Qeios

Particle Entanglement with the Observer's Polarized Dual Consciousness

A Modified Stern Gerlach Experiment, as proof

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Abstract

Note: This article is an extension of my 2023 Qeios article titled: "Quantum Non-Separability, Consciousness, Negentropy and a New Concept of Gravity" [1]. The novel insights and contributions are listed in section 7

A Theoretical proposition of particle entanglement with the polarized dual Consciousness of a single observer (and subsequent local and remote environments) during Quantum Decoherence, explains the Two-State System experiments, and is **supported by mathematical conjecture**, using a Classic Space analogue to Quantum Decoherence: Recursive information exchange (RIE), within the framework of reinforcement loops, between agents. From this dynamic system of information exchange, the resulting decreased Shannon entropy, increased potential energy, polarization and preferential growth (over scales) are compared with Von Neuman entropy during Quantum Entanglement and collapse. The observational components of RIE (biased observation, interpretation, response and self-validation) are analyzed and shown to be **subjectively validated**. This corollary of "self-validated observation" explains the logical inconsistencies in the Two States Experiments.
A **simple modified Stern Gerlach experimental is proposed as a proof**.

Keywords: Von Neuman entropy; quantum entanglement; Jarzynski equality; quantum decoherence; potential energy

1 Introduction

As the polarization from recursive information exchange translates across scales of human conscious, ranging from neurological decision making to global information exchange, it's reasonable to assume that it also plays a fundamental role in quantum decoherence.
I ask you to consider how ubiquitous positive reinforcement loops and power-law distributions are in nature. In particular, how recursive information exchange (within the framework of reinforcement loops) translates across scales, ranging from local, regional, national, and global. However prior to any initial local exchange of information, there first exists an exchange within the conscious decision making of an agent, at the neurological scale. For example. The "Archduke Ferdinand moment" was not initiated by the pull of a trigger. The initial state began at the neurological scale, within the dual opposing consciousness of the assassin. So the Classic Space sequence of information exchange **escalated through successive scales of: neurological, local, regional, National and global**

The conjecture in this article uses a formal working hypothesis:

Hypothesis 1 *A dual and opposing consciousness exists within the mind of the single observer (per studies on post corpus callosotomy patients. [2]). During the process of particle observation, a positive feedback loop of recursive information exchange (RIE) occurs between these dual and opposing conscious operations. This dynamic process follows a recurring and escalating sequence (of biased observation, interpretation, response and self-validation), with an associated decease in Shannon entropy and an increase in potential energy, resulting in the* ***polarization of the observer's dual consciousness to a single state****. Subsequently the observed particle, which exists in superposition becomes polarized / entangled in correspondence with the observer's polarizes state, along with the local environment and subsequent remote environment. This emergence of a single polarized state (of spacetime), from a mixed superposition state is the essential process which results in quantum decoherence.*

A simple inexpensive modified Stern Gerlach experiment is proposed as proof of a high Pearson R correlation between the observer's dual consciousness and the particle orientation.

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2 The Two States Experiments are Explained by the Entanglement of Observer and Particle

The reason that the observer can not explain the logical inconsistencies of the "Two States Experiments" [3] is because the observer undergoes a profound change during each validation (I prefer to use validation, instead of "observation" or "measure", as it's more useful), such that the observer's opposing dual consciousness becomes polarized, through a sequence of recursive information exchange, that results in lower entropy, higher potential energy, and collapses to a single validated state (unconscious to the single observer). Subsequently, the particle becomes polarized and entangled with this single validated state (and subsequent local and remote environments). Figure 1 shows the three stage sequence of $x \rightarrow y \rightarrow x$ axis orientations and resulting percentages of possible binary states of angular momentum. **Note: conjecture to follow**

