The Rose colored Glasses Effect in Contemporary Physics

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Abstract

The central issue to be explored relates to what might be called the "rose colored glasses" effect, or Sir Eddington's Fish Story, which note that observer characteristics may be inadvertently assigned to the systems being observed. If Eddington's conjecture is applicable the most fundamental properties of nature will turn out to be the construction rules of the observer who measures nature. Since the human observer is the final measuring instrument which collapses the wave function at the end of vonNeumann's measurement chain, and no one knows exactly how the brain works, it is likely that observer characteristics have been falsely attributed to physical reality and our theories of it. These errors may prevent us from understanding consciousness because they mask the actual operations of the psyche. Starting with Velmans' model of consciousness we analyze role of cognitive models in the development of science. We then model how both the setup of experiments and the interpretation of resulting data could be influenced to arrive at erroneous theories. Using examples we show how potential errors, due to incorrect understanding of the conscious process, have crept into physics. These will need to be corrected in order to evolve a concept of physical reality that includes the conscious experiences.

Key Words: Consciousness, Reality Models, Process Ontology,Loading Theory, Cognitive Action Theory, Plato's Cave, Natural Philosophy, Photo-electric Effect,

I- Introduction

The Observer Model, used for the interpretation of experimental results that underpin our physical theories, influences the very theories we believe to be supported by their objective observation. Much of the foundations of physics are based upon Observer Models that vary from 1) no model at all, to 2) objective eye witness, and occasionally 3) a quantum observer models. The first option is most prevalent.

Scientific tradition strongly favors the elimination of subjective experience in its head long quest to discover the secrets of an objective observer independent universe. It has developed theories and methodologies consistent with this quest. As pointed out by H. Stapp (1993) this has left us with an objective world view and a physics which cannot explain consciousness even in principle. Quantum theory suggests this goal is misplaced because the reality we know is not observer independent. It is therefore likely that traditional science has interpreted properties of the conscious observer as attributes of an objective universe in order to be consistent with its basic beliefs. This is the rose colored glasses effect and this paper will explore the extent to which it may have happened and why such errors may limit our ability to explain consciousness in scientific terms.

We will approach the problem by noting two differing concepts of reality underlying the two major periods in our western intellectual tradition. These are the dark ages of the first millennium dominated by the doctrines of the Catholic Church and the rise of classical science beginning with the Renaissance that has dominated the second millennium. The differing concepts of reality underlying these two periods were already debated in the works of the Greek philosophers and this article will attach the names of Plato and Aristotle to these opposing views. The first, originally expressed in Plato's Cave Analogy describes what we experience as shadows on the walls of a cave projected from an unobservable reality outside the cave. We are not referring to Plato's entire philosophy but only the distinction made between what we experience and the reality that is responsible for those experiences. Aristotle eliminated this distinction and believed we see the reality directly through the windows of our senses. This "naïve reality" shortcut was incorporated in his natural philosophy which evolved into modern science and classic physics. Classic science treats our eye-witness experience as objective reality and perversely leaves no room for our feelings to be anything other than a configuration of objects in that reality. Quantum theory is then identified as a fledgling step back to a view expressed in Plato's Cave Analogy in which immediate experiences are distinctly separated from actual reality. We are not claiming Plato's ideals are that reality or that Aristotle's philosophy is "naïve reality" incarnate. The difference is that for Aristotle "the world

which we experience through our senses is not, as Plato taught, a mere copy [shadow] of the real world, but is *the real world*." (Frost 1947) We are only attaching Plato's name to the idea that reality is *inferred* from direct experience of objects and attaching Aristotle's name to the view that our direct experience of objects are at least *representative* of reality.

Next we present several models of a cognitive being. This starts with the model proposed by Velmans (2000) grounded in the classic scientific framework. We then expand the model to accommodate the discoveries of quantum theory, which is more closely aligned with Plato's inferred reality thinking. This is followed by a further improvement in which the role of events (Whitehead 1959) is featured. The cognitive process is now modeled as a feed-forward loop between sensations and their explanation.

Armed with these models of the conscious process we then see how the interpretation of major physical experiments is altered when a model of the experimenter's thinking process is included. This inclusion gives us an opportunity to examine the attributes and prejudices in the measurement and interpretation methodologies employed in order to see how theories may be affected. We discuss the photo-electric effect in detail as an example. This will show how characteristics of the measurement apparatus can be inadvertently projected onto the world being measured.

