Opinion and Perspectives

Quantum Physics and the Dream Metaphor Part II

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Abstract

The discussion of quantum physics and the metabrain dream paradigm is continued. The consequences of this paradigm is compared with quantum statistics, decoherence, the Schrödinger equation and the anthropic principle.

Key Words: quantum, entanglement, decoherence, statistics, consciousness

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Introduction and Review of Part I

In our previous article we noted that physical events produce mental experience and that quantum physics and the evolution of emotions, as well as other arguments, show that mental events produce physical effects. From this we argued for the unification of the mental and physical worlds and hence for the dream metaphor and the fundamental nature of the stream of consciousness without a corresponding outside world. The non-local hidden variables which determine the manner of "collapse" of the quantum wave function are part of a "meta-brain", outside the observed four dimensional space-time continua, a metabrain which produces the streams of consciousness of all conscious beings.

Just as Siamese twins or multiplets joined at the brain may share many but not all aspects of their streams of consciousness so various sections of the metabrain may have individual streams of consciousness which share some common aspects of experience which appear as an independently existing external world (Figure 1).

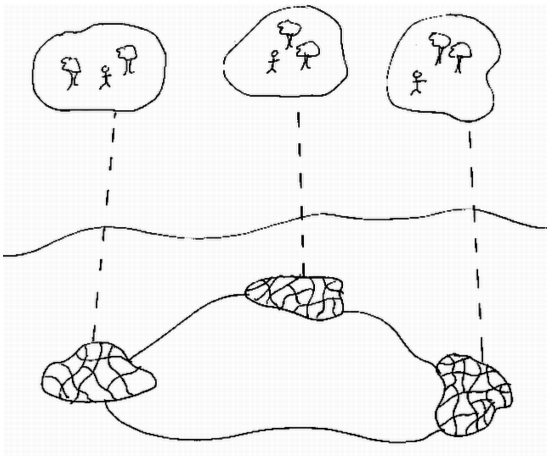

Figure 1. Many sub-brains in the "meta-brain" are connected to guarantee that the streams of consciousness ("dreams") produced by the sub-brains are correlated to each other.

Also derived from this model were some aspects of quantum physics (non-commutation of observables and disturbance of systems by observation, even without apparent physical interaction).

Using a space-time diagram of the Einstein-Podolsky-Rosen (Schumann, 2007) situation it was shown (Schumann, 2007; 2000; 1991) that the waves function and its reduction (or "collapse") is subjective. In one region of space-time it has not been reduced according to one observer but in the same space-time region it has been reduced according to another observer. This subjective

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nature of the wave function is consistent with the conventional interpretation of probability. If a deck of cards is shuffled you can only know the probability that the top card is, say, the ten of diamonds. But someone who has peeked at the card knows for sure what it is. For that person the probability has "collapsed" or the probability amplitude or wave function has "collapsed". For you it has not. The "collapse" has nothing to do with the size of the observed system and gravity plays no special role, in sharp contrast to the "objective reduction" view. Each wave function is just related to the probability, relative to each consciousness, of the unfolding of that stream of consciousness.

There is no problem with Schrödinger's cat (Schrödinger, 1935). The "dream" or stream of consciousness of the non-observing scientist does not include the cat and he can describe it as a superposition of alive and dead for purposes of prediction. For the observing scientist or for the cat itself the wave function has collapsed.

There is also no problem with the location of a von Neumann cut. There is no separation between observer and observed; there is just a stream of consciousness which includes sensations of one's body and thoughts as well as sensations of other observed entities which superficially appear to be part of an outside world.

Our paradigm is also consistent with the phenomenon of quantum tunneling by which a particle can "travel" from point A to point B even though a wall prevents it from existing or being observed in a region between A and B. Thus the particle does not have a continuous existence when not observed.

Statistics

Quantum statistics are easier to understand in the dream model than in the assumption of an independent external world. Consider two particles, A and B, with two possible sets of characteristics, each set characterized by a "box", box 1 and box 2. The presence of a particle in a particular box indicates it has the corresponding set of characteristics.

