Is Magic Possible Within A Quantum Mechanical Framework?

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In this paper I intend to explore the possibility of a 'theory of magic' within a scientific framework, specifically in a quantum mechanical context, as I do not intend to go too far beyond established science. The term 'magic' as used here can be understood as the craft of those who call themselves 'magicians' or 'witches', professed psychic abilities, or any form of physical modification of the world caused by the mind alone. I exclude the 'evocation of spirits' etc here as outside of current scientific understanding, though not necessarily beyond future scientific interpretation. In doing so I shall be opposing the great tide of philosophical and scientific bias in favour of Realism - the doctrine of a physical, mind independent and causally closed, objective reality - and hope to reveal this as a prejudiced dogma through its exposure to rival possibilities.

The way I shall do this is through an analysis of our present understanding of quantum mechanics, with special reference to magic, and an exploration of those interpretations that might allow magic, or are believed to by those with little knowledge of the subject. I will end with an original examination of the metaphysical possibilities of the

best case for a 'quantum mechanical magic'. I do this as a philosopher of science and of mind, rather than as a scientist or mathematician, but will be outlining the basic mathematical formalism and science in the first section, without which no understanding of the subject would be complete.

In the course of the paper I will also be criticizing the misconceptions and misuses of quantum mechanics in the hands of so-called 'New Agers', but also some of the crypto-mystical tendencies found even amongst trained scientists.

Admittedly this is an ambitious task considering the unresolved philosophical problems associated with quantum mechanics, and the innate mysteries inherent in the concept of 'magic'. It will also of necessity touch on the probable relationship between physics and that other great enigma, consciousness. As such this may strike some as worthy of the classic retort of 'attempting to explain one mystery in terms of another'. However I hope to demonstrate that the possible interpretations of quantum mechanics are narrower than many believe, and that its nature might only be regarded as 'mysterious' when viewed within the framework of the current Realist metaparadigm.[1] I conclude magic is indeed possible within a scientific framework and may even be a necessary consequence of the best explanation of quantum cosmology.

What follows is a beginning and should be considered as an opening into a deeper study and possible research project

What is Quantum Mechanics?

Quantum mechanics is essentially a mathematical model for predicting the behavior of subatomic phenomena. It was adopted in the face of a series of bizarre experimental results that could not be understood within the context of any of the existing models of physics, or indeed within that of any rational explanative theory - the famous superposition of particles and a general defiance of the basic 'laws of physics'. It was found, largely through trial and error, that the form of mathematics now utilized in the standard quantum mechanical equations was the only formulation capable of producing accurate predictions. The accuracy of these predictions over the course of nearly a century has since shown to be 100%, an unheard of degree of accuracy within any science. What's more much of our everyday electronic technology has been based on the consequences of these equations. Quantum mechanics, hence forth referred to as QM, has thus been sometimes dubbed the "only true science".

The main philosophical problem with QM is that it appears to make no rational sense whatsoever, and arguably its mathematics can not be visualized. The breakdown of reason inherent is largely due to the fact it uses a different mathematical model to that subconsciously deployed in our intuitive judgments of the world, as well due to the related redundancy of classical concepts, such as position, motion, time and identity, within its domain. This has been often interpreted in the context of a Neo-Kantian notion of the conceptual construction of the world of everyday experience being distinct from a non-conceptualisable underlying reality. The problem is accentuated by our relative inability to visualize what is being represented by the QM equations. Whereas

the mathematics of Newtonian mechanics could be visualized in terms of billiard balls no such visualization is possible with QM, again due to its apparent departure from 'common sense' perceptions of 'reality'.

Two approaches have been taken in dealing with this. One extreme is to argue that the formulation is simply a function that outputs results, that is it is not representing anything, in the way geometry is supposed to, it is in essence a kind of 'rule of thumb' for producing results. Any visualization we might achieve in such a scenario is thus at best an explanatory metaphor for understanding the equation rather than a description of reality (something often also held to be the case for General Relativity Theory and its 'curvature of space'). The other option is to argue that the QM formalism is indicative of something ontological, but is enigmatic due to its incompleteness. The amazing degree of predictability it produces is said to mitigate against any 'rule of thumb', and an 'exact model' which 'does not represent anything' might be justifiably regarded as contradictory. I shall be taking the latter perspective in this paper.

