

UNITY CONSCIOUSNESS
&

The Perfect Observer



QUANTUM UNDERSTANDING BEYOND REASON AND REALITY

by

Graeme Robertson





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15 Little Basing, Old Basing,
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Dedicated to
Deborah, Andrew and James
and all our beloved
relatives and friends.

Contents

Stage	Page
Preface	
1 There is a Problem 	1
1 Questions: Can there be an end to suffering?	5
2 Existence: What is matter, is it real?	8
Quantum Ontology	10
3 Knowledge: What is mind, is it rational?	14
Quantum Epistemology	14
2 There is a Solution 	21
1 Answers: reduction to self-evidence	26
2 The Standard Model: a great achievement	29
Elementary Field Physics	31
Quantum Chromodynamics	33
Electroweak Theory	34
3 Theory of Everything: required improvement	38
Space-Time-Matter	38
Evolution of the Universe	41
Matter-Force Supersymmetry	43
Quantum Geometry	44
3 This is It 	49
1 Extended Sense: deep understanding	52
Blinded by Science	54
2 The Perfect Observer: n th cousin identity	58
Quantum Identity	59
Quantum Numerology	62
3 Unity Consciousness: transcending the loop	65
Perfect Language	65
Self-Evident Supertruth	69

CONTENTS

4	That is That		73
1	Causal Reason: free control of future and past		75
	Quantum Logic		75
	Freewill		78
2	Conscious Evolution: programming of instinct		83
	Life-Forms		84
	Layer upon Layer of Programming		85
	Formation of Deterministic Structure from Naught		86
3	World History: the strong influences		89
	The 20 th Century		89
	Interfering Civilisations		90
	The Psychic Atmosphere		92
5	0		93
1	Psychotropic Conquest: Experiment with mind!		95
	Hindu Vedic Philosophy		99
2	Loopless Itness: Be without time, now!		102
	Quantum Philosophy		105
3	Godship: Fulfil selfless purposes!		110
	Quantum Religion		111
	Sociable Vocations		114
	The Five Propositions		115

Order Forms

Preface

WE LIVE IN A TIME OF EXTREME DANGER. The reason is that we have discovered how to *do* so much yet we don't understand what it all *means*.

What is the proper interpretation of science? Physics has revealed clusters of clusters of galaxies at the large scale of things, and constituents of the proton at the small scale of things. We have been brought to a stage where we do not expect that there *is* any reckoning of how our galaxy can be directly relevant to us as individuals even though most of our atoms were created inside one of its stars and ejected by a supernova explosion. Nor do we expect an explanation of how protons or neutrons can be of immediate relevance to us as persons even though we are almost entirely made of them.

We have come to believe that we exist fundamentally at the biological level and that the outer workings of the cosmos or the inner workings of the atomic nucleus must be irrelevant to life. Physics has allowed us to stop wondering because it has supported the inadequate and stultifying belief that we are just small cogs in a huge machine.

Science (from the Latin *scire* to know) is all about knowledge and as such can only be judged as profoundly successful. However, philosophy (from the Greek *φιλο* love of, *σοφος* wisdom) should be all about wisdom. As such it is a failure because, while modern science has filled us with great new knowledge, modern philosophy has NOT filled us with great new wisdom.

Wisdom derives from deep understanding and understanding is the fruit of thorough knowledge. Since few professional philosophers feel the need to become well versed in the new scientific knowledge, it is hardly surprising that philosophy as it stands today is of little practical significance. Many so-called philosophers have even cast aside constructive metaphysics, ethics and theology using empiricist arguments based on an outmoded understanding of logic, science and scientific method. This might explain why those who ought to have something constructive to say seldom make useful comments on current affairs.

The real problem of today is that the man in the street can't find an *oracle* to answer his questions satisfactorily. Traditionally this role has been played by the Church, but most eighteen year olds today cannot be expected to accept the biblical account of 'the creation of Adam and Eve'

PREFACE

or ‘the fall of man’ or ‘the virgin birth and resurrection of Jesus Christ’ without a lot more meaty explanation. The Church has great difficulty supplying an explanation, if indeed they believe there is one. Certainly they do not often utilize scientific theories in their preachings, nor, one would suspect, in their own musings. Furthermore, scientists spend less time than they should attempting to make their work comprehensible to non-specialists. In any case they are reluctant to think very hard about overall world-views because they are too satisfied with what they’ve inherited and scorn every alternative.

This book has been written for eighteen year olds (or anyone who will listen) as an honest attempt to face their justified questionings and to offer them a metaphysical framework with which to confront the twenty-first century. It is vitally important that certain modes of thought are uprooted and new modes put in their place if mankind and planet Earth are not soon to suffer an historic global catastrophe. Apart from the continuing world-wide proliferation of conventional, chemical, biological and nuclear weaponry, the temperature of the planet has risen more rapidly in the last twenty-five years than it has since the year 900AD, which confirms global warming by some cause or other. These and the many intensifying human conflicts and natural disasters demand that some fundamental changes to our *thinking* are made as soon as possible.

The *extralogical* or transcendental argument is this..... Face problems. Believe in solutions. Identify with the *source* of all. Come to sound conclusions. Hence see clearly. So step beyond the cycle of question and answer, of mania and depression, of sleep and wakefulness, of boom and bust, of war and peace, *of birth and death*. Realise the proper place of past and future by using the extralogical argument of the *five propositions*, or stages, to grasp a new understanding beyond the harsh confines of cold dead logic or the impersonality of material reality.

The five propositions will rouse different thoughts in different people. That does not matter as long as they lead eventually to a cessation or reduction of brain noise and a strengthening, intensification and controlling of long trains of clear thought underpinning action. The five propositions constitute a kind of poetic algorithm for action. Following the train of thought induced by concatenating these propositions together into a relevant *extralogical argument*, the non-cavilling are led to courageous action with transparent meaning and definite purpose. If the mind is prepared to admit *quantum explanation* then the neural network

may be optimally reconnected to mirror a new revelation of life. Even an associated desirable conscious genetic adjustment is conceivable.

This book is supposed to be pointing at something. The content, which is all about sense, has been dismissed as nonsense by professional philosophers. Maybe it is, I don't really know. I am NOT claiming to be a perfect observer or unity conscious or anything special at all. I don't even imagine that my attempts to summarize various scientific domains are entirely accurate or acceptable to experts. If I manage to convey only a tender modicum of scientific knowledge then that is enough for my purpose.

Although turned down by over fifty publishers, I still feel the urgent need to publicise my philosophical opinion so that *you* can decide for *yourself* whether there is anything in it.

PREFACE



STAGE 1

There is a Problem

Who is as the wise man? and who
knoweth the interpretation of a thing?
The Preacher



Please help!

WITHIN US ALL THERE IS A NATURAL DESIRE TO KNOW. Given this curiosity, questions arise for the creative mind to answer. Usually these are straightforward questions concerning the immediate

UNITY CONSCIOUSNESS AND THE PERFECT OBSERVER

requirements of life, but sometimes profound questions surface, deep answers to which are not immediately forthcoming. Who am I? Where did I come from? What is the purpose of life? Is there life after death?

Christian theology says you are a child of God with an indestructible soul which survives bodily death, and that the purpose of life is to do the will of God. But who is God, and what is his will? What is the soul?

Biological science answers such questions in a very different way. It says you are a biological organism which has developed through your lifetime from a single cell that encoded information from your parents' cells on how to unfold and grow into a potential parent yourself. According to bioscience, this reproduction *is* the purpose of life which has gradually developed from a primeval molecular soup by a process of blind evolution through natural selection by the survival of the fittest. When you die, you, as a conscious thinking individual, are totally extinguished along with your body: you are no more. But what *exactly* is a molecule? And what is the true explanation of MIND?

According to modern astrophysical science, a *molecule* is made of atoms whose nuclei were created from hydrogen and helium nuclei inside stars during their natural evolutionary process. Hydrogen nuclei (protons) and neutrons came from a quark-lepton fireball in the first second of the evolution of the universe. Within a few minutes some deuterium, helium and small amounts of lithium and beryllium nuclei were manufactured from these protons and neutrons. Eventually the nuclei cooled sufficiently to combine with electrons to form atoms and these atoms clumped together to form galaxies and then further coagulated into stars which exploded and coagulated again and again. As for the *mind*, psychological science considers it to be an epiphenomenon of the brain; a spontaneous emergent property of the exceedingly complex neural network. But what *exactly* are quarks and leptons? And how could *consciousness* appear from a physical conglomeration, however complex?

Answers to questions themselves give rise to questions and they to more. Is there no end to questions? Even an onion which has many layers has a heart that somehow accounts for its characteristics. What explains Nature herself? Can there be such a question which, if answered, would answer all questions? There is a perennial problem in science. Ignorance.

For Christian theology the problem is yet more serious than this. Adam sinned against God and thence mankind needs redemption before he can 'see the light'. In a story about Jesus, the redeemer, no man cast the

first stone on the woman because all of them, in effect, acknowledged their sinful nature. There is a problem just being human? Sin.

Physics, the most fundamental science, traditionally concerns itself with what is objective reality. The word ‘physics’ comes from *φυσικα* meaning *things of nature*. In its highest traditional expression, physics looks for basic constituents, elementary particles, in terms of which the entire objective world can be explained. But even if it is completely successful and proves beyond doubt that everything we see around us is made ultimately of quarks and leptons, there still remains the question: why do these particular elementary particles exist and not different ones?

Cosmology is that branch of physics which attempts to explain why anything at all exists in the first place. The universe is observed to be uniformly expanding. Projecting backwards in time, apparently the whole universe started about fifteen billion years ago from a dense small point. But why did it start? Whence existence? There is a problem. Existence.

If there is more than a certain ‘critical’ amount of matter in the universe then current cosmology says that the whole universe will stop expanding and begin to contract, returning to the small dense point. Everything in the universe will return to its original state. Biological life will return to mere molecules, molecules to atoms, atoms to a quark-lepton fireball. Quickly, that too will be snuffed out in a black hole singularity. Everything biological, chemical and even physical, will die and return to its pre-elemental nature to be described *without any* temporal or spacial or structural characteristics.

Even given the fact that some of a parent’s traits survive genetically in their children, in some sense representing immortality, nevertheless their children’s children’s children’s children will ultimately surely die in a biological sense, and then in a chemical, and then a physical sense, in the ultimate fate of the universe as a whole. There is a blatant problem. Death.

In our day people think little about death. Few have sufficient faith in traditional religion to feel totally confident about an indestructible soul. Most seem to take it for granted that death will be the end: at death consciousness will fade to nothing, leaving nothing of the life that was; no perpetuation in spirit, no heaven, nor hell, nor reincarnation.

To kick a brick is sufficient evidence of materialism for materialists. But materialism is an outdated philosophy. It is too superficial to be of any real value in delivering meaningful answers to serious questions about the experience and nature of self-death. Unless a deeper philosophy is

UNITY CONSCIOUSNESS AND THE PERFECT OBSERVER

furnished and quickly becomes accepted by people at large, society will crumble, as societies have before, because it will have no essential optimism for the long term future and no selfless motivation to seek after pure truth.

In this particular period of history, when rapid change is all around us, there is another problem; violent conflict. In other words, look, it really is getting VERY DANGEROUS NOW!

① Questions: Can there be an end to suffering?

“LIFE IS SUFFERING” said Gautama Buddha around 500 BC. Why did he say that? Was it because so many people in the world happen to find themselves in appalling circumstances? Was it because we all suffer life’s tribulations at some time or another. Or was it because most humans, however well off, always seem to want a bigger house or a better car or just more fun and more money? It is not often that you hear of someone giving away most of their money just because they feel they have too much. By equating value with money, everyone, almost by definition, wants more.

Life sometimes does seem to be a struggle to earn a living, eke out an existence, compete with whatever elements. Stop eating! If that is no problem then it will be in a week. Stop breathing! If that is no problem then it will be in a minute. In fact, if we don’t continually keep our life support systems running then we are just one moment from death. What a responsibility! Perhaps it is as well that we are generally unconscious of these functions, otherwise we might forget, mishandle or play with the vital controls. Who has the patience to keep their heart ticking faultlessly for a hundred years? One would be well advised to master self control before approaching such powers. Is this why we suffer; deep rooted fear?

Perhaps Buddha was referring to the anxieties we sometimes inflict upon ourselves when we ask pessimistic “what if ...?” questions. Anyone with a comfortable life can spoil their contentment by dwelling on a lamentable past or on negative future possibilities. Either we have a life of real problems and difficulties or else we are apt to invent or imagine them. Either way we suffer.

Is it possible to be truly and constantly *ecstatic* then? Anything less than ecstasy involves a degree of suffering. Faced with the ultimate prospect of death, and an intermediate likely prospect of some pain, it is hard to see how *total ecstasy* is achievable. Only by some way managing to escape the grip of death does it seem possible to cast off suffering entirely. Until then we are stuck with problems of one sort or another.

On the intellectual level, there is a problem unless one has a completely unified credible satisfactory explanation for *everything*. Once religion assumed this rôle. Now science provides astonishingly concise and beautiful alternative explanations of very many natural phenomena. Theoretical physicists are currently expressing the view that the final explanation of everything might soon be found. Unless they reject all the

UNITY CONSCIOUSNESS AND THE PERFECT OBSERVER

following concepts as superficial, they ought to be able to present their theory in a way which shows how these concepts fit into the general scheme: truth, goodness, beauty; faith, hope, charity; peace, love, courage; honesty, humility, dignity, virtue; happiness, enchantment, joy; wisdom, prudence, understanding; zeal, loyalty, devotion; purpose, meaning, responsibility, justice; grace, charm, value; wonder, awe, amazement, astonishment, rapture; righteousness, holiness, divinity. Any unified *theory of everything* that mentions none of these notions is completely missing the human dimension unless they can be explicitly reconstructed. Otherwise they might as well all be totally disregarded as being of no fundamental consequence whatsoever.

As there is no largest number, so there is no final question. (What is the number after that one?...) Even if there was a general theory that accounted for everything, unless it was totally understood *intuitively* one could still ask of it any number of difficult questions reflecting different specific conditions in this chaotic world.

Scientific method itself is sometimes considered as a meta-theory which can be applied to yield answers (theories), and that it is about to yield the final answer to the most fundamental of questions. But scientific method does not only involve verification of a theory by testing against observations. This could be conceived as a mechanical process. It involves the difficult creative act of induction of generalities from particulars.

Remember Bob Hope said: "He who generalises generally lies!" Inventing accurate new theories is NOT easy. The criteria for accepting a scientific theory involve gauging the veracity and surprising novelty of predictions, measuring the simplicity, elegance, economy and beauty of a theory, and weighing the value, import, content and generality of an explanation. Are not these teleological, ethical and aesthetic measures doomed to be outside the scope of any scientific theory? What then is their status in a scientific theory of everything? What indeed are the limits of science?

According to *quantum* philosophy, the characteristics of physical phenomena are fundamentally defined by the questions we ask. The way an observation is made determines the concepts that can be meaningfully applied to the resulting observed phenomenon. Thus the rôle of the inquisitor actually takes on an active significance. It is through questions that we can find out about the world. Indeed it is through active questions that the world takes on specific shape and size and structure. Generally, in

order to ask a question of a scientific theory, an apparatus must be carefully set up in order to ask the question of nature. In quantum philosophy the interaction between apparatus and nature is so intrinsic that the properties ascribed to nature can not be extricated from those of the apparatus. Nature does not present herself for an inspection of her absolute appearance but rather changes her very heart according to the intentions of the inquisitor.