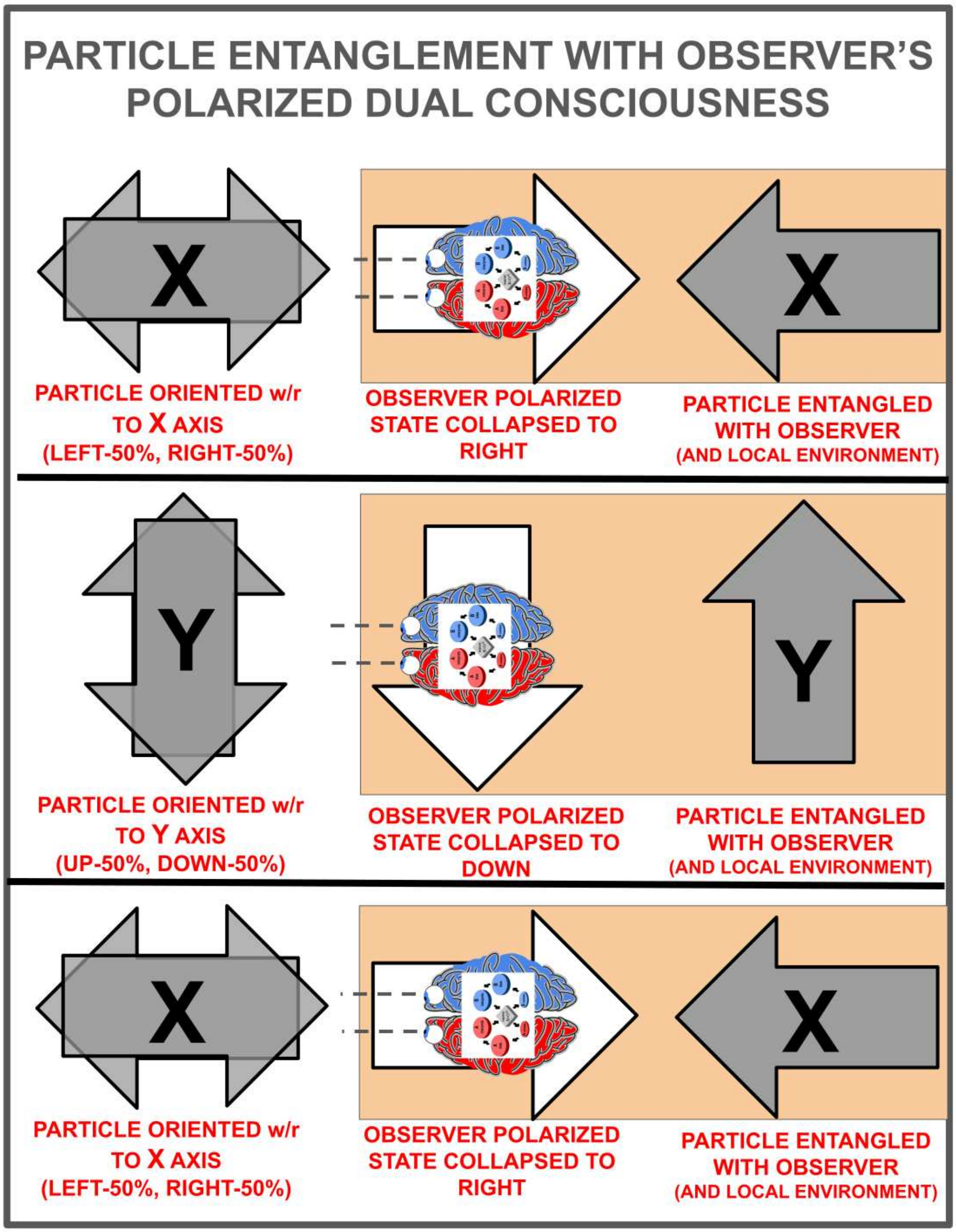


Figure 1: Two States Experiment, with three stages of x, y, x axis orientations and resulting percentages of possible binary states.

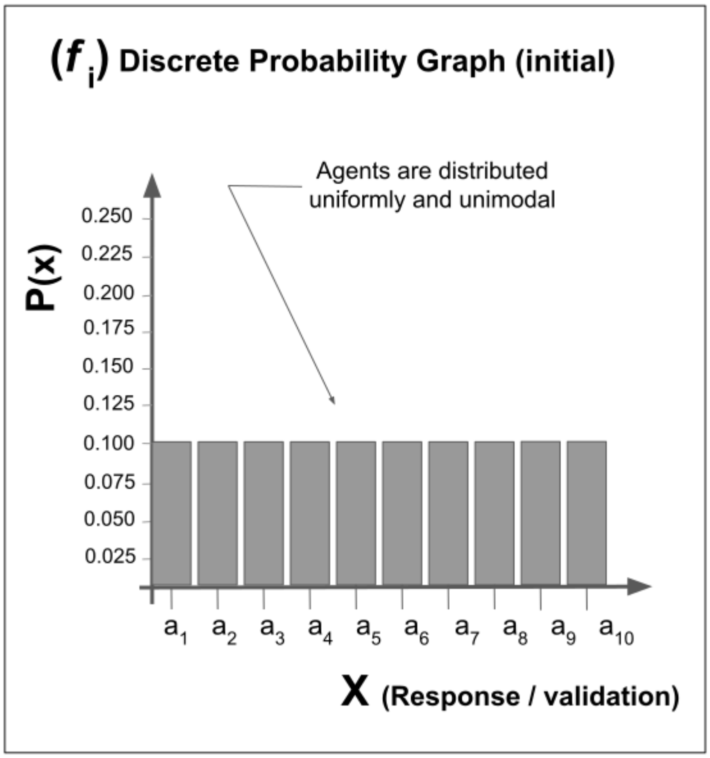
Notice that for each observation (validation) the observer's opposing dual consciousness collapses to one of two potential states, then repeats with each orthogonal orientation.
The following sections provide mathematical support for this proposal, with a Classic Space analogue to Quantons.

3 An Analogy Between Polarization in Classic Space and Quantum Decoherence

Recursive Information Exchanges in Classic Space (Entropy Decreases and Potential Energy Increases)

Universal set U contains ten agents as noted: $U \mid \{a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}\} \in U$

figure 2 shows the discrete probability graph of set U at initial state f^i, along with it's associated information ($I(a_i)$) and Shannon entropy ($H(X)$): [4]



x_i	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
a_1	0.100	3.322	0.332
a_2	0.100	3.322	0.332
a_3	0.100	3.322	0.332
a_4	0.100	3.322	0.332
a_5	0.100	3.322	0.332
a_6	0.100	3.322	0.332
a_7	0.100	3.322	0.332
a_8	0.100	3.322	0.332
a_9	0.100	3.322	0.332
a_{10}	0.100	3.322	0.332
	1.000		$H(x) = 3.322$