There are two forms of mathematics used in QM, one is referred to as Matrix Mechanics, the other Wave Mechanics, both have been demonstrated to be mathematically equivalent and are used interchangeably in standard QM. Wave Mechanics is sometimes represented as 'easier to conceptualize' than Matrix Mechanics, but the latter is easier to describe in my view and appears to be more fundamental. In very simple terms Matrix Mechanics represents a simulation of the world in which all the possible states of an object or system under investigation are represented as vectors (often used to represent forces in classical physics) within an abstract state space, which

includes a representation of normal space-time (using the Four Dimensional Space Operator). This is formulated as a series of coordinates for each vector visualisable as a graph-like map, in which four axes represent space-time referents and the rest the possible states of a system. Most of the oddities of the model occur due to the fact that the apparent properties of the object are not representable within vector space at all, but only within variables representing the operations that alter that vector space - the primary operation actually being the measurement of the property. That is the perceived 'redness' of a 'red object', to use a simple archetype, is not the state 'red' recorded in vector space but is given by the operation that measures that property of the object. The operation is represented by a matrix of numbers that represent the operational 'influences' on the vectors, and the properties of the object have to be coded here in order to match experimental data. This seems to imply that the act of measurement, and possibly other operations on the object, are required for it to actually have any observable properties at all! Note this is not saying that these cannot be measured without measurement, which would be trivially true. It is saying there are no properties without measurement or some similar operation. That is, the operation profoundly changes and defines the state of the object. No other form of mathematical representation fits the experiments. Another oddity is that only so called 'eigenvectors' within vector space have fixed values in relation to an operation, such as measurement. To understand what this means we can propose a 'hand rule'. Hold your hand out and point forwards with your index finger while your thumb is vertically raised, then rotate your thumb to a horizontal position on the axis of your index finger. If your fingers were the vector axes of the vector space, your index finger would be an

eigenvector (it is unchanged) while your thumb is not (it changes). Now rotate your index finger up or down vertically on the axis of your thumb. In this operation your thumb is now an eigenvector (it is unchanged) and your finger not (as it moves). The motion of your hand is an operation, measurement is an operation in which only the 'stationary vectors' have fixed measurable values, while the moving vector does not. The direction of the index finger up or down is a random event and defines the outcome of the measurement as say 'up spin' or down spin'. This is the core of what the maths of Matrix Mechanics is describing. The rest basically consists of a more detailed description, one that dovetails into that large array of equations that constitute physics as a whole. This core formulation describes why a particle whose momentum is measured has no position until a position measurement is made. It also describes how the measured position will have a random outcome based on a probability formula. Wave mechanics essentially describes the same thing, but actually represents the probability curve in a mathematical wave description. A wave that has direct correlations with the electromagnetic waves involved, being based on a probability that is objective or deterministic, rather than subjective or epistemic. Finally we need to mention the phenomena of entanglement, where the operational result on one object simultaneously affects the another in the same complex system or two 'linked systems'. This can be demonstrated by performing the hand maneuver with two hands, with the thumbs touching and the index fingers pointing in opposite directions. This systemical connection seems to suggest the two objects are interconnected in someway, however they can be light years apart in time and space - a fact that arguably indicates a non-local acausal relation if not a holistic underpinning of the cosmos. That's quantum mechanics

in a nutshell, or at least all of it needed for the purposes of this paper (a more detailed but simplified outline of the formalism can be found on by website, see bibliography). The process modeled by Matrix Mechanics is not really a conceptual problem, however what all this actually means ontologically is a huge problem!

Quantum Mechanics and Consciousness

The most obvious response to the so called 'problem of measurement' in QM is to assume that a measurement is an observation or a perception. Indeed this idea was first put forward Eugene Wigner in 1960, "My chief scientific interest in the last 20 years has been to somehow extend theoretical physics into the realm of consciousness — consciousness is beautifully complex. It has never been properly described, certainly not by physics or mathematics" (Cited in Szanton 1992, p 309). He argued that consciousness was the key factor in the act of measurement. That is the effect of measurement on an observed system is the effect of consciousness on it, or that the properties of an object need to be perceived in order to exist. This seems fair enough, how can one measure an event without observing it and so being conscious of it? But we have to be very careful with this as the situation is not as straight forward as this view might imply. For some the basic notion that 'properties require observation' implies the Berkleyan notion that 'to be is to be perceived', and from there leap head long into the absurdities of ontological idealism. Worse still this has been taken onboard by New Agers who believe 'we create our own reality through our perceptions'. The easiest counter argument to such a patently false notion would be to throw its proponents out of very high window and ask them to perceive gravity differently. Fortunately we don't have to take such drastic

