

# On the Origin of Space

## Part 8A: Mind over Machine – The Basics

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### Abstract

*Is Life able to do things that machines can't? If yes, then Life is based on physical principles different from the ones of Newton's mechanics. The characteristics of the central computation of Life introduced in a prior article are looked at in this light here. We first go over the basic features of a Self-Contained Composite Quantum System (SCQS) from a physics standpoint, thereby preparing the ground for evaluating the higher functions addressed in the second half of this article.*

**Keywords:** cognitive science, qualia, being, the self, creativity, many-worlds

## Introduction

In a previous article,[1] we introduced **self-contained quantum systems** (SCQS) as the space-embedded central controls for Life's **local** functions, allowing Life's mastery of both its various parts and the separated environments they face.

**Definition:** *A SCQS is a **composite quantum system** made out of electrons and photons (which are its **physical support**) embedded within a **dual layer region** of ordinary space. Instead of interacting with photons from all directions at any time as quantum systems do in ordinary space, electrons within a given processing subsystem (a quantum processor) only interact discretely in one-dimensional ways with electrons of other subsystems through separate spatial connections.*

As discussed in another article,[2] such electrons are separated from the rest of reality by being brought together away from it by the evolution of ordinary space into two layers within the area occupied by the SCQS. Even though the electronic evolutions within each processor would be separate, exchanges of quanta with other processors then create and maintain a space separate from ordinary space. The SCQS would be a whole coherent quantum system evolving as any composite quantum system can evolve, that is, as a **multiple reality with exchanges of quanta between its various subsystems**, with the extra benefit of being in its own space, thereby remaining undisturbed and separate from ordinary space and its disordered (“decohered”) contents.

To bring this kind of physical system in the perspective of reality at large, we shall make an analogy with the nuclei of atoms. Each nucleon is a space by itself generated out of the evolution of quarks/gluons, embedded within ordinary space. This last space is itself generated by the evolution of leptons/photons, and identified as an **electromagnetic space**. There is a coupling between these spaces because the elementary parts of nucleons can have electromagnetic interactions due to the geometry of nuclear spaces versus the geometry of the common electromagnetic space. (We won't go further into this subject here – see [3].) A SCQS space - called earlier a “leptonic” space - would be then also coupled to ordinary (electromagnetic) space, but its isolation from this outside reality would be effected differently from the isolation of nucleon spaces: Its evolution (computation) would be related to the evolution of ordinary space only through the **records** effected by localized quantum states, its **input/output quantum states**, effecting its **memory**, which would be its “information” interface with the outside **decohered reality**.

## A coherent many-realities world

Per Everett's interpretation of quantum mechanics, the evolution of external reality is made out of infinitely multiple realities within a **structured** contin-

uum;[4] then, per the **decoherence theory** developed decades after Everett's work,[5] these realities would decohere into a single one (through "wave function collapses") due to the impossibility to maintain **coherence** among many quantum systems in **differentiated localities** (that exist through the strong forces) within ordinary space. A SCQS would be able to keep its multiple realities coherent thanks to its generation of a separate space without strong forces.[3]

### **The reference reality and consequent dreams**

The external reality would be then the **reference reality** used by the support of the SCQS (electrons and photons) to collectively structure their multiply parallel computations. When such a reference is not there, "dreams" would occur, being computations replaying reality in their own space and arbitrary time (stream of changes) as constructed by the ongoing computation.

### **The creative evolution - qualia**

Hameroff and Penrose brought out the idea that our psychological life could be explained from the nature of space as General Relativity describes by adding the hypothesis of a "quantum wave function collapse" from the distortion of space geometry (gravitation) within GR.[6, 7] This is a definite wishful thinking because (1) **GR does not include a description of how space itself comes into being**, something that bothered Einstein from the beginning of his theory, and (2) on the side of quantum theory, the creative aspect of the quantum acting on space has been missed from the beginnings of that theory also, with the unstated **assumption that space is merely an arena, and not related in any way to the existence of its contents**. Thus a modified GR theory of the kind above cannot explain the origin of the **internal space** of the mind, with its objects we all experience. GR and QM simply ignore the quantum aspect of space and the features that are inherently attached to this aspect.