Figure 2: Discrete probability graph at initial state f^i

Note: Entropy in the initial state is at maximum

$$H(X) \rightarrow max$$

Using a modified version of Shannon entropy for convenience,

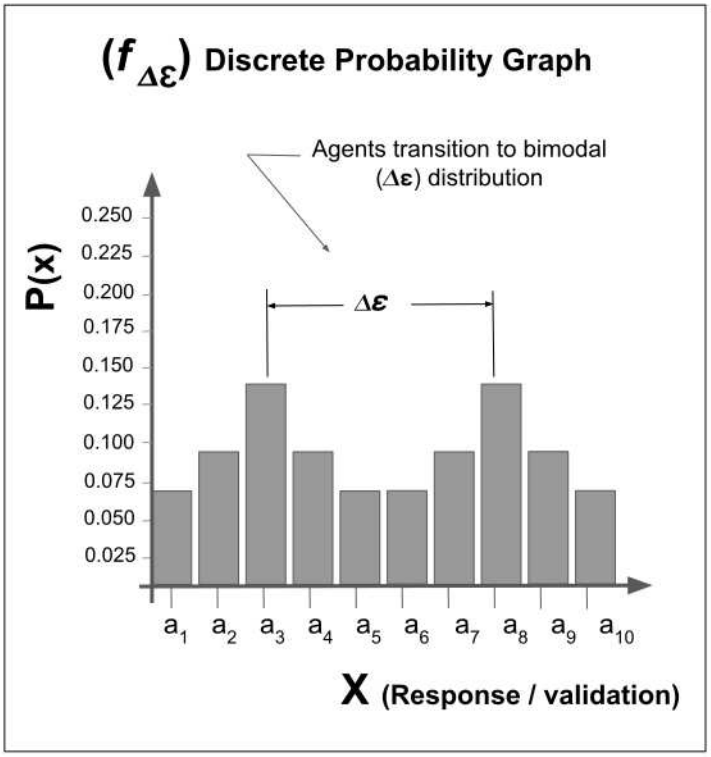
$$H(X) = -\sum_{i}^{n}(p(x_i) * log_2[p(x_i))],$$

$$Modified\ version\ of\ entropy\ equation:$$

$$I(a_i) = -log_2(p(a_i)) \tag{1}$$

$$H(X) = \sum_{i}^{10}(I(a_i) * p(a_i)) \tag{2}$$

At initial iteration f^i, the distribution is uniform with high entropy of $H(x) = 3.322$.
However in the natural world, recursive information exchange tends to result in variance and division. Thus, subsequent iterations tend to transition to a bimodal distribution of two subsets A and B: $A\ and\ B \subseteq U$, and lower associated entropy (see figure 3).



x_i	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
a_1	0.075	3.737	0.280
a_2	0.100	3.322	0.332
a_3	0.150	2.737	0.411
a_4	0.100	3.322	0.332
a_5	0.075	3.737	0.280
a_6	0.075	3.737	0.280
a_7	0.100	3.322	0.332
a_8	0.150	2.737	0.411
a_9	0.100	3.322	0.332
a_{10}	0.075	3.737	0.280
	1.000		$H(x) = 3.271$

Figure 3: Discrete probability graph transitioning to a bimodal distribution

Note: Entropy decreasing over iterations f_n

$$H(X) = 3.271$$

How Distributions Become Separated over Recursive Iterations of Information Exchange

The diagram in figure 4 shows the flow of incremental recursive information exchanges, within the framework of positive reinforcement loops. The observational components (of bias, interpret, response and validation) are mutually mirrored between agents A and B, and **follow a figure eight pattern**. Typically, divisions tend to escalate over time in this format. A real world example might be the polarization which occurs during dysfunctional political rivalry.

Self-Validation of Subjective Observation

The separation ϵ escalates between the agents in subsets A and B during each iteration, as a result of oppositional dynamics (biased interpretations and responses from opposing perspectives). Note that their mutual responses only seem to validate their interpretation. However, the outcome is merely confirmation bias. In other words, their subjective observations are **self-validated**. This concept of self-validation is referenced in section 4, as it relates to validation in Quantum Decoherence.

