness Studies 1996; 3: 36-53.

Hameroff S and Penrose R. Consciousness in the universe. Physics of Life Reviews 2014; 11: 39-79.

Jordan T. Quantum Mechanics in Simple Matrix Form. N.Y: Dover Publications, 1986.

Katz J. How Emotions Work. Chicago: University of Chicago Press, 1999.

Lacan J. Écrits. NY: Norton, 1977.

Laszlo E. Science and the Akashic Field. Rochester: Inner Traditions, 2007.

Marcer P. and Schempp W. Model of neuron working by quantum holography. Informatica 1997; 21: 519-534.

Marcer P. and Schempp W. The Brain as a conscious system. International Journal of General Systems 1998; 27(1): 231-248.

McCraty R, Atkinson M, Tomasino D and Bradley R. The coherent heart. Integral Review 2009; 5(2); 10-115.

Milovanovic D. Quantum Holographic Criminology. Durham: Carolina Academic Press, 2014.

Mitchell E and Staretz R. Quantum hologram and nature of consciousness. Journal of Cosmology 2011; 14: 1-19.

Penrose R and Hameroff S. Consciousness in the universe. Journal of Cosmology 2011; 14: 1-31.

Peruse M. Conscious image processing. NeuroQuantology 2003; 2: 200-231.

Plikynas D. A virtual field-based conceptual framework for the simulation of complex social systems. Journal of Systems Science and Complexity 2010; 23(2): 232-248.

Plikynas D. Basinskas G, and Laukaitis A. Towards oscillation-based simulation of social systems. Connection Science 2015; 27(2): 188-211.

Plikynas D. Oscillating agent model: quantum approach. NeuroQuantology 2015; 13(1): 20-34.

Pribram K. Brain and Perception. Hilsdale: Lawrence and Erlbaum, 1991.

Robbins S. Bergson and the holographic theory of mind. Phenomenological Cognitive Science 2006; 5: 365-395.

Robbins S. Time and Memory. North Charleston, South Carolina: CreateSpace Ind. Publishing Platform, 2012.

Shannon C and Weaver W. A Mathematical Model of Communication. Champagne: University of Illinois Press, 1998.

Stapp H. Mindful Universe. Berlin: Springer-Verlag, 2007.

Sterns A. Matrix Logic and the Mind. Amsterdam: North-Holland-Elsevier, 1992.

Wendt A. Quantum Mind and Social Sciences. Cambridge: Cambridge University Press, 2015.

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