steps to reveal that this view is misguided. The simple fact is that even objects in superposition are 'real' in some way, as they react with each other and with defined particles according to the same laws applicable to any particle. They just appear to be in a 'ghost-like' state that enables them to be in two places at once, and do apparently impossible things, such as appearing from nowhere and just as mysteriously disappearing again. If consciousness does anything at all it merely modifies the state of the object, fixing it into a definable classical one. But there is no empirical indication that the final results of this 'random fixation' are in anyway influenced by consciousness. Therefore consciousness does not appear to have any influence on the actual outcome, which remains entirely probabilistic. But beyond this it is by no means certain that consciousness is involved in a determinating operation such as measurement anyway, which may be one observed type amongst many other observer less operations. Worse, even if it was we would then be faced by the question of 'whose consciousness and why' which may lead us towards solipsism. The alternative view is that the key factor in measurement is the quantum object's connection with the wider world, by becoming part of an interactive system that includes the measuring device, it's operator and their entire environment. It is quite possible that other operations that involve connecting the quantum system with a larger macro-system might also have the same effect as measurement, even when consciousness is not present. However this is difficult to demonstrate experimentally as all experiments involve observation at one stage or another. Thus the properties of a system would only exist by virtue of a set of holistic relations.

Another closely related idea to this is that of the 'wave function collapse'. As said earlier the wave function is basically a complex variable containing all the possible superimposed states of an object or system, as well as their respective probabilities. When a defining operation such as a measurement is performed the wave function is sometimes said to have 'collapsed', meaning the wave function is no longer applicable to the situation, as the state of the object is now determinate and classical and no longer in superposition. Here the measurement operation, and often consciousness, is typically said to have 'collapsed the wave function'. However what this means is by no means clearly understood. This shift from probability to certainty is sometimes said to simply represent a change in our awareness of the situation, however as we have already observed the wave function only makes sense if it codes an objective probability (the likelihood of an indeterminate situation becoming the case) not a subjective one the likelihood of a belief being true, which implies a determinate situation), so this purely cognitive interpretation of probability does not seem to fit the picture. The mathematics represents actual situations not mere knowledge of situations.

Part of the motivation for this belief in a 'collapse' is the common sense assumption that quantum mechanics (perhaps) applies at the micro-level and classical mechanics definitely applies at the macro-level, with some cut off point between them. Thus either the connection between the quantum system and the wider world brings it into the classical domain, or alternatively consciousness does the trick, and the wave function is no longer representational. However there is nothing in the core mathematical formalism of QM to suggest any demarcation

between quantum and classical domains, it is simply introduced as a 'fiddle factor' in the equations, the so called 'correspondence principle' which indexes the wave equation to Planck's constant (which defines the smallest quanta[2]), thus solely linking it to quantum scales. There is no reason why this should be the case however. Thus the principle is quite contrary to the descriptive elements of the equation which attempt to map a bizarre set of data, in that it does the opposite and tries to preserve 'common sense'. Many contemporary interpretations of QM thus reject this and argue that the formalism applies at every scale even the macro-level. The real mystery is in this view why large objects do not behave as weirdly as quanta, and many speculative reasons have been posited. The whole idea of the 'wave function collapse' is now often rejected and rightly in my opinion. If an equation in physics describes an objective situation it always does so, the mathematical laws do not change according to perspective or scale. After all Schroedinger's equation is essentially a variant on Newtonian laws, as is Relativity Theory, and it would be bizarre to say these are changed according to scale, mass or statistics (this should not be mistaken for an ignorance of Relativity Theory, as we are talking of the consistency of the laws themselves not their application or form). Thus the wave function almost certainly constantly applies and never 'collapses'. I would suggest this seems a basic truism from our understanding of the close parallelism between mathematics and physics.

Two closely related interpretations of QM currently incorporate this non-collapse assumption, referred to as so-called Relative State Theories by Hugh Everett.[3] One is the Many Worlds Theory, the other is Decoherence Theory. The way the first model represents this is well