Though only one example is discussed in detail we believe the rose colored glasses effect is pervasive and attention should be paid to the possibility that we are inadvertently discovering our own methods of inquiry. This possibility was exemplified by Sir Arthur Eddington's Fish Story. In this analogy investigators were sent out with a net, which had a two inch grid mesh, to explore the oceans. After many trials they discovered that all the creatures found had gills and were longer than two inches. Eddington then asks, "Which is a more fundamental conclusion to draw from these data?" That all creatures in the ocean have gills or that they are all longer than two inches. His counterintuitive answer is that the two inch rule would become the more fundamental law because it encapsulates a basic characteristic of the measurement methodology i.e. the use of a two inch net. If the net is identified with the properties of our neural net then the moral is obvious.

The further we dig into reality with the methodologies burned into our neural net the more likely it is we will discover the characteristics of that net. The net, like rose colored glasses, will color everything and if we do not understand that the effect is of our own making we will get a wrong belief of the reality we think we are looking at.

Such a mistake has certainly happened when classic physics conceived of physical reality as a 3D objective universe because that's the way we see it. People built impressive classic theories consistent with this assumption until quantum theory showed this to be in error. By the example outlined in this paper we hope to show aspects of quantum theory may also suffer from the same problem. If a false projection of an observer characteristic can be identified not only will a specific field of study be affected, but a new paradigm of an observer inclusive physics will emerge. Such physics would greatly reduce the difficulty in finding explanations for consciousness because it would be included along with the observer.

II- Plato's Modern Cave

In western traditions there are two fundamental approaches to the nature of reality. I will label these as Platonic and Aristotelian. The differences are graphically shown in figure 1 and 2 below. As shown in figure 1 Plato thought that the experiences of our daily lives are like the shadows on a cave projected from an ideal reality outside. Little-men-inside the cave are bound only to experience these projections. Though his example described a literal cave in the mountains and his prisoners were bound by ropes and chains his allegorical message translated into modern language was that we (little-men-inside) are bound in the cave of our skull and experience the processed result of our measurement activities on a screen we call our mind. The chains holding us captive may be interpreted as some psycho-physical phenomena yet to be discovered but reasonably attributed to forces involving our brain. The bright world of ideals outside the caves is today a more humble scientific

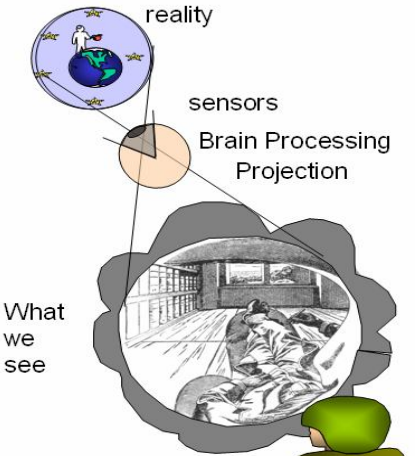

Fig. 1 – Plato's Cosmology

world of models and theories rather than the literal universe, which Plato's ideals would have us imagine. Simply stated what is outside the cave is what we now call reality and his student Aristotle believed we see that external reality not as a second hand projection but directly through the windows of our senses.

Figure 2 shows a little-man-inside looking from a dark cave wall through the opening into a bright external world. Of all the things we can see out there, some of them respond to our will and move to our command. This subset is called our body and we can use our control over it to change the appearance of reality to fit our needs and desires. Concentrating on this world outside and honing our ability to make it do what we want has been the story of scientific development ever since. The success of science is renowned. It is based on the "naïve reality" assumption that things are *really* where they appear to be and the simplifications that came with it. Material success as defined by the direct appearance of the outside world is the hallmark of western progress in the second millennium. However this was not always the case. What Aristotle sacrificed by looking directly through the entrance is the world of feelings and experiences that still fill the darker recesses of the cave. Such a sacrifice was not immediately accepted. The dominance of feelings and the Platonic belief that reality was external to those feelings provided a favorable ground for religious dominance during the first millennium. It was much easier to convince a public that spiritual powers exist beyond the immediate experience of their lives when their fundamental cosmology already contained a separate place for true reality as Plato proposed. The image of being released from ones bonds and venture through the entrance to an ideal world is readily adapted to the promise of heaven and all the comfort it supplies. The Catholic, Moslem, and Nordic mythology all promise a life in heaven where happiness is guaranteed and these beliefs dominated the European continent through out the dark and middle ages.

