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Holographic Quantum Theory of Consciousness

There are two important questions in the science of consciousness. One is how a physical object such as the brain has conscious experience. The other is how consciousness affects or even creates the observed phenomena. In this paper, we presume and demonstrate how human consciousness manifests observed natural laws and phenomena. The basic constituents of human consciousness are proposed to be two basic pairs of duality consciousness: the change-unchange duality consciousness and the inclusion-exclusion duality consciousness. The mathematical action to describe the maximum amount of information created by human consciousness is derived as the holographic action. From this action, one can obtain the mathematical formula expressing the hologram which describes the possible information, energy, and matter that can be manifested by human consciousness. In this way, one can study all the possible natural laws and phenomena observed by human consciousness. This holographic quantum theory of consciousness has six predictions: 1) The existence of a grand unification theory which can use one mathematical formula to describe the observed natural laws and phenomena; 2) The universality of space and time scale invariance; 3) The emergence of the observed phenomena from a hologram described by the holographic action; 4) The one-way direction of conscious time and its relation to the total information of the system; 5) The possibility to transcend currently observed natural laws when one can go beyond duality consciousness and emerge into emptiness; and 6) The observed natural laws, phenomena, and experiences can be described mathematically. This work demonstrates mathematically how the observed natural laws and phenomena are manifested from human consciousness. It reveals the profound connection between the observed natural laws and human consciousness. This insight can lead to a deep understanding of the greater human potential and abilities. It also provides a new physical foundation and mathematical tool to study DNA, the brain, life, cosmology, the grand unified theory, and all scientific and spiritual disciplines.

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Keywords: Holographic Quantum Theory of Consciousness, basic constituents of consciousness, holographic action, space and time scaling invariance, direction of time, grand unification theory, duality consciousness, mind and body problem.

https://doi.org/10.32388/KULKA0

1. Introduction

Consciousness relates to awareness. It is a phenomenal experience of the internal and external world. Our views of reality, of the universe, and of ourselves depend on consciousness [1][2]. The father of modern western science, René Descartes, states that "The only certainty there is: I am conscious therefore I am". This suggests that consciousness may be more fundamental than the physical reality we experience. Consciousness could be the defining element for our existence.

Most theories of consciousness fall into two categories: physicalist theories and non-physicalist theories. In physicalist theories, consciousness emerges out of physical existence, such as from networks of synapses within the brain [3]. In non-physicalist models, consciousness is considered fundamental, from which space and time and physical reality emerge. J. Schooler [4], Imants Baruš and Julia Mossbridge [5] summarize the necessary change to recede from materialism and consider consciousness as primary and playing a key role. Donald D. Hoffman [6][7] suggests that the physical world is not objective but is an epiphenomenon (secondary phenomenon) caused by consciousness. Through supposing that consciousness is fundamental, Hoffman provides a possible solution to the hard problem of consciousness. The challenge with these non-physicalist theories is to obtain the mathematical formulation which can indicate how the observed natural laws and phenomena emerge from consciousness.

In our previous paper [8], we presented a quantum theory of consciousness (QTOC). We show that everything one observes and experiences is fundamentally a quantum phenomenon. Quantum phenomena occur through the measurement process, in which detectors are used to initiate, create, and exhibit quantum phenomena. A detector is an instrument that can absorb vibrations and exhibit certain changes. Because consciousness is involved in all quantum measurements from designing, receiving data, to reviewing and understanding the results, this suggests that consciousness could be the driving force in manifesting and determining observed physical phenomena.

In this paper, we presume and explore how consciousness determines what is being observed and experienced. Especially, we want to show how human consciousness manifests the observed natural laws and phenomena. We propose to demonstrate mathematically how observed physical laws and phenomena emerge from human consciousness through the following four-step process:

1. Find the basic constituents, the essential elements, of human consciousness.
   We propose that the basic constituents of human consciousness are two pairs of elementary duality consciousness: the change-unchange elementary duality consciousness and the inclusion-exclusion elementary duality consciousness.
2. Come up with the simplest mathematical formula describing the action created by these two pairs of elementary duality consciousness.
   The simplest mathematical action created by these two duality pairs turns out to be the holographic action, which describes the information encoded within a hologram. In other words, the two pairs of elementary duality consciousness create a hologram, which is described mathematically by the holographic action.