According to Buddha, the enlightened, or aware, or undeluded one, liberation from suffering is to be achieved by higher states of consciousness, leading ultimately to nirvana where one is finally freed from the cycle of birth and rebirth. In quantum philosophy the interaction relating observer to observed is so intimate that no clear division can be maintained between the two during the moment of observation. During this moment the seer and the seen are one. The mind is expanded by becoming aware of the object. The body is expanded by becoming ontologically one with it.

A sound theory that is not understood is full of conceptual difficulties and paradoxes. When the theory is assimilated, the paradigm shift involved reflects a general alteration and expansion of consciousness. A unified theory of everything, if understood fully and intimately, ought to end in enlightenment whereby all problems are immediately soluble and one is thereby freed from all material and intellectual suffering.

What would you do if you discovered that a mere thimble-full of the chemical methylenedioxymethamphetamine (MDMA) could make you feel ecstatically happy for a year without any loss of control whatsoever? Would you want others to be ecstatic when you're not? Is the psychic atmosphere against it? If Popeye was right about the power of spinach, it would be totally illegal, but the army would eat it.

② Existence: What is matter, is it real?

SIR ISAAC NEWTON'S CLASSICAL MECHANICS of 1687 and James Clerk Maxwell's classical electromagnetism of 1873 are without doubt *tremendous theoretical and practical successes*. By the year 1899 many physicists believed that physics had just about reached a successful final conclusion, only a few odd peripheral problems remaining to be cleared up.

One such problem is called the *ultraviolet catastrophe*. Classical theory predicts that far more high frequency radiation should be emitted from a very hot object than is actually observed. Around 1900 Max Planck discovered that he could correctly account for the observed distribution of frequencies by making the radical assumption that energy exchange between matter and radiation takes place by way of a discrete indivisible *quantum* of radiation whose *energy is directly proportional to the frequency* of the radiation. The absolute universal constant of proportionality is now called Planck's constant and equals a thousandth of a trillionth of a trillionth of the action associated with a mass of one gram moving at a velocity of one centimetre per second over a distance of one centimetre. (A billion is here defined as a thousand million, and a trillion is a thousand billion.)

In 1905 Albert Einstein used Planck's linear relationship between energy and frequency to explain another outstanding problem called the *photoelectric effect* in which light falling on a metal releases electrons whose kinetic energy is observed to be independent of the intensity of the incident light. Einstein postulated that light consists of particles, now called *photons*, whose energy is Planck's constant times their classical frequency. This explained why the energy of the released electrons should be limited by the frequency, not the intensity, of the incident photons.

Another question which classical theory could not answer concerned the *stability of atoms*. An atom was considered to be composed of very light electrons encircling the relatively heavy nucleus which had been discovered by Ernest Rutherford in 1911. But no known mechanism could stop the electrons from emitting radiation and spiralling into the nucleus. In 1913 Niels Bohr postulated that in an atom, electron energy can only take on discrete values. Jumps from one energy level to another could then only take place by the emission or absorption of photons whose frequency is given by the Planck relationship as being directly proportional to the energy difference between the two levels. This new picture of the atom

could then explain, amongst other things, the origin of the spectral lines characteristic of each atom.

Although Planck's relationship was proving successful, it did not constitute a theory but rather was regarded as an *ad hoc* hypothesis to be coupled onto classical physics. A major step towards the totally new theory of quantum mechanics came in 1923 when Lewis de Broglie proposed that matter has wave-like properties in a counter-analogous way to Einstein's proposal that light has particle-like properties. Knowing from special relativity that *mass is a form of energy*, and from Planck that *energy comes in quanta of a proportionate frequency*, de Broglie simply derived the explicit *linear relationship between mass and frequency*.

Erwin Schrödinger in 1926 developed de Broglie's proposal into a *wave equation for matter*. This equation, together with a probabilistic interpretation of the matter wave given by Max Born in the same year, constituted a radical and revolutionary new fundamental theory called *wave mechanics*. Born realized that the square of the modulus of the complex wave function governed by the Schrödinger equation of motion gives a measure of the *probability* of finding a particle at a given position and time.

Working from a very different perspective, Werner Heisenberg pursued a deeper explanation than Bohr's of the origin of the spectral lines of atoms. Sticking closely only to those quantities that are in principle physically observable, like frequency and intensity rather than hypothetical electron orbits or trajectories, he developed in 1925 a theory wherein physical (i.e. measurable) quantities are represented by matrices. The fact that matrices generally do not commute with one another under multiplication led Heisenberg to his famous *uncertainty principle*. It states that physical quantities represented by non-commuting matrices, such as is the case for position and momentum, cannot both at once be measured exactly, but can be simultaneously specified only up to a certain LIMIT equal to Planck's exceedingly small constant of proportionality. In classical physics this limit is presumed to be zero.

In 1926, Schrödinger proved that his wave mechanics and Heisenberg's *matrix mechanics* are EQUIVALENT theories. They came to be known as *quantum mechanics*. Despite its highly technical historical origins, quantum mechanics turns out to be such a profoundly radical theory that it modifies *all* previous understanding of the nature of the physical world. When a fundamental scientific theory tampers with everyone's cherished preconceptions then a conceptual revolution, a

paradigm shift, a transformation of consciousness is underway which is very likely to have powerful unforeseen implications world-wide.

Schrödinger's equation almost immediately led to a good basic mathematical understanding of the reason for the periodicity of the periodic table of chemical elements, now called atoms, which had been constructed by Dimitri Mendeléeff in 1869. It also gave a quantitative account of chemical bonding. This led to rapid advances in chemistry and then to advances in molecular biology. Another domain in which quantum mechanics proves to be of enormous value is in the study of solids in the crystalline state. Out of this particular application of quantum mechanics has come microelectronics with, in particular, its replacement of electronic valves by microelectronic transistors. Another major area of study which has been transformed by quantum ideas is the physics of the atomic nucleus to be discussed in Stage 2.

Quantum Ontology

Let us outline some of the major *conceptual* difficulties of quantum mechanics. In so far as these difficulties conflict with our world view, our world view will probably have to change.

In ancient Greece, Democritus argued that reality consists of atoms moving in a void, or vacuum. This is the view which Newton supported and which is still largely prevalent today. The relatively recent success of the Rutherford-Bohr model of the atom in 1913 and the particle language adopted by present day elementary 'particle' physicists has given weight to the common misconception that quantum philosophy basically agrees with Democritus. (Actually, even the concept of a vacuum is quantized in quantum field theory.)

Contrary to Democritean atomism, Parmenides argued that reality is a solid homogeneous plenum without void. Space is like a jelly. Ripples within the jelly account for matter in motion. This view has much in common with Maxwell's approach to electromagnetic phenomena as well as Schrödinger's own interpretation of wave mechanics.

Parmenides and Democritus flatly CONTRADICT one another. The two ontologies, or theories of being, are mutually exclusive. So what does quantum mechanics tell us? It says that if you set up an experiment designed to produce an interference pattern, a signature of WAVES, then this can be done with photons or electrons or, in principle, *any material object* such as whole atoms or molecules or even tennis balls or stars. If on

the other hand you set up another experiment designed to identify precise location, a signature of PARTICLES, then this can be done with photons or electrons or *any material object*, even sound waves (phonons) or radio waves (photons) as well as tennis balls and stars. But classical understanding calls for a *monistic* ontology; waves *or* particles not both mutually exclusive concepts. So what IS reality?

At this point Heisenberg's approach should be recalled. In his construction of matrix mechanics he only gave credit to those physical quantities which are actually observable. If, for example, you assume that an electron IS a particle which goes one way *or* the other round an obstacle then the resulting interference pattern leads to an ontological contradiction because only waves can interfere. On the other hand, if you supply equipment to observe which way round the electron actually goes, and this can always be done, then you *necessarily* lose the conditions required for interference, and so destroy the pattern thus avoiding manifest conflict between wave and particle natures. It is in quantum principle not possible to show which way the electron goes *and* at the same time demonstrate the wave interference pattern. In this way quantum mechanics just manages to avoid a direct ontological contradiction. Thus quantum theory loosens the usual strangle-hold of any universal absolute ontology. Everyone sees it differently. Everyone has it different!

Treating everything as interfering Schrödinger waves works in theory until one actually looks at the spacio-temporal position of some particular thing. At that moment all semblance of a spread out wave in continuous space disappears and one observes a localised object at a definite place. To avoid a dilemma, Heisenberg concluded that in describing nature one is NOT obliged to fill in a picture of the *interphenomenon*, or *noumenon*, particularly in a situation where observing that noumenon necessarily alters the original phenomenon itself. Indeed, an attempt to cling to a simple model of what is happening 'behind the scenes' of a quantum phenomenon always leads to an ontological contradiction in circumstances where verifying by observation the validity of the ontological model of the noumenon would destroy the original observed phenomenon.

Anything that is in principle not demonstrable should be disallowed as part of the ontological description of nature. For example, any attempt to demonstrate that electrons follow definite trajectories round the nucleus of an atom will fail because using X-rays, which are needed to identify the location sufficiently, transfers to the electron a quantum of energy of a

UNITY CONSCIOUSNESS AND THE PERFECT OBSERVER

definite amount directly proportional to the high frequency of X-rays, thus *significantly* affecting any trajectory which the electron might hypothetically have had. Quantum philosophy prevents one from conceiving an atom as a nucleus surrounded by orbiting electrons, like solid planets round a star. Instead one is forced to the conclusion that INTERPHENOMENA ARE NOT OBJECTIVE. This does not mean that nothing can be said about noumena. Quantum mechanics says a great deal about that in terms of the Schrödinger wave. But noumena can't be fully understood in ordinary classical terms, only in quantum terms.

As an illustration which demonstrates that noumena behind phenomena cannot be accorded a simple classical ontology, consider the simple case of a dim source of light which releases a single photon. Corresponding to this will be a Schrödinger-type wave spreading out at the speed of light in every possible direction. If the photon is detected with a photomultiplier some distance away then immediately the Schrödinger wave must change its configuration to become zero everywhere except at the location of the photomultiplier, having been as it were transformed by the Heisenberg matrix representing the position measurement. This instantaneous change of the wave over a considerable volume cannot simply be physical without violating the tenet of special relativity that no information can travel faster than light.

Einstein was VERY UNHAPPY about this non-local aspect of the Schrödinger wave. In order to demonstrate what he regarded as an unacceptable consequence of the theory as presented by Bohr and Heisenberg, he, Boris Podolski and Nathen Rosen devised in 1935 what has come to be called the EPR thought-experiment.

Einstein felt that if an object could have its properties predicted with certainty without its being disturbed in any way then one was justified in regarding these properties as belonging to the object itself, prior to and independent of any observation. This sounds eminently reasonable. Consider, for example, a particle which spontaneously splits into two equal mass parts. If one part is found to have a certain momentum then the other will certainly be found to have, by conservation of momentum, an equal and opposite momentum. If on the other hand the position of one particle is measured precisely then the position of the other can be predicted with certainty by quantum mechanics. This suggests that particles actually *have* precise positions and momenta simultaneously even though Heisenberg's uncertainty principle says that quantum mechanics cannot simultaneously specify both precisely.

This argument led Einstein to propose that quantum mechanics is a statistical approximation to a deeper theory in much the same way that classical statistical mechanics is an indispensable approximation to classical mechanics for describing large numbers of particles in, for example, thermodynamic considerations. There has been much effort expended in trying to discover this hypothetical deeper theory, now called generically a *hidden variable theory*. However it was shown in 1964 by John Bell that any theory which preserves the classical *separability* of the two component particles described above AND restores classical *determinism* AND reproduces the *predictions of quantum mechanics*, will lead to certain restrictions on the results of a series of Einstein-Podolski-Rosen type measurements. A number of different experiments have now shown that these restrictions are violated which means that *there are no hidden variables* of the kind believed by Einstein.

The quantum philosophical resolution of the conceptual difficulty rests on the conclusion: *interphenomena are not objective*. It is incorrect to visualise the situation in terms of particles flying off in opposite directions. Rather there is a Schrödinger wave propagating outwards and this wave encapsulates all the *entangled* correlations between potential observations. When an observation is made the wave immediately changes form over the entire volume. This non-local behaviour ties the observer to the observed yet more intimately than Newtonian physics does. Newton's conception of gravity involves *action at a distance* which implies instantaneous non-local transfer of information. That is quite an attachment. However relativistic theory does not allow such instantaneous transfer of information. The new intimate quantum relationship between interacting entities is sometimes called *passion at a distance*. Quantum stuff hardly even has properties of its own.

It is difficult to make the necessary conceptual leap from ontological monism to ontological-cum-epistemological holism which quantum rationally invokes dramatic instantaneous large scale change behind the face of modest observation, but this is what quantum reality demands. The most subtle observation can have an almost omnipresent significance over a huge spacial range, especially when prior interactions of the observed object are taken into account. We might have thought that we knew what brute matter was, but now it seems more alive than dead.

③ Knowledge: What is mind, is it rational?

THE COMMON SENSE NOTION OF PROBABILITY refers implicitly to some contingent lack of knowledge which makes certainty unavailable. It is therefore natural to think that the Schrödinger wave is merely an incomplete expression of what is known about a physical situation, making non-local changes in the wave merely *changes of knowledge*. But the Born interpretation of the wave function as giving a measure of the probability of observing a specific outcome can not support an understanding purely based on what is known rather than what is the case.

Quantum Epistemology

Quantum probability does not reflect a lack of knowledge in the usual sense because once the wave function has been specified completely then nothing more can be said about the state of the world. There are no hidden variables to discover: no relevant information is left out. And yet predictions may still only be expressed as probabilities. The fundamental indeterminism of quantum mechanics leads to probabilistic predictions. Since we have been used to thinking in terms of deterministic mechanical theories, any mention of probability naturally implies ignorance. However in indeterministic quantum mechanics **IGNORANCE IS THEORETICAL**. That is, the theory itself implies necessary ignorance. Ignorance is rational. Statistics can be deep; quantum statistics.

Consider electrons passing by an obstacle and producing an interference pattern on the far side. The pattern can be built up slowly on a photographic plate by sending one electron at a time. If this classically indivisible material particle with its classically indivisible electric charge goes *either* round one side *or* round the other side of the obstacle then **NO** interference could possibly occur. Only if the electron wave goes round *both* ways, and then interferes with itself, can the pattern be produced. If the wave solely expressed knowledge and not reality then how could a real interference pattern appear? *No local deterministic hidden variable theory can account for such phenomena.*

Bohr devised a new word to describe the situation encountered in quantum mechanics relevant to two observables related by the uncertainty principle. When one describes a phenomenon in quantum mechanics certain words are naturally involved in the description; for example

position or time. Other words, which are not simultaneously applicable according to the uncertainty principle, such as wavelength and frequency, Bohr called *complementary*. Complementary measurements must be represented by matrices in matrix mechanics (or differential operators in wave mechanics) which do not commute. The complementarity relation has often been compared to the relationship between yin and yang in Chinese philosophy because of the essential unity beyond yin-yang duality (☯). Ordinary vocabulary seems to split into two sets of complementary words and each word seems to hold something of the essence of its complement. Further than this basic duality, angular momentum seems to exemplify a *trinity* or three fold entanglement and there are other examples of more complicated entanglements or *contextuality*.