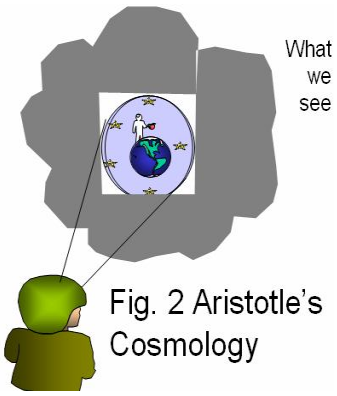

Fig. 2 Aristotle's Cosmology

Though the Natural Philosophy inspired by Aristotle never vanished, its ideas were largely the topic of debate among theologians until the beginning of the second millennium as shown in figure 3. It is not clear what triggered the disenchantment with

Catholicism at the beginning of the second millennium. Perhaps the corruption that infected the Church in Rome, or the ravages of the Black Death convinced people to look beyond Platonic cosmology and embrace a more direct interaction with their reality. Historians argue about causes, but the writings of Thomas Aquinas around 1250AD could be cited as the turning point (Cahill 2006). His works were an updated rediscovery of Aristotelian thinking and presented Natural Philosophy as a candidate for Catholic doctrine. Though he was canonized only 50 years after his death his writings were not fully adopted as gospel for about 500 years. By this time the Renaissance, Kepler, Newton, Libnitz, and others had clearly established the dominance of "naïve reality" based science. Classic physics successfully explained everything in sight. Its success continued until the beginning of the 20'Th century when it failed to account for properties of material at atomic scales and ushered in the new quantum theory which returned to a form of Platonic thinking.

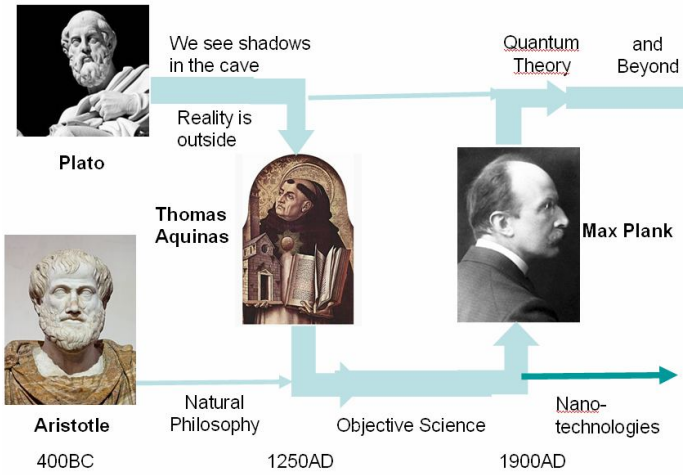

Fig. 3 – The Pendulum Swings

The turning point for this latest move is often marked by the discovery of the action quantum "h" by Max Plank at the turn of the 20'Th century. This discovery allowed the explanation of Black Body radiation and encouraged further interpretations of spectral light emissions from material with the new theory of Quantum Mechanics. The break with classic physics was momentous. No longer were we looking at reality directly. No longer could the objects in front of our noses or even the entire objective universe with all its stars and distant masses be reality. All these normal things that 20'Th century man experiences are now the data produced by measurement operations carried out by a wall of detectors. That wall of detectors surrounds all our measurement based data from which science is built and when we

include the detector arrays inside your skull the wall completely separates, us little-men-inside from the reality outside the wall.

Quantum theory is based upon the reintroduction of the Platonic cosmology into scientific thinking. As D'Espagnat (1979) pointed out, "the doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and with facts established by experiment." The objective world we see is analogous to the projection on Plato's cave wall. Reality is outside the cave. Is it as bright and dazzling as Plato's ideal? No! Now days, quantum theory describes reality as waves whose amplitude squared determines the probability of interaction between the outside and our surrounding wall. Most of those interactions are absorbed by the outer walls of the cave, your skull, but through windows, made of reporting detector arrays, data are streaming in to be processed and displayed on the inner walls of our cave. An updated picture of Plato's cave is shown in figure 4. We are inside a skull looking at what is projected on the wall. The projection has been outfitted with modern furniture and the main entrance has been outfitted with optical transmission devices, so it looks a bit like an outer chamber has been built around the inner wall of our cave. When we believed in Aristotle's philosophy the furniture, walls, lamps and the cat were real objects. This meant the image of the cat actually surrounded an actual cat made of bones and flesh. A modern quantum Plato would say the image of the cat is certainly a real image but it has been created inside your skull by processing sensor data gathered by the detector array windows built into the wall of your skull. The reality outside that wall is best described as an interaction probability wave and from a large number of interactions we can calculate the useful image to project on the screen.