3. Deduce the mathematical formula describing all the possible information, energy, and matter that can be created by the holographic action, i.e., all the possible information, energy, and matter that can be manifested by the human consciousness. The holographic function, which is a wave function created by the holographic action derived through steps 1 and 2, describes the possible information, energy, and matter that can be created by the holographic action and thus can be manifested by human consciousness.
4. Derive the phenomena that can emerge from the hologram described by the holographic action and function
   In our previous work [9], we show that physical laws and phenomena such as elementary particles, fundamental forces, the Higgs mechanism, dark matter, dark energy, black holes, and the large structure of the universe emerge from the wave function created by the holographic action.

In this paper, we will first present the above derivation; then, we will show six major predictions from the holographic quantum theory of consciousness (HQTOC).

Human consciousness

Elementary human consciousness

↓ ↓

Consciousness of Change-Unchange

τ_i σ_i

Consciousness of Inclusion-Exclusion

τ_i, σ_i $\theta_{\tau_i}, \theta_{\sigma_i}$

↓ ↓

Holographic action

The information created by the human consciousness:

$$S = \sum_i \tau_i \, \sigma_i \theta_{\tau_i} \theta_{\sigma_i}$$

$\sum_i^{\tau_i}$ is to sum over all the conscious moment I and the consciousness at those moments.

↓

Six predictions:

- Grand Unification Theory
- Space and time scale invariance
- Hologram
- Direction of time
- Transcendence of natural laws
- Possibility to mathematically describe natural laws, phenomena & experiences

Fig. 1. Illustration of the derivation and prediction of HQTOC

2. Basic Constituents of Consciousness and Its Manifestation

In quantum physics, emptiness, also called vacuum, is not empty. According to the Feynman path integral method [10], to calculate a wave function, one needs to sum up all possible trajectories. Because emptiness has infinite possible trajectories, the vibrational field of emptiness contains infinite information, energy, and matter.

A vibrational field contains various possible vibrations and states. A quantum measurement determines which states are being observed, thus influencing the observed quantum phenomena. Since human consciousness is involved in all measurements, it is natural to presume that consciousness is critical in manifesting and determining the observed natural laws and phenomena.

2.1. Basic Constituents of Human Consciousness - Elementary Consciousness

To account for the observed physical laws and phenomena manifested by human consciousness, we need to uncover the basic constituents of human consciousness, the elementary consciousness that makes up human consciousness. If one examines human consciousness, one finds that an essential quality of human consciousness is duality, expressed in Chinese philosophy as Yin and Yang. Yin and Yang represent opposite elements, such as feminine and masculine, good and bad, left and right, fast and slow. In human consciousness, these opposite qualities always exist as a pair. When we think of one of them, we are comparing it with the other. The opposites are inseparable and co-dependent in human consciousness. The elementary consciousness is duality consciousness.

We propose that there are two elementary duality consciousnesses [11][12]: the consciousness of changing or unchanging and the consciousness of inclusion or exclusion. All human consciousness is a combination of these two types of elementary duality consciousness.

Our consciousness of the unchanging and unmoving is related to our consciousness and measurement of space [10][11]. For example, when we measure the physical space, the length, we use our consciousness of something's unchanging quality. The length, height, and width of an object are the measurements of its unchanging quality. Our consciousness of change and movement is related to our consciousness of time and the measurement of time. For instance, the consciousness of the movement of sand in a container, the burning of incense, and the movement of the sun, earth, and moon, are involved in the consciousness and measurement of time. Therefore, the elementary consciousness of change and/or unchanged is related to the time consciousness and the space consciousness.

We presume and find that all human consciousness and measurement are based on these two basic duality pairs: space-time consciousness and inclusive-exclusive consciousness [10][11][12]. For instance, to measure mass with a mass scale, we put the object to be measured on one side of the scale and the weights with known mass on the other side. When both sides of the scale are completely balanced, we obtain the measurement of the mass. In this measurement, conscious space and time are used to make sure that the two arms of the scale are equal and

still. The inclusion and exclusion consciousness are applied when one adds weights to the scale.