It is often supposed that the conceptual difficulties of quantum mechanics refer primarily to the prediction of the *future* and that retrodiction of the *past* can be freed of the restrictions of the uncertainty principle, leading, for example, to a complete reconstruction of the historical path of a particle. However, in 1931 Einstein, Richard Tolman and Podolski showed that such retrodiction of the past can lead to prediction of the future which violates the restrictions of the uncertainty principle. They concluded that the principles of quantum mechanics actually involve an uncertainty in the description of *past* events analogous to the uncertainty in the prediction of future events. This forcefully tells us what we already intuitively know: *now* is a very special window on the world, alone in giving certainty. There is nothing so special about ‘now’ in classical or relativistic physics.

Quantum mechanics applies to microscopic objects. It also applies to larger objects such as crystals, superconductors and superfluids. Indeed, there is every reason to suppose that quantum mechanics applies to all objects no matter what their size or function. In particular quantum mechanical description can be given of a measuring instrument itself. The purpose of a quantum measuring instrument is to magnify microscopic possibilities into quantitative macroscopic possibilities. Although not deterministic, quantum mechanics is causal with regard to the propagation of possibilities. Thus the Schrödinger equation can be used to show how the wave describing the microscopic set of possibilities can be amplified into a wave describing a corresponding set of macroscopic possibilities of the measuring instrument.

Look at a revealing example of this macroquantum mechanics. Schrödinger *imagined* putting his poor cat into an opaque sound-proof

box. The cat is connected to an electrocuting device which is triggered if a single photon hits a photomultiplier that has been placed behind a semi-silvered mirror. A single photon is directed towards the mirror. On hitting the mirror the Schrödinger wave splits into two components, one which goes through the mirror and one which is reflected by the mirror. These two components represent the two possible phenomenal outcomes, the 50% chance that the photon has passed through and the 50% chance that it was reflected by the mirror, in classical thinking. The wave component passing through the mirror hits the photomultiplier and is amplified into a wave triggering the electrocuting device which then kills the cat. The wave component not passing through the mirror does not hit the photomultiplier and leaves the cat unharmed.

At the end of this unpleasant imaginary experiment one is left with a box, the contents of which are described quantum mechanically by a Schrödinger wave made up of two distinct components. Classically the two possibilities, a box containing a dead cat and a box containing a live cat, are mutually exclusive. One presumes that one possibility is actually the case in fact and the other is actually not, but one just *does not know* which is the case until one looks.

Quantum mechanically, probability is not interpreted as mere lack of knowledge but, because of the experimental and theoretical evidence of interference of classical possibilities, probability has to be given epistemological *and* ontological significance. We know that when we look we shall see a cat which is either dead or alive and not in any sense both, and that a consistent classical history will follow too. Similarly we know that when we look at an electron wave, however complex, we shall see only an integral charged electron of a particular mass at some particular place. For both the electron and the cat the uncertainty involved is of the same quantum mechanical quality and must be given ontological as well as epistemological weight. In other words, we can't regard the cat as being *either* dead *or* alive in reality but we just don't know which. We have to accept that the cat is in a *superposition* of live and dead states or *superstate* or noumenal state.

Common sense tells us that if the cat is found alive then it has been alive all the time, the electric shock machine did not work and the photon did not pass the mirror. Such retrodiction is allowed, but not before the cat is observed. In quantum sense, prior to observation, ignorance is theoretical, interphenomena are not objective, the past and the future are both superstates. Sleep is a myth.

Even if we are prepared to grant that the cat, as well as everything else that we are *necessarily ignorant of*, is in a noumenal as opposed to phenomenal state, what does the cat herself think? If she suffered the electric shock then she can think no more, but if she did not receive the shock then presumably she has, in some sense, verified to herself that she is not in a paradoxical noumenal state but in a simple phenomenal live state.

This conceptual obstacle was expressed most acutely by Eugene Wigner in 1961. He imagined a friend had already looked in the box to discover the state of the cat. Wigner realised that he must describe his friend as being in a noumenal state too. After hearing about the fate of the cat Wigner therefore asks his friend the presumed superfluous rhetorical question, “Just before I asked you about the cat you were in a noumenal state. What was it like?” His friend replies, “No. I was in a definite phenomenal state and the cat too has been in a definite live state, at least ever since *I* looked at it.”

One would be justified in arguing that in this case there obviously are ‘hidden’ (classical) variables which we have not taken into account such as the temperature of the cat. However the account is still valid in (quantum) principle because it is theoretically possible to organise the experiment in such a way that, by suitable screening, it is impossible to know what happened to the cat, and then also impossible to know what the friend saw. In this circumstance the particular life or death information has to be given in terms of a noumenal superposed state. Much more can be said about other secondary matters, but as regards the simple life or death situation a superposed noumenal state embodies the complete quantum description. Likewise the pointer reading on a measuring instrument is the significant datum. This too is in a noumenal state unless being actually read in which case it is phenomenal. That is, it is in a definite unsuperposed quantum state as regards the observation in question. As regards a complementary observation, however, the state is again a superposition.

In terms of Schrödinger waves, at the semi-silvered mirror the wave divides into two components which remain a distinct non-interfering superposition of two spiky waves thereafter until the state is observed. But did the photomultiplier *observe* and so *collapse* the superstate into one definite state, or did the cat, or did the friend, or did Wigner himself? There can be no question of an ordinary classical explanation of this collapse because that would invoke deterministic hidden variables which

would necessarily be *non-local* making the notion of explanation unlike that expected of a mechanical understanding anyway. For this reason the notion of a dynamical collapse is too realistic and therefore unhelpful.

Quantum mechanics applies to biological matter as well as atoms and elementary particles. Wigner is therefore obliged to describe the photomultiplier, the cat AND his friend as noumenal until observed by *himself*. He is not treating himself as a physical object to be included in an objective account of the physical situation, rather his consciousness of the external world is the terminal link in the chain wherein the world is not so much confronted hypothetically as directly and actually. Probability is not a notion needed to describe an immediate conscious experience in the way that it is required to describe potential, or latent, or 'would-be', experiences. However, exactly this argument which satisfies Wigner that the buck stops here, in his mind, also satisfies his friend. Is Wigner therefore plain wrong to describe his friend as noumenal?

For Eugene, before discovering the fate of the cat, the cat is in a noumenal state. For his friend, the cat is not. The conclusion to be drawn from this is that *ontology itself is relative to the conscious observer*. We are quite familiar with the notion that *knowledge* is relative to the conscious observer. Now it is necessary to extend this relativity to *being*, so that what can be said to BE is not absolute but relative to consciousness. Mass is a form of energy. Energy is complementary to time. Therefore the concepts of material reality and passage of time cannot both together be applied with impunity.

The quantum wave function or superstate or noumenal state of a system accommodates the complete description of the system. It incorporates everything that can be known about the system. It has both ontological and epistemological force. It is not just a statement of knowledge and it is not a simple statement of being. The quantum state is of a different order of reality, which intimately unites knowledge and being, as well as ignorance and nothingness.

Consider hypothetically some object behind your head. You take it to still be the thing you perceived it to be a moment ago. However, it will by now have interacted with something which itself was in a superposed noumenal state. This puts that object in a noumenal state too, and hence you in a state of relative ignorance about it. The thing is now neither known for sure nor is it even something definite. It's not phenomenal, it's entirely noumenal. Indeed *only* those things of which you are currently directly aware are not noumenal: they are the only true phenomena. Turn

round. Look at the object. Now it's phenomenal, definite, certain, if it's still there.

In terms of wave mechanics, the thing which you are looking at can be represented by a sharp spikey wave implying relative certainty of something, position for example. As soon as the thing is not in conscious focus, waves from the surroundings splash against the spikes turning them into flatter distributions representing things which are in quantum principle less than certain, less than real, but more than impossible, more than mere ideas.

Of course in science everyone has to agree at the end of the day about what the world is like. When dealing with actions which are large with respect to Planck's constant then the familiar concepts of classical mechanics become meaningfully applicable in practice and so large objects can usually be taken as definite, even when not being scrutinized. But when instruments magnify quantum possibilities, what ensures that everyone experiences a consistent world? In 1957 Hugh Everett III offered a quantum mechanical proof that everyone would agree when they confer about the state of the world even though different observers can have had different noumenal histories.

It is by looking at the world that we obtain our sense of rationality. Classical physics can appear as the epitome of reason because it coincides so well with what we have come to regard as giving a reasonable and rational explanation. The concepts of classical physics constitute such an entrenched paradigm, a paradigm which might even be physically wired into our brains, that we forget that the concept of rationality itself is ultimately determined by the nature of the world and not just by pure abstract thinking. When the world is given a new quantum form of explanation, with it comes a new paradigm of rationality.

Ontology and epistemology, while clear and distinct concepts in Aritotelian and Newtonian physics, are intimately yoked together in quantum physics. This union causes such a change of perspective that possibly no one has yet succeeded in achieving a clear understanding of it. Omniscience can no longer mean knowing all about everything in the obvious classical sense because *ignorance is theoretical*. And reality is not ultimately brick-like because *interphenomena are not objective*. Classical understanding kept mind and matter distinct. Quantum understanding makes their acquaintance.



STAGE 2

There is a Solution

Ask, and it shall be given unto you;
seek, and ye shall find.

Jesus Christ



Help!

THE SCIENTIST HAS GREAT FAITH. He believes that sensible questions will have meaningful answers. Unwavering confidence in this, together with the doctrine, attributed to Francis Bacon around 1600 that there can be no final claim to scientific knowledge until a proposition

has been subjected to experimental verification, has led to rapidly accelerating progress in science and technology since the time of Newton, about three hundred years ago.

The fundamental theoretical discoveries of Newton published in 1687 led DIRECTLY AND INDIRECTLY, over the following hundred and fifty years, to dramatic developments in large and small scale engineering; to steam engines (1700), steam pumps (1705), steam ships, railway trains (1814), reflecting telescopes and pendulum clocks, as well as to better bridges, microscopes, guns, locks and keys, pumps, pulleys, weighing machines, nuts and bolts, ball bearings, spectacles, spinning and weaving machines, musical instruments and all kinds of tools and manufacturing processes. It might even be possible to argue that Newton was responsible for ensuring the dawn and relentless rise of the Industrial Age which rested firmly not only on blast furnaces but also on the *mechanical philosophy* which seems to follow naturally from Newton's physics. He even had a mechanical *corpuscular* theory of light.

Galileo Galilei in 1632 published work which greatly offended the Church. He reported his observations by telescope of, for example, the movements of Sun spots, which led him to agree with the opinion of Nicholas Copernicus, published 1543, that the planets revolve around the Sun: the Earth goes round the Sun once a year and about its own axis once a day. This shattered the Aristotelian world view which had been adopted by Christianity since the time of Saint Thomas Aquinas around 1265. However Newton's mechanical theories did not cause an immediate split with the Church. Newton's own ardent Protestant theology evoked a *God of the gaps* to justify the apparent action at a distance of gravitation, and he believed in a theological division between *matter* and *powers*. This was accepted as sufficiently consistent with Christian and Platonic ideas not to be heretical. Perhaps the Church did not protest because the clergy did not understand the unprecedented radical significance of the first truly dynamical deterministic theory which was expressed mathematically using Newton's new and difficult *calculus*. Also pure idealism had already been tempered by the mind-matter dualism of the devoutly Catholic René Descartes in 1637.

The discovery by Sir Charles Darwin, published in 1859, that all life EVOLVED from a common origin fitted in well with the mechanical philosophy. "All living things are as they are because their forms have undergone a long process of evolution from simpler ones." Soon after, in 1865, Gregor Mendel published his laws of heredity which reinforced

Darwinian ideas. However Darwin's theory *flatly contradicted* the biblical account of the creation of man. This immediately provoked uproar and a furious conflict between the evidence of science and the dogma of religion.

In the seventy years between 1800 and 1870 the world changed more than it had in the previous thousand years. Much of this was due to the mathematical theories of Newton which formed a precise rigorous and accurate foundation to the mechanical understanding of the world thus allowing it to be interpreted, moulded and conquered by science and engineering. There is a solid solution. Mechanics.

Adding to the clamour of the mechanical revolution came the electrical revolution, initiated by Alessandro Volta, Charles Coulomb, Jean-Baptiste Biot, Félix Savart, André-Marie Ampère and Michael Faraday, and crowned by Maxwell in 1873. This quite literally gave a new (electromotive) force to the accelerating pace of change in the shrinking planet Earth. Again, having a firm mathematical foundation to their understanding, inventors began to produce a shower of spectacular new undreamt-of applications and appliances.

Within a hundred years the world had been shrunk by a revolution in communications; by the telegraph (exploited by Morse 1844), the telephone (Alexander Graham Bell 1876), wireless (Guglielmo Marconi 1899, popularised from 1939) and television (John Logie Baird 1925, popularised from 1950). It had been lit with electric light bulbs (Thomas Eddison 1879) and brought to life with bells, buzzers and electric motors. Homes were being powered by electricity generating stations leading to a flood of revolutionary domestic appliances such as room heaters, electric kettles, vacuum cleaners, refrigerators, electric toasters, record players, sewing machines, electric razors and washing machines. Business and industry also received a considerable boost from a host of other new tools, such as dictaphones and automatic assembly lines, to improve business efficiency and speed up repetitive manufacturing processes. The petrol motor car (Karl Benz 1885) and aeroplane (first flight Wilbur & Orville Wright 1903) combined both mechanical and electrical expertise. The mathematical equations of Maxwell were a huge success and have now affected in one way or another almost everyone on our planet. There is a solution. Electromagnetism.

In the last fifty years some consequences of the profound new *quantum revolution* have taken visible shape and are beginning to influence every corner of our lives. Quantum mechanical devices, upon which many modern gadgets, gear and gismos are based, include

transistors (1947), integrated circuits and very large scale integrated circuits (VLSICs), fluorescent tubes, laser beams (used for holograms, fibre optics and laser gyroscopes), ultrasound scanners, superfluids, superconductors, superconducting quantum interference devices (SQUIDS) and quantum fridges.

Quantum theory first found mathematical formulation in the works of Heisenberg and Schrödinger who independently, around 1926, found a quantum version of Newton's mechanics, called quantum mechanics. This *modern* mechanics was immediately imported into chemistry and soon into molecular biology making many discoveries possible from plastics (1933) to the double helix of deoxyribonucleic acid (DNA) (Francis Crick and James Watson 1953). Without the quantum mechanical revelations concerning new principles behind the physical world many of the recently growing industries would hardly be conceivable; microelectronics, transputers, high speed data communications, precision robotics, computer aided design and manufacture (CAD/CAM), modern pharmaceuticals, genetic engineering, space exploration, modern scientific instrumentation, radioactive material application and the very new micro-robotics and nanotechnology. There is a new solution. Quantum mechanics.

Prior to the advent of quantum mechanics, Einstein found that Newton's mechanics and Maxwell's electromagnetism were mutually *inconsistent* in their account of motion. This he rectified in 1905 with his theory of special, or restricted, *relativity* which simply but profoundly adjusted mechanics to incorporate the velocity of light as an ABSOLUTE CONSTANT for all observers irrespective of their state of rectilinear motion. In so doing Einstein revealed that *mass is a form of energy*. Just how much energy can be extracted from a small mass was demonstrated most conclusively by the atomic bombs used on Japan in 1945 and later by nuclear powered electricity generating stations and submarines.