Fig 4 - Plato's Modern Cave – Baer PhD Thesis 1972AD

In the Aristotelian view such an assertion would seem to be an unnecessary complication. If the cat were really an interaction possibility then in order to let you

see what created that possibility pattern your brain would have to automatically run a recognition program on the data and select a cat icon from the ideals available in ones memory, tailor it a bit to match the interaction specifics, and project it on the screen. That is a lot of work to keep in mind and the end result is that as long as that brain functions normally the images you see faithfully represent the real causes. So why not believe there are real objects in front of you? The modern Platonist would respond by acknowledging the practicality of Aristotle's philosophy but nevertheless would only consider it to be a practical shortcut that works when the assumption of a normally functioning brain is fulfilled. And furthermore the Platonist would point out that the definition of "normally functioning" means the brain produces images of objects, which is a restriction we have been forced to eliminate when dealing with quantum phenomena.

This brings us back to the central question of this paper. If we trust our brain is functioning *correctly* so that what it projects on the wall is an image or token, which may actually be like reality itself, then we are probably too optimistic. *Correctly* is an elusive goal. If our brain does make a mistake, however unlikely, the artifacts resulting from these errors will be assumed to be properties of reality. A reality error could have disastrous consequences. However unless we recognize the short cut underpinning Aristotle's Natural Philosophy and return to the architecture suggested by Plato we will not have the freedom to find the root of the problem. Only Plato proposes a flow of influence from an actual reality outside to a perceptive reality inside. The flow from outside to inside when added to the reverse flow required by us to control at least some part of reality makes Plato's flow an extended processing event. Once such an extended processing event is accepted as our reality rather than objects created in one phase of this event, then we can investigate our new found reality for the occurrence of false projections. One of the most important such confusion may have occurred during the interpretation of the photo-electric effect. Section 4 will address this possibility.

III- A Review of the Consciousness Process

The exact details of the consciousness process is unknown, however under the guidance of Aristotle's natural philosophy science provides a general outline provided by Velmans (2000) which is summarized in figure 5. Light from objects in an independent universe – in this case the cat - stimulates our sensors. This stimulation is processed into the images of objects we experience. These images are projected back onto the objects we see because we believe they are really there in the first place. In a nutshell this circular reasoning is based upon the "naïve reality" assumption that things are what and where they appear to be. Once this assumption is accepted, things obviously appear in front of our noses because they are there and we can treat those appearances as realities for most of our lives.

If the "naïve reality" assumption is wrong then all we can safely say is that we have a cat experience but whether that experience is a representation of anything at all is no more obvious than any other possibility. Dreams and hallucinations that feel real happen quite frequently. Velmans however does leave us with a way out. He describes the original "cat as perceived by an external observer". This implies he believes in a consensus reality. So that we understand that we see a mental image but if a third person, or better all persons, agrees with us that image and its location can be treated as real. Fair enough for a practical rule to guide our behavior so that our concept of reality avoids conflicts with those others. However by eliminating a Kantian thing-onto-itself in favor of consensus perception we reduce the reality of the cat to a common hallucination and ourselves to Lemming believers, who will one day plunge over the cliff of our common error.