2.2. The Mathematical Formula Describing All Human Consciousness

Since all human consciousness is made of two elementary duality consciousness, i.e., two basic duality pairs (space-time consciousness and inclusive-exclusive consciousness), all consciousness can be expressed in terms of four components. Let's use τ, σ, θ_1, θ_2 to represent each of the four components. Any consciousness can be expressed in the form of a summation of these four elements:

$$A_1 = \sum_{summation} \tau\, \sigma\, \theta_1 \theta_2$$

In physics, action is an attribute of the dynamics of a system from which the wave function and the equations of motion of the system can be derived. To see what action these two pairs of elementary duality consciousness induce, we first write down the simplest action created by the space-time duality pair, which is:

$A_1 = \alpha \int \Delta\tau \Delta\sigma (1)$

Here we use the symbol σ to represent conscious space and the symbol τ to represent conscious time. We use Δσ and Δτ to represent the space and time duration or variation to be measured. The symbol ∫ represents the summation over space and time from the beginning τ = 0 and σ = 0 till τ = T and σ = L. Here, L and T are the space and time measurement durations for the observed phenomena. For instance, for the observed universe, T is the age of our universe and L is the horizon of our universe. And α is a constant, which is determined in our paper in [9] to be related to the Planck time and the Planck length.

To introduce the second consciousness duality pair, inclusion and exclusion, into the action, it is important to realize that corresponding to the inclusion and exclusion duality pair, in nature, there exist two types of particles: fermions and bosons. Fermions have half (1/2) spin. They repel each other. They refuse to co-exist in the same state. Particles such as electrons, neutrinos, and quarks are fermions. Bosons have integer spin. They tend to clump. They love to stay in the same state together. Particles such as photons, gravitons, and gluons are bosons. Supersymmetry (SUSY) is the symmetry originally proposed to connect fermions and bosons. The normal time and space coordinates τ and σ are of bosonic nature. We can expand each space or time coordinate to have both the fermionic and bosonic parts, and each time and space coordinate becomes two elements:

$\tau \rightarrow (\tau, \theta_\tau)$,
$\sigma \rightarrow (\sigma, \theta_\sigma)$.

Here we use θ_σ and θ_τ to represent the fermion partners of the space and time coordinates σ and τ. The θ_σ and θ_τ can only take on the values 0 or 1 because they are repulsive and refuse to stay at the same place with another element. The σ, τ, θ_σ, and θ_τ represent the four elements of the two duality pairs, the space-time duality pair and the inclusion-exclusion duality pair.

The simplest action created by these two duality pairs is:

$A_2 = \alpha \int \Delta\tau\Delta\sigma\Delta\ \theta_\tau\Delta\theta_\sigma$

The symbol $\int$ is to represent the summation over the space σ and the time τ and θ_τ and θ_σ.

It is interesting to see that the actions A_1 and A_2 are the holographic and super-holographic actions derived in the grand unification theory based on the holographic principle [9]. The super-holographic action is the action that contains both the bosonic spacetime and the fermionic spacetime and has supersymmetry. Supersymmetry is the symmetry between a bosonic element and a fermionic element. In our work [9], we find that the actions (1) and (2) mathematically represent a hologram which holds the information about a system. The holographic action is an extended and generalized action encompassing string theory, general relativity, and thermodynamics.

To see how physical phenomena emerge from the hologram, we need to write down the action in terms of physical space and time X^μ. For the simplicity of illustration, we just consider space σ and time τ and neglect the fermionic parts for now. In this case, the physical spacetime X^μ is a projection from the conscious spacetime (τ, σ),

X^μ: (τ, σ) -> X^μ (τ, σ).