Apart from these awful and awesome examples, special relativity has had little impact on everyday life. It is essential in explaining high energy processes like that responsible for the Sun's radiation but it has not *yet* led directly to inventions for low energy home use. However, the possibility, for example, of travelling *forwards* in time at different rates has been established definitively by a pair of identical atomic clocks, one flown right round the world and the other kept stationary on the ground. The clocks were synchronised at the start and were DIFFERENT at the end of the flight by the predicted amount. The theory has also been verified in

many other places where Newton's classical mechanics manifestly fails. There is another new solution. Special relativistic mechanics.

While none of these scientific theories is entirely satisfactory, they have supplied mankind with ever more sophisticated equipment with which to fulfil his needs and satisfy his desires. And while there is very good reason to be concerned about the uncontrolled accelerating pace of change and the new potential for destruction, caused by technical advances, themselves for the most part made possible ultimately by the advances in theoretical physics, one important factor behind the astounding success of fundamental science is the entrenched belief that *every sensible question has a meaningful answer; every real problem has a comprehensible solution.*

At a time when rapid changes are taking place all around us, more than ever requiring responsible technological and orderly social progress, there is a solution; faith in QUANTUM PHILOSOPHY. We are in the throes of an almighty potential catastrophe. Science got us in. Philosophy *can* get us out.

① Answers: reduction to self-evidence

THAT MAN HAS THE CAPACITY TO ANSWER difficult questions is a wonderful treasure indeed. How exactly it is possible to induce deep original generalities from particulars by means of a creative leap of imagination is not at all understood by science. It is only clear that without conscious mind such guessing power would be almost inconceivable, if not completely meaningless.

But man can answer questions of a most penetrating kind and can demonstrate the validity of his arguments with, in some cases, fantastic precision. His scientific conclusions are not usually held to be ultimate, absolute truths which are unassailable by all future generations of thinkers - although Euclid's geometry and Aristotle's logic have been considered as such until relatively recently. Nevertheless, in the last three hundred years there have been a few scientific theories which answer with considerable elegance and comprehensibility a tremendous number of questions about nature.

Physicists realise that all the theories which they currently recognise and accept as the best they have have problems associated with them making it highly unlikely that any of them is final. Nevertheless these theories must encapsulate something of essential truth because of their startling success in giving us power over nature through exact understanding. Those who argue that the current scientific theories are not too important because they will eventually be refuted and replaced by others considerably mislead. Current theories are exceedingly important both to science and to society. Their importance cannot be overstated. The modern world cannot be understood without them. They form the new rational basis of our modern culture.

In the last hundred years, millions of man-years of thought have gone into making a huge web of rigorously solid and thoroughly tested scientific theories. Any attempt to improve upon that structure is considered dispassionately and installed only after being subjected to careful experimental verification. Anyone attempting to criticise or debase this structure as a whole must replace it with something at least as useful, or else show themselves up as unable to appreciate its massive importance to us all.

It is necessary to be able to suspend dogmatic judgements and preconceptions in the pursuit of science. However it is also vital that those theories which are found to work are given the weight and credit they

deserve. It is possible to apply scientific theory in the wrong direction, to take the power of science and use it selfishly, or to disrespectfully degrade the insights of many great thinkers without bothering to understand what they actually meant. For example, most interpreters of quantum theory try to fundamentally change the theory according to their prior predilections. Instead, scientists and non-scientists alike ought to place great faith in those theories which are shaping the world around us at breakneck speed.

A crucial aspect of the methodology of science is the demand that everyone can, at least in principle, confirm all the experimental evidence supporting a theory. It is the lack of reliable repeatable evidence for ghosts, clairvoyance, psychokinesis and telepathy which has led the scientific community to denounce and completely disregard the subject of parapsychology. While there is probably too much haste in the dismissal of this field of study because claims to evidence tend to be ruled out pre-emptively since they do not sit well in the current classical paradigm, there is nothing like seeing the evidence with your own eyes.

Most people do not feel the need to validate in detail the assertions of experimental scientists whom they implicitly trust not to be intentionally fraudulent. Nevertheless it can be argued that by switching on and viewing your television you are indirectly verifying quantum mechanics yourself since the rationale behind the construction and function of a transistor relies substantially on the validity of quantum mechanics as applied to silicon or germanium crystals. It is very hard to see why a transistor should ever have been constructed without the theoretical justification. Neanderthal man should not have made an electronic computer nor should the proverbial monkeys have written ‘A Midsummer Night’s Dream’. The real progress comes through *understanding*.

If you ought strongly to believe theories which are known to have only limited application, like classical relativity which does not apply at microscopic scales, or non-relativistic quantum mechanics which does not apply at very high velocities, then how much more strongly ought you to believe a general philosophy which seems to have unlimited application. This relativistic *quantum philosophy* is different from a theory. One can take a theory and *quantize* it. For example classical mechanics, when subjected to a quantization procedure which turns functions that act on variables into operators that act on functions, becomes quantum mechanics and classical electrodynamics, when subjected to a rather more elaborate but essentially similar quantization procedure, becomes quantum electrodynamics. Indeed all quantum theories considered until very

recently started as classical theories which were then quantized. Quantum philosophy prescribes the *type of mathematics* to be used, not necessarily the detailed form of the theory which still has to be teased from nature.

There is something essentially correct about classical mechanics but, as with every other physical theory, it has to be viewed now with quantum philosophy in which, for example, a measurement must of necessity have an essential influence on that being measured, as opposed to mechanical philosophy where the disturbing influence of a measuring instrument can be reduced without theoretical limit, and hence removed in classical principle.

A major effect of moving from a mechanical to a quantum philosophy is that the very concept of *explanation* itself shifts in meaning. One has fully explained something when one has managed to reduce it to self-evident propositions. In the mechanical philosophy it was sufficient to give a mechanical model or analogy to be satisfied. If one can picture the process then further justification is hardly necessary because ‘familiarity breeds self-evidence’. But in quantum philosophy outcomes generally do not follow deterministically from initial states, however well specified, so that there are some things which, from the old point of view, *can never have an explanation!* On the other hand from the new quantum point of view it is self-evident that a particle in a box can not have zero kinetic energy. This understanding is incomprehensible in the mechanical paradigm.

The ultimate goal of any scientific theory is that it constitutes a SELF-EVIDENT explanation of the relevant facts. Science has adopted a very successful iterative approach whereby the current best theories are acknowledged to be partial and yet greatly respected. While it can be argued that science is diversifying all the time and expanding rapidly in all directions, the complement is also true that science is rapidly leading to a unification of all interactions and a UNIFICATION OF ALL IDEAS.

② The Standard Model: a great achievement

IN COMMON CIRCUMSTANCES special relativistic mechanics gives almost exactly the same predictions as classical mechanics which itself has come to be seen to mirror common sense. At HIGH ENERGIES relativity makes very different predictions and it is the predictions of relativity that are borne out by experiment. Schrödinger therefore first set out to obtain a *relativistic* wave equation for matter. This equation, now called the Klein-Gordon equation, did not give correct predictions for the behaviour of electrons in hydrogen. Schrödinger realised that the *non-relativistic* wave equation gave rough agreement with observation and so published the non-relativistic one in 1926.

It was not until 1928 when Paul Dirac published his relativistic quantum theory that the reason why Schrödinger's relativistic equation did not work became clear. In Dirac's theory the electron has an intrinsically quantum property called *spin* which has no classical analogue and which is still not entirely understood. The magnitude of the electron's spin is exactly half of Planck's constant. Although experimental evidence for the existence of electron spin had been accumulating from certain experiments since 1922 and from Wolfgang Pauli's *exclusion principle* proposed in 1925, Schrödinger had not taken these into account.

Dirac's equation gives a more detailed understanding than Schrödinger's equation of atomic fine structure and the periodic table of chemical elements. Chemical bonding and crystalline solids can now be described extremely accurately from a quantum point of view. The reductionist ambition to rest chemistry firmly on physics is beginning to be realised. As quantum chemistry came to account for more, the whole of biology reoriented to a functional as well as a mechanical approach. This organic story has still a long way to go, but it is already clear that in some important and highly significant sense biology *can* be reduced to chemistry and chemistry to quantum physics.

Another new consequence of the Dirac theory concerns the existence of negative energy solutions. These are interpreted as indicating a new manifestation of matter called ANTIMATTER. In 1931 Dirac predicted the antielectron or *positron*. The existence of the positron was not believed by Bohr or Pauli until it was experimentally observed by C.D.Anderson in 1932. Since, according to relativity, mass is a form of energy, it should be possible to convert a photon of sufficient energy, at least the equivalent of two electron masses, into an electron plus a positron

since their charges are exactly equal and opposite and therefore cancel. This is the cornerstone of *quantum electrodynamics*

One of the greatest successes of the quantum philosophy was the quantization of electrodynamics in 1948. It took 20 years to obtain a fully predictive quantum theory of photons and electrons. The *number* of massive particles is no longer constant. To accommodate this new *dynamical* observable of number, the Dirac wave or *state function* describing the noumena was re-expressed in terms of creation and annihilation operators acting on a vacuum state or noumenal nothingness. Electrons and photons were thus put on a similar footing to one another and wave-particle duality was thereby made more manifest. Thinking purely in terms of a particle interpretation of noumena, Richard Feynman enumerated all the possible classical-type particle interactions noumenally involved behind some particular phenomenon. He found an *infinite number of types* of processes each with an *infinite number of processes* involved. As with an electron passing an obstacle, every classical possibility has to be added together to obtain the quantum prediction. This led to predictions of INFINITY for the mass of the electron and INFINITY for the charge on the electron, which are obviously nonsense from an experimental point of view.

To understand the conceptual origin of these infinities, consider an implication of the uncertainty principle when the number of electrons and photons is variable. What might happen to an electron in an exceedingly short interval of time? According to Heisenberg's uncertainty principle, *the product of the uncertainty in the time of an event, times the uncertainty in the total energy of an event, is greater than or equal to Planck's constant.* Therefore, during a very short time interval the classical principle of conservation of energy does not apply so that the energy of the electron is very uncertain which means that it would be possible for it to emit a high energy photon as long as the photon is reabsorbed *within* the implied short time interval. In this way the electron has to be regarded noumenally as being surrounded by a seething bundle of *virtual* photons, virtual because they are noumenal and therefore unobservable in quantum principle. This potentiality produces the electron self-energy which turns out to be infinite when calculated by quantum electrodynamics. Similarly a photon can spontaneously change into an electron-positron pair for an instant so long as they quickly recombine to form the photon again. This produces a seething bundle of virtual electrons and positrons causing a

polarisation effect of the vacuum which makes the electron charge theoretically appear infinite.

Despite this mathematical impasse, in 1947 Hans Bethe surmised that if one replaced the infinite constants with the corresponding *experimental values* of mass and charge wherever they appear in the theory then the theory might yield *finite* results which could then be compared with experiment. This procedure of *renormalization* was developed principally by Feynman and Julian Schwinger, and resulted in a theory which is in excellent agreement with experimental facts such as the scattering of photons off electrons, or the ‘Lamb shift’ observed in atomic spectra, or the ‘anomalous’ magnetic moment of the electron. Calculations in quantum electrodynamics are very hard though. For example if the supposed particle interaction involved say eight individual interaction vertices then this would lead to almost nine hundred Feynman diagrams to be calculated. The number can be reduced to eighty six by symmetry arguments, but this still results in twenty thousand mathematical functions each of which has to be integrated over ten dimensions.

Elementary Field Physics

The study of *particle physics*, which should really now be called *field physics*, can be said to have started in 1897 when J.J.Thomson discovered the electron. By 1930 three fundamental particles, the *proton*, the *electron* and the *photon*, were recognised as elementary. In 1932 James Chadwick distinguished the *neutron* from the proton in atomic nuclei and in the same year Anderson found the *positron*. From then on every material particle was presumed to have an antimatter counterpart, as required by the Dirac equation. In 1937 a heavy electron called a *muon* was discovered entirely unexpectedly. It is still not actually predicted by any theory. In 1947 a number of other unexpected particles called π , κ , Λ , Σ and Ξ were discovered in cosmic rays.

After the second world war, really huge particle accelerators were built which led to the discovery of a profusion of other new particles. In 1953 the *electron-antineutrino* was discovered. It had been predicted by Pauli in 1933 in order to remove energy, momentum and angular momentum discrepancies in the decay of a neutron into a proton plus an electron. In 1955 the *antiproton* was observed. By 1957 the number of known fundamental particles had increased to about thirty. In 1962 a new type of neutrino, the *muon-neutrino*, associated with the muon rather than

the electron, was found. By 1964 the number of known particles had increased to about a hundred. None of these new particles had been seen earlier because most of them are more massive than the proton and so require a large amount of energy to produce. Also they are highly unstable, decaying extremely rapidly into lighter particles.

A hundred different particles could not really all be embraced as fundamental building blocks of matter. Plato had a few geometric solids and Aristotle only had FOUR essences; earth, fire, air and water. From attempts to develop a theory explaining why so many new particles should exist emerged a few utterly new quantum properties of matter: *baryon number* from βαρυς meaning heavy, *lepton number* from λεπτος meaning light, *isotopic spin* relating for example neutron to proton, and *strangeness* which is zero in all but a few of the new particles. These were the true (quantum) hidden variables.

In 1964 Murray Gell-Mann and George Zweig independently proposed a classification scheme based on these quantum numbers into which all particles with zero lepton number, except light, could be placed. The scheme introduced three new particles called *quarks* and, of course, the corresponding three antiquarks. Every known particle, except the leptons (electron, muon, neutrinos, and their antiparticles) and the photon, which are exceedingly well described by quantum electrodynamics, was shown to be made up of either a quark and an antiquark or three quarks or three antiquarks. The scheme is based on a deep symmetry exemplified by the set of *Special* (i.e. determinant one) *Unitary* (i.e. inverse equals complex conjugate of transpose) $\underline{3}$ by $\underline{3}$ matrices, called SU(3) symmetry. The symmetric scheme predicted that there must exist an unknown particle called Ω . The Ω was sought and found in 1964. Suddenly the abstract mathematical theory of *groups* had found a new and profound application in physics.

Despite this predictive success the quark model was not taken very seriously by most physicists who considered that it was only a classification system and not a dynamical theory. Even after 1968 when evidence of quark-like constituents of the proton was found in high energy electron-proton collisions, the preferred approach to a dynamical theory was not SU(3) theory but *Scattering matrix theory*. Although having only limited success, the ultimate goal of this S-matrix theory was really very ambitious indeed. Its foundation is the democratic notion that *all* particles may be composites of other particles, none of them being any more elementary than any other. In this way the whole set of particles would

hold itself up by its own bootstraps. The bootstrap approach is not necessarily misguided and may yet be resurrected in a future theory, but it has not supplanted quarks.

Quantum Chromodynamics

The original quantum field approach has held the day. Each quark is assigned a new unseen quantum number called *colour* which can be labelled red, green or blue. By analogy with addition of visible coloured filters, red plus green plus blue is colourless (black). Also antired (cyan) plus antigreen (violet) plus antiblue (yellow) is colourless, as is a colour plus its anticolour. Postulating that all observed particles have to be colourless accounts for the existence of all the observed baryons.