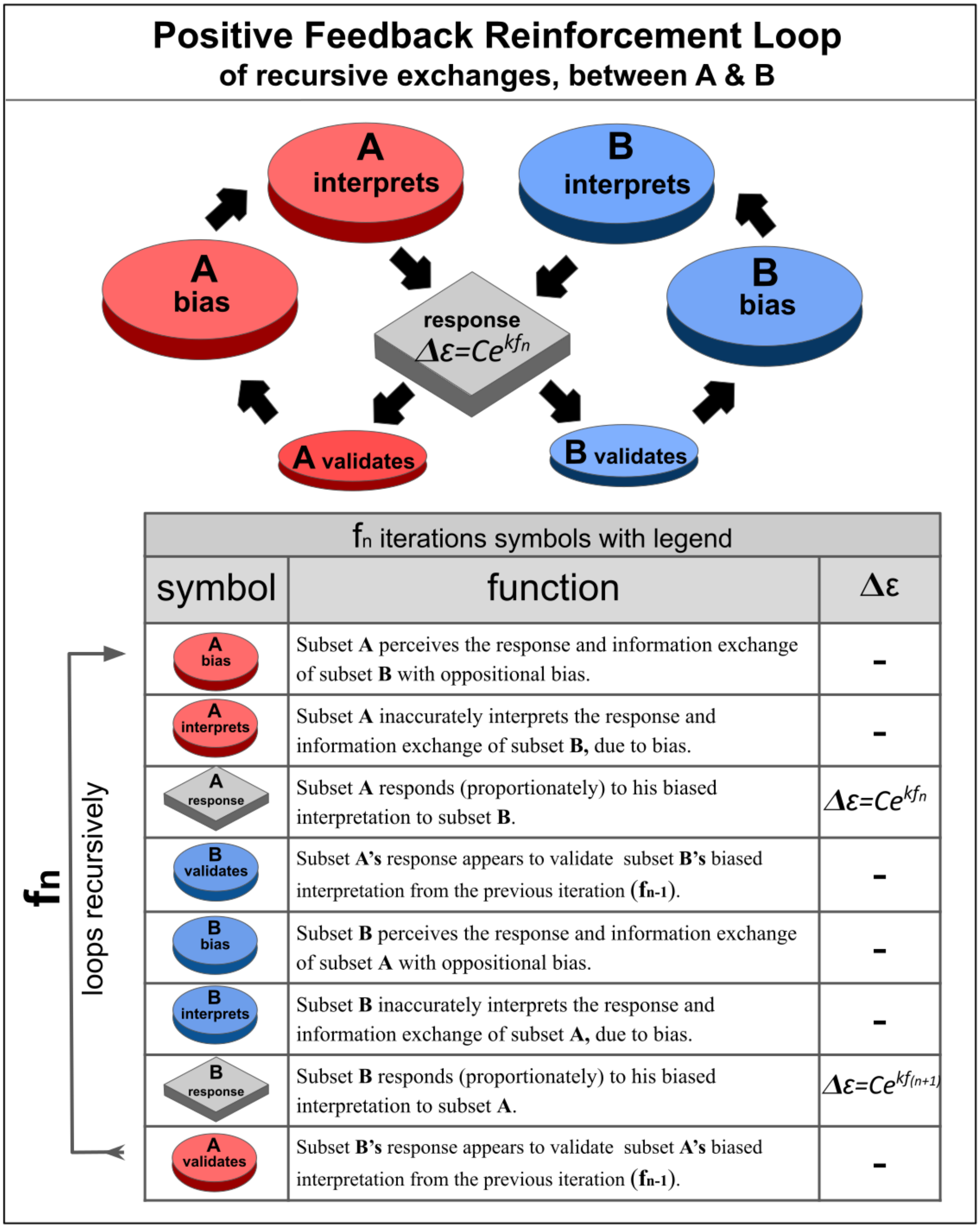


Figure 4: Division develops within positive feedback reinforcement loops, of recursive information exchange

How Separation $\Delta\epsilon$ Increases over Iterations

Subsequent iterations follow the same sequence, and result in an incremental positive feedback loop. As separation escalates over iterations, $\Delta\epsilon$ increases exponentially with each iteration (f^n), per the following differential equation and exponential solution. **Note,** that interpretations become increasingly distorted over iterations. This is demonstrated in the children's game "Chinese Whispers", [5] where an original message becomes unrecognizable, after multiple recursive information exchanges between players of the game,

$$\frac{d\epsilon}{df^n} = K\epsilon \tag{3}$$

$$\frac{1}{\epsilon} d\epsilon = k df^n \tag{4}$$

$$\int \frac{1}{\epsilon} d\epsilon = \int k df^n \tag{5}$$

$$ln|\epsilon| = kf^n + c \tag{6}$$

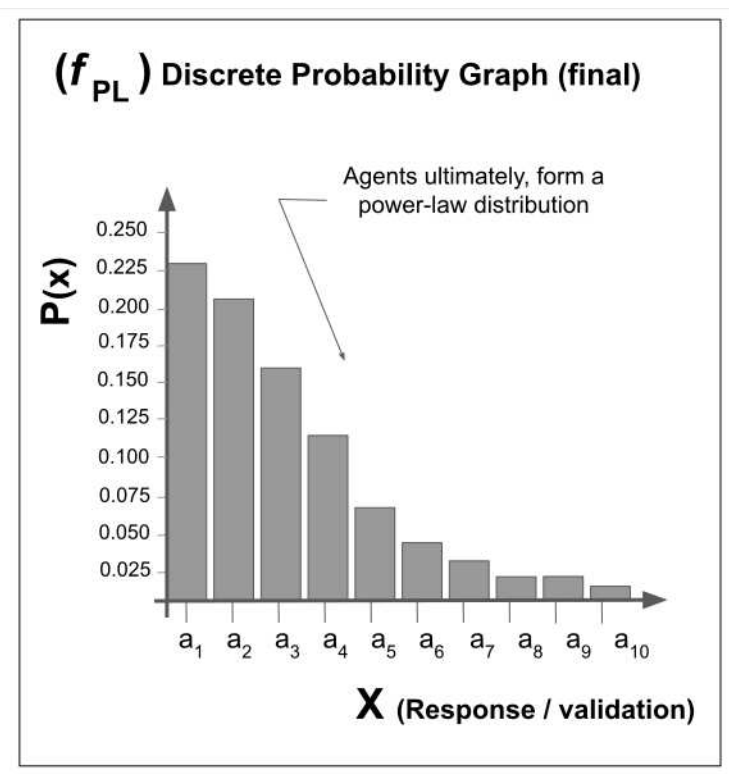
$$|\epsilon| = e^{kf^n + c} \tag{7}$$

$$\epsilon = Ce^{kf^n} \tag{8}$$

Critical Stage of Interation f_i Power-law Distributions

Per the law of preferential attachment, a power-law distribution (a functional relationship between two quantities, where a relative change in one quantity results in a relative change in the other quantity proportional to a power of the change, independent of the initial size of those quantities: one quantity varies as a power of another) will develop. Power-laws occur ubiquitously throughout nature. Some obvious real-world examples are: The largest trees tend to dominate to sun rays, and thus grow at proportionately higher rates. The most massive planets in a stellar system attract more space debris, and thus grow at proportionately higher rates.

