THE CONSERVATION OF PRESENCE

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ABSTRACT. The central puzzle of time is passage in the context of presence. No matter how many moments sequentially participate in presence or "the now," none carries it with them into history. Somehow, time remains current even as it passes. Like a river continually recharged from a lake, time has two aspects, one spending what the other saves. I call this principle “the conservation of presence”, and it provides a means of reconciling the classical world to the quantum reality.

KEYWORDS: time, wave function, superposition, de-coherence, relativity of simultaneity

Introduction

Based on experience, we infer that present moments recede into past moments. No matter how many moments pass, however, presence is undiminished. By analogy, energetic transactions fail to reduce how much energy exists. For temporal presence to be conserved, it cannot inhere to distinct moments, as a piece of presence would be carted off with the passing of each moment, reducing the total supply until none remained and time came to an end. Since time does not end, we can assume that each moment contains no presence of its own but merely expresses underlying ongoing presence.

What defines a distinct moment is that it breaks from the ongoing presence that precedes it. To crystallize into a complete moment is therefore to cease to be present. What we consider the present moment is precisely what has *just now* been ejected from presence. To complete a moment is to unplug it, so to speak, from the temporal current. In order for the possible to become definite, the moment must be set off from the flow and abandoned to the oblivion we call the past. The price of becoming tangible is immediate extinction. The price of ongoing presence, on the other hand, is never settling on a particular way of being.

Like a living system dissipating entropy, time is ongoing presence spitting out expired moments. Inspite of being fundamentally a state of continuous presence, time is also a sequence of discontinuous moments. Time can flow both continuously and in pieces, because each piece has no reality except as far as it (momentarily) expresses ongoing presence.

Given the complementary aspects of time implicit in the conservation of presence, we should expect ambiguity in extremely small timeframes – that is, in the domain of continuous presence – and definitude in much larger timeframes. This is indeed what we find.

Time and the Quantum

At the smallest known spatial and temporal scales, matter seems to be ambiguous.

Properties like position, mass and velocity resolve into precise values only with the intrusion of the local environment, most famously in the form of human measurement. Odder still, despite giving rise to quantum field theory and the standard model of particles and forces, quantum mechanics contains no hint of the world of the senses. The classical level is assumed only from an observer perspective. If the quantum is primary, how does the classical emerge from it?

An electron's orbit is 10^{-15} seconds, which is a roundabout way of saying that an atom does not exist as such in a timeframe smaller than 10^{-15} seconds (Nichol 2003, 34). Within less than this timeframe, an atom is a collection of subatomic particles. Inhabiting the realm of the spatial-temporal infinitesimal, these particles are inherently imprecise in their properties. If we examine through measurement searching for a property, for instance the momentum or spin of an electron, we find a definite value. This in no way implies, however, that the particle had this value prior to our measurement. We might think of it as a particle with definite values, but the electron itself is inherently vague or "uncertain," more like a wave than a particle.

Unmeasured quantum systems are described by the Schrödinger equation, the solution to which for any given system is the wave function. The continuity of the wave function from one state to the next represents the continuous evolution of that system. Instead of occupying successive defined states, an undisturbed quantum system segues from one superposition of possible states to the next. Because the Schrödinger equation does not specify any break in the unfolding of superpositions, in order to determine a definite value, researchers must intervene in the system by way of measurement, thereby "collapsing" the wave function in defiance of the Schrödinger equation.

In the absence of human measurements, how does a quantum system shed its superposition to arrive at a definite set of properties? According to the model for decoherence, not only human interaction in the form of measurement but any environmental intrusion resolves superpositions of values into something resembling familiar "classical" existence. Zurek (2002, 14) has calculated that a mass of one gram has so many potential local interactions that it ought to decohere every 10^{-23} seconds, with or without measurement. Given the vast number of potential interactions in an organism, Schrödinger's cat would decohere at least as rapidly. By contrast, an isolated electron should retain its quantum coherence for at least a billion years (Bohm and Hiley 1993, 329).

Implicit in the decoherence model is the key role of time in the transition from wave to particle. Just as the ambiguity of superposition and the precision of measured values constitute complementary pictures of matter, ongoing presence and discrete moments are complementary pictures of time. Matter decoheres because the flow of presence is periodically rounded out, in the context of local interaction, into completed moments. The Schrödinger equation makes no allowance for wave function collapse because it concerns only one aspect of time, the continuous present of wave evolution, and leaves out the discontinuity of instantiation.

The undisturbed quantum system retains coherence -- meaning not only superposition but also a nonlocal entanglement – because it occupies the fundamental time of ongoing presence. Whereas the natural state of a quantum system is the unbroken development represented by the continuously evolving wave function, environmental interaction draws the system into a completed moment. The intrusion of a large-scale measuring apparatus, which has no existence as such, except over a sequence of definite moments, cannot help but impose a definite moment onto a microphysical system, translating it from the domain of ongoing presence to that of momentary presence.

Whereas large-scale matter ordinarily has no existence as such except in a definite state over a sequence of distinct moments, microphysical systems can exist either continuously in an evolving state of superposition or, momentarily, in a definite state due to interaction with other systems (such as measuring devices).

The underlying meaning of decoherence is that the interaction of the local environment with a quantum system draws that system from its default state of ongoing presence, as described by the continuously evolving wave function, into a completed moment. Since time evidently does not stop, as soon as a complete moment is defined, temporal flow carries on from its ground state, the always present starting point of prespace.