known, the wave function always applies to the universe as a whole, but the universe is a multiverse, it branches into alternative possibilities and we can only exist in one. From an internal perspective each of the components of the wave function is instantiated in a world of its own, and we only experience one world. When a measurement is made we thus enter one of several 'parallel alternative worlds'. Whether the universe splits, our minds do, or reality itself does, varies between different versions of this theory. There are several reasons this approach is popular, apart from doing away with wave collapse, one is the potential for bridging quantum mechanics and Relativity, the other is that it is entirely Realist. A Realist metaphysics in which conscious plays no role and the world is entirely physical and causally closed to the mind. Realism is still the dominant metaparadigm amongst Physicists, a paradigm shift from classical to quantum physics is one thing, but a metaparadigm shift in the deepest metaphysical assumptions of science is quite another! The branching of worlds is purely a mechanical process in which all the potential futures split off from each other and our awareness randomly follows one timeline. It is perplexing and not a little irritating to read some New Agers take up this idea of the multiverse and give it their characteristic Idealist spin, as if our minds choose the future world, something very far from the truth. But this theory is not without its problems. What the branching actually means, and how separate branches can interact, and later remerge, is a mystery that seems to add even more confusion to the situation. The popular idea of parallel universes or space-times is totally absurd, and not what any serious physicist believes at all. Interaction across disconnected spaces being impossible as there is no continuum or medium between them. It is rather as if some abyss opens up between the alternative states of a system, and

seems to imply some non-space on which the branches supervene, and within which neither classical nor quantum laws could apply. This would obviously seem to make the 'branches' incapable of causally interacting and they most definitely can, as numerous experiments have demonstrated. Another serious misgiving many have with this theory is that it implies an infinite or innumerable number of parallel worlds, something that seems excessive even to the most ardent critics of parsimony and energy conservation!

One thing is certain, 'magic' would not function within its context. This may not be the case with Decoherence Theory however. This second thesis is a little harder to grasp, essentially it says that superposition, and all the quantum weirdness that goes with it, is the normal state of the universe and always remains so. Classical physics is an illusion in this model, but there really is one universe rather than a multiverse as we shall see despite attempts that have been made to make Decoherence a mechanism within one version of the Many Worlds Theory. What happens in the clearest version of this interpretation is that when we make a measurement we simply reduce the superpositional possibilities of the system and make a quasi-classical world more probable. This is because whereas conventional quantum mechanics assigns a unique vector space to each 'isolated' system, the Decoherence model is theoretically rooted in unifiable vector space, where entanglement is the norm, and spaces representing defined systems can fuse together as subspaces of a higher dimensional vector space mutually interacting. Thus when an isolated quantum micro subspace, full of superpositional potential, connects with a measuring device, or any other environmental macro subspace, it merges with it and shifts it into superposition, with

all the components of the new vector space combining into a much larger entangled array of superpositions. However the large size of the new space disengages the superpositional elements from each other, 'spreading them out', by entangling them with the more 'separated' elements in the macro space, thus negating their mutual interference, or coherence. This creates a non interfering quasi-classical situation, which is further modified by the history of the macro system it entangles with. That is a consistent history is imposed on the measured superpositions creating the coherent 'classical' world of everyday experience. However all the superpositions still remain but we can only measure one consistent quasi-classical set of them with each measurement. There are an infinite number of such potential sets and so each measurement will be a unique quasi-classical perspective on a single universe in eternal superposition. Whereas the previous interpretation had an observer entering one of many possible 'classical' worlds on each measurement, this one has one superpositional world with several possible 'classical' observations of it, rather like Relativity Theory, with which it is hoped it will merge. All the perspectives are assumed to be ultimately consistent with each other, though simultaneously incompatible, as the quantum mechanical history of the entire universe, its 'quantum cosmology', should be consistent (otherwise we have the possibility of alternative universes again). This is somewhat like a non-collapse version of Bohr's Complimentarity, a singularly incompatible but mutually completing set of situations.

One remaining problem with Decoherence Theory is the absence of a Superselection rule that would predict which one of many possible consistent sets of histories is selected and maintain the overall consistency. In other words why we experience a particular consistent

history of the world. Some speculate on a kind of logical essentialism that predisposes the necessity of a coherent and consistent reality, but why this should be so is inexplicable and smacks of a crypto-mystical Platonic 'order' that transcends everyday reality. One interesting alternative possibility however is that this relates to the Anthropic Principle, the idea that our very existence depends on a consistent history in a coherent world which we ourselves thus 'impose' on the universe. Thus it would be the necessity of some future human situation rather than individual observation that figures the human into the equation. This idea currently exists only on the vaguer speculative fringes of theoretical physics however, and so it is at this point we must leave the philosophy of physics and embark on a more metaphysical analysis.

The Metaphysics of Magic?