The discrete probability graph in figure 5 is approaching a power-law distribution, with a much lower entropy of $H(x) = 2.818$. Of course, distributions of individual sets of agents will vary.



x_i	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
a_1	0.250	2.000	0.500
a_2	0.225	2.152	0.484
a_3	0.175	2.515	0.440
a_4	0.125	3.000	0.375
a_5	0.075	3.737	0.280
a_6	0.050	4.322	0.216
a_7	0.038	4.737	0.178
a_8	0.025	5.322	0.133
a_9	0.025	5.322	0.133
a_{10}	6.322	3.322	0.079
	1.000		$H(x) = 2.818$

Figure 5: Discrete probability graph transitioning to a power-law distribution

Note: Entropy decreasing over iterations f_n

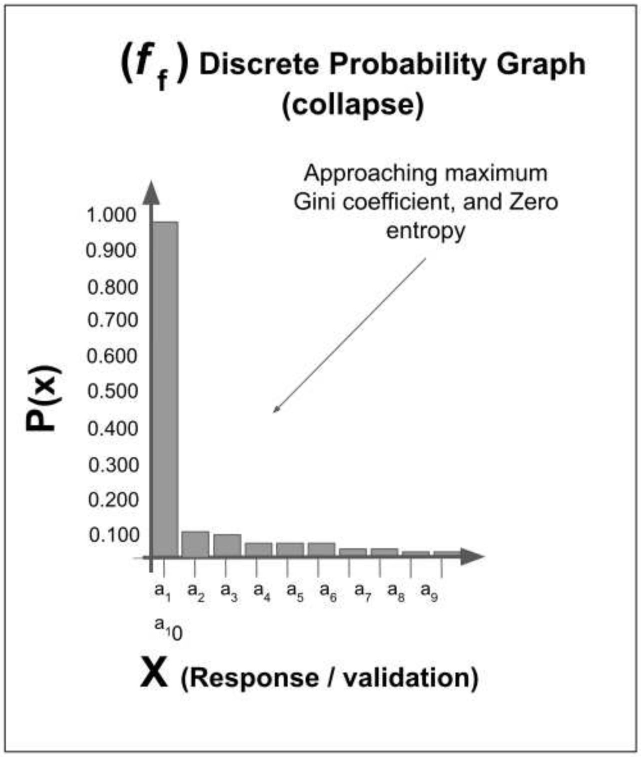
$$H(X) = 2.818$$

Asymptotic Entropy of Open Systems with Power-law Distributions

At a critical Gini coefficient, power-law distributions tend to collapse and then reform. Some real world examples include: The collapse of stars (capable of becoming nova) act as a catalyst to the birth of new stars in a nebula system. The sinusoidal economic cycles, between growth and recession. Note, that such systems tend to maintain their ordered state asymptotically in an open system, regardless of the universal direction of entropy.

Collapse stage f_{fin}

Figure 6 shows a power-law distribution approaching maximum Gini coefficient.



x_i	$P(x_i)$	$I(x_i)$	$P(x_i) * P(x_i)$
a_1	0.950	0.074	0.070
a_2	0.025	5.322	0.133
a_3	0.015	6.059	0.090
a_4	0.005	7.644	0.038
a_5	0.001	9.966	0.010
a_6	0.001	9.966	0.010
a_7	0.001	9.966	0.010
a_8	0.001	9.966	0.010
a_9	0.001	9.966	0.010
a_{10}	0.000	0.000	0.000
	1.000		$H(x) = 0.381$

Figure 6: As the Gini coefficient of a power-law distribution increases to maximum, the entropy approaches zero.

Again, per the law of preferential attachment, a power-law distribution will develop in the form of:

$$p(x) = C(x)^{-\alpha} \tag{9}$$

if we regard random information exchange to be connections between nodes,

$$\begin{aligned}
k &= connections \\
p &= the\ probability\ of\ a\ an\ isolated\ random\ connection \\
(1-p) &= the\ probability\ proportionate\ to\ accumulating\ connections \\
C &= fraction\ of\ nodes \\
L &= the\ fraction\ of\ nodes\ with\ connections \\
then, & \\
L &= Ck^{-\alpha}, \qquad (10) \\
where & \\
\alpha &= 1 + \frac{1}{1-p} \qquad (11)
\end{aligned}$$

Note: As the Gini coefficient of a power-law distribution increases to maximum, the entropy approaches zero. This final stage can be regarded as a collapse, which is analogous to the transition from positive to the zero state in Von Neumann entropy.

$$H(X) \to 0\ as\ G \to max$$

Potential Energy Increases

Note: As entropy $H(x)$ goes to zero, potential energy U goes to maximum This gain of potential energy, from negentropy is real in classic space, if you consider how a Demagogue divides and polarizes a population, then uses the doped energy within this divided population to suit his own purposes

$$U \rightarrow \ max \ as \ H(X) \rightarrow 0$$

Polarization Emerges, Becomes Entangled, and Escalates

Figure 7 shows Classic Space polarization over iterations f_n. This natural result is commonly observed between polar opposites (political, etc). **It's important to note that polarization becomes entagled with it's local environment and subsequently escalates over scales (neurological decisions, local, regional, national, global) in the natural world**