This creative feature of space and its contents appears now to be a fundamental necessity for our understanding of the creativity of the mind. Within the picture of a SCQS, our dreams, imagination and concepts are objects generated by such a creative process, and within a space coming out also from that process.

Since there is no other example of SCQS than minds at this point we shall look at what minds experience from our own introspection. For an introduction to the concepts see [8], Parts II-6 and III-12. A SCQS would experience objects such as **feelings** (needs, colors, etc.) collectively called **qualia** in Cognitive Science. Schroedinger addressed this subject in [9], Chap. 6. These would be **objects** (real) built out of (**created from**) elements within the SCQS spacetime through its uncountably infinite (extended) computational process.[3]

Such objects would be **real, as quantum states in the memory banks of the SCQS**, because the SCQS internal evolution is a fundamentally **creative process**: Instead of the **contiguous** arrangements of classical systems, which cannot create anything except large scale patterns, the objects existing in the SCQS spacetime would have new features not part of the computation original data (i.e. the outside world input). Classical computation can provide large scale patterns, but with overall features that only a mind can discern as a pattern, and make sense from it as a whole - see for example [10]. These patterns cannot be recognized as such by the classical computation, only the human observer, who sees the result, sees the patterns and thus creates them. Artificial Life experiments depend on the human observer to make sense of the “emergences.” Emergences originate ultimately all from the quantum, starting with “simple” chemical reactions, which are localized emergences of quantum phenomena.

The process by the SCQS resulting in new features would be like passing at the continuum limit from a series to an integration process, where, for example, the volume obtained is an entirely new feature of the set of elements used in the uncountably infinite process.

Even though the computation is finite, it runs through quantum **states** of electrons and photons, which are themselves uncountably infinite in number. Then such a computation is in fact an uncountably infinite process. This is a concept fundamentally foreign to the present base of Computer Science since this base originated in classical mechanics, using separated things such as numbers. In other words, the **decoherence** process separating and distinguishing things **within the composite quantum system making up the classical world** renders it discrete, if not finite, but this is not how reality in general appears to be built.[3]

We describe in a subsequent section something that can be personally experienced to demonstrate this fundamental creativity of the quantum within us: the superposition effects we experience in **stereovision**. Such phenomena are created through the evolution of the mind’s physical support (electrons/photons), the SCQS own kind of **particles, trajectories** as well as extended (space-wise) objects that could be seen as the **condensed matter** of that world, i.e. the patterns in the memory of the SCQS.

These extended objects have multiple features and patterns (including a **feel**, which is also a created object) that the SCQS can experience and recognize (1) by recording its own evolution as part of the external reality, and (2) through the structured relations built across the subsystems making up the composite system. Such relations are modifiable by the computation, thus potentially realize not only a self-constructing computer as Turing and von Neumann envisioned, [11] but also a **self-modifying one according to the needs of the computation**.

### **An isolated world**

Such objects would exist through the evolution of the SCQS physical support, but, unlike the spaces and quanta of external reality, they would not be separated within the SCQS space through a localization process (“wave function collapse”), and thus would remain as non-local data in its memory. In contrast, the external reality connects undistinguishable units to create separate, distinguishable things extended in both its space and time through the creation of classical features from the quantum via **localizations** that happen thanks to the **localized quanta** existing in that reality called atomic nuclei.[3]

The localized quanta of the SCQS are the states of its electrons in the molecular structures effecting its memory, as well as certain states of its computation that would effect a **dynamic memory**. As in the case of the elements of nuclei, the quarks and gluons, being forever part of nucleon spaces, these phenomena would never be able to be observed by themselves in our classical reality, **being also in an entirely different space**. Unlike quarks however, which can be localized through e-m interaction from the contents of the outside space, these localized quanta in SCQSs could not even interact with the electron and photon parts of external reality since the SCQS space has no common evolution with that reality except its input/output states. Only the SCQS itself is able to experience them within its quantum environment.