The Anthropic Pinciple was once thought to be wild speculation in some quarters, but today seems forced on us by another consequence of modern science. This consequence involves the mystery of the initial conditions and precise constants of our universe. It is now widely accepted that the constants of the equations representing natural laws are incredibly finely tuned to form the kind of universe we exist in. A tiny difference in any one of them would make the universe unable to support our existence. Examples range from the charge on an electron to the cosmological constant. This has led to many to argue that such a situation could not have come about through random chance. Solutions to this problem have been sort by invoking parallel universes and the big bang / big crunch cycle, to argue for many sequential universes, with our universe a necessary rarity among a great many possibilities. However from our understanding of objective probability (Popper 1959)[4]

we can not really apply what appears to be a particular objective property of our universe, with its own laws, across all the, very different, disconnected universes, any more than we could apply Newtonian Mechanics. The only recourse appears to be Theology or the Anthropic Principle. Personally I am convinced by the many atheistic arguments within the philosophical literature of the absurdity of theism and deism to believe the latter is the only option.

The mystery of the particular consistency in experience posed by Decoherence theory is also found in arguments for Idealism, here some ordering principle is usually posited to solve the problem, be it various God concepts, shared language / narrative or the 'human collective consciousness'. We seem to be faced with a similar situation with the Anthropic solution to the QM Superselection problem. Interestingly within Decoherence Theory it is also said that the initial conditions of the universe at the Big Bang must meet a certain requirement for the consistent history theory to work and perhaps some parallel lies here. With the Anthropic Principle what all this adds up to is the idea that our future or current existance somehow constitutes a telos or goal towards which the past has been drawn. Such teleology has been made unpopular by historicist theories which claim to be able to determine such a telos, however this is not a necessary part of the theory, and I will argue does not apply here. How the telos works depends on the nature of the universe, a deterministic, finite cosmos might have an 'omega point' towards which events are directed, a less deterministic model might have several possible 'omega points' whose probability changes with events, while an infinite cosmos might have many teloi that form a chain of teleological focal points stretched out in time.

Whatever the case, the telos reaches back with reverse causation, a real possibility in a quantum cosmology, to engineer the very events that lead to those existances. Such a state of affairs being perceived by any situated observer as a mysterious historical process leading towards a certain end result. From a magical point of view one necessary component of the world is 'free will' of course, and to account for this a multiplicity of possible time-lines must be taken into account, and the less deterministic variety of the principle adopted. Such time-lines would probably manifest as a series of coincidences, such as the convenient extinction of the dinosaurs, a kind of purposeful synchronicity. With which we seem to already be approaching a magical viewpoint. Whether all this requires the temporary presence of humanity (or any other collective of sentient life forms) at time T, or whether it requires the stronger requirement of a specific historical situation at time T depends how strong the Anthropic Principle is taken to be. For magic to have a place in this hypothesis it would have to be very strong.

One of the problems with such a strong application of the Anthropic Principle is that it seems to imply that certain specific future situations have a high probability of occurring. Which would seem to indicate a very tight net of causal interactions extending in both directions across time, and, given the quantum mechanical aspects, it also indicates a tight net of limited acausal entanglements too. This however is quite likely within the context of a possible form of what I would dub a Hi-Strength Anthropic Decoherence Theory (HADT), that I would suggest may underlie any possibility of magic. Of course this is purely a metaphysical thesis, as such a theory has yet to be devised. Another major problem for this kind of Anthropic Principle is the fact that it not

only appears to be having a reverse causal influence, or even just an acausal influence, but rather appears to be influencing the very constants of the universe and therefore the laws of nature themselves. That is the way the pre-geometry of the universe came together to fix the constants is also being influenced - something that seems a lot more than a causal influence or acausal influence. This is not only like building your ship in the middle of the ocean, but even in the absence of any ocean! How could such a thing be possible? What could be the possible position this was performed from?

What would appear to be required would be a continuum of influence between an 'ordered space' and a 'non-ordered space', something outside the range of causation under natural laws of any kind. An obvious answer is a greater dimensionality, a 'higher dimensional space' in which order emerges, a stratification running from the pre-geometry of the universe to the realm of quantum mechanics and the probability laws, down to the quasi-classical level of a unified set of consistent histories and apparent classical reality. Such a dimension might be considered a logoic dimension, one in which order emerges to fit the end result defined by the telos under the control of a logos or ordering principle. The teleological influence would thus be working backwards along the time axis, shaping events and defining the consistent histories, and simultaneously acting along the logoic axis defining the mode of ordering of those events. Including the 'random' structuring of space-time from pre-geometry that defines those mysterious constants and the nature of the ordered universe. Such a higher dimensionality would be visualisable as a projected hypercube (either with the time dimension ignored or the first three space dimensions collapsed into a 2D 'flatland'), in which