Proposed by Wheeler in accord with Planck length (10^{-33} cm) and Planck time (10^{-43} seconds), prespace is that which lies beyond the boundary of measurability in the small (Griffin 1986, 192). Prespace is time-zero, the eternal re-beginning. The decoupling of the quantum system from ongoing presence, signified by decoherence, causes the wave function to reset at the inner boundary of space-time as defined by Planck. Once again, electrons and other particles exist in superpositions of properties, and these possible states multiply as the wave function evolves. With sufficient duration (10^{-15} seconds) the atom comes into being as such. By a billionth of a second, a sugar molecule exists not just as a collection of particles but also *as a sugar molecule* (Zeh 2010, 106). The emergence of scale, however, triggers another decoherence and the capping off of the moment, which therefore ceases to be *the* moment but only *a* moment, specifically the most recent past moment -- past insofar as it no longer participates in ongoing presence.

"Quantum" is Latin for "how many," implying that quantum properties exist in discrete units that can be counted. Though quantum mechanics got its name from the fact that measurements of electron orbitals yield discrete values, these values are products of the measurements themselves and are not inherent to the microphysical systems.

Though the wave function applies at all scales, including the cosmic, its effect is ordinarily negligible beyond a certain spatial-temporal limit. That limit, known as the classical limit, is simply a complete moment. A water molecule lies beyond the classical limit, because it does not exist as such in durations shorter than a complete moment. An electron lies within the classical limit, because it occupies such a miniscule spatial-temporal expanse that its identity as an electron does not require a complete moment. Via environmental interaction it can be drawn into a complete moment and thus take on determinate properties, but after sufficient interval it resumes its natural course in the domain of ongoing presence.

Just as classical physics approximates relativity and quantum theory, each distinct moment approximates ongoing presence. Probability waves and definite particles are complementary aspects of matter because continuous presence and discrete moments are complementary aspects of time.

The first prediction of the conservation of presence – ambiguity in the small and definitude in the large – is modified by a second prediction: because classical time is an approximate expression of quantum time, the boundary between the quantum and the classical cannot be fixed, whether spatially or temporally. Again, this is exactly what we find. Contrary to Heisenberg's famous "cut," quantum effects can be scaled up well beyond the atom. By preventing environmental interaction, researchers have demonstrated superposition in large molecules and among trillions of atoms. Moreover, very cold temperature, as in Bose-Einstein condensates, extends the usual timeframe of quantum coherence, demonstrating that ongoing presence need not yield at regular intervals to completed moments (Vedral 2015, 102).

Time and Relativity

Standing in the way of a time-based resolution of the quantum dilemma is the general unwillingness among theoretical physics to acknowledge the reality of time. The denial of intrinsic time is a radical claim, and a radical claim requires a decisive argument. Yet the linchpin of that argument, Einstein's principle of the relativity of simultaneity -- which ostensibly eliminates a universal present moment and therefore the orderly passage of time – is wholly unconvincing.

Einstein's 1905 paper on relativity begins with an examination of electricity and magnetism (1923, 37). Disputing the prevailing wisdom that the cause of an electric current depends on whether the conductor or the magnet is in motion, Einstein observed that the motion of each is relative to that of the other. If no frame of reference is privileged above all others, we must choose a frame from which to observe the current. To attribute the current to a magnetic field is simply to say that our frame of reference is the conductor. To attribute the current to an electric field is to specify our frame as the magnet. In reality, whichever frame we choose, the current is caused by an *electromagnetic* field.

So far so good. However, the equality of all frames of reference with respect to physical law – including the law of the transmission of light – in no way implies the equality of frames when it comes to the timing of events. If we wish to measure the timing of the electric current, its location in the conductor privileges the conductor frame over the magnet frame. The absence of a universally preferred frame or "ether" has no bearing on the fact that a particular set of events privileges a particular frame in the measurement of the timing of those events. Instead of equally valid frames occupying different moments, the valid conductor frame and the invalid magnet frame share the same moment.

Nor does the proven phenomenon of time dilation verify the relativity of simultaneity. Quite the contrary, a high-speed frame of reference remains present to a low-speed frame even as the high-speed frame undergoes reduced rate of decay (Bailey, et al, 1977, 301-05). Einstein provides no basis for doubting the nature of time as the orderly passage of distinct moments, each of which expresses ongoing universal presence.

Unlike the fundamental time of ongoing presence, which cannot be compared to anything outside itself, the subsidiary flow of classical time is subject to measurement. Yet its very measurability exposes it to mismeasure, since the act of timing events in a reference frame other than the proper frame of the events themselves generates the illusion that the present differs across frames.

Despite the likelihood that they occupy different frames of reference, distantly entangled particles express a single wave function and therefore share a present moment when that wave function resets due to environmental interaction in one location or the other. Like a quantum system, time is fundamentally nonlocal. The present does not exist across the universe; the universe exists in the present. In whatever quantum system a moment rounds off, that moment is the immediate wake of ongoing universal presence.

Conclusion

Key to the quantum transition is the role of time. Superposition is intrinsic to the wave function because perpetual potential is implicit in ongoing presence. The longer the duration of the undisturbed quantum present, the wider the field of potential events when large-scale interaction triggers the rounding out of the moment.

The series of moments sequentially ejected from ongoing presence is subsidiary to fundamental time. Without ever passing, presence nonetheless gives rise to the passage of distinct moments we know as time. Whereas the rate of fundamental time is absolute and immeasurable, the rate of subsidiary time varies relativistic. Space-time is the "marriage" of space with subsidiary time. Fundamentally, time is untouched by relativity.

Time is defined by the tension between distinct moments and the self-propagating *current* that lends each one a fleeting approximation of presence. A moment is a temporal transaction. For ongoing presence to crystallize into definite existence, a price must be paid. That price is instantaneous posterity. To define a particular portion of duration is to segment it from the flow, subjecting it to replacement by subsequent particularized duration. No conceivable number of such transactions can subtract from the totality of temporal presence.

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