

Neuronal Time Crystals: Shared Intelligence as an Everettian Phone

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Abstract

Commensurate with our work on dark consciousness, we present a small extension of our previous formalism to model the mixed frequency states as time crystals. We then posit shared intelligence as an Everettian phone, which is a looking-glass periodicity in time.

The Curiosity of Temporal Periodicity

A time crystal [5] is, informally, a quantum system of particles that is, curiously, periodic in time. “They represent spontaneous emergence of a clock within a time-invariant dynamical system” [5]. This time periodicity is achieved when a time translational symmetry is spontaneously broken. In a canonical crystal, atoms are arranged in some form of a lattice, so that the crystal exhibits spatial periodicity upon the spontaneous breaking of translational symmetry. Thus, a time crystal is a quantum system that self-organizes in temporal periodicity. Moreover, this temporal periodicity is extraordinarily novel. Even more peculiar is the fact that the particles in a time crystal continue oscillating even in their lowest energy level, and are thus never at rest in their ground state. In a canonical crystal, when the atoms are in their lowest energy level they cease moving by definition. Thus, the

motion of a time crystal is a crypto-equilibrium “motion without energy” [5], as it can continuously cycle between states while simultaneously not requiring or exhausting fuel. It is, simply put, an incredible new phase of non-equilibrium matter.

What allows the time crystal to remain non-chaotic, and perpetually cycling, in apparent violation of entropy, is that all change to the system is localized via a quantum mechanical property called *many-object localization* [2]. That is, forces which affect one particle are confined to solely that particle and do not spread globally to the other particles in the system. Thus, time crystals, while extraordinarily novel, are also extraordinarily delicate. Being quantum systems subject to Bohr’s Complementarity Principle, they can sustain their oscillations in perpetuity only when they do not interact with their environment. In Copenhagen terms, their temporal symmetry will break upon the collapse of the wave function.

One important application of time crystals is linking them together to form a quantum computer, wherein each time crystal is constructed as a qbit [2] and the time crystals can support quantum logic operations.

We wish to posit two further applications of time crystals. First, we claim that we can model the mixed-frequency neuronal states in what we’ve coined dark consciousness [4] as time crystals. Second, we postulate shared intelligence as a looking-glass periodicity in time, which is an Everettian phone [1].

Mixed-Frequency Neuronal Clusters as Time Crystals

We recently investigated the idea of sleep as the protostate, with waking state as exaptation, and offered three sheaf-theoretic mathematical models of the mixed frequency states of N3 and conscious activity in what we have called *dark consciousness*¹ [4]. We noted that sleep appeared to be a local phenomena, and the once canonical line between

¹ We formally define dark consciousness as the state of being conscious while simultaneously being in N3 deep sleep [4].

NREM and REM sleep states is much less definitive. We now extend our model to include the property of *many-object localization* as a mechanism for the locality of sleep given sleep as the protostate. If the brain-wave geometries particular to deep sleep states maintain a non-diffeomorphic distinction from the geometries of waking state activity, then our idea may have true merit. If these geometries are not invariant and spread by some waking contagion, however, then we cannot reliably look to many-object localization for support.

We proceed with the former and claim that it is precisely these non-diffeomorphic bursts in temporal periodicity that give rise to any semblance of brain pattern. Specifically, bursts of fronto-central/occipital-temporal sawtooth waves that synchronize in temporal periodicity give rise to states characteristic of sleep [4]; *sleep as time crystal*. Regularizing these bursts gives rise to sustained sleep, as per the nature of Archimedean waves. We can further contend that the very idea of sleep is due to the *spontaneous emergence of a clock* within the mixed frequency states. Then dark consciousness itself could be the *spontaneous emergence of a clock* within the paradox of infinite identity.

We now draw a further comparison between the unsynchronized activity characteristic of REM dreams and the spontaneous emergence of a clock, as waking exaptation. We know that one sleep cycle consists of moving from N1 to N2 to N3, back through N2 to N1, and right before we wake up, we enter REM. However, it is known that as we cycle through the stages of sleep, we spend less time in N3 and more and more time in REM, characteristically passing through REM before waking. Using the language of time crystal, it could be stated that the waking state *is* a spontaneous periodicity in time [4]. As Deleuze [3] poignantly states,

"Alice and Through the Looking-Glass involve a category of very special things: events, pure events. When I say "Alice becomes larger," I mean that she becomes larger than she was. By the same token, however, she becomes smaller than she is now. Certainly, she is not bigger and smaller at the same time. She is larger now; she was smaller before. But it is at the

same moment that one becomes larger than one was and smaller than one becomes. This is the simultaneity of a becoming whose characteristic is to elude the present “ [3].