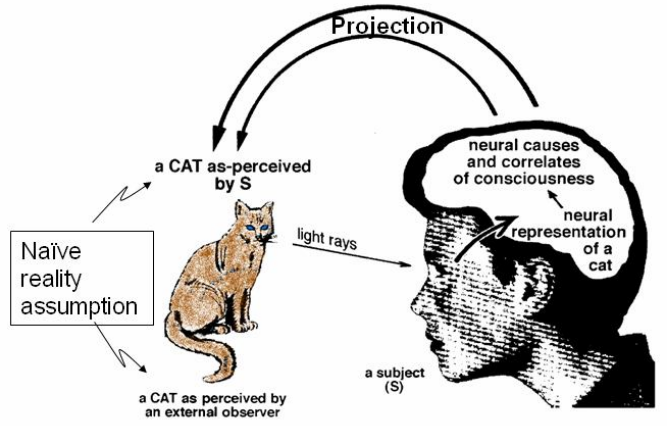

Fig 5 – Velmans' Consciousness Process

Furthermore the cat, which is here used as a stand in for any and all objects, would certainly object to being merely a hallucination in our societal consensus. If this were true then we would be merely a consensus hallucination in the cat's society.

Then the whole reality of our brain in which the neural representations, causes and correlates are supposed to happen would also be a hallucination leaving no real mechanism responsible for what we experience. Consensus reality may emphasize the existence of common mental images much as it emphasizes the existence of common words but some real mechanism is still required to make the whole thing happen. Therefore we must either stick with the naïve reality assumption if we are to make Velmans' model of consciousness work or give it up and return to the Platonic philosophy which includes a reality that may be substantially different from the experiences it causes on the screen of our cave. Such a return is forced upon us by the principles of quantum theory, which describes a corrected consciousness process as shown in figure 6.

Here we no longer assume things are what they appear to be, but define reality as a pattern of probability amplitudes which propagate like waves in a quantum reality. Using quantum logic the image of the cat is no longer projected onto an object but rather a mental screen along with all our experiences. The content of the screen then forms the input to an explanatory operation that traces the cause of our experience to deBroglie matter waves in an independent quantum world. This reintroduces a reality which, like Plato's ideal, differs markedly from the objects we see.

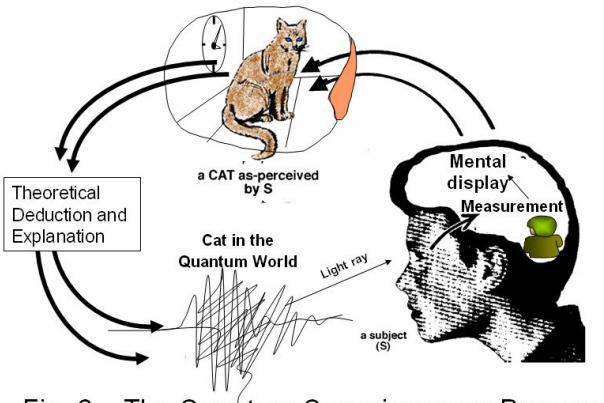

Fig. 6 – The Quantum Consciousness Process

The cat as perceived represents our classic world of objects that are experienced in every day life. The physical reality which caused the classic world to appear is described as a quantum world which interacts with a wall of detectors imbedded in our skull. This wall of detectors is referred to the Heisenberg or vonNeumann cut, which separates the quantum domain from the classic world of objects. We little-men-inside the wall of sensors are looking at the result of a measurement process that is projected on the screen. What is not included in Plato's cave analogy is that we, little men, are

not satisfied with simply experiencing what is projected into our cave, but go on to execute further mental processing operations that generate an explanation of what we see. These explanations are embodied in the symbols of the theory we believe accurately describes the reality outside the cave. In this case the theory is quantum mechanics and the symbols are the waves described by Schrödinger's equation.

This brings up a very important point. In the Velmans' view we projected our mental image onto what we believed was reality. In the quantum view reality is outside the cave. We cannot get out to see that reality is directly. The theoretical explanations are symbols which are produced within the cave and are at best our model contained in our memory of what that external reality might be like. Of course that model is assumed to be correct if the symbols of explanation can reproduce the sensations projected from the external reality outside the cave. But, this implies that figure 6 describes an internal loop of activity happening in the cave. The explanatory process produces symbols of the external reality it does not recreate reality outside the cave. Rather the loop acts more like an amplifier and refresh loop which reinforces external sensations when these can be positively reinforced by internal sensations produced by the model of reality held inside the cave.