Can a quantum theory of colour charge be devised by analogy with quantum electrodynamics, the hugely successful quantum theory of electric charge? In quantum mechanics all observables can be calculated in terms of the modulus of the complex wave function. This means that the wave function can be multiplied by a complex phase factor without affecting any observable quantity. The most general way of constructing quantum electrodynamics is to look for a theory which is invariant in the case where this single complex phase factor is allowed to be any arbitrary function of space-time position. This is called U(1) local gauge invariance. The U(1) symmetry is directly associated with conservation of electric charge. Imposing this invariance on the electron field *forces* one, in a bootstrap sort of way, to introduce the photon field. This is a very satisfactory unifying consequence.

For different coloured quarks to stick together in baryons, the mediators of the force must themselves be coloured. They must carry colour and anticolour, and since there are three colours, there must be nine possible types of these *gluons*, one of which is colourless and consequently has no observable effect. In this case, to account for conservation of colour charge, one can introduce an SU(3) symmetry describing local phase transformations of the three colours. Imposing this symmetry on the quark fields forces one to introduce eight gluon fields exactly as required. Quarks imply gluons and gluons imply quarks. They ‘bootstrap’ one another into existence.

The resulting theory of *quantum chromodynamics*, discovered in 1973 by Harald Fritzsch, Gell-Mann, H.D.Politzer, David Gross and Frank Wilczek, is renormalizable although significantly more complicated than

quantum electrodynamics because gluons can interact with other gluons whereas photons can not interact with other photons. In particular, in a very short time interval a gluon noumenally can turn into a virtual quark and antiquark pair which recombine to give a gluon again. As in the case for a photon, this causes vacuum polarisation effects. However the gluon can also turn into two other gluons which recombine again to give a single gluon within the implied instant of time as required by the uncertainty principle. This new potentiality has a much stronger reverse polarization effect on the vacuum. It causes the colour force to be very short range because the total effect is that the colour force *increases rapidly* with distance unlike the electric force which is long range and *falls off slowly* with distance. The great strength of the colour force means that it becomes easier to create new particles than to stretch the colour field lines. This accounts for the *jets* of particles seen by large detectors emanating back to back from very high energy collisions. They are the remains of quarks.

Electroweak Theory

Quantum chromodynamics and quantum electrodynamics together explain very well, in principle, almost all observable physics with just a few unexplained constants such as the various particle masses. But so far we have not considered interaction between quarks and leptons, nor the observed weak decay of neutron into proton plus electron plus electron-antineutrino, nor the violation of parity (or mirror symmetry), first observed in 1957 by T.D.Lee and C.N.Yang, nor quark mixing which is needed to suppress certain unwanted strangeness changing decays.

The quantum theory which does account for these particular phenomena was pioneered by Enrico Fermi in 1933 to explain radioactive decay. It was finally constructed in renormalizable form by the efforts of Sheldon Glashow in 1961, Steven Weinberg in 1967 and Abdus Salam in 1968. The *electroweak theory*, sometimes called quantum flavodynamics, is again based on a local gauge invariance but this time the theory contains a number of unsavoury conceptual complications.

First an attempt was made to describe neutron decay in terms of an SU(2) local gauge invariance. This introduced three new W fields to mediate the interaction between neutron, proton, electron and electron-antineutrino. The model was improved by Glashow who introduced an extra U(1) local invariance making U(1)×SU(2) invariance. This allowed quantum electrodynamics to be incorporated in a natural way. The U(1)

had an associated B field. The photon field is then formed by a superposition of the B and the neutral W. The remaining orthogonal superposition of B and neutral W makes a new neutral Z field. The two remaining charged Ws, the Z and the photon become the mediators of the new electroweak force which unifies quantum electrodynamics with the theory of weak interactions.

In order to explain nature's lack of left-right symmetry, the left handed and right handed spin projections of some fields have to be treated differently. Indeed, right handed neutrinos are usually completely omitted from the model as they have never been observed. Because left and right handed components of neutrinos behave differently, it is not possible to introduce non-zero masses for any of the particles and retain the $U(1) \times SU(2)$ gauge invariance which is necessary for renormalization. This problem was solved independently by Wienberg and Salam who applied an idea devised in 1964 by Peter Higgs to break symmetry and hence, in this case, allow fields to 'acquire' a mass. The resulting theory was shown to be renormalizable in 1972 by Gerard 't Hooft and Martinus Veltmann. Higgs' mechanism retained the underlying symmetry of the theory but *broke the symmetry of the vacuum state*. By introducing a Higgs field into the vacuum to which other fields in the theory can couple, these other field can consequently have mass.

Electroweak theory predicted some new hitherto unknown interactions by way of the new neutral Z field. Some of these interactions were observed in 1973. The theory also predicted very precisely what the masses of the W and Z fields should be, but there was no accelerator large enough to produce and detect them. In 1973 there were only three *flavours* of quark involved in quantum chromodynamics; up, down and strange. However, electroweak theory suggested that quarks, like leptons with their corresponding neutrino field, should come in pairs. A fourth *charmed* quark had already been proposed in 1970 by Glashow, John Iliopoulos and Luciano Maiani in order to cancel out certain flavour changing processes which were not observed. The charmed quark was discovered experimentally in 1974.

In 1975 a new unexpected lepton, heavier than the muon, called *tau*, was found. This spoilt the symmetry between the number of lepton doublets and the number of quark doublets. This new tau lepton is assumed to form a doublet with a *tau-neutrino*. Neither the tau-neutrino nor the tau-antineutrino have been observed directly yet. To redress the balance, a new third generation of quarks forming a pair of new flavours

called *truth* and *beauty* (often called top and bottom) was proposed. In 1977 the beauty quark was identified in the form of a beauty-antibeauty pair. In 1983 accelerators became large enough to generate W and Z fields. Amid much excitement, W and Z were both found at the predicted energy levels.

In 1989 a new large £1billion electron-positron collider started operating in Switzerland. To date this machine has verified with great accuracy the description given by the *standard model*; of quantum chromodynamics plus electroweak theory. This 1 2 3 theory based on the internal symmetry group $U(1)\times SU(2)\times SU(3)$ accounts, in principle, for all the observed phenomena of micro physics right down to the scale of a thousand trillionths of a millimetre, where a thousand million is a billion and a thousand billion is a trillion. This is a great achievement which will doubtless eventually have unbelievable technical applications causing a revolution at least as profound as the electrical revolution and probably generating a third and fourth wave of nanotechnology miniaturisation, the second wave having already started to produce atomic and molecular devices such as single atom transistors, nuclear gyroscopes, bistable switches sensitive to the motion of a single atom, and quantum fridges.

There is now an unprecedented situation in science. There are essentially *no* outstanding totally mysterious experimental results in physics. Everything terrestrial which is known is consistent with the standard theory of particle physics. There is no *experimental* evidence of a limit or flaw in this theory. However, the standard theory has twenty one free parameters, including the quark and lepton masses, the various interaction strengths, the quark mixing angles and the Higgs particle mass. So the theory could be more tightly constrained than it is. And there are a host of other unexplained facts about the form of the theory, such as why *fractional* electric charges on quarks. Nevertheless just about all results from experiments are in terrific agreement with the predictions of the standard model. Also there is evidence from cosmology that there are no more than three types of neutrino in the universe. This evidence suggests that the three generations of quarks and of leptons in the standard model comprise the complete set of fundamental matter fields to be found in nature.

Nature is believed to be composed materially of three pairs of quark flavours; up and down, strange and charmed, truth and beauty. And three pairs of lepton flavours; electron and electron-neutrino, muon and muon-neutrino, tau and tau-neutrino. Each quark flavour comes in three different

colours. These together with their associated antifields account for the material constitution of the entire observed universe. The fact that all the commonly observed matter in the universe is composed solely of up and down quarks and electrons raises a deep question of why nature chose to include two extra generations of matter fields. “Who ordered that?” said Pauli.

As well as the matter fields, there are the fields associated with the different types of force or interaction. For quantum chromodynamics we need eight differently coloured gluons. For electroweak theory we need one photon, one neutral Z and two oppositely charged W fields.

From these ingredients *all* the many hundreds of observed particles, including the proton and the neutron and all the atoms, are believed to be generated and all their known properties are believed, in principle, to be exhaustively predictable. This is a glorious theoretical triumph. While the above description is just the tip of the iceberg of the full explanation of the standard model, it does indicate how firm is the grip of modern physics on reality as we know it, albeit quantum reality.

③ Theory of Everything: required improvement

THE STANDARD MODEL OF ELEMENTARY PARTICLES is very impressive and very comprehensive and hundreds of detailed experiments agree with its predictions, but it is *not beautiful enough!* Physicists believe that nature is simple and beautiful and that everything comes from next to nothing. All of nature can already be explained in terms of just a few basic principles and a few special fundamental constituents. But this standard model still has too many arbitrary unexplained features and is generally too complicated to apply in practice. It has been estimated recently that it could take ten years for theorists to calculate some particular number from the theory, and it could take twenty years for experimentalists to measure the number!

Although based on a rather beautiful 1 2 3 symmetry, written by mathematicians as $U(1) \times SU(2) \times SU(3)$, the theory can not be described as self-evident. The job of the scientist is not finished until the whole of nature is understood intuitively. It is necessary, but not sufficient, to have a means of predicting all reproducible experimental results. There should be no arbitrary parameters, unless one is needed in principle to set the scale of things. There should be no more than one type of fundamental entity, unless matter and force are distinct, in which case two, and *everything should be obvious*.

There have been many attempts to improve upon the standard model, using aesthetic criteria in the absence of any recognisable anomalous experimental clues. For example, there was an attractive attempt based on $U(1) \times SU(3) \times SU(3)$ to build all quarks, leptons and interaction fields from just TWO *rishons* having fractional electric charges, any of three colours and a new property called hypercolour which comes in three varieties. An alternative approach has been to search for a *grand unified theory* in which the symmetry group $U(1) \times SU(2) \times SU(3)$ is a subgroup of a larger symmetry such as $SU(5)$, but no new predictions of any of these theories has been confirmed to date.

Space-Time-Matter

And anyway, what about gravity? In all this discussion about unification of the forces why have we not mentioned the obvious force of gravity? How does that fit into the standard unified scheme? The answer is that it does not fit in at all because nobody knows how to quantize it

properly. Physicists have been trying to solve this puzzle for the last sixty nine years, with ever growing clarity and zeal. This is without doubt the greatest, the deepest, and the most exciting problem in science today. Apart from the intellectual satisfaction of possessing a unified description of nature, the technological repercussions of such understanding could be totally astounding making most science fiction (which is actually based on real science) seem elementary. For example, it may be possible to travel instantly across vast tracts of space-time through a *wormhole*. It may be possible to shoot an imploding '*seed bomb*' straight through the Earth toward a city on the far surface. As the seed slows it will gulp in more mass. If it is projected at the correct velocity, just as it leaves the far surface it will take with it an exponential cone, including the entire city!

The deepest theory of gravity found to date is based on Einstein's general theory of relativity, published in 1916. If you ever find yourself in free fall towards Mercury, which has only an extremely tenuous atmosphere, you might notice, if you are content to reflect calmly, that you are almost completely *weightless*. It is as if your acceleration towards Mercury cancels out its gravity. On the other hand if you are spinning on a merry-go-round you will feel a centrifugal force, very much like an outward gravitational pull, caused by the acceleration involved in the circular path. Einstein's special theory of relativity restricted itself to uniform *linear motion*. Einstein realised that if his theory was generalised to include *acceleration* then the result might be a theory of gravity.

An *imaginary* number is one which, when multiplied by itself, gives an ordinary *real negative* number. No ordinary number multiplied by itself can give an ordinary *negative* number. What then could be the square root of a negative number? In 1908 Herman Minkowski showed that, by treating time as an imaginary number, special relativity could be viewed as describing paths in a *flat four-dimensional space-time*. The whole theory can be derived from the simple geometrical principle that nature chooses the shortest possible path for particle trajectories in four dimensional space-time. All this suggested to Einstein a geometrical approach to gravity.

In 1827 Carl Fredrick Gauss showed how a surface can have *intrinsic curvature*. This is a curvature which can be defined from within the surface itself, rather than the more familiar concept of *extrinsic curvature* which is associated with the embedding of a surface in a higher dimensional space, for example a soap bubble in ordinary space. If the surface of the bubble is considered not as an embedding in three

dimensional space but entirely on its own, without reference to an outside, then 'straight lines' on the surface will close on themselves leading to the conclusion that the surface has some intrinsic curvature.

In 1861 G.F.B.Riemann developed the study of two dimensional intrinsic geometry and provided an exact mathematical measure of the departure from flatness of such a non-Euclidean surface. This measure was generalised to any number of dimensions by E.B.Christoffel in 1869. Einstein and Marcel Grossmann guessed that matter intrinsically curves space-time and in 1915, after an incorrect guess, Einstein found the simplest possible relativistically consistent equation directly relating matter distribution to curvature, saying in some sense that *matter is geometry*. The constant of proportionality was found by requiring that, in the limit of weak gravitational forces and with velocities small compared to the velocity of light, Einstein's equation must reduce precisely to Newton's gravitation theory, whose predictions are known, by optical astronomy, to be very accurate.

By means of his equation, Einstein showed that light should appear to bend in the vicinity of matter. This was verified by Sir Arthur Eddington looking at starlight passing close to the Sun during a total eclipse in 1919. General relativity also gave the correct magnitude for the precession of Mercury's elliptical orbit round the Sun for which the prediction of Newton's theory was too slow by about one hundredth of a degree per century. Many other tests have now been performed and they all confirm the predictions of general relativity. Recent observations of *pulsars*, which are neutron stars rotating sometimes very many times per second, show that general relativity is also valid in *strong* gravitational fields and at velocities at least up to a thousandth of the speed of light.

In 1929 Edwin Hubble observed that the spectrum of light emitted from remote galaxies is systematically shifted to the red end, and that the amount of the shift is proportional to the distance of the galaxy from us who live in the Milky Way galaxy. According to general relativity this means that all the matter in the universe, and therefore by Einstein's equation, the fabric of space-time itself is not in static equilibrium as had always been implicitly assumed. Some sort of *big bang* explosion of space-time-matter in the distant past, about fifteen billion years ago, caused everything to fly apart. The rate of expansion of space-time is slowing down because of gravitational attraction. It is not known whether there is enough matter in the universe to eventually stop the expansion and cause it to recollapse because not all the matter in the universe gives off

detectable radiation, so it hasn't all been identified yet. The contribution of the neutrino relic from the big bang is a case in point.

Stephen Hawking and Sir Roger Penrose showed in 1970 that the initial matter density, and therefore the initial curvature of the universe, was necessarily infinite, according to general relativity. This really means that general relativity is unsatisfactory as a theory to describe the universe before a certain very early time. However general relativity does give a very plausible cosmological description right back to the first trillionth of a second of the life of the universe as a whole.