In this projection, the action remains unchanged:

$$A_1 = \alpha \int d\tau\, d\sigma = \alpha \int dX^\mu\, dX_\mu \quad (3)$$

In the presence of a background field $G^{\mu\nu}$ in physical space and time, the action (3) becomes:

$$A_1 = i\alpha \int_0^T d\tau \int_0^L d\sigma\, G^{\mu\nu} \partial_\tau X_\mu \partial_\sigma X_\nu \quad (4)$$

Using the action in (4), we can obtain the holographic function Ψ_h (T, L):

$$\Psi_h (T, L) = \exp(i A_1) = \sum_{sum\ over\ possible\ X^\mu} \exp(iA'_h). \quad (5)$$

The holographic function Ψ_h (T, L) corresponds to the wave function in quantum physics. It describes the possible vibrations, energy, information, and matter in a system. It gives the possible vibrational fields, information, energy, and matter that can be manifested by human consciousness.

3. Predictions of HQTOC

There are six major predictions from HTOC.

3.1. Prediction of a grand unified theory

If everything we observe is determined by consciousness, and our consciousness can be mathematically expressed by the holographic action, then all the observed natural laws and phenomena should emerge from this one formula. This gives the first prediction of this theory:

HQTOC Prediction I

A grand unification theory, which uses one mathematical formula to describe everything, including the observed natural laws and phenomena, exists.

In our previous work [9], we demonstrated that natural phenomena and the laws of physics emerge from the holograms described in (1), (2), (3), and (4). Specifically, we found that elementary particles emerge from holographic action due to Poincaré symmetry. Gravity and gauge interactions, including electromagnetic forces, weak and strong forces, emerge due to diffeomorphic symmetry, and the classical equation of motion emerges due to Weyl symmetry. Dark matter and dark energy emerge due to vibrations on the horizon scale of the universe. Higgs bosons and the Higgs mechanism emerge due to boson and fermion condensation. We find that holographic action describes a grand unification theory, which can use one mathematical formula to account for various laws and phenomena in physics [9][10][11][12].

3.2. Predictions of the hologram described by the four components

The fundamental assumption of HQTOC is that everything one observes and experiences is determined by one's consciousness. Because the basic components of human consciousness are four elements and two duality pairs, all the observed phenomena are projections from the hologram formed by these four elements and two duality pairs. This is the second prediction of HQTOC.

HQTOC Prediction II

All the observed phenomena emerge from a hologram which is encoded with two duality pairs and four components, and are described by holographic action.

In addition to our findings that physical laws and phenomena, from elementary particles, fundamental forces, Higgs bosons and mechanisms, dark matter, dark energy, and black holes, to the large structure of the universe, emerge from the hologram described by the holographic action of the four components, it is assuring to notice that a life system also uses four elements and two duality pairs to encode the information of the life system. The carrier of genetic information, DNA, is a polymer composed of two polynucleotide chains made of four elements (cytosine [C], guanine [G], adenine [A], or thymine [T]) that coil around each other to form a double helix**.** This double helix structure of DNA is a typical holographic structure, the structures that are mathematically described by the holographic action. One can see this through the action that can mathematically express this structure, $\boldsymbol{A_D}$:

$$\boldsymbol{A_D} = \sum_{n=1}^{N} \boldsymbol{h_{nn}}\, \boldsymbol{\sigma^n \tau^n} \quad (6)$$

Here $\boldsymbol{\sigma^n}$ represents the components on one of the double helices, $\boldsymbol{\tau^n}$ represents the components on the other, and $\boldsymbol{\tau^n}$ represents the interaction between these two components. The symbol $\sum_{n=1}^{N}$ represents summation over all the components on the DNA helix, ranging from 1 to N. Here N represents the total number of components on the double helix. One can see that $\boldsymbol{A_D}$is a special case of the holographic action in (1) and (2).

The physical forms, phenomena, and experience of the life system emerge from the information encoded in the DNA, which can be mathematically expressed by the holographic action. One can apply the holographic action to mathematically study the vibrational field created from the information of DNA and how the field of the environment can affect the structure and expression of DNA. The holographic action gives us a new mathematical tool to study DNA, brain structure, and life in general. We will explore and discuss this in greater detail in future work.

3.3. Prediction of space and time scaling invariance

The holographic action has conformal invariance [9], meaning that the holographic action, function, and the observed phenomena remain the same when one changes the scale of space or time.