III.a- The Event Oriented Conscious Process

The previous paragraph implies that the real mechanism responsible for what we experience when we reside inside the cave acts like a loop that is stimulated from the outside by a Kantian "Ding-an-Sich" reality we can not experience directly. What could that reality be? To be consistent if we are really a processing loop inside the cave then it seems reasonable to assume the same mechanisms are also present outside the cave. This leads to an event oriented model of interacting consciousness processes as shown in figure 7. That such a model has the property of self consistency was first proposed in the Journal of Consciousness Studies (Baer 2010). Further details have been worked out in several publications (Baer 2011, 2013,2014) but the practical development of an event oriented physics is still a work in progress.

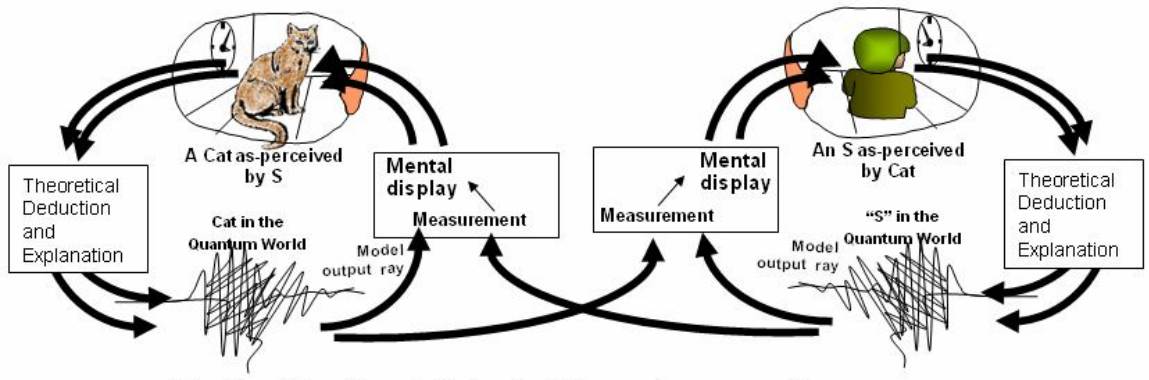

Fig. 7 – The Event Oriented Consciousness Process

What is shown in figure 7 is the larger mechanism that produces our sensations. In this model the really of our existence is interacting process loops. The loops process memories into experiences and explain those experiences in memories again. The use of the quantum model to reference what is outside pays homage to the best concept of reality physics has to offer to date. A classic objective world model, or even religious world models could be used in the loop. These have advantages in many personal situations but would not help us develop products at the atomic scale. Whatever model of physical reality is used, a self contained measurement-explanatory cycle remains as the architecture within which such models are used.

The analogy with modern computer refresh cycles is appropriate, but care must be taken to remember that we must be inside the loop and cannot get out. The time line of the loop runs through us and whatever little-men are inside a computer refresh cycle. Computers could at best possess extremely primitive forms of consciousness differing greatly from our own. Nevertheless the idea that we are a self refreshing permanent existence which adjusts its internal processing activities to accommodate stimulation from an external world is revolutionary. A full exposition of a process physics that accompanies an event oriented world view is being developed by the author under the name of Cognitive Action Theory (Baer 2016). Such physics goes beyond current quantum theory and has its origins in the writings of Whitehead (1959) who postulated that events not particles should be the basis of reality.

One step in that development is the re-examination of the physics we have inherited. We do not want to throw the baby out with the bath water but at the same time must be careful to keep only those parts which make sense when events,

containing some forms of primitive consciousness rather than particles are assumed as basic building blocks. The Aristotelian shortcut collapses sensation and the objective reality into a single entity. This means properties of the perceptive mechanism have been collapsed into the reality that is being perceived. The Platonic view explicitly separates what we see from what actually is. So we need to examine our legacy of physical theory to ferret out where attributes of our measuring processes have been inadvertently projected into reality. This is the rose colored glasses effect discussed in section I of this paper. One of the critical experiments underpinning the development of quantum theory is the photo-electric effect, which lead to the assumption of light as small particles and the doctrine of wave particle duality. This experiment will be discussed in more detail in the next section.

IV- Possible Reinterpretation of the Photoelectric Effect

The photo electric effect consists of the phenomena that light when impingent on matter will eject electrons. The effect is used to build photo multipliers which can absorb faint light energies and produce an electric current that can be recorded. The amount of current produced will depend upon the intensity of the light falling on the material. However whether or not any electricity flows depends upon the color or frequency of the light. Figure 8 shows a very simplified experiment designed to observe the effect. The experimental setup includes Velmans conscious subject with the capability of projecting what he perceives back into the reality of light he believes to be measuring.