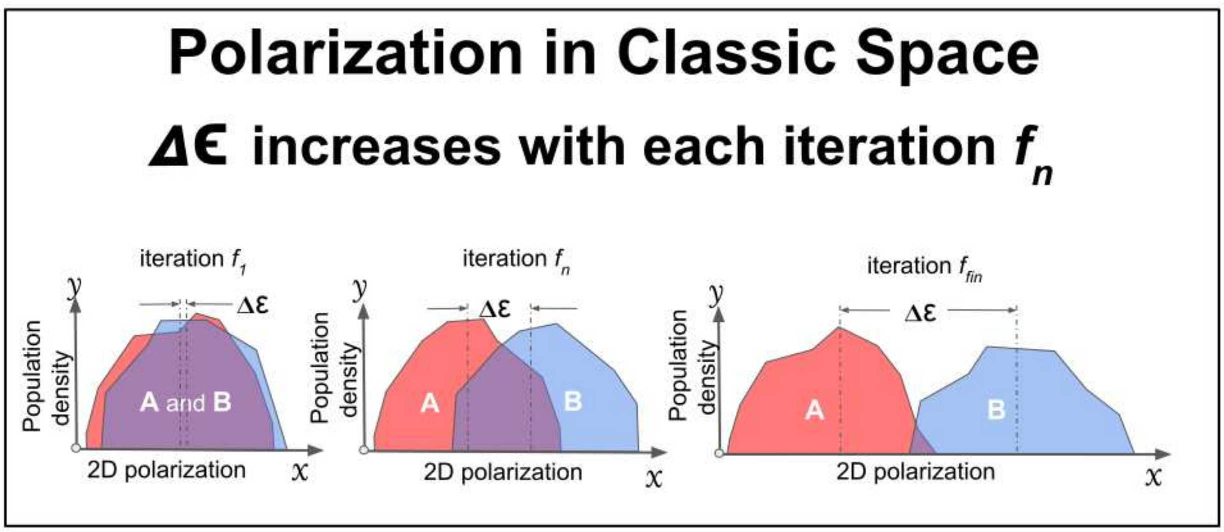


Figure 7: Polarization tends to emerges in the natural world (classic space) over iterations f_n

Note: Polarity becomes entangled with it's local environment, and tends to escalate over scales

$$X_e \rightarrow max$$

Negentropy as Potential Energy

The probability of negentropy $P(J)$ of a set is proportionate to it's polarization $|\rightarrow\rangle$, over recursive information exchanges,

$$P(J) = k\,\frac{|\rightarrow\rangle}{f^n} \tag{12}$$

Where k is a constant or proportionality

4 Recursive Information Exchanges in Quantum Decoherence

Information as Energy

An experiment in 2010, by a team of Tokyo scientists, [6] demonstrated that a non-equilibrium feedback manipulation of a Brownian particle on the basis of information about its location achieves a Szilárd-type [7] information-to-energy conversion, using real-time feedback control. In thermodynamics, the Jarzynski equality [8] (free energy difference) $\Delta F = F_B - F_A \Delta F = F_B - F_A$ between two states A and B is connected to the work W done on the system through the inequality: $\Delta F \leq W \Delta F \leq W$. In microscopic systems, thermodynamic quantities such as work, heat and internal energy do not remain constant but fluctuate. Nonetheless, the second law [9] still holds, on average, if the initial state is in thermal equilibrium: $\langle \Delta F - W \leq 0 \rangle$, where ΔF is the free-energy difference between states, W the work done on the system and $\langle * \rangle$ the ensemble average. However, the feedback control enables selective manipulation of specific fluctuations that cause $\Delta F - W > 0$, by using the information about the system. The feedback control can increase the likelihood of occurrence of such an event. This is the crux of the control in the thought experiment: "Maxwell's Demon". [10] Thus, it is concluded that the particle is driven by the 'information' gained by the measurement of the particle location.

The Measurement Problem

In quantum mechanics, a matter wave collapses as it interacts with a macroscopic photographic plate, seemingly at the point where an intelligent agent observes the plate. [11] This seems to defy a logical explanation, as the matter wave is in a superposition of several eigenstates and evolves deterministically, yet the resulting single eigenstate is determined by the state at the point of interaction (measurement). For any observable, the wave function is initially some linear combination of the eigenbasis $\{|\phi_i\rangle\}\{|\phi_i\rangle\}$ of that observable. When an external agency (an observer, experimenter) measures the observable associated with the eigenbasis $\{|\phi_i\rangle\}\{|\phi_i\rangle\}$, the wave function collapses from the full $|\psi\rangle|\psi\rangle$ to just one of the basis eigenstates, $|\phi_i\rangle|\phi_i\rangle$, that is: $|\psi\rangle \rightarrow |\phi_i\rangle.|\psi\rangle \rightarrow |\phi_i\rangle$.

The Key to the Measurement Problem: Two Minds of Observation in the Single Observer.

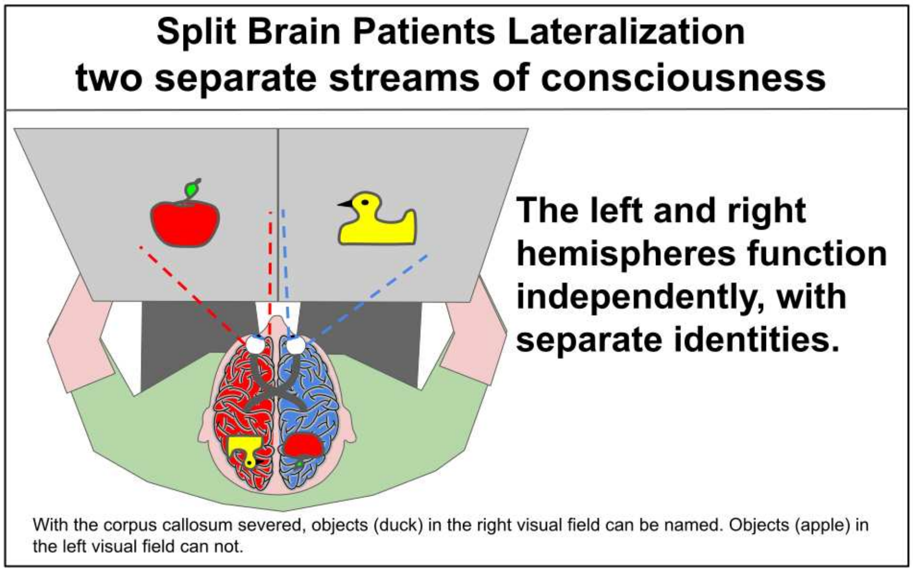


Figure 8: Split Brain Patients Lateralization two separate streams of consciousness

Neuroscience has theorized the duel (two minds) model of the human brain from research on post-surgery consciousness of split-brain patients. [2] Following surgery, **these two minds are typically opposing, such that both minds simultaneously perform opposing functions** (see figure 8).