As the general form of the hologram is the same for different systems, except that their conscious/holographic time and space scale is different, the time and space scaling invariance should also be present among different objects and phenomena. This generalized scaling invariance is the third prediction of HQTOC.

HQTOC Prediction III

There is space and time scaling symmetry/invariance within and among different phenomena and objects.

Phenomena exhibiting scale-invariance have been observed in various natural systems, ranging from large-scale objects in astrophysics [13][14][15][16][17] or geology [18], over natural disasters [19], electric breakdown phenomena [20], to plant structure [21][22], to properties of proteins in specific organisms [23], and noncoding areas of DNA [24]. Even the behavior of humans and animals is observed to exhibit scale-free properties [25][26][27][28]. Man-made objects and phenomena show scale-free properties as well. For example, scale-free phenomena have been observed in the field of software programming. Gisiger has compiled a comprehensive overview and more examples in [29]. There has been extensive research on the fractal structure and scale-free dynamics in the brain in the past 40 years [30][31][32][33][34][35][36][37][38][39][40][41][42][43][44].

In [45], F. Vazza and A. Feletti show that the network of neuronal cells in the human brain and the cosmic network of galaxies share structural and morphological similarities, as well as likenesses in network properties and memory capacity. It states: “The tantalizing degree of similarity that our analysis exposes seems to suggest that the self-organization of both complex systems is likely being shaped by similar principles of network dynamics, despite the radically different scales and processes at play.”

HQTOC provides the physics principles about why such space and time scaling invariance should exist in everything. It also gives the mathematical formulation to describe, study, and utilize this symmetry to make predictions. We will explore this further in future work.

3.4. Prediction of the Arrow of Time

The arrow of time is the concept positing the "one-way direction" of time. It was developed by the British astrophysicist Arthur Eddington in 1927 and is an unsolved general physics

question. This direction, according to Eddington, could be determined by studying the organization of atoms, molecules, and bodies, and might be drawn upon a four-dimensional relativistic map of the world ("a solid block of paper") [46].

This direction of time can be clearly recognized by consciousness and reasoning. However, the direction of time does not appear in physics except in entropy, a statistical mechanics and macroscopic phenomenon arising from a system. Modern physics reveals that at the microscopic level, physical laws and processes are mostly time-symmetric (except for a small violation in the case of the weak interaction), meaning that they are the same whether time moves forward or backward. At the macroscopic level, it is not the case: there is an obvious direction of time. Some suggest that this direction of time may be connected with the growth of entropy.

In HQTOC, there exist two kinds of space and time [47]. One is consciousness spacetime (τ, σ), the other is physical spacetime X^{μ}. The conscious space and time (τ, σ), also called holographic space and time [9], or information space and time [48], form the hologram from which the physical space and time and phenomena emerge. The physical spacetime X^{μ} is a projection from the conscious spacetime (τ, σ), X^{μ}: (τ, σ) -> X^{μ} (τ, σ). Physical time X^{0} is the time that can be measured by a clock. As one can turn the hands of a clock both backward and forward, physical time can be both positive and negative. It does not necessarily have a direction.

Conscious time and space together are related to the information in a system. The actions (1) and (2) give the relationship between conscious time and space and the information in a system. This confirms and mathematically expresses the fact that the direction of time is related to the total information of the system, which grows as conscious time goes by. This gives the third prediction of HQTOC:

HQTOC Prediction IV

Conscious time and space together are proportional to the total information of a system. As conscious time goes by, there will be more and more information related to the object or system. Conscious time can have a direction.

It is interesting to notice that, according to HQTOC, the total maximum amount of information in a system is proportional to both conscious time and conscious space. Our expanding universe is an example of this, in which as time goes by, both the age of the universe and the horizon of the universe grow. In this case, both the conscious space and time have a direction. The meaning of the direction of conscious space is that as conscious time goes by, the maximum amount of space one can be conscious of also increases. In this case, the amount of information in the system grows with both conscious space and time.