Evolution of the Universe

The very first second of the life of the universe has been called the golden age of particle physics because during that second the universe was extremely hot and dense and field interactions, which these days require an accelerator to induce, were commonplace. Using arguments based on the standard model, before about the first trillionth of a second, quarks and leptons behaved similarly to each other and were in equilibrium with photons, Ws, Zs and gluons, which also behaved similarly to each other. Then photons, Ws and Zs began to become distinguishable. Quarks also distinguished themselves from leptons. After about the first millionth of a second, quarks combined into pairs or triplets, forming mostly neutrons and protons. Within a few minutes primordial nucleosynthesis finished, having made isotopes of hydrogen, helium, small quantities of lithium and beryllium and minute amounts of some heavier nuclei. After a year of expansion, neutrinos ceased to interact much with other matter and decoupled. After about one hundred thousand years, the photons, which are by far the most numerous type of particle in the universe, decoupled leaving a photon 'relic' background which was first predicted in the late 1940s by Ralph Alpher and Robert Herman and was happened upon by Arno Penzias and Robert Wilson in 1965.

The photons decoupled because the universe had cooled sufficiently for electrons to combine with nuclei to make electrically neutral atoms. After another ten million years these atoms clumped together under gravitational attraction to form galactic nebulae, and then stars within galaxies.

A star starts life as a large nebulous ball of atoms, mostly hydrogen. The star contracts under gravitational pressure until the temperature in the centre rises to about a thousand million degrees when nucleosynthesis can

take place. Nuclei within the star combine, forming shells of heavier and heavier elements - iron being a particularly stable core end point.

If the mass of the star is more than about one and a half times the mass of our Sun then, according to general relativity, gravitational collapse will continue indefinitely because the internal pressure will never be able, by any known means, to resist the inexorably cumulative gravitational pressure. According to standard astrophysics, at a certain point in time, in a process taking only one second, stellar electrons will combine with stellar protons to form a single massive atomic nucleus a few kilometres across made mostly of neutrons. The centre of the star is thus a single atom of atomic weight about one thousand million trillion trillion. At this point the core loses elasticity and the imploding outer layers strike it and rebound under the shock. These layers are thus ejected into outer space in a *supernova* explosion leaving a neutron star, or gigantic atom, behind. This phenomenon is visible to the naked eye about once every thirty years in our galaxy: one happened in 1987.

According to general relativity, collapse of this nucleus will continue beyond the point where electrons or even photons can escape the gravitational field. Photons become trapped when the local curvature of space-time is so great that it curves right round in a circle to form a *horizon*. Inside is a *black hole*. None has yet been identified for certain, although Cygnus X1 could be one. There is also mounting evidence of a black hole of about two million stellar masses, perhaps accompanied by another of about five hundred stellar masses, at the centre of our galaxy which is three hundred thousand trillion kilometres in the direction of the Sagittarius constellation.

A direct attempt to quantize Einstein's gravitational field equations leads to an impasse because any number of *gravitons*, the hypothetical quantum of the gravitational field, can theoretically interact with each other at any point. This makes the theory unrenormalizable. Nevertheless there have been many attempts to introduce quantum ideas into general relativity. In quantum gravity one expects the very geometry of space-time to be subject to uncertainty.

In 1919 Theodor Kaluza proposed a brilliantly simple classical way of unifying general relativity with electromagnetism. He wrote down Einstein's gravitational field equations in FIVE dimensions instead of four and then proposed that the fifth dimension is rolled up tightly into a very small loop so that any observer attempting to penetrate the fifth dimension will almost instantly find himself back where he started. He then

demonstrated that Maxwell's equations were satisfied by a field which was naturally associated with the fifth dimension, but he made no new predictions. Although Einstein was fascinated by the theory he delayed publication of Kaluza's paper for two and a half years because he felt the theory required more work. In 1926 Oscar Klein took Kaluza's theory and wrote down a five dimensional version of Schrödinger's relativistic wave equation. He then showed how to interpret the solutions as waves of gravitational and electromagnetic fields moving in four dimensional space-time, but again no new predictions were forthcoming. Anyway we would now want to use the Dirac equation and include the other known interactions as well.

Another worthy approach to a quantum mechanical understanding of gravity was made by Hawking in 1974. He showed that near the boundary of a black hole virtual pairs of particles could be created from the vacuum. One particle could fall into the black hole leaving the other to escape by quantum tunnelling. In this way *Hawking radiation* could be *emitted* from a black hole. Small 'primordial' black holes created in the early days of the universe could be slowly losing their mass by this mechanism and when almost all their mass has gone they could pop out of existence with a huge explosion leaving nothing but flat empty space behind. No such evaporating black hole has yet been identified.

Here is another quantum parable. Since close to a massive body the energy of a particle is, in a sense, less than the energy of the particle when further away because work has to be done to take it away due to the attractive nature of gravity, and since a particle's energy can thus theoretically become *negative* inside the horizon of a black hole, it is conceivable that the universe began with a total energy *almost exactly equal to zero*. According to the uncertainty principle, a very *small* amount of energy can spontaneously appear out of nothing for a relatively *long* period of time, say eighty thousand million years. This is a quantum theory of the creation of everything *ex nihilo*, from nothing!

Matter-Force Supersymmetry

In 1974 Julian Wess and Bruno Zumino made a wonderful discovery which has had a major influence on the practitioners of quantum gravity. Wess and Zumino introduced physicists to a new kind of anticommuting number first defined by H.Grassmann in 1844. This kind of number has the property that the sign of the result of multiplying two of these numbers

together is reversed if the order of multiplication is reversed. This implies that the square of a Grassmann number is identically zero. Thus ordinary numbers commute while Grassmann numbers anticommute. In a quantum field theory, the force fields satisfy commutation relations while the matter fields satisfy anticommutation relations. Wess and Zumino introduced *superspace* in which some of the dimensions represent real lines and others represent Grassmann lines. A point in this superspace is represented by a *supernumber* which has a *body* of ordinary numbers and a *soul* of Grassmann numbers, analogous to the real and imaginary parts of a complex number.

A *superfield* is a function ranging over supernumbers. Wess and Zumino showed how a superfield can be used to represent *both* the anticommutation relations of matter fields *and* the commutation relations of force fields, *both at once*. They showed how a *supersymmetry* transformation in superspace can change force fields into matter fields or matter fields into force fields. Thus it became conceivable, although not yet actually achieved in practice, that quarks may be related directly, by a rotation in superspace, to gluons in a supersymmetric generalisation of quantum chromodynamics. In 1977 Wess and Zumino demonstrated how to give a geometrical formulation of *supergravity* in superspace by introducing a local space-time supersymmetry. There is no experimental evidence in favour of supersymmetry and the theory of quantum supergravity is unrenormalisable but the basic idea is still very appealing to theoreticians.

Quantum Geometry

In 1984 Michael Green and John Schwarz proved that a particular supersymmetric string (*superstring*) theory in ten dimensional space-time is renormalisable. This caused great excitement amongst theoretical physicists. String theory had begun in 1970 during the period of interest in scattering matrix theory when Yoichiro Nambu, T.Goto, Holger Nielsen and Leonard Susskind suggested a kind of rubber band model of the strong force holding quarks together. With the advent of quantum chromodynamics interest in this new string theory, wherein nature minimises the area of the string world sheet, rather than the length of a particle world line as in general relativity, diminished considerably. However around 1974 Jöel Scherk and Schwartz demonstrated that unbelievably tiny quantized string loops can be interpreted consistently as gravitons. The theory can be

quantized in twenty six space-time dimensions and contains no matter fields. Such strings are about a trillionth of a trillionth of a trillionth of a millimetre long.

In 1985 David Gross, Jeffrey Harvey, Emil Martinec and Ryan Rohm managed to combine string in twenty six dimensions with superstring in ten dimensions making a quantum theory of closed string loops in which waves travelling in one direction round the string are waves of the twenty six dimensional kind, and waves in the other direction are waves of the ten dimensional supersymmetric kind. This leaves sixteen dimensions which could be wrapped up and interpreted as internal dimensions, like Kaluza's fifth dimension. Sixteen internal dimensions give more than enough space in which to fit the standard model internal symmetry group of $U(1) \times SU(2) \times SU(3)$. Many physicists have set to work to try to find a natural way of *compactifying* the free dimensions and breaking the unobserved supersymmetry in order to obtain the standard model ontology. Many different alternatives have been tried using *symmetric* and *asymmetric orbifolds, lattices, twists* and *shifts* but nobody has yet managed to find a natural way to obtain the standard model material requirements. Nor has anyone found any testable consequences from this highly mathematical theory.

It had been argued that this string theory was in some sense *unique* since it was the only real contender for a theory of everything, which obviously must include gravity. However a number of modified string theories have recently been suggested. A very interesting alternative was proposed by A.M.Polyakov in 1986. He showed that it is possible to generalise the original version of string by incorporating extrinsic curvature as well as intrinsic curvature into the theory. This gives string a lateral rigidity which opposes string world-sheet bending making it a rather more realistic model since the original theory could not distinguish between a smooth world-sheet and an arbitrarily creased world-sheet of the same area.

In 1989 I showed mathematically how to tie knots in rigid string and proposed that simple knots, like the left and right handed trefoils in loops of string, account for the elementary fields. One might further speculate that the universe is gradually becoming more knotted, and the observable stable structure, from individual electrons to galaxies, which we see around us, is associated ultimately with the stability of knots in string. Knot theory has now become a major area of study for theoretical physicists. Would an electric current through a wire with a knot in it emit a toridal

photon from the essential singularity? Aerial theory might take a quantum topological leap.

In 1983 W.Siegel found that a supersymmetric particle (*superparticle*) has a new and rather mysterious symmetry called κ -symmetry. In 1986 Ed Witten extended superstring theory to incorporate this κ -symmetry. The Green-Schwarz-Witten superstring was then extrapolated mathematically to *supermembrane* by Eric Bergshoeff, Ergin Sezgin and Paul Townsend in 1987. The idea of a fundamental membrane theory had been introduced originally by Dirac in 1962 in a partially successful attempt, prompted by the inexplicable discovery of the muon, to classically model an electron and muon as different quantum states of a closed spherical membrane. With the popularity of string, rather than point particles, as a serious model for fundamental quantum fields, it was natural to generalise the notion of extensibility to a membrane theory, especially since the membrane could be wrapped into a tube by the Kaluza-Klein method, immediately giving a string theory by *dimensional reduction*. One particularly attractive feature of supermembrane in eleven dimensions is that the constraints on the torsion of superspace, required for κ -symmetry of the supermembrane, are exactly equivalent to the constraints implied by the equations of motion of eleven dimensional supergravity. This establishes an intimate connection between foreground world-volume geometry and background space-time geometry; a sort of membrane generalisation of Einstein's equation.

The next natural generalisation from points to strings to membranes is to *lumps*. A lump is a three dimensionally extended object embedded in a higher dimensional space-time. In this case the dynamical theory can be derived from the principle that nature acts to minimise the four dimensional volume of a lump's world-path. These and other generalisations are collectively called *p-branes* where p is a whole number specifying the dimensionality of the spacial extension; zero for particles, one for strings, two for membranes, three for lumps, etc. In 1987 Anna Achúcarro, Jonathan Evans, Townsend and David Wiltshire showed that the Green-Schwarz-Witten theory could be extrapolated to twelve *super p-brane* theories; from superstring in three dimensions, through supermembrane in eleven dimensions up to super 5-brane in ten dimensions. All other possible κ -symmetric theories can not be made supersymmetric.

Quaternions were introduced by Sir William Hamilton in 1843 as a generalisation to four dimensions of the two dimensional complex plane of real and imaginary numbers. Minkowski space-time is so similar to

quaternionic space that very significant progress in mathematical physics would doubtless occur if a deep quaternionic equivalent of complex analysis were to be discovered. Complex analysis is a theory credited to A.Cauchy in 1821. It can be regarded as the necessary foundation for the mathematical completion of Newton's calculus. Early unsuccessful attempts to define quaternionic analysis led Maxwell eventually to abandon the real part of quaternions and use only the vector part for the *vector analysis* which he used to present his electromagnetic theory. Quaternionic analysis is not these days regarded by most physicists or mathematicians as a particularly hopeful pursuit. However, $SU(2)$ is a symmetry associated with unit quaternions, special relativity *can* be formulated succinctly using quaternions and quaternions, like the observables of quantum mechanics, do not commute. Therefore quaternions are not without precedent in modern physics.

The last member of the series of numbers real, complex, quaternion - with the characteristic property that the modulus of the product of a pair of them is equal to the product of the modulus of each - was found in 1859 by A.Cayley and called an *octonion* because it had *eight* elements. It is therefore particularly interesting to find that superlumps in eight dimensions are amongst the list of allowed super p-branes because they might be interpreted as a supersymmetric embedding of quaternions in octonions.

In 1990 I discovered the first theoretical examples of lumps in eight dimensions. At the same time I found a completely new beautiful theory of LUMPS IN OCTONIONIC SPACE. Unlike all other contenders for a theory of everything, this new theory is not based on a geometrical minimum world-path principle but on an algebraic principle minimising the non-associativity of octonions - that is the amount of difference there is when multiplying three octonions together when starting with different pairs of the trio. The equations of motion have not yet been derived from the action functional because it is based on an $SO(8)$ invariant rank four tensor about which not much is known.

However, there are three aspects of this new theory of lumps which make it appear significant. Firstly it dispenses with a square root which is ultimately the reason for the distinction between the Dirac and the Klein-Gordon equations, and hence the distinction between matter and force fields. Thus the need for supersymmetry might be obviated. Secondly the theory had its origin in the *instanton* sector of a previous theory which was discovered by Ed Corrigan and me in 1987 and independently by Marek

Grabowski and Chia-Hsiung Tze in 1989. This sector is entirely attributed to quantum transitions between stable topological structures. Thus the theory might have a natural quantum interpretation. Thirdly, although not yet mathematically proven, the new theory of *associative lumps* might be interpreted as a dynamical theory of the embedding of four dimensional quaternionic lumps in eight dimensional octonionic space-time. This leaves four space-time dimensions to be compactified. Four dimensions is just sufficient room to incorporate a slightly streamlined version of the standard model internal symmetry group.

The standard model has got a number of inelegant features. There have been many marvellous attempts to improve on the model and one day someone will make further verifiable progress. Maybe someone will even stumble on the beautiful theory which explains, in quantum terms, everything. Physicists and mathematicians seem to be getting very close to the ultimate analytic statement, a succinct mathematical expression from which an account of everything known can be drawn. Even as they are, the standard model plus general relativity can explain, *in principle* (the reductionist principle upon which the scientific approach is based), all observations in particle physics, all nuclear and atomic physics, all molecular theory (chemistry), all macro-molecular theory (biology, physiology, neurophysiology), all geology, astrophysics and just about all cosmology! What of psychology, sociology and politics? Nothing?



STAGE 3

This is It

The truth speaks within us
without noise of words.

Thomas à Kempis



You must help!

THE TWO GREAT THEORETICAL PILLARS of the twentieth century, relativity and quantum mechanics, both give a crucial central rôle to the notion of the *observer*. In this, philosophical thought has gone full circle.

According to Aristotle, whose views were generally deep enough to accommodate Christian theology, the Earth is a sphere surrounded first by water, then by air and then by fire; the fire showing as stars through holes in a celestial sphere. This view gives mankind a central *privileged* position in the order of things.

This privilege was withdrawn by Copernicus who placed the Sun at the centre. Newton's theory of gravitation and his mechanics both denied a privileged position to any observer anywhere in the universe. Rather the whole was imagined to be being observed by an omnipotent omnipresent omniscient God who by his vision gave all conceivable observables equal ontological status. Hence everything just exists, quaquaversally.