the 'pre-ordered' domain was the 'outer cube' and the 'inner cube' the realm of ordinary physics. It also likely that this 'pre-ordered' domain also corresponds at least in part to the quantum realm that makes up the universe as a whole. Because what is interesting then is that a hypercube can be more easily analyzed by way of a set of 3D cross sections which produce self contained geometric forms, and such a mathematical approach seems close to the quasi-classical perspectival domains isolated from the quantum universe through measurement. It is also not hard to see a parallel in this with David Bohm's theories (see endnotes), and this approach could be a way of combining Bohmian and Decoherent Models. However there is still a missing factor in all this if the both events and order are shaped by the telos, what is it before these realities are shaped? In imagining a Anthropic universe based on (a)causation alone we can overcome the linear time paradox by positing a bootstrap cosmos within quantum mechanical framework, but when we talk about an influence of a pre-ordered universe we arguably have a completely different situation. One in which at least part of the telos must lie outside of the ordered physical universe of space-time in order to interact in a hypothetical logoic dimension. But what could be the nature of this existance?

The solution I would suggest, is one that also makes a scientific theory of magic possible. That is the extra dimension hypothesized above may be identical to the fourth or fifth dimension suggested by P D Ouspensky in 1912, in his controversial work Tertium Organum - in other words, a dimension of consciousness. Contemporary Philosophy of Mind now takes very seriously the possibility of a non-reductive, panpsychic theory of 'potential awareness' (many of us would in fact suggest this is the

only rational possibility given the evidence. See Chalmers 1996). One way of making sense of this would be to posit that the very capacity of objects in space-time ('us' for instance) to have 'qualitative experiences' is through the medium of an extra dimension of consciousness in which such things exist. That is just as within an Einsteinian view of space-time an object can exist in a certain spatial coordinate, but not 'exist for us' until it also exists in our temporal coordinates (the block theory of space-time), so might an object exist in space-time but not 'exist for us' until it exists in our consciousness, that is within our conscious coordinates within an extra dimension. Ouspensky explores such possibilities in the early chapters of his book, as well as relating this to a Neo-Kantian phenomenal conception of reality (though unfortunately he later drifts off into some bizarre speculations based on this insight). But within the context of quantum Physics it could be said that the difference between being or not being in our conscious coordinates is identical to the domains of quantum superposition, i.e. reality, and the quasi-classical domain of consistent history. Thus the idea of a dimension of consciousness begins to sound very much like the logoic dimension postulated earlier. An important note to make here is this is not a conscious coordinate based on perception, as is deployed in the 'observer effect' of a single measurement, it would be based on a collective cognition or awareness of reality based on belief systems. Or to put it another way on the 'information field' of this dimension (akin to the gravity field of normal space). Such a field may correspond to what Bohm called the 'information field' of the super-implicate order. Thus the measurement itself, as Decoherentists rightly claim would not need an observer, and a measurement may be only one form of Decoherence, however the consistency necessary for a HADT type

theory would require a shared cognitive information field to order it, and that field could reside in an extra dimension of shared consciousness - the ultimate origin of that information field being the telos of the Anthropic Principle. Empirical indications that this might be the case range from the effects of mind on probability distribution recorded by the famous MIT experiment and the alleged effect of scientific consensus on the 'impossible' crystallization of glycerine.[5] It should be noted that with this hypothesis we might also close the gap between subjective and objective interpretations of probability, where subjective belief includes conceptual and cultural 'possibilities', as the gap between belief and actuality narrows to a hair's breadth in this model.

Admittedly this is a bold hypothesis and as yet underdeveloped, however it may be a fertile starting point for a more detailed scientific research program. One of the interesting and testable things about is that it perhaps also facilitates a bridge between a Decoherence Theory, firmly rooted in the quantum mechanical formalism, and the more speculative insights of David Bohm with his Implicate and Explicate Orders. For it to be a serious theory of course it would need to be formalized. This poses a serious problem however with the full extent of the hypothesis, in that how could the content of a dimension of consciousness be represented? It is not hard to see how the mysterious subspace base shift in Matrix mechanics could be tied into an entanglement with another subspace in a higher dimensional vector space, but the exact result of the entanglement remains random in this formalism. It may be that this would be the limit of science a mysterious pseudo-randomness that actually masked a hidden order that could not be represented in any formalism. Even if we extended the Four Dimensional Space Operator

from a 4 x 4 array to a 5 x 5 array it is hard to see how this could help. In theory there may well be a way of codifying the effects of the extra dimension on the mechanics but the system would be so complex as to be incalculable. A typical chaos / complexity theory situation. Normally when this situation is met science turns to modeling and simulacra rather than calculation, but here we may have to model the entire timeline of the universe which would be quite hard to say the least. Science may have to eventually accept its limits and embrace an essential mystery. A possible limited formulation might involve subteloi however. Given that there will be an indefinite number of paths between now and any final telos, or teloi, we might speculate that a number of subteloi may exist along these paths. This would be like the various routes we could take between say Charing Cross (now) and Kings Cross (the telos) on the London Underground with a variety of lines used and stations (subteloi) passed through. We could project a range of possible future subteloi say a fraction of a second in the future and formalize these through a fifth Dimension, however this would still be a probabilistic solution.