Thus, Hypothesis 1 implies the following, in the Measurement Problem,

- The observer's opposing dual consciousness exchange information about the particle being observed, and follow an essentially similar process (components of bias, interpret, response and validation) as the figure 8 flow diagram shown in figure 4.
- The two opposing observables ultimately collapse into one of two (polarized) states

$$|\psi\rangle \rightarrow |\phi_i\rangle . |\psi\rangle \rightarrow |\phi_i\rangle .$$

- The collapsed state corresponds to either a "spin up" or "spin down" state.

$$\uparrow\downarrow$$

- The evolution of a particle in the wave function is actually deterministic. However, the single measurable result (eigenvalue) λ_n is in correspondence with the polarized state of the observer's dual consciousness $|\textcircled{<}\rangle$, for the measurable $\hat{H}$ of of the measured state $|a_n\rangle$, in the Hermitian equation,

$$\hat{H}|a_n\rangle = \lambda_n|a_n\rangle$$

Such that the observer's polarized dual conscious is entangle with

$$|a_n\rangle, |\textcircled{<}_1\rangle \otimes |a_1\rangle + |\textcircled{<}_2\rangle \otimes |a_2\rangle$$

- This entanglement, between both the observer and particle, provides the missing deterministic feature, which Einstein objected to, as being "incomplete" in his equation, where he concludes that the entanglement of two particles, which are widely summed, can not be divided into two separated wave functions. Can be expressed as,

$$\Psi(x_1, x_2) = \sum_{n=1}^{\infty} \psi_n(x_2) U_n(x_1) \neq \chi(x)_1 \theta(x)_2 \tag{13}$$

- This process of exchange between the observer's dual consciousness **occurs instantaneously to the single observer, who is unaware of the subconscious dynamics**.
- Hypothesis 1 can be experimentally verified, by demonstrating a correspondence between the observer's dual consciousness, the observer and the local environment, at any single moment. (See section 5).

5 Proposed Experiment to Prove that Decoherence is Influenced by the Polarized State of the Observer

An entanglement between the polarized observer's dual consciousness and the particular angular momentum of an electron, implies a correspondence with the observer, particle and local environment, at any single moment. Thus, a statistical correlation can be demonstrated between two independent detector systems, as viewed by a single observer. The following experimental is proposed, as empirical evidence of observer influenced particle collapse, to a measurable state (figure 9),

- Two parallel Stern Gerlach [12] electron deflector systems ($a\ and\ b$) emit respective single unpaired electrons ($e_a\ and\ e_b$), at regular intervals through an inhomogeneous magnetic field, toward their respective detector screens ($d_a\ and\ d_b$).
- The two separated and parallel electrons ($e_a\ and\ e_b$) are emitted in sync, such that they strike their respective screens (virtually) simultaneous.
- A single observer is oriented to view both detector screens ($d_a\ and\ d_b$), with the following constraints,
- Detector d_a is viewed exclusively, by the observer's left field of vision, and detector d_b is viewed exclusively, by the observer's right field of vision.
- The null hypothesis would expect a weak correlation of $\pm \leq R$ 0.3, between the two systems spins. A reasonable sample size might be 500 unpaired electrons.
- A correlation value of $\geq \pm R$ 0.5 would demonstrate a **significant observer influenced particle bias. If proven, deterministic particle evolution would be of great benefit to science, and the field of Quantum Mechanics, in particular**.