By focusing on the comparative experiences of observers in motion with respect to one another, Einstein showed that measurements of lengths in space and durations of time are *not* the universal absolutes supposed by Newton, but are dependant on the relative velocity of the observer with respect to that being observed. In this way, particular characteristics of observers begin once again to play a more central rôle in the theoretical account of phenomena.

In Newton's and Einstein's mechanics, observables are represented by passive *functions* which evolve continuously according to deterministic equations of motion, without reference to the actuality of any observation. In quantum mechanics however, the observable quantities are represented by *operators* that act, when an observation or measurement is made, to transform the mathematical function describing the state of the world into a *different function*. So the observer is thrust onto the stage to act, rather than left in the audience to enjoy, but not partake in, the phenomenal performance of conscious experience.

Giving the observer a special significance in the theory reintroduces the possibility of asking a certain type of question which had become rather meaningless from Newton's objective perspective. We look *out* on the world, *not down*. We are, as it were, embodied inside the world not outside it. We subjectively experience phenomena in our mind through our senses. We do not experience that apparently solid *external* reality either directly or objectively or absolutely.

Newton's mechanical view of the world gives each individual equal ontological status. This is quite foreign to actual experience wherein the *self* is necessarily central. That which is inferred to be, remains in truth just that; an inference. *This* direct subjective existential phenomenal experience is not an inference. *It is all that is not an inference*. This

phenomenal immediate experience *is* the fundamental substance, the basic stuff, the ground of being, the essence. Whether the glow of consciousness is bright or faint, this here and now presence is absolutely *it*.

Questions arise in the mind. Problems manifest themselves. Scientists have considerable faith that solutions can be found, with time and effort; that with appropriate analytic and synthetic thought, and deliberate actions, answers will avail themselves to properly posed questions. We can't necessarily force the answer to be what we might want it to be, but we can arrive at the correct answer to *complete the sense of any appropriate question*.

Questions arise in the mind. They are unfulfilled ideas or *semipropositions*. Eventually answers may arise in the mind, by whatever direct or roundabout route, to make a whole *proposition*. Until they are consciously understood, questions are not questions and answers are not answers.

Problems do not necessarily arise in the mind through the ordinary channels of the five external senses. There are many internal sources of stimuli - for example the sense of thirst and hunger or the sense of fun, of anticipation or timing. Problems reflect unfulfilled phenomenal experience. Problems together with their solutions fulfil the phenomenal experience. This immediate phenomenal world, whatever it might be, is the *source* of all problems and the *source* of all solutions. Therefore this phenomenal world transcends the concepts of 'problem' and 'solution', of 'question' and 'answer'. This essence, which we are aiming to grasp, is not about questions and answers but, as the source of both, transcends them. This phenomenal experience, which is truly the integral totality of all there actually is, is that essence. This is it.

Quantum philosophy, in empathy with existentialism, phenomenology and relative idealism and in sympathy with materialism, logical positivism and pragmatism, reintroduces one to one's soul. This is it.

There is at the quantum level no classical solid outside world. The world centres round the observer who, just by being conscious, is the witness of all that can *conceivably* be real.

Not that theory-laden unknowable noumenal world but *this phenomenal world, whatever it is, is the source of the problem and the source of the solution*. This is it, ultimately the consciousness of the perfect observer; perfect sense through perfect communication; indivisible unity and essential oneness.

① Extended Sense: deep understanding

WE COMMUNICATE WITH THE EXTERNAL WORLD using our five *senses*. Sight, hearing and touch may be regarded as physical senses, taste and smell as chemical senses. All these signify domains where our nervous system terminates with *feelers* or *sense organs* such as retinae, ear drums feeding into vestibulocochlear nerves, skin receptors, olfactory nerves and tastebuds. These feelers are designed to capture signals arriving from 'the outside'. The information received by the bodily instruments is sent through the nervous system to the brain and can somehow reach the mind where conscious intelligence makes *sense* of integrated impressions.

In this way for a hundred million years we have gathered data from the world and formulated comprehension, or understanding, or a basic scientific theory, of the nature of external reality. This theory, called *common sense*, seems to us to be the most obvious and indisputable system of facts there could possibly be. For example, the hypothesis that there *is* an outside world at all seems certain to us, although we know that the brain has to construct and constantly update a detailed neurochemical picture and history which is crucial to the maintenance of the common sense perception of that world. Common sense refers not only to practical wisdom derived from millennia of gathering information and assimilating knowledge but also to the common instruments of sense; those outward-reaching organs with which mankind is blessed; the senses we share in common.

From the time when Stone Age Man first made the hand-axe about three million years ago and lit fires about one million years ago, he has begun to change more rapidly and control more precisely his perception of the world, thus developing in an upward spiral ever more sophisticated tools for hand and thought. Verbal understanding of the world has developed to include abstract symbols of art, magic and the supernatural. Around the time of Newton, alchemists were looking for 'the philosopher's stone' to convert base metals into gold or 'the elixir of life' to bestow immortality. In a real sense Rutherford discovered how to turn lead into gold when he split the atomic nucleus. By this means gold actually turns into lead inside large stars. As regards an elixir of life, a clue might lie in the recent discovery that bacterial cells can divide any number of times whereas the cells of higher organisms can only divide about twenty times before the whole organism dies.

An astrological interpretation of personality and destiny and a medicine based on four *humours* made from the elements earth, fire, air and water were part of the common sense of sixteenth century man. It is hard to appreciate just how different and how similar was the mode of thought of generations past, or indeed of different civilisations past and present.

In 1608 the telescope was invented. This allowed Galileo to improve upon the observations of his contemporary, Tycho Brahe, and thus verify the elliptical planetary orbits predicted by Johannes Kepler, Brahe's assistant. Galileo was able to confirm the heliocentric theory of Copernicus which had in fact been propounded much earlier by Aristarchus, around 280BC. This is an historic example of a *forced* change of common sense necessitated as a result of a sophisticated external instrument, the telescope, linked to a human sense organ, the eye, allowing a sense, sight, to be *extended* beyond its normal domain.

In 1609 the microscope was invented. These *extended senses* brought with them an extended consciousness somewhat different from the normal consciousness of the then current everyday common sense. New theories came with the new observational capabilities to give the observations meaning within the new overall world-experience. The observations themselves were only available to those having access to the new specialised equipment, but the resulting new understanding, or system of beliefs and evidence, or scientific theory, or *extended sense*, was less restricted in its circulation. Wood-block printing was invented in China around 800AD and movable-type printing was invented in Europe around 1450. Publishing, which encourages diffusion of new ideas, was already well underway by 1500.

Since the time of Newton and his contemporaries, scientific apparatus has developed from the optical and mechanical, through the electrical and electrochemical, to the microelectronic and computer-based. Eyes have been extended to see, through television, live events hundreds or, by satellite, thousands of miles away. Ears have been extended to allow us to hear, in 1969, Neil Armstrong say "One small step for man, one giant leap for mankind!" while strolling onto the Moon. Computers can reconstruct images of anything from individual elementary particle interactions and metallic surfaces at atomic scales to radio galaxies, pulsars and quasars. Man's senses have been extended more and more until these days hospital staff routinely X-ray bones, monitor heartbeats and brain

waves, look inside arteries and veins, see inside blood cells, scan brains, measure specific hormone levels and even label strands of DNA.

At the same time as observing all these new phenomena with equipment which extends our powers of observation, our mind applies itself to the task of integrating this new information into a unified extended world-view which incorporates and gives meaning to the new, as well as the old, phenomena. New equipment is constructed based on the current world-theory in an upward accumulative spiral of development. Old theories are seldom completely scrapped. They are deepened. Truth is the deepest.

For hundreds of millions of years life developed and perfected onboard instruments, including eyes and ears, and, alongside, constructed a world-map in the brain reflecting the meaning of those received impressions which are naturally interpreted as being from outside the body. This is classical understanding - common sense. Quantum mechanically, if you empirically seek the mechanism of the senses, you will find mechanism. But if you don't then you see no mechanism - just transparent sensations, revealing a complementarity between brain analysis and mental synthesis, between matter and mind.

In the last three hundred years, and particularly in the last fifty years, we have availed ourselves of a vast range of peripheral apparati with which to examine more closely than ever before the minute details of ourselves and our surroundings. Using, as far as possible, rigorous mathematical procedures, scientists have been able to construct elaborate dynamical theories built layer by layer upon the solid foundation of Newton's mechanics. By carefully comparing predictions with evidence they have put aside refuted guesses and further developed observationally confirmed theories. By this rational procedure scientists have built up a vast library store of established knowledge beyond the bounds of everyday common sense and at the same time they have developed a sound mathematical *quantum explanation* of their observations.

Blinded by Science

Most people are not privy to the theoretical edifice behind the gadgetry upon which modern man depends. Most have had their physical senses extended by the use of radios, televisions, computers and other scientific equipment, but they have not had their mental sense, or meaning, sufficiently extended by having the theoretical background to the

construction of this equipment properly explained to them. This imbalance has produced a parlous situation which is exacerbated by the fact that, at least since the time of Maxwell's electromagnetic theory and probably since Newton's calculus, even those who claim to understand the scientific theory rely too heavily on mathematical intuition and too lightly on physical intuition making understanding seem almost impossible to those without very significant mathematical training. In the terminology of Immanuel Kant, mankind is rapidly having his *forms of perception* extended but is not having his *categories of understanding* extended. The man in the street is being bewildered and left behind in a selfish secretive race to power and domination. Instead he should be enlightened in a drive to free the spirit and illuminate the soul.

What would be the social consequence of selling the following three inventions?

First a *no-muscle switch* with which you can switch a switch without moving a muscle! Is *psychokinesis* possible?

The gadget fits into a hat which you wear on your head. Inside the hat are electrodes which connect in a simple and painless way onto your scalp to monitor brain *alpha* waves. Listening to the amplified output you can in fact learn, using biofeedback, to control the alpha wave frequency. Once you have learnt how to control the frequency very precisely, an aerial on the hat can transmit signals which depend on the alpha wave frequency. Thus the lights could be switched on, or the television channel changed, or solenoid-controlled doors opened, just by altering the brain alpha wave frequency. That is, everything could be done at will without the need to move a single muscle in your body. In this way the whole musculo-skeletal system could be dispensed with at the cost of replacing hundreds of millions of years of evolutionary development by a newfangled brain-compatible opto-electronic gimbo. Anyone who would consider undergoing the radical change without understanding how the device is designed and built must already feel that he does not really understand his own body, but that it just works, SOMEHOW. Is this how we ought to feel about our own bodies? Are we getting mentally blinded?

Second comes an *invisibility machine*; a device that can make you disappear at the flick of a switch! Are *ghosts* possible then?

Imagine a tight-fitting all-over body suit. When examined closely this suit can be seen to have a microscopic chessboard pattern on it. The light square dots are microscreens which can emit light. The dark square dots are microcameras which register incoming light. The wiring is so

arranged that a light square dot intensely emits the light which is registered by the dark square dot diagonally opposite it when the suit is being worn. This means that light appears to pass straight through the body making it invisible. When the suit is switched off, or made to emit all pink light, or has been made double sided so it can become transparent, then the wearer will immediately reappear. In this way we could all become an off-the-peg invisible person. This is an example of *retracted senses*. As well as being freed from the 'trappings of appearance', the wearer is freed from immediate responsibility for the consequences of his actions. Such an invention could be a frightening reality, especially for those who do not appreciate how it works.

Third is a *notravel travel machine*. With this machine you can effectively travel huge distances almost instantaneously at the touch of a switch. Is there an *astral body*?

The device requires a large box filled with very light foam rubber and having a large movable ball-bearing on the floor. You enter the box, stand on the middle of the ball bearing, put on headphones and wear glasses consisting of two small flat television screens. At other distant locations are humanoid robots. One particular robot is selected by the turn of a switch in the box. Then, whatever light enters that robot's eyes (cameras), you see in your TV glasses (or better, MASER hologram to video transducers), whatever sound the robot hears through its ears (microphones), you hear in your headphones. When you move your legs, arms or fingers in the sensitised foam rubber, the robot moves identically by remote control. When you walk on the ball-bearing, the robot walks accordingly. Then, to all intents and purposes, *you are* where that robot is. Switch the switch and immediately you are at a different location in another robot's body. If there is not already enough confusion about which characters on TV are real and which are fictitious, then this invention might confuse everyone about who's who and who's where.

If the mighty power of science is given to military generals without at the same time delivering a rapturous amazement at the harmony of nature, then it is impossible for them to deeply understand what they are doing. A monkey can learn to drive a car. *Extended sense* is to be understood as new instrumentation (*senses*) with which to see new phenomena, and *simultaneously* new meaning (*sense*) with which to fully appreciate the new phenomena. One without the other is inadequate. One with the other makes *perfect sense*.

Question: why do we have the sense organs that we do and not telescopic eyes to see for miles or sharply pointed fingers to feel individual molecules? Answer: our instruments were designed to cope with the pressing business of bodily survival and cumulative development. All the senses are perfectly constructed and co-ordinated to utilise most, if not all, of the useful signals reaching the body which would be vital for day to day maintenance and gradual evolution. The brain takes these signals and integrates them into a single whole impression of the state of the outside world. Essential to the process is a theory, or world-view, which gives meaning to, and enables the construction of, this integrated impression.

The similarity between brain processes and scientific apparatus is striking. For example, in large particle accelerators there are large computerised detectors to register and interpret events. Many related events are detected in parallel and then analysed for intensity, distribution and coincidence. The standard physics is applied by transputers to decipher the meaning of the signals. Finally the complete reconstruction is presented on a computer screen as a simulated picture of the underlying event. Similar coincidence detectors have been found in the brain. Parallel neuron wiring has been identified which employs spacial separation to compensate for temporal differences, thus enabling one to identify precise coincidence.

Under normal circumstances, even while employing many sense instruments, one feels comfortable with the agreement between incoming signals and their interpretation by the mind's world-view, or broad theory, or common sense. There is a close and intimate relationship between *sense* understood as material instrumentation and *sense* understood as mental meaning. This material and simultaneous mental pun on the use of the word 'sense' is intentionally employed in order to convey the wholesome notion that, with a comprehensive theory of everything, *one is perfect sense*.

If we had, instead of two eyes, two portable radio telescopes then a deeper common sense theory would have to be developed and installed into the brain. For the purposes of superficial everyday living, this theory would be unnecessarily complicated and the senses would not be easily integrable into a single overall impression because sounds heard with our ears on Earth would not have any obvious bearing on the appearance of distant galaxies. So apparati and theory have to tie together into a unified consistent package for everyday needs, as they seem in fact able to do in all living organisms.

② The Perfect Observer: n^{th} cousin identity

A WORLD-VIEW IS ASSIMILATED to the evidence viewed. The theoretical understanding one has is therefore likely to be limited by the viewing equipment at one's disposal. Living organisms have equipped themselves with, perhaps, a perfect set of viewing and manipulating apparatus to go with their current theoretical understanding of the 'outside' world. The equipment is perfect in the way that a working television is perfect: it delivers the co-ordinated sound and picture as an integrated whole which is not manifestly lacking unless untuned or broken. From a Newtonian point of view a lot may be totally missing from a TV, like smell, tactility or three dimensionality. But from the *quantum* point of view, precision in one aspect implies great uncertainty in the complementary aspect so that *perfection cannot mean absolute accuracy* or classical exhaustiveness but rather a BALANCED VIEW giving sufficient weight to both or numerous aspects.

