A Note on Psychoanalysis and Quantum Physics

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Abstract - We explore, in an exploratory spirit, several correspondences between quantum properties and the characteristics of the unconscious.

Recent quantum theories of the emergence of consciousness hold a non-negligible interest for psychoanalysis[1]. Let us recall that we still do not know how the process of consciousness emerges from neuronal matter. Is this an emergence achieved by crossing a critical threshold — a stratum of catastrophic bifurcation situated between physiological dynamics and mental dynamics ? How can the continuous feeling of consciousness arise from discontinuous neuronal dynamics ? Or is René Thom right in holding that the continuous comes first, and that neuronal dynamics are merely regulatory catastrophes secondary to a primary, continuous vital dynamic ? But if so, how are we then to explain the apparent continuity of conscious feeling ? It is not even certain that the question of consciousness has been properly framed in the first place, and our mental models — themselves products of our own conscious activity — struggle under the weight of the question and risk becoming trapped in the dead ends of self-reference.

Quantum theories of consciousness offer an interesting alternative. It is known that the release of neurotransmitters at the level of the synapse is governed by the action of calcium ions of nanometer scale, which pass through channels of similar dimensions. At this order of magnitude, the phenomena that occur are quantum in nature. Quantum mechanics proposes to treat physical quantities in an entirely novel way, by introducing the idea of a quantization of values (discontinuous "packets" of values) within domains ordinarily described as involving continuous quantities[2]. In quantum physics, the notion of an object disappears in favor of an operator within a complex vector space (Hilbert space). In quantum theory, a dynamical system is represented, within a space of possible states, by a state vector — termed the wave function by Schrödinger in 1927. Unlike classical mechanics, the state vector does not assign a precise value to physical quantities such as position and velocity. The vector indicates (1) the probability that, at a given instant, a position measurement will localize the state of the system within this or that region of space, and (2) the measurement of momentum, from which velocity can be inferred. The probabilistic character of these predictions is not a removable defect awaiting a better understanding of the underlying realities — it is intrinsic to them. This element of randomness cannot be reduced below a certain threshold. The more precisely a given quantity — say, position — is known, the less precisely its conjugate quantity — in this case, momentum — can be known (Heisenberg's uncertainty principle). Heisenberg's uncertainty relations are thus a defining feature of objective knowledge itself[3]. In the absence of a measurement assigning the particle a precise position, the particle does not behave as though it were here or there, but as though it were distributed across space according to the probabilities carried by the state vector. This uncertainty is not due to our limited means of accessing reality, but to reality itself, which does not conform to the classical concepts we use to describe it. And since we cannot cognitively apprehend reality without these very concepts, quantum physics is, by its nature, incomprehensible[4].

Unlike the principles of classical physics, quantum operators do not possess the property of distributivity, owing to the incompatibility of descriptive perspectives[5]. This results in a highly counterintuitive property, according to which the existence of a phenomenon is not governed by a classical two-valued logic (true or false), but by a three-valued logic (true, false, and indeterminate). A second property is quantum entanglement — a phenomenon observed in quantum mechanics in which the quantum state of two objects must be described globally, without being able to separate one object from the other, even though they may be spatially separated. These quantum models have attempted to explain the emergence of objects through quantum entanglement, without any contiguous link to an underlying substrate, and have been applied to modeling the emergence of consciousness[6]. An object emergent from a quantum system differs from the sum of its partial objects, since it does not possess determinate properties in its own right. Wholly counterintuitive, these models nonetheless appear promising for explaining phenomena of emergence that are indifferent to the constraints of locality — a phenomenon emerges at a distance from its substrate, without macroscopic contiguity with it — and indifferent to the constraints of time : a phenomenon may appear prior to its apparent physical cause! Quantum models thus deconstruct the relations between time and space, dealing a violent blow to our preconceptions regarding the spatiotemporal stability of reality.

If we project these quantum properties onto the scale of a mental self, we obtain some striking parallels :

— There would exist, within the self, a superposition of mental states — coexisting despite their opposing valences, indestructible, unaltered by time — properties strikingly reminiscent of those of the Freudian unconscious.

— There would exist an interference between locally distant objects — a proposition unacceptable within the framework of a naïve physics, yet one that is nonetheless consonant with the mental phenomena of inter-psychic communication.

— The quantum property of entanglement between objects bears a curious resemblance to the phenomena of objectal fusion and projective duplication.

— Quantum entanglement might also allow for a new understanding of the entangled relations between the life drive and the death drive — and thus between the evolution and involution of complexity — relations that have themselves been likened to a form of chiasmus[7]

— The spontaneous oscillation between attractors, without the imposition of any external force upon the system, might explain the periodicities observable in psychopathology.

— Finally, the most interesting quantum property of all is that of *decoherence*, which brings about the selection of one state rather than another. It is tempting to see in consciousness — which functions permanently as a selective agent (William James) — the expression of a phenomenon of decoherence. If so, one of the functions of the self, that of achieving coherence through intentionality, would itself depend upon a decoherence occurring at another level!

Although an unbridgeable gap remains, at present, between the scale of psychic phenomena and that of quantum processes, the idea that consciousness arises from a phenomenon of decoherence among superposed mental states within the self may well open striking new perspectives for approaching the relation between the unconscious and consciousness.

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Notes

[1] : Cf. Asano, M., Khrennikov, A., et al. *Quantum Adaptivity in Biology : From Genetics to Cognition*. Springer, 2015.

[2] : Schrödinger, E. *Physique quantique et représentation du monde*, 1954, Seuil, 1992.

[3] : Rey, O. *Itinéraire de l'égarement : Du rôle de la science dans l'absurdité contemporaine*. Seuil, 2003.

[4] : "I think I can safely say that nobody understands quantum mechanics." Feynman, R. *The Character of Physical Law*. Cambridge, MA : MIT Press, 1965, p. 129.

[5] : Cf. Parrochia, D. *La forme des crises*, 2008, p. 298.

[6] : Cf. Eccles, J., 1989 ; and Asano, M., 2015.

[7] : Laplanche, J. *Vie et mort en psychanalyse*. Flammarion, 1970.

Translator's note : This is a scientific English translation of the French original by Benoît Virole. The Feynman quotation, originally given in English translation within the French text, has been restored to Feynman's own original English wording rather than back-translated. Quantum-mechanical terminology (state vector, wave function, Hilbert space, entanglement, decoherence, Heisenberg's uncertainty principle) follows standard English usage in physics ; psychoanalytic vocabulary (the unconscious, objectal fusion, projective duplication, the life and death drives) follows established English usage in the field.