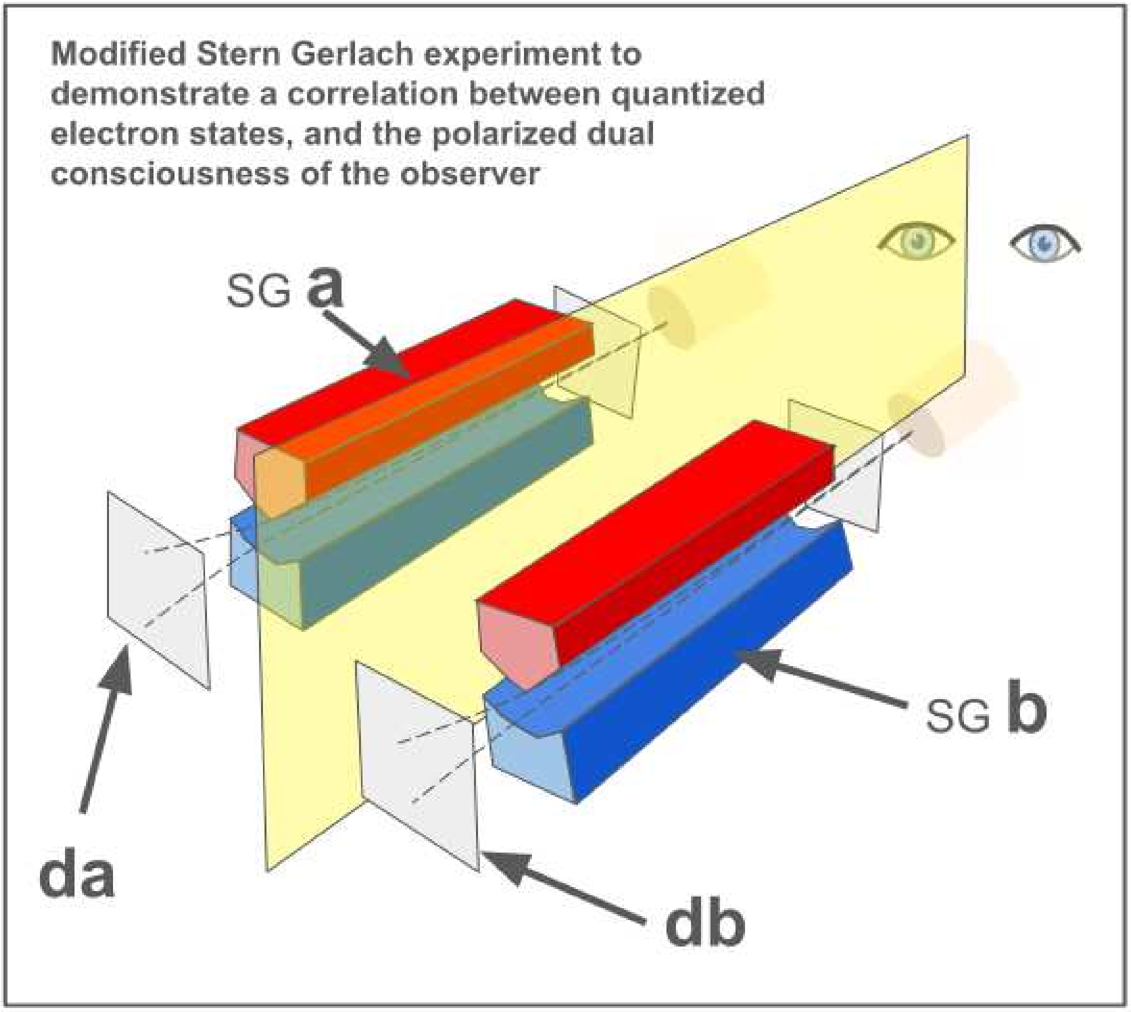


Figure 9: Modified Stern Gerlach experiment to demonstrate a correlation between quantized electron states, and the polarized dual consciousness of the observer.

6 Conclusion

Recursive information exchange and the resulting low-entropy power-law distributions, are ubiquitous in Classic Space. **As RIE translate across scales of human conscious, ranging from neurological decision making to global information exchange, it's reasonable to assume that they also play a fundamental role in quantum decoherence**. Hypothesis 1 suggests that matter which is separated in $\mathbb{R}^3$ spatial dimensions is actually connected in within a higher $\mathbb{R}^4$ dimensional space, which provides a basis for entanglement at a remote distance. Conceivably, it could provide a radically alternate model of gravity as a repellent force of separation.

References

[1] PletcherwhitenA. Quantum non-separability, consciousness, negentropy and a new concept of gravity. *Qeios, 2023;*, https://doi.org/10.32388/0EQOTJ.6.

[2] Gazzaniga M. *The Integrated Mind.* The Integrated Mind, New York, 1978.

[3] Adams A. Lecture 1 introduction to superposition - massachusetts institute of technology. 2013. 8.04: Quantum Mechanics.

[4] Shannon C. *A Mathematical Theory of Communication.* University of Illinois Press, Champaign, 1963.

[5] Blackmore S. *The Meme Machine.* Oxford University Press, P.X., 2000.

[6] Shoichi T. Experimental demonstration of information-to-energy conversion and validation of the generalized jarzynski equality. *Nature Physics 2010;*, 6: 988–992.

[7] Lanouette W. *Genius in the Shadows: A Biography of Leo Szilard.* Skyhorse Publishing, New York, 1992.

[8] Jarzynski C. Nonequilibrium equality for free energy differences. *Phys. Rev. Lett 2010;*, 78 (14): 2690.

[9] Jaffe R. *The Physics of Energy.* Cambridge University Press, Cambridge UK, 2018.

[10] Thomson W. Kinetic theory of the dissipation of energy. *Nature 1874;*, 8: pages441–444.

[11] Zurek W. Decoherence, einselection, and the quantum origins of the classical. *Reviews of Modern Physics 2003;*, 75 (3): 715-775.

[12] Gerlach W. Der experimentelle nachweis der richtungsquantelung im magnetfeld. *Zeitschrift für Physik 1922;*, 9 (1): 349-352.

7 Novel Insights and Contributions

The particular Novel contributions and insights of this article, and how they build upon my previous article is itemized below:

- In the Introduction, The hypothesis is introduced, with an emphasis on the concept of scales; Recursive information exchange translating from an initial state of neurological decision to global information exchange. The "Archduke Ferdinand moment" is used as an example.
- In addition to relevancy in the "Measurement Problem", section 2 describes relevance to the "Two States Experiments", clearly described in figure: 1.

- I section 3, the decreasing entropy, and increasing potential entropy are emphasized and clearly noted in all stages.
- In the "collapse stage f_{fin}", it is noted that as the Gini coefficient of a power-law distribution increases to maximum, the entropy approaches zero $H(X) \to 0\ as\ G \to max$. This limiting factor is a necessary condition for polarization.
- In the new subsection: "Potential Energy Increases", it is noted that Potential Energy Increases to maximum. $U \to\ max\ as\ H(X) \to 0$. This inverse relationship describes the resulting polarization.
- In the new subsection "Polarization Emerges, Becomes Entangled, and Escalates", it is shown that (during iterations) Polarity becomes entangled with it's local environment, and tends to escalate over scales, as the separation is described in figure7.
- In subsection "The Key to the Measurement Problem: Two Minds of Observation in the Single Observer", The corollaries of hypothesis 1 are listed with their relevance to the "Two States Experiments" (spin up and spin down).
- In section 'Proposed Experiment to Prove that Decoherence is Influenced by the Polarized State of the Observer", figure 9 has been added which illustrates the arrangement of the two apparatus and observer.
- Section "A novel Concept of Gravity" has been removed for simplicity, with the intent of publishing in a separate article.

Declaration of Interests

The author declares that I have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

The author declares that no independent research data is included in this article.

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