We thus read this *simultaneity of a becoming* as the emergence of temporal periodicity. The same moment that *one becomes larger than one was and smaller than one becomes* is the moment of the time crystal, that of periodicity in time.

Our use of the word dark denoted a two-fold hybrid: the simultaneity of infinite identity, and of a becoming that eludes the present [4]. We aver that we can read Deleuze’s paradox of infinite identity as a temporal periodicity in the time that *must be grasped twice*.

“Thus time must be grasped twice, in two complementary though mutually exclusive fashions. First, it must be grasped entirely as the living present in bodies which act and are acted upon. Second, it must be grasped entirely as an entity infinitely divisible into past and future, and into the incorporeal effects which result from bodies, their actions and their passions. Only the present exists in time and gathers together or absorbs the past and future. But only the past and future inhere in time and divide each present infinitely. These are not three successive dimensions, but two simultaneous readings of time” [3].

When Deleuze says *it is at the same moment*, the time of this simultaneity is the temporal periodicity of a time crystal. Thus, we read Deleuze’s *time must be grasped twice* as once at the molar level on the order of identity, and twice at the *quantum haecceity* level of incorporeal divisibility. These are not the same time, but it is the temporal periodicity which gives the *same time*.

Shared Intelligence as an Everettian Phone

Wilczek states that “time translation symmetry underlies the reproducibility of experience” [5]. We wish to examine this idea of *reproducibility of experience* from the lens of shared intelligence, with a very strong statement: *reproducibility of experience as shared*

intelligence. Two questions immediately arise: *What makes experience reproducible in the face of the no-go no-cloning theorem of quantum mechanics? What would experience look like if experience were not reproducible?* In light of formally answering these questions (extraordinarily difficult!), we can at least try to hold onto them as they move swiftly like wild balloons, and attempt a grounding-clairvoyance by way of the formalism of exchange.

The heart of shared intelligence in the Active Inference formalism centers around the meaningful exchange of messages between self-organizing entities and themselves, other entities, and/or their environments. Without getting into the proper mess of what a thought is or how to define a thought which leads to a notion of belief, we aver that the essence of message exchange is identity. Thus, if the essence of shared intelligence is to make experience reproducible, therein identity would provide the reproducibility of experience. We now go further and claim that where there is identity there has occurred *a spontaneous emergence of a clock within a time-invariant dynamical system*; that is, message exchange is impossible without a breaking in time translation. We are informally saying that active inference actively encodes breaks in time-translational symmetry. To state it formally would require a very robust definition of a time crystal using entanglement entropy, which we will do forthcoming.

That is all fine and swell, but what happens when identity becomes fractal? Recall, we spoke of dark reflexivity [4] taking the form of a fractal identity, wherein the reflexivity loop from *I to me* is a fractal, where dark consciousness operates in a p-adic time characteristic of no linear ordering. When identity itself is fractal, what becomes of the message exchange? What becomes of entanglement entropy? We claim that shared intelligence with a fractal identity would be a periodicity in time that is Everettian, resembling an Everettian phone² [1]. Such a radical paradigmatic-extension in shared intelligence would be a superior form of distributed quantum cognition, and we could formulate an entanglement entropy commensurate with such an Everettian phone. So be it.

² In an Everett phone, we can send signals between the other branches of wave functions [1].

In closing, we examine what it means for shared intelligence to continually cycle; that there is no notion of kinetic energy commensurate with shared intelligence. To be dynamic in its ground state, is to never cease; to never rest. *For whom could ever rest in an Everettian phone?* Profound are the ramifications to shared intelligence of this type of motion in the ground state. For now, we see it as a sparkling optimism, eternal in that sparkle, that shared intelligence itself will temporalize continually in the absence of energetic manipulation.

And that is about as positive as futurecasting can get.

For now;

the now of a time crystal.

References

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