For a mind, nervous impulses would only give a stochastic rendition of quanta exchanges occurring at the biomolecular memory level, not the internal computational world of the mind in any way. The evolution of a SCQS in general would be able to affect the external reality by the computation selecting which, among its internal realities, is to act on its input/output memory. In the case of a mind, unobservable photon pulses in leptonic space produce classical ion impulses that act on the classical world.[1] Conversely, external reality would affect the subsequent evolution of the SCQS through changing parts of its memory. This is a modern answer to the old conundrum of Descartes about the relation between mind and matter, or the duality subject-object. ([12], p. 339)

But how can these internal objects be experienced if they are all part of the same system that experiences it? Isn't there a need for some kind of **information transfer** between the various parts of this system for such experiences to occur? This key question will be answered below. Questions like these raise the subject of **SCQS internal features**, which can of course vary according to the complexity of the composite system arrangement. At this point, we can obtain only a very cursory knowledge of such features through **Cognitive Science**. But there seems to be a few that can be identified besides the one discussed above (qualia). Future studies will have to discover the precise physical configurations effecting them in a SCQS.

### The “Being” or the sense of a whole

As a general feature, a SCQS **knows** the state of its various parts instantaneously in its space through the **observation** by a **supervisory computation** within one of its internal realities of the quasi-infinite set of its other ones, and this as an **Everett Observer** within a many-realities world,[13] not via a wave function collapse. In the case of a mind, this would have allowed the programming of a basic **sense of preservation** for that whole, a sense which otherwise could not be present.

The SCQS individual processors constantly scan the input/output memory of the system, so the knowledge is locally updated but is available globally. This **information** is similar to the **differentiated localities and directions** that are created in ordinary reality by the strong forces defining nuclei of atoms and their nucleonic spaces.

In a SCQS there is no information transfer, as **information** is the character of a differentiated set of entities, and can only be defined by the states of its various memories, and thus there is only information available to the system through its memory banks, which are themselves **individually local but non-local as a whole**. There is no conflict with the speed of light as a barrier for information transfer since **there is no such transfer** within the SCQS, it being a non-local whole system, as space itself is.

In the case of a mind, on the classical world **side** (i.e. the microtubules of neurons) appreciable time lapses are seen for a mind to be informed through its various sensory parts. But this is only due to Nature’s limited choice of means through evolution to keep the central computation updated. In that type of SCQS, the updating has to go through a chain of neurons requiring chemical (classical) connections called synapses.[1] There could be much more direct (purely quantum) physical alternatives for such a linkage.

On the other hand, the classical world could experience **contextual** choices made by a SCQS without knowing this contextual character: If a SCQS extended in space is considered, with corresponding sensory-motor parts, these choices may then be made in the **spacelike portion of the light-cone of General Relativity**, whereby the external classical observers of such a SCQS would have no clue on the **contextuality** character of such choices. (Contextual phenomena are related to EPR experiments, but emphasize even more the quantum aspect of space - see [6], Sect. 5.3 and 5.18.) The SCQS switch of internal reality in its computation, a fundamental quantum feature of space per [13], would be instantaneous across space. In biology, outside SCQSs, the common production by DNA of molecules may lead to quantum “entanglements” between them within cells and across cells through which contextual choices may be made by seemingly isolated molecules at great distances from each other.

The maintenance of a leptonic space manifold connection across large distances would be then required for a SCQS, but would not be impossible if means different from the one Nature found are used. In this respect, the two halves of the brain have such extended connections, via its **commissures**, and these cover pretty large distances to form a single mind when considering biomolecular scales and biomolecular means.

### **The “focus of attention”**

The quantum system may be able to shift its **focus of attention** on external or internal events as Dennett describes.[8] With a focus of attention, the SCQS can be called an “observer.” If the SCQS does not have this feature, the term “experience” for its observations needs to be used as then it just interfaces the outside reality and its own reality in many unfocused ways. This feature is not in the definition of SCQSs given earlier - it is an addition from the generic design above corresponding to a physical layout of the quantum system components which needs to be theoretically identified. We present below only a metaphoric clue to where the feature may come from.