A perfect observer is therefore an observer with an appropriate mix of observing equipment, such that the incoming signals are understood perfectly well in terms of the accepted theory and that the range of signals is sufficient to build an optimally coherent impression of the state of the environment. This impression is used in conjunction with the accepted theory to predict the most likely future for the conscious observer. This is the quantum understanding of life. Perfect knowledge is represented by a complete specification of the *quantum*, not classical, state of the system, being or object in question.

Classical understanding is different. Therein all material nature is believed to obey deterministic laws. Given a complete description of the state of affairs in terms of positions and velocities of all particles (whose masses must have already been determined exactly) the future can be predicted in term of positions and velocities exactly. This leads to a very different concept of a perfect observer who knows every conceivable classically knowable thing in absolute detail. This omniscient perfect observer was taken by religious scientists to be the nature of the God of Christianity. On this common view the word 'perfect' becomes practically useless as, almost by definition, nothing can live up to it except God himself. For that reason many will write off this book as soon as they read the title.

On the other hand, the God of Judaism is a perfect observer who accepts the freedom of man to act as he wishes but who can see clearly into a man's heart and mind and knows his spirit, or disposition. This understanding is closer to the quantum view of a perfect observer than Newton's view because it allows room for meaningful freedom of choice, THE essential requirement for all ethical deliberations.

While undamaged human senses are perfectly designed and constructed and supply information in tune with common sense theory, when the senses are *extended*, the common sense theory sometimes has to be improved because it turns out to be inadequate. Any replacement theory has to be good enough that all available physical extensions supply data which fit comfortably into the theory. A perfect observer is not one who has attached to himself all possible sense extensions. Rather he is one who can correctly interpret observations made by using whatever additional (or subtractional) technological means, if any, is supplied. This means having an appropriately general theoretical framework in place - that is, a deep understanding.

Quantum Identity

Consider the proposition that the phenomenon of purpleness, that is 'seeing purple', corresponds to an *archetypal idea* which is IDENTICAL for all observers. Or, generally, identical phenomena observed by different observers constitute identical experiences. In quantum philosophy there is a *physical* justification for this claim . . .

Take two fundamental fields of any type; two electrons say. Electronness is defined in terms of mass and a few quantum numbers such as electric charge and lepton number. Every electron will have the same values for these quantities. The only observable differences between any two given electrons are their position, velocity and direction of intrinsic spin. All electrons, in themselves, are identical. If two somehow swapped places, no mark could be made on one to enable an absolute identification of which one it is. This *indistinguishability in quantum principle* leads to observable consequences.

Large numbers of milk bottles, which can be marked and so separately identified at the classical level, obey the usual type of mathematical statistics as expressed by Maxwell and Ludwig Boltzman. However large numbers of electrons, because they are identical in principle, obey a *different type of statistics* discovered by Fermi and Dirac.

A third type of statistics, whose discovery is attributed to Satyendra Nath Bose and Einstein, is obeyed by force fields such as photons and gluons. Fermi-Dirac statistics explains, for example, why atomic orbitals get filled up. Bose-Einstein statistics explains, for example, the spectrum of hot body radiation. It might even be that pounds in the bank are best described by Bose-Einstein statistics too because they are, when in the bank, indistinguishable in principle!

So electrons are not just the same but are *identical*. This claim is verified by the many successes of Fermi-Dirac statistics. That particular type of mathematical statistics follows directly as a result of the electron field satisfying the Dirac equation. Bose-Einstein statistics, on the other hand, is appropriate for fields satisfying the Klein-Gordon equation.

At the foundations of quantum field theory is a mathematical theorem due to Pauli (1955) and G.Lüders (1957) called the CPT theorem. It states that if any quantum field is inverted in space by a *Parity transformation* like a reflection in a mirror, reversed in time by a *Time reversal transformation* like a video played backwards, and is given opposite quantum numbers in a *Charge conjugation* which transforms matter to antimatter, then the result is a field which is mathematically and therefore physically *exactly equivalent* to the original field. Thus an electron moving forwards in time to the left can be considered as being exactly equivalent to a positron moving backwards in time to the right, as when seen in a mirror (which means that its intrinsic spin will be flipped too).

While contemplating this theorem, Feynman realised a consequence which brings out the full force of *identity* amongst quantum fields. He immediately phoned his friend and former tutor John Archibald Wheeler about it. If an electron moving naturally into the future can hit, say, a photon and get scattered backwards in time as a positron, then we *now* might see two particles, an electron and a positron, when from the theoretical perspective only one original particle is required to mathematically explain the phenomenon. If this positron then moves into our past and scatters off another photon in the past becoming an electron moving forwards in time, and if this happens again and again, then all the electrons that we now observe might be explicable theoretically in terms of only one original archetypal electron. Wheeler liked the idea and believed it even more than Feynman himself. Wheeler suggested that there are more electrons than positrons in the world because the positrons come back through the charge on protons.

This quantum parable makes conceivable for the first time the exceedingly economical notion that there need be only *one* electron in the entire universe. That certainly accounts for their identity. More than that, if there is only one electron in the universe then things which were once regarded as absolutely distinct become intimately and inextricably associated. For example, your brain and my brain are composed of electrons - *the very same electron*. Therefore there is a quantum physical basis for asserting that purpleness might be an identical experience for us all.

Indeed, only *one of each type* of field - quark, photon, Z, ... - is quantum theoretically absolutely necessary. When a satisfactory theory of everything is found then there will probably be *only one type* of field. Therefore there would only need to be one field in the universe. This makes us all much more identical to one-another than we might have imagined, or wished.

The more complex a composite object is, the more chance there is that two of them will be in differentiable states. But still the identity between like constituents has consequence. Atomic nuclei with an *even* number of protons plus neutrons obey Bose-Einstein statistics while nuclei with an odd number of protons plus neutrons obey Fermi-Dirac statistics. By the time the level of complexity is very high the consequences of identity become more subtle. Nevertheless two benzene molecules are, in some real sense, identical and therefore one. Likewise two milk bottles, or indeed two buckets of milk, have an underlying theoretical inextricable identity unappreciated by the more superficial Maxwell-Boltzman statistics. The more alike two things are, the more manifest identity they share. Two brains share a lot more of this physical identity than a cricket ball and a tennis ball. The surface of the Sun is more water than cheese, the surface of the Moon is more cheese than water! This is not classical sameness but identity we are comparing; elementary constitution, hydrogenness and carbonness for example.

Identical twins have a lot of this *quantum identity*. If they have similar ideas and similar trains of thought, which apparently they can do, then there is some justification in quantum field theory for arguing that these parallel thoughts are *one and the same* thought. Carl Jung around 1948 had a theory of mind in which thoughts are built from elementary *archetypal* ideas. These ideas are profoundly common to all humans, the circle being one powerful example. Ludwig Wittgenstein in 1921 presented his theory of logical atomism in which the world is said to be

made up of atomic facts which cannot be further analysed. In the ancient Hindu Vedas, thought is considered as whirlpools of force. Mindstuff is supposed to be made of a subtle material called *chitta* in which waves, or *vrittis*, ebb and flow. But beyond that is the soul, Atman, which is ultimately identical to the supreme soul, Brahman. In all these theories of mind, purpleness is, in essence, quantum identical for all purple experiences by all individuals.

Quantum Numerology

The predictions of quantum theories are given, as shown by Born, in terms of the mathematical modulus of the state function. The state function results in a *complex* quantity which has both real and imaginary numerical parts. What is an imaginary number? One cannot point to an example set as one can with a real number. An imaginary number is so called because it is even more of a Platonic ideal than a real number is, quantifying ideas about numbers rather than real elements. The *modulus* function combines real and imaginary parts of a complex number into a real part only. This real part is invoked in the description of the world when formulating quantum propositions which can be directly tested. When the full meaning of quantum philosophy is uncovered, the real part of the wave function may have some direct reference to the observed phenomenon while the imaginary part may have some direct reference to the unobserved noumenon. By taking the modulus, only phenomena are described. This would not imply a return to determinism, but rather a unified mathematical description of mind-matter essence.

Here is another quantum parable which may help us to appreciate the mighty form of the new paradigm. In the everyday world one can represent a positive number by that number of physical *counters*. We can add to the number or subtract from the number as long as the result is zero or positive. Question: how can we represent negative numbers? Answer: antimatter! Taking one counter from zero counters (which requires the power of many nuclear bombs) leaves one (negative energy) anticounter. This anticounter is real enough. It can be seen. It reflects light. But in our world of predominantly matter, antimatter, unless carefully suspended in vacuum, violently annihilates with the surrounding matter almost immediately. We can theoretically take away another counter and get two anticounters, literally *minus two* counters. And we can add two material counters to get zero counters again. Thus *all* the integers have physical

manifestation in quantum numerology. Fractions just involve division of counters or anticounters. Irrational numbers, particularly transcendental numbers like π , remain to be scientifically interpreted.

In special relativity there are, theoretically, three different manifestations of particle: there are *tardyons* which travel slower than the speed of light, there are *luxons* which travel at the speed of light, and there are *tachyons* which travel faster than the speed of light. Tachyons are usually ignored in physics as they have imaginary mass. However they are treated seriously in string theory, although only as a nuisance which has to be eliminated. By interpreting imaginary properties as referring to unobserved imagined noumenal stuff, could tachyons help us to understand anything? Think of Jupiter. If it took less than half an hour then your mind got there faster than the speed of light, so to speak. Now try to take half an hour to think of Jupiter. That seems impossible. Thoughts like that *can't* move slowly.

Consider that the properties of material objects are associated with real numbers and that the properties of thoughts are associated with imaginary numbers. Minkowski argued that Pythagoras' theorem could usefully be extended to four dimensions if the fourth dimension was taken to consist of imaginary numbers. In particular, time and energy seem appropriately represented as imaginary dimensions. Making time and energy imaginary numbers in the uncertainty principle changes the sign of the product and hence the direction of the inequality. The time-energy uncertainty principle becomes a sort of *certainty principle* for mental properties. It becomes the statement that the product of the uncertainty in the time of an event multiplied by the uncertainty in the energy of an event is *less than or equal to* minus Planck's constant. Particles with properties obeying this type of certainty principle we might call *sophons* while those obeying the usual uncertainty principle we might call *megons*. Perhaps *sophons* originate in a *principle of most action* while *megons* originate, as they do, from a principle of least action.

When both real and imaginary properties are involved, as is envisaged in a quaternionic theory, quantum description might be yet more revealing, perhaps providing a detailed mathematical explanation of the relationship between mind and matter. Descartes, the founder of modern Western philosophy, when viewing a table, considered there to be one material table and another table 'in the mind', contingently identical. The full quantum theory of *sophons* and *megons* could herald Cartesian

monism, or a lifting of the Vedic *māyā*, the illusion by which one appears as many.

The perfect observer is in full possession of a comprehensive and comprehensible theory of everything which causally accounts for any observation he may care to make using whatever equipment. Say he meets another perfect observer. They both realise that their sense data are at root identical and that their interpretation of that data is one and the same - THE unified idea. They fully appreciate the identity between them. Are they two observers or one? As the signals from two eyes or ears merge through two halves of one brain to become one unified picture or impression, so there is only one perfect observer, *looking out* on the world, not down. What was disparagingly called solipsism becomes the warm embodiment of the perfect observer. *One is the perfect observer when the unified theory of everything becomes self-evident.*

The logical conclusion of Darwin's observations is that all of life, from plants to man, originated four thousand million years ago all from the very same source, some blue-green algae, or whatever. Now, *first cousins* have common grandparents, *second cousins* have common great grandparents, *third cousins* have common great great grandparents, and so on. A person being one generation away from a first cousin relationship makes a relationship of first cousin *once removed*, either up a generation or down. Two generations away would be first cousin *twice removed*, either positive (up) or negative (down). Thus the relationship between anybody and anybody else can be significantly expressed by just *two numbers*, one positive number (n^{th} cousin) and one integer (generations removed). The magnitudes of these numbers statistically represent the degree of genetic identity between two individuals. Zero and zero for brothers and sisters up to, say, one thousand and zero for contemporary strangers on different continents.

There is a deep identity amongst all living beings from animals to plants. Something like 98% of a monkey's genes are identical to human genes. This identity binds us all together into a quantum mechanical whole much deeper than the superficial 'sameness' granted by classical understanding. Perhaps it is easiest for identical twins to understand the oneness of the perfect observer who is in undeluded truth us each and all.

③ Unity Consciousness: transcending the loop

THE PERFECT OBSERVER KNOWS AND UNDERSTANDS the theory of everything so thoroughly that any observation he may choose to make fits harmoniously into his scheme of things. To him the explanation behind every phenomenon is self-evident in terms of causal propagation of some sort of *square root of probability*, whatever that means. What had started as a somewhat abstract mathematical theory allowing accurate prediction of specific outcomes in contrived experimental circumstances becomes, for the perfect observer who has reprogrammed his brain, a new common sense, appreciated as intuitively and as directly as a fist on a brick.

To become so familiar with the theory, that the extended sense of it, which was originally paradoxical and repulsive in the old local deterministic paradigm, becomes obvious, natural and deeply satisfying, is the goal pursued by the genuine mystical scientist. How is it possible and what does it mean?

Perfect Language

We are so attached to our mother tongue that we don't often wonder how well we could communicate and how effectively we could think without ordinary language. At school we learn grammar, but before we go to school we have already learnt to understand and speak words, phrases and sentences of our native language. In the very early years of life neurons are still *visibly* growing and making physical connections with one another inside the brain, especially in response to external stimuli. In this formative period not only is learning taking place in the mind, reflected in a physical RNA memory within nerve cell nuclei, but also brain construction by neuron connection is taking place, especially when stimulated by rich external environments. That construction mirrors the associations made in response to conscious experiences which are, to a large extent, themselves already portrayed in language.

Before we can begin to read words we ought, logically, to learn the phonetic alphabet. Reading English is then just a matter of enunciating the phonemes in order of their appearance on a linear basis. A number of special cases require one to look ahead two characters(as in *sh ph th ch wh oo ee ei ie ai ae ea qu ps pn ge ng*), three (as in *ate ide ure uni igh ike ome tio*) or even four characters(as in *ough eigh augh*) in order to identify the

correct phonetic pronunciation. In English, the flow is strictly linear most of the time. The biggest problem is with the vowels *a, e, i, o, u*. Each of these can assume three or four different sounds depending on the context. These vowels are well integrated into our thinking. Recent observations have shown that, at a very early stage in our lives, vowels have been singled out by the brain for special treatment. There is a clinical case where damage to the left side of someone's brain selectively impaired his writing of vowels. All the consonants were completely unaffected. This exemplifies the level of detail at which the brain analyses, sorts and stores information about language of which we are, by age four, hardly conscious and must formally relearn about at school. Reading out loud is another example of the accuracy, intensity and grace with which the brain can decipher from symbols to phonemes to words to sentences, in real time co-ordination with eyes tongue and lips, paragraph after paragraph of ideas, scenes and stories. *Ordinary language mirrors brain function which maps the world.*

Studying pure mathematics is like studying Sanskrit grammar with the minimum vocabulary. It is dry and strict and can appear cold, dead and repelling. But mathematics seems to form the syntax of the language of nature and as