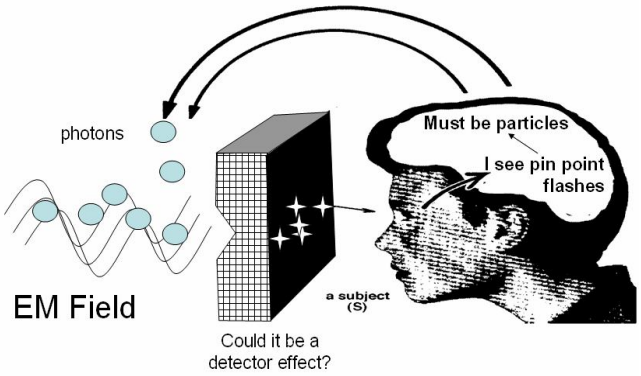

Fig. 8 – Photo electric effect experiment

That assumed physical reality is an electromagnetic field of waves which hit a detector plane from the left. The detector absorbs some of the light, which ejects electrons that hit a screen and produces small flashes that are observed by the experimenter. The wall of detectors has been moved outside of the experimenter's skull so that he is essentially the little-man inside aware of the flashes. The problem

confronting early investigators of this phenomena is that at low intensity light of sufficiently high frequency (blue color) will produce a small localized flashes at random positions on the screen. If the lashes are stored for example on a long exposure photographic plate the pattern will conform to the intensity of light in the beam. However the pattern is built up from small individual flashes. Since each flash is produced by the ejection of an electron from an atom in the material we must assume that sufficient energy is localized at the atom to knock out the electron. However the diameter of an atom is on the order of 1 Angstrom while the wavelength of blue light is around 5000 Angstroms. If you wanted to hit a golf ball out of the rough you need to hit it with a club about the size of the ball. If the material of the club were spread out over 5000 lengths of the ball a swing would move it less than a puff of air. This is the dilemma facing experimenters 100 years ago. How can a gossamer amount of energy in a wave concentrate enough force to hit an electron less than 1000's of its size out of an atom?

The answer is that it cannot. No more than blowing on a golf ball will make it fly to the green. Therefore the pioneers of quantum theory concluded that light must be composed of equally small or smaller particles than an atom in order to explain the electron ejection effect. Figure 8 shows an experimenter projecting these small particles, now called photons, back in front of the detector wall. So light is composed of photons. Unfortunately this projection contradicts the fact that the very same light also bends around objects and squeezes through small openings producing diffraction patterns that are characteristic of waves. So how was this contradiction rationalized? The pioneers of quantum theory, specifically the group that became to be known as the Copenhagen School, said light is neither a particle nor a wave but rather acts like a particle, when performing a photo-electric effect experiment, but acts like a wave when performing a diffraction experiment. In other words what reality is depends upon how one looks at it. Well that is certainly true of the mental image. Looking at a scene from different angles makes it look different. But reality?

Sounds a bit like we are falling back into the consensus trap discussed in Velmans explanation of consciousness. So for the Copenhagen quantum crowd, reality is the way we see it. It is hard to give up Aristotle and the naïve reality assumption. It

is so practical. It is easier to say reality changes and then convince people that things are more mysterious than we ever thought. The argument becomes even more attractive when these mysteries are only comprehendible by a selected few who derive great benefit from their claims of special understanding of such mysteries.

But the attributes of reality we are expected to believe get even weirder. Particles of light are projected to exist in the electric field (EM) as shown in figure 9 even when the light is examined with a what had been a classic wave interference phenomena experiment. Since particles travel in straight lines the light intensity pattern shown as the wavy line in front of the detector in figure 9 can only be explained if light as a wave which interferes with itself. But if light is made of particles then the particle, we are told, must go through both slits and thereby interfere with itself. Thus we are told that a particle can be in two places at once. Furthermore if we devise an experiment in which we find out through which slit the particle went our knowledge is enough to change the pattern to one compatible with straight line propagation. In other words our knowledge would control whether we see two bright spots behind the slits or the wavy diffraction pattern.