It would be a computational feature that provides the ability to select a set of memories (either affected by the external world, the internal world, or both) in the space of the SCQS through an **overall evolutionary state** of the system modified by **all** the inputs from its memory. It cannot be a Darwinian search as Dennett proposes in light of the size of the memory banks involved. In a quantum perspective, a much simpler and quicker method is available, more like, as Feynman would have put out, a change of drumbeat as a result of a computation of the change in drum membrane vibration frequency and mode from the amount of tightening of the screws around the drum (corresponding to the total qualia experienced by the system).

### **The “Self”**

The quantum system may experience its own **self** and the state of its sub-systems by exchanges between undistinguishable parts of the computation, and thus creating the Self through an **infinitely recursive process** since involving power of monadic space sets,. (As for the focus of attention, the Self is not part of the original SCQS definition.) Such a phenomenon may use a **quantum superposition effect** when the self observes (in the Everett sense) and recognizes sub-quantum systems, very much as stereoscopic vision appears to be a quantum superposition effect creating the depth **sensation** through creating a recognizable subspace within leptonic space (with an elated sensation upon the recognition).

The fact that stereovision may not be a mere pre-existing mapping of reality but a continuous creation of a subspace out of the recognition of its content, in the way external reality creates its own space, is supported by the **conscious**

**experience** obtained through staring at single 2D images constructed in a special manner. Bela Julesz's 1971 experiments on 3-D perceived 2-D computerized images are reported in [14], p. 117-119 - for vivid color examples, see [15].

Here it must be said that we certainly are not creating ordinary space, as followers of the philosopher Kant believe; **the contents of that space do, independently of us and our minds.**[3]

In the case of minds, schizophrenia, and other mental disorders such as split personalities, point to the physical splitting of leptonic space, and may then point to the origin of the phenomenon of **Self** creation by identifying how the reflection effect above can break down. Exchanges of quanta between undistinguishable entities would still effect unseparable wholes, but then such wholes could only be connected **via the external classical single reality**, through separate SCQSs biomolecular memories developed for that purpose, and thus would be distinguishable (through perceived **internal voices**). If no physical connection between the various selves is effected, the result would be seen externally as **split personalities**, a behavior occurring unbeknownst to the mind developing it, with switches done entirely as the result of a change of focus of attention between selves taking over the system. (Here it is worth remembering that this computer can modify itself for the needs of the computation - certain mental states are then prone to physically develop spurious connections, in a sense "driving someone insane.")

### **Subjective time**

As part of the construction of the Self, a SCQS needs to evolve another **overall computation** in one of its realities **observing** the other computations that occur within different realities. This specific ongoing overall computation leads the SCQS then to the "experience" of a **subjective time** from its output, taking as input the **amount of processing** done by the rest of the system. The time in the SCQS space would then only be loosely coordinated with streams of changes in the outside (reference) reality, and this only through the biomolecular systems effecting the memory-mapped input/output quantum states connecting it to that reality. Dream time would not be connected at all.[16]

Saniga has developed a mathematical model of the mind's constructed time,[17] and identified in particular that, for their internal time perception,[18] minds appear to be using oscillator phase locking in a discrete algebraic way related to Shor's quantum computation model of prime number factorization (see second half of this article). Since prime numbers and primitive roots of algebraic equations require exponential classical computer time to compute, our intuitive sense of them is an indication of the quantum basis of minds.

## Conclusion

Both SCQS and the outside reality are quantum, i.e. non-local, entities. A mind, as a SCQS, is thus able to meet the universe in a much more intimate way than we can guess from our separated view of reality, a view itself created by the computation our minds perform in order to handle local events. We indeed perceive reality as classical, i.e. with local things making up a "landscape" with separated elements. This landscape is misleading, as space is a whole.

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