

# Quantum Theory of Placebos

“An important lesson in physic is here to be learnt, the wonderful and powerful influence of the passions of the mind upon the state and disorder of the body.”

John Haygarth, 1801

The author, John Haygarth, is the scientist who conducted in 1799 what may have been the first placebo controlled trial.

The claim being made is that a person's mind can influence---i.e., alter by its presence---the state of his body.

# The Defining Characteristics of Physical and Mental

- Physical properties are properties that are specified by assigning mathematical features to space-time points.
- Mental realities have been characterized by William James as being, in a broad sense of the word, “feelings”: A feeling is a mental reality, and a “passion of mind” is a feeling, hence a mental reality!

# The Claimed Mind-Brain Connection Cannot Be Explained Within the Conceptual Framework of Classical Physics.

- According to classical physics, the human body is fully described, for all causal purposes, in terms of physically described properties.
- According to that theory, physically described properties can be influenced *only* by other physically described properties.
- Thus mental realities cannot causally influence the body, or *anything that can influence the body*, without being, at least in part, a physically described property.
- But one cannot identify, on the basis of their disjunctive defining characteristics, mental feelings with physical properties, without going beyond the framework provided by classical physics, which excludes all mention of mental qualities.
- A deeper theory is required!

# Option 1: Deepen the Theory Without Changing the Dynamics.

- A first option is to deepen classical physics, without altering the physically described dynamics, by simply asserting that mental feelings **are** physically defined properties, in spite of the absence of any rational connection between their disparate defining characteristics, or of any support from classical physics itself, which eschews all mention of mental qualities.
- This is the “blind-fold” approach. It blinds itself to the fact that classical physics is now known to be false, and has, moreover, been replaced by a theory that deals explicitly in great detail with the connection between the mentally described and the physically described aspects of nature.

## Option 2: Accept Quantum Theory!

Physicists have discovered a deeper theory that changes the basic dynamics in very essential ways.

Classical mechanics has been replaced at the basic level by quantum mechanics, *which injects “the observer” into the dynamics a way that naturally allows an influence of mind upon body!*

A PREVALENT MISUNDERSTANDING  
ASSERTS THAT:

Even within a quantum mechanical universe, classical mechanics is sufficient for understanding the mind-brain connection because:

- 1) Mind is connected to the *macroscopic* aspects of brain, and
- 2) Classical mechanics controls all macroscopic aspects.

# The Correction!

- In both classical mechanics and quantum mechanics big things are built up out of smaller things.
- The continuous lawful evolution of the smaller things---the atoms and ions---controls the continuous lawful evolution of the bigger things that are built up out of them.
- Thus quantum mechanics does not entail that the macroscopic properties of the brain are completely controlled by classical physics.
- The underlying quantum dynamics of the ions and atoms contributes very importantly to the dynamics of *macroscopic* properties of the brain!

# The Basic Difference Between Classical Physics and Quantum Physics.

- Classical mechanics deals with physically described properties alone, completely ignoring the mental realities, whereas:
- Quantum physics deals explicitly with the connection between the physical properties of the systems being observed and the experiences of the observers.
- These experiences are a key part of science, because they contain the empirical data.
- Quantum physics was *specifically designed* to deal with the basic issue before us: the connection between the mental and physical aspects of nature!

# The Linchpin: The pointer

- In quantum mechanics the element that links the physically described observed system to the psychologically described experiences of an observer is “The Pointer”.
- The pointer is a *macroscopic* aspect of the physically described system that is being observed.
- Its disposition can be grasped by a “probing act of observation”, and experienced in the mind of the observer as an increment in knowledge!
- Thus the quantum link between mental and physical occurs at the *macroscopic* level!

# The Basic Difficulty/Opportunity!

- The *huge* basic apparent difficulty blocking the creation of rationally coherent quantum mechanics was this: The primary dynamical law, the Schroedinger equation, causes the evolving quantum state of any pointer to be almost always a combination of *many* components of the kind that we humans can experience.
- The lawfully evolving quantum state of the pointer will therefore *almost never* correspond to a *possible* human experience!

- This difficulty brings to center stage, in a way that can no longer be ignored, the problem of the relationship between the *experientially described* and the *physically described* aspects of our science-based understanding of nature!

# Exploiting the Difficulty!

- The founders of quantum mechanics came up with a brilliant, practically useful, and empirically testable solution:
- Empower the observer!
- Convert “the observer” from a causally inert witness to a causally effective agent!
- Allow the observer to choose, and perform, dynamical acts of observation!
- Each such act selects some conceivable state  $S$  of the pointer that *does* correspond to a possible experience.

# The Quantum Jumps!

- Once the observer chooses an experientible state  $S$ , the state of the pointer is required immediately either to “jump” to that state  $S$ , in conjunction with the occurrence of the corresponding experience, or to jump to a state  $S'$  that is “perpendicular” to  $S$ .
- These “jumps” are the notorious “quantum jumps”.

- The observer has thus been elevated from the role of a mere passive spectator to the role of both passive spectator and causally efficacious actor!

“... in the great drama of existence we ourselves are both actors and spectators .”

(Niels Bohr, 1963, p.15. among many other places)

# The Observer's Freedom of Choice!

- Within contemporary orthodox quantum mechanics the observer's choice of the observable state  $S$  is not constrained by any known law, either statistical or deterministic!
- *In that very specific sense*, the observer's choice is, "a free choice"!

# Enter Quantum Randomness.

- The “free choices” are merely choices of which probing action to initiate.
- That “free choice” made by the observer is not constrained by any known statistical condition.
- But the **selection of the outcome** of that probing action, either  $S$  or  $S'$ , is random.
- Two Choices: The first one completely undetermined by contemporary physics; second one random!