First suppose that the two particles are distinguishable. There are four possibilities, generally assumed to have equal probabilities: Particle A in box 1 with particle B in box 2; both particles in box 1 with no particles in box 2; no particles in box 1 and both particles in box 2; particle B in box 1 with particle A in box 2. This is the classical Maxwell-Boltzmann statistics.

Box1	Box2	Box1	Box2	Box1	Box2	Box1	Box2
A	B	AB	0	0	AB	B	A

Figure 2. Maxwell-Boltzmann Statistics

Next consider the case in which the particles are indistinguishable. Each particle is labeled A.

According to classical thinking it should not matter that one cannot distinguish one particle from the other. One can still talk about the first particle "really" being in box 1 and the second particle "really" being in box 2 and the reverse situation as being distinct. However in our model, it is the experience or "dream" which is the fundamental reality. Thus there is only one (experiential) situation with one particle in each box. Thus quantum statistics becomes more intuitive. Shown below are the situations for Bose-Einstein statistics and for Fermi-Dirac statistics (in which case the Pauli principle forbids more than one particle in each box).

Box1	Box2	Box1	Box2	Box1	Box2
A	A	AA	0	0	AA

Figure 3. Bose-Einstein Statistics

Box1	Box2
A	A

Figure 4. Fermi-Dirac Statistics

We see with our model that it is quite reasonable that if two particles are distinguishable they should obey different statistics than if they are indistinguishable.

If the characteristics of one particle could continuously approach the characteristics of the other particle there would be a discontinuity in statistical behavior when the particles become indistinguishable. They would suddenly switch from Maxwell-Boltzmann statistics to either Bose-Einstein or Fermi-Dirac statistics. That presents a paradox. Perhaps that is a reason why particle characteristics are quantized, so that cannot happen. Initially distinguishable particles, with different masses, charges or spins cannot continuously change their properties to approach indistinguishability.

Decoherence, Density Matrix, Wave Function

According to the theory of decoherence, the wave function of an originally isolated particle gets entangled with the many particles in its environment. If the original wave function was a superposition of possible measurements, after the complex entanglement if one calculates the density matrix (which determines the probabilities for the various measurement outcomes) the cross terms between the various measurements possibilities cancel almost completely. Thus the density matrix is essentially the same as for a mixed state.

According to the orthodox interpretation, the situation still is entirely different from the mixed state. After the interaction with the environment one still has a superposition of states. This is entirely different from a mixed state. A mixed state has a definite set of characteristics but the observer doesn't know which characteristics "really" exist. With an entangled superposition, even though the density matrix looks like that of a mixed state, no definite set of characteristics "really" exist until a measurement takes place. Thus the entangled density matrix only mimics a mixed state.

There is no such problem with our view because similar density matrices make similar predictions as to what will be observed, not what "is". The physical state does not "really exist" outside of the observer's experience or "dream". Thus the two situations, with essentially the same density matrices, are essentially the same. Where the orthodox interpretation has two (or more) situations for one density matrix, our paradigm has one situation for one density matrix. The interpretation fits the mathematics better in our model.

We can make a similar argument for the wave function that we did for the density matrix. Different interpretations of quantum theory differ as to whether the wave function is "real" or is "merely" a mathematical means (though a strange one) to calculate probabilities. In our approach it is the same because everything we are aware of is an experience. Thus we lump together the experience of seeing a table, the experience of feeling pain, the experience of thinking about mathematics or even the experience of calculating probabilities.

Metabrain and Anthropic Principle

In our model the metabrain produces all experience but it appears that a brain or nervous system within that stream of consciousness is always associated and correlated with that consciousness and is generally assumed to be the cause of it. One can make an analogy. Quarks (analogue: metabrain) produce a gluon field (analogue: streams of consciousness) which includes gluons (analogue: observable brains) which in turn produce a gluon field (analogue: streams of consciousness).