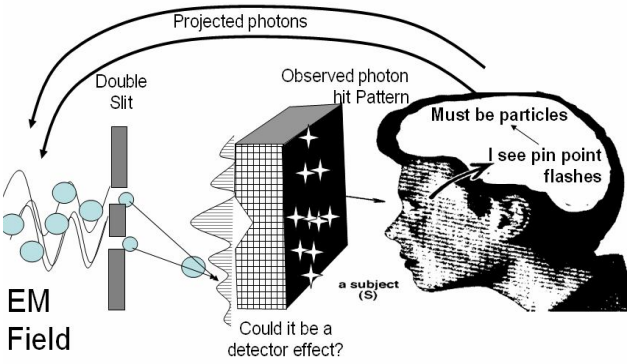

Fig. 9 – Double Slit Experiment

IV.a- Alternative Explanations

As mentioned in section III we are bound inside our cave and cannot get out to see what reality actually is directly. Therefore reality is always referred to by symbols which convey a feeling that gives us comfort and is consistent with what we do experience. There are many examples in human history when explanations no matter how fanciful become popular and are taken as fact. Once we understand how the human thinking process is involved the interpretation of physical experiments it becomes easy to see how artifacts of that process can produce weird properties of reality. In this example the photo-electric effect it is easily explained by fairly simple

processes taking place in the detector material. In other words it is a false projection of a measurement artifact projected into the reality being measured. Such an attempt was proposed by Sommerfeld (1913) under the name of loading theory. The idea is that electrons in atoms are always fluctuating due to thermal or other influences from the universe in which they are imbedded. Therefore sometimes they are close to an energy threshold that is required for leaving an atom but most of the time they fall back and remain captured. For the small number relatively close to the threshold a small energy push will vault them over the threshold and apparently random emission events will happen when low intensity light is smeared out evenly across the surface.

The experimental verification of Sommerfeld's ideas was attempted by E. Reiter (2014) one of the San Francisco Bay area's rebel physicists. His experiment attempted to measure the energy emerging from tandem detectors using gamma rays to show that more energy was emitted as the result of multiple collusions than was in the particle before it entered the detector. The logic is straight forward. If more energy comes out than goes in it must have been stored or loaded into the atomic structure before the collisions. The extra energy stored in the atoms would be released when an impinging field disturbance pushes the atom over the threshold. Though he reported seeing more energy coming out than going in, thus lending proof to his conjecture, there is some doubt whether detector correlations have been properly taken into account and a verification experiment is highly advisable.

A separate but theoretical analysis of the double slit experiment by Baer (2015) suggested that the random disturbances in the detector used in such experiments could be responsible for the result. An electron orbiting inside detector atoms, In Bohr's original visualization, typically requires more energy to be ejected than is available from thermal agitation. However gravitational fluctuations due to the random motion of distant masses in the universe could supply the energy. Newtonian universal attractive gravity force is much too weak to accomplish this. Inertial forces which are responsible for fluctuations in the effective mass (m) in Newton's second law, F=M*a, could be adequate. Sciama's (1953) calculation showed that at very long ranges the inertial force is much stronger than the relatively weak attractive gravity when the distant masses are taken into account. They could therefore be an alternative

explanation for the random individual hits which in the aggregate sum to give diffraction patterns as required by the wave character of light. Sciama originally proposed a gravitational vector potential to account for inertia; however it was later discovered Einstein's general relativity equations also yielded a vector potential. (Moller 1972)

5) Summary

We have shown several plausible models of the human cognitive process. In each case an immediate experience is interpreted as a symptom of a reality that is projected onto the sensation experienced. If we introduce such processing steps into physical experiments we have the possibility to differentiate those aspects of our experience that are due to our measurement and mental processing and those that are due to the reality we are trying to measure.

Modern physics is based upon the tradition that our theories of physical reality should not be dependent upon the characteristics of the human observer. This tradition is supported by the Aristotelian naïve reality assumption that we are seeing things as they are. The possibility for confusion between real characteristics and false projection of measurement artifacts into those characteristics exists. We have reviewed a number of ways such confusion may have happened. In specific we have provided a detail account of experiments in which such confusion may have happened and provided references to alternative explanations which identify the possible measurement artifacts responsible. The analysis suggests that some of the current mystery and weirdness attributed to reality by quantum theory may have their origin in such confusion.

A full review of scientific theories which includes the conscious processes of the practitioners involved may lead to both a more accurate science and a science in which consciousness finds its natural place.

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