3.5. Prediction of the possibility to transcend natural laws through going beyond duality

In HQTOC, the observed natural laws and phenomena are manifested from human duality consciousness. If one can change one's consciousness and go beyond duality consciousness, one may transcend currently observed natural laws, such as gravity, electromagnetic fields, and more. This brings the fifth prediction of HQTOC.

Quantum physics reveals that the vacuum contains infinite potential matter, energy, and information. The vacuum is a physical state of emptiness. There also exists the conscious state of emptiness, which is a state of consciousness free of duality consciousness. If one cultivates oneself and goes into the conscious state of emptiness, according to this HQTOC, the manifestation of consciousness, the observed laws and phenomena, will be different. This brings the fifth prediction of HQTOC.

HQTOC Prediction V

If one goes beyond duality consciousness and enters into emptiness, one may transcend currently observed natural laws and phenomena.

In Chinese history and in many cultures, it is recorded that high-level cultivated masters could exhibit the ability to levitate, fly, disappear, and transform matter through going to a higher consciousness state beyond duality. These folklore stories suggest the occurrence of the phenomena indicated by the fifth prediction. To test this fifth prediction, scientific studies are needed. It may be difficult to conduct this type of research because it takes many years of serious practice to get into a deep state of emptiness before a person can exhibit such abilities. People with this type of ability may not want to participate in experiments since they need to be in the emptiness state to perform such feats. We will defer designing experiments to test this and other predictions to future work.

3.6. Prediction of the possibility to use mathematics to describe the observed natural laws, phenomena, and experiences

E.P. Wigner, in his influential article "The Unreasonable Effectiveness of Mathematics in the Natural Sciences" [48], argued that biology and cognition could be the origin of physical concepts, as we humans perceive them, and that the happy coincidence that mathematics and physics were so well matched seemed to be "unreasonable" and hard to explain.

We propose to consider mathematics as the abstract language of human consciousness. Based on the basic assumption in this paper that our consciousness manifests the observed natural laws, phenomena, and experiences, it is a natural conclusion that the observed natural laws, phenomena, and experiences can be described mathematically. The mysterious coincidence pointed out by E.P. Wigner can be explained in HQTOC. This is the sixth prediction of HQTOC.

HQTOC Prediction VI

All observed natural laws, phenomena, and experiences can be described mathematically.

4. Discussion and Conclusion

In this paper, we propose HQTOC based on the assumption that consciousness is the driving force determining what is manifested, observed, and experienced. By finding the basic constituents of human consciousness to be the two basic pairs of duality consciousness (the change-unchange duality consciousness and the inclusion-exclusion duality consciousness), we derive the holographic action and function that describes the hologram created by human

consciousness and the possible information, energy, and matter that can be manifested by human consciousness. This HQTOC has six major predictions:

1. There exists a grand unified theory, which can use one mathematical formula, the holographic action, to describe all observed laws and phenomena.
2. All the observed laws and phenomena emerge from a hologram created by four components and two duality pairs.
3. Time and space scaling invariance is a universal symmetry occurring in various phenomena.
4. Conscious space and time are proportional to the maximum amount of information in a system. Conscious time can have a direction.
5. If one goes beyond duality consciousness and gets into an emptiness state, one may transcend currently observed natural laws and phenomena.
6. Natural laws, phenomena, and experiences can be described mathematically.

The grand unification theory (GUT) is an important pursuit in physics. This research indicates that understanding consciousness is a critical element for finding the ultimate GUT. This work also provides a mathematical formula to study the relationship between the information encoded in DNA or brain structure and the field created by them.

This work demonstrates mathematically how the observed natural laws and phenomena are manifested from human consciousness. It reveals the profound connection between the observed natural laws and human consciousness. This insight can lead to a deep understanding of the greater human potential and abilities. It also provides a new physical foundation and mathematical tools to study DNA, the brain, life, cosmology, the grand unified theory, and all scientific and spiritual disciplines.

Acknowledgments

We want to thank Jonathan Schooler for advice and suggestions, Nikki Johnson for helping with references, Edward Wuenschel for editing, Daniela Rambaldini, Corina Sarb, and Ivo Banaco for creating the illustrations and figures in the paper.

This research was supported in part by the National Science Foundation under Grant No. NSF PHY-1748958.

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