But how does all this relate to magic? Well in terms of cosmology it is not hard to imagine the extra dimension of consciousness as being equivalent to the entity Occultists have poetically referred to as the Astral Plane, the Imaginal or the Dreamworld etc. It is highly tempting to equate the quantum realms of this dimension with these occult ideas, as well as with the more modern concept of the Collective Unconscious. Of course such imaginative speculations, though fascinating, would have to be constrained to fit the logical consequences of any more developed HADT formulation. Given this speculation however a more practical explanation of magic arises, one in which the teleology of a

HADT model was being exploited. If as seems likely one or more teloi in history are shaping and drawing events in particular directions, perceived as synchronicities by participants in these timelines, and that this influence is operating in part through an extra dimension of consciousness, than any manipulations of this extra dimension would modify the directions such timelines take. In other words we may have the ability to generate subteloi that steer events in a certain direction, that is create synchronicities, within the context of the overall telos. This raises problems for the testability of magic however, as from an experimental perspective any 'magical effect' would appear as a set of random coincidences and the causal factors themselves would be entirely explicable by relatively conventional physics. A testable consequence of this theory however might be the failure of magic to avert a major historical event, if we commited to the hypothesis of 'real magic' as an experimental stance. The deviation from the primary teleology might be too great. Given known magical techniques it seems likely that subteloi might be generated by the imagination but need some form of 'mental energy' to actualize them. This could be compared with the indentation of space-time by gravity and the amount of energy required to do this. Images in the fifth dimension might be understood as an equivalent 'indentation' or 'impression' in a malleable medium requiring energy. The energy concerned from studies of magic (Austin Osman Spare's orgasmic sigils and abstinence practice, and the infamous black fast of witchcraft) seems to be one of great psychological tension or will, and often is linked to a necessity for survival, the black fast being an obvious example, but addiction might be another (one ponders on the potential of 'crack magic'!). This might indicate that the driving force of the teleology is indeed the necessity of survival however

perceived. Such an idea would not be far from the necessary human existence postulated by the Anthropic Principle, which if taking the form of a particular outcome, as necessary in this theory, might well require the existence of a certain pre-existence of precursor events and ancestors. Such metaphysical speculation could go on and on, but it would be folly to get too far ahead of the useful limits of our, lagging but crucial, experimental physics.

In conclusion I would sum up the essence of this paper by saying contrary to popular philosophical prejudices there is really nothing 'impossible' about magic within the context of modern science. Whether the thesis outlined here is true or partly true or false, it at the very least demonstrates a possible mechanism for magic within contemporary physics and a starting point for a more detailed philosophical analysis, within what might be dubbed the Philosophy of Magic, and perhaps an eventual scientific research program.

Endnotes

1. The term Metaparadigm, or Metadigm in popular usage, refers to the more stable paradigmal assumptions shared by different Kuhnian paradigms. For example both the Newtonian and Einsteinian Physics paradigms are Classical in nature, while both Relativity Theory and the Many Worlds Interpretation of quantum mechanics adopt a Realist metaphysical foundation. It is much harder for Scientific Revolutions to shift metaparadigms than paradigms.
2. Planck's Constant is a consequence of early Quantum Theory, the discovery that energy was not emitted continuously from objects but rather in continual quantifiable bursts of radiation. The smallest burst being the size of this constant, and all other values being multiples of it. This was explained in terms of EM energy particles, or photons. It was subsequently found the subatomic particles also correspoded to this scale, which was thus defined as the smallest possible size for any entity.

Planck' Constant thus featured legitimately in many subatomic and electromagnetic equations.