It appears then, that one must experience a world capable of producing a brain; this greatly constrains the kind of world that can be experienced and hence, in our paradigm, it constrains the kind of world that can exist as well as the kind of "physical" laws which can exist to allow for such a world. Thus we arrive at something like an anthropic principle. A multiverse with an infinite number of "dead" universes is not necessary.

The Schrödinger Equation and the Metabrain

The Hamilonian is a function of the observable properties of the system and its observable environment. As shown by the Schrödinger equation, it determines the changes in the probability amplitude of the system and hence the probabilities for possible measurements made on the system. The hidden, unobservable, variables of the metabrain determine the collapse of the wave function and thus determine what is actually observed within the constraints of the probabilities. Thus the final result is determined partly by aspects of the stream of consciousness and partly by the subconscious part of the metabrain. One can make an analogy with a deck of cards. If one shuffles the deck and asks what is the probability that a ten of diamonds is the top card one answers one chance in 52. If one then observes someone removing some cards from the deck, seen not to be the ten of diamonds, the probability that the top card is the ten of diamonds has changed.

Consequences of EPR Diagrams

In the Einstein-Podolsky-Rosen situation as modified by Bohm, a particle of spin zero decays into two particles, each of spin 1/2 so that if one particle has z-component of spin +1/2 the other has z-component of spin -1/2 and vice versa. By measuring one particle "physically" one indirectly measures the other particle without any physical interaction because the sum of the z-components must add to zero. See Figure 5. The dashed lines represent simultaneity in differently moving reference frames. A is an observer with simultaneity (A-P) and B is an observer with simultaneity (B-P). P represents a location in space-time of the particle on the left and M represents a measurement of the z-component of spin of the particle on the right.

For observer A the particle state at P has not "collapsed" whereas for B the particle state at P has "collapsed". Thus reduction or "collapse" of the wave function of the particle at point P is observer dependent.

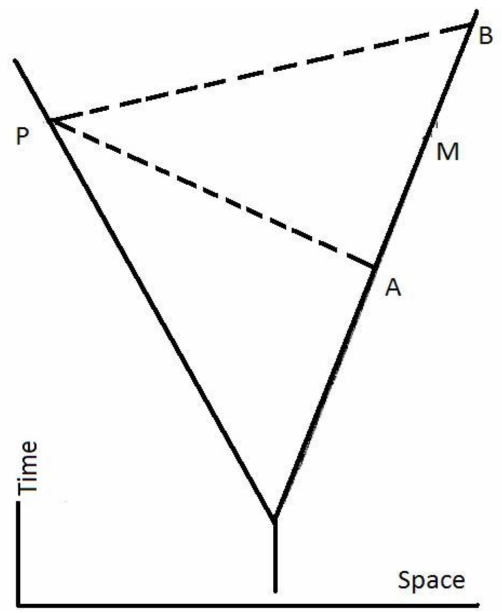

Figure 5

We may note that if one (incorrectly) assumes that collapse of the wave function produced observable effects that this would violate the principles of special relativity. If, in the B-P reference frame the measurement M produced an observable effect at P, then an observer at P would know that a measurement at M had, indeed, been carried out. Thus information would have traveled across a space-like interval, contrary to special relativity.

In Figure 6 observers (A-Q*) and (A-P*) are both near the right particle at point A but are moving at different velocities and thus have different simultaneities. Both have been informed that a measurement M* is to be made but they do not know the outcome. They are both at space-like separations from M* and they can communicate with each other.

For (A-Q*) the particle at right at point A is in a "mixed state", a "definite" but unknown state. For (A-P*) the particle at right at point A is in a superposition of states.

The difference, if any, depends on the observer. The reader may refer back to the section on decoherence.