# **Control Via Focused Attention that Activates the Quantum Zeno Effect!**

- There is, however, a way in which the “free choices” of probing actions can produce intentional control over the behavior of the system being observed.
- This control is brought about by a focusing of attention that activates the quantum Zeno effect.

# The Quantum Zeno Effect.

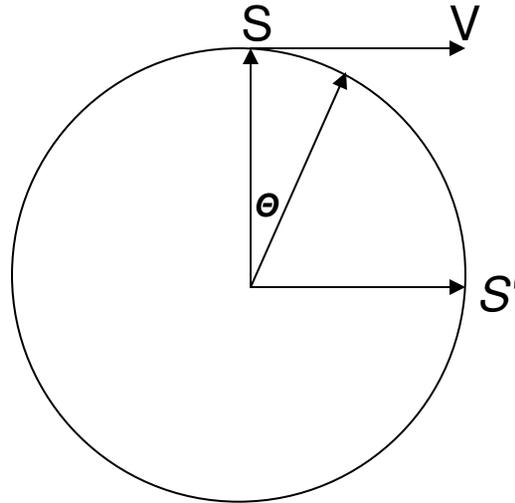
- My main objective in this talk is to explain, in a simple easily visualizable way, how the quantum Zeno effect permits focused attention to influence bodily behavior *in the consciously intended way!*
- I want to make the words “quantum Zeno effect” to signify for you, not an incomprehensible quantum mystery, but a simple mechanism that allows the patient’s mind to influence his body.

# A Simplification that Facilitate Easy Visualization of QZE

- In my previous descriptions of the QZE I have used the “density matrix” formulation of quantum mechanics.
- That is the completely correct thing to do.
- But for the present didactic purpose I revert to a *state vector* formulation that, in this context, is merely “essentially” correct.

# Reduction to Two Dimensions

- When not being observed the quantum state of the pointer is represented by a unit-length vector evolving continuously in a space of a huge number of variables.
- For easy visualization I shall reduce that huge number to two.
- Then the (tip of the) unit-length vector, when unobserved, moves continuously around the unit circle: See Fig. 1.



- Fig.1 Diagram indicating the evolution of the unit-length state vector that represents an evolving macroscopic pattern of neurological activity in the brain of the experiencing observer. The vertical and horizontal lines from the center of the circle are  $S$  and  $S'$ , respectively, and the sloping line from the center of the circle is the state vector after it has rotated by a small angle  $\theta$  away from vertical. The vector  $V$  represents the velocity at  $\theta = 0$  of the tip of the state vector.

# Quantum Zeno Mechanism

- Suppose at time  $t=0$  a probing action is made and the state jumps to the state  $S$ . The tip of the vector in Fig. 1 will then immediately start moving, say to the right, around the circle of radius one:  $\theta$  will begin to increase, say at a constant rate. If when the tip reaches the point specified by the value  $\theta$  *the same probing action is made*, then the vector will jump back to position  $S$  with probability equal to the square of cosine  $\theta$ , or to  $S'$  with probability equal to the square of sine  $\theta$ .

# Quantum Zeno Mechanism

- Given just that fact alone, it is a simple exercise to prove that if the probing actions occur at a constant rate of  $n$  per second then the probability that, after one second, ***every one of the  $n$  jumps will be to  $S$ , and hence none to  $S'$*** , tends to unity as  $n$  tends to infinity.
- Both the *experience* of the disposition of the macroscopic physical system, and its neural correlate (namely that physical system itself) will tend to be held in place by the rapid sequence of observations of that system.

# Quantum Zeno Mechanism

- The result just stated means that if a human observer/actor, by his “free choice”, focuses his attention on a possible experience, and if that focusing of attention activates sufficiently rapid repetitions of the probing action associated with that experience, then the neural correlate of that experience will tend to be held in place longer than would otherwise be the case.

(Often Called the “Watched Pot Effect”)

- Thus the patient’s mind is able to influence his body in a way dependent upon his “free choices”!

# A Placebo Experiment.

- Price et.al. (Pain 127,63-72,2007) conducted a placebo experiment in which the patients were subjected to a procedure that produced a heightened level of pain
- In a first session the patients were told that they would receive no treatment.
- In a subsequent second (placebo) session, which adhered to the same physical procedures, the doctor told the patient: “The agent you have just received is known to powerfully reduce pain in some patients.”

# Empirical Results

- The 'reported pain' in the second session was significantly less than in the first.
- An fMRI study showed that the neural activity in identified pain centers in the thalamus, somatosensory cortices, and insula, is significantly less in session two than in session one.
- Thus the spoken words influence not just the verbal reports, but also basic pain centers in the brain.

# Conclusion:

## Given the facts that classical physics

- Is *in principle* inapplicable to the mind-body problem, because it does not correctly describe the underlying micro-causal brain dynamics.
- Fails to accommodate the complex interplay between mind and body that is a crucial features of the switch from classical mechanics to quantum mechanics.
- Demands, *a priori*, that any scientific explanation of behavior be exclusively in terms of physically described properties alone, which, among other things,
- Precludes, *ab initio*, the possibility that the patient's conscious understanding of spoken words can influence the state of order or disorder of his or her brain.

# One may ask:

- Is there any good reason for a rational scientist or physician to restrict his theorizing, *a priori*, about mind and brain by imposing the highly restrictive conditions imposed by known-to-be-false classical physics?

# CONCLUSION

The likelihood of achieving a useful scientific theory of the mind-brain connection is far greater for a quantum-physics-based psycho-physical approach that incorporates quantum dynamical effects of the conscious mind upon the physical brain, than for a “promissory classical-physics-based physicalism” that excludes from the outset the possibility of any effect of the patient’s mind upon his body.