3. I have excluded one other possibility here the Implicate Order Theory of David Bohm, as like many I feel its significance is as yet unclarified, and following Bohm's death such clarification may be a long time coming. Though reference is made to it in conclusion so a basic understanding will be useful. Essentially Bohm argues that the probabilistic wave function describes an ontological wave of propensity, a 'force' which governs the distribution, movement and localization of particles. Moreover such 'waves' are manifestations of a universal 'field' that governs such probabilities in the same way light waves are an oscillation in an electromagnetic field. Beyond this the particles that are determined by this field are in fact a localized 'unfolding', or manifestation, in what Bohm calls the explicate (directly connecting causal) order, of an 'enfolded' or hidden holistic order, universally extended in spacetime as an implicate (indirectly connecting acausal) order, that is experienced as non-local relations of entanglement and propensity. The 'universal field' is regarded as a way of modeling how the implicate order unfolds as the explicate order. Bohm thus appears to imply that each photon is a local manifestation of a universal electromagnetic field, and all photons essentially manifestations of that one field, and so universally interconnected through it, and that electrons have the same relation to a universal electric field, and so on into unified field theory. With the 'implicate field' being the primary foundation of these, as well as the source of propensity. He describes how particles unfold from this field through metaphors of vortexes and most detailedly through the example of an ink drop suspended in a container of glycerine, that can be stirred anti-clockwise, thus defusing the drop and making it disappear into the glycerine, but can also then be stirred clockwise making the inkdrop reappear, its order or structure having been secretly 'preserved' diffusely in the solution. These ideas are fascinating and arguably aesthetically appealing, however Bohm fails to explicitly relate these metaphors to the formalism of quantum mechanics, the core of the the physics, or any other foundational model, other than to say that the wave function refers to the implicate order and classical physics to the explicate order (and perhaps to imply the vortex of unfoldment is related to the rotational parallels of measurement. Remember the hand rule). He does say that the idea was inspired by

Green's Function, an acknowledged part of quantum mechanics, however inspired and derived are too different things. Instead he merely uses them to describe his intuitive understanding of quantum phenomena. Where he does use mathematical formalization to describe his theory the maths just appear to be algebraic definitions of his metaphors, notably the defusing inkblot. For this reason he has had little impact on mainstream physics and more importantly what all these metaphors are supposed to actually represent within established physics is very unclear.

4. Karl Popper demonstrated that Physics required a singular objective measure of probability to completely model events. Before this probability was either measured in terms of subjectivity (how certain we were in our knowledge) or objectively, but collectively, in the Frequency Theory (which formulated the 'rules' of probabality, i.e those stating the familiar averaging of heads and tails for large numbers of coin throws). But Physics required individual probabilities for singular 'random' events, to explain which required the concept of Propensity. That is for example a coin has a 'tendency' to be either heads or tails and this manifests evenly over time. Popper argued if this theory matches reality, as it appeared to, this propensity was very much like any force of nature that determined a physical result. Thus Probability had 'natural laws'.

5. The mystery around the crystallisation of glycerine is still controversial. The phenomena was first popularly reported in the book *Lifetides* by Lyall Watson. In this account liquid glycerine was regarded as uncrystalisable until 1923, when it was found in crystalline state by chance in various locations, Watson highlights a dramatic tale of a ship carry liquid glycerine being caught in storm which seemed to catalyze the crystallization. On the news of this reaching other scientists, and in particular of crystal samples reaching them, Glycerine suddenly becomes crystalisable, despite previously failed attempts, Watson claims in one case, "that soon after their first crystals arrived in the mail and were used successfully for inducing crystallization in an experiment on one sample of glycerine, all the other glycerine in their laboratory began to crystallize spontaneously, despite the fact that some was sealed in airtight containers" (p 47). This story has been used to support claims such of those made by Rupert Sheldrake in his now discredited Morphogenetic Fields theory, however the key point is that it is the knowledge of and belief in the crystallization that triggers the possibility of crystallization.

However things are not this simple, skeptics have pointed out that the crystallization could have easily occurred through the seeding of glycerine by microscopic fragments of the mailed crystals, whether purposefully or accidentally. The issue turns on the details of the events, and unfortunately Watson relies on an ambiguous paper in a rare Journal of Chemistry published in 1923 as his only factual source (this was formerly available on the Internet but no longer seems to be available). The sober paper roughly corresponds to Watson's more dramatic account, but simply says glycerine crystallized within 'sealed containers'. No reference is made to their air tightness or whether they had been previously opened. Read through a conservative mindset this is not a conclusive case therefore. Though does correspond to less dramatic and scientifically documented anecdotes of a similar nature. The case is thus still open. The MIT experiment is well known and involved a cascade of ball bearings being allowed to freely drop one at a time and form a physical even probability curve within a precisely engineered sealed mechanism designed to create this effect. Experimental subjects were asked to concentrate on the mechanism and attempt to change the probability curve. According to the experimenter's conclusions a very slight shift was detected.

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