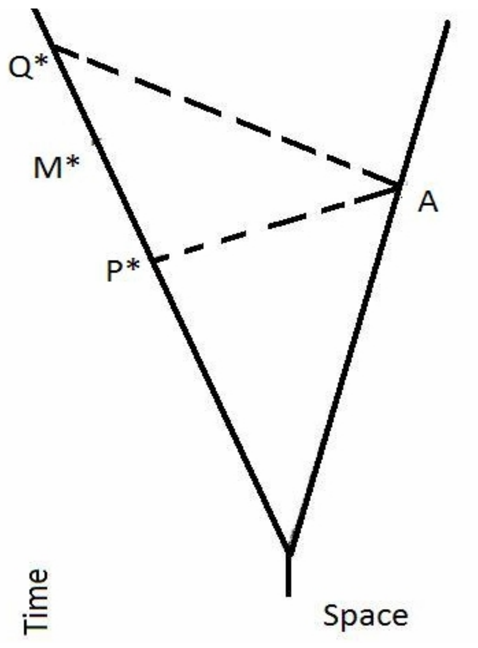

Figure 6

In Figure 7 M^*_z represents measurement of the z-component of spin of the left particle and M_X represents measurement of the x-component of the spin of the right particle. According to observer B* the particle at right at point P has a definite z-component of spin. However according to observer A, who believes in the existence of characteristics of objects prior to observation, the same particle at point P had a definite x-component of spin.

The particle at point P cannot have both definite x-component of spin and definite z-component of spin because the corresponding operators do not commute. Thus the assumption that the particle exists with definite characteristics prior to measurement or observation, independent of observer, is false. (A similar argument could be made for the particle at point P*.) Notice that we did not use any counterfactual arguments. This discussion, together with others in this article, strongly suggests the “dream” metaphor.

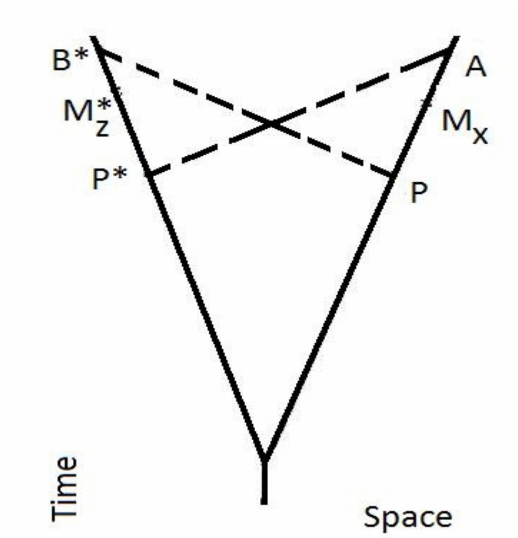

Figure 7

Conclusion

The metabrain paradigm, which describes the world we experience with aspects of a “dream”, resonates with the character of quantum physics. It also is compatible with otherwise puzzling aspects of relativity theory in which different observers may have very different experiences. One such example would be comparison of the experiences of an astronaut falling into a black hole with those of a distant outside observer watching the falling astronaut. From the point of view of the distant outside observer the astronaut never passes through the horizon of the black hole whereas for the falling astronaut this occurs in a short time. These distinct experiences are difficult to reconcile with a unique observable external world.

The metabrain is split into many parts producing many streams of consciousness in a manner similar to what occurs to the human brain when it is split, as discussed by Roger Sperry (Sperry, 1986) and others. Our knowledge of the relationship of a brain or a metabrain to experience is very primitive. Knowing the experience we do not know how to predict the properties of a brain capable of having that experience. And even if given complete “physical” knowledge of a brain and its activities we do not know how to predict what kind of experiences it could possibly have.

The language that we traditionally use to describe experience (pain, pleasure, the color blue, feelings, etc.) is very different from that which we use to describe brains (nerves, axons, ions, electric potentials, etc.). We need a Rosetta stone to fill the gap. Perhaps the incorporation of quantum phenomena in our thinking will be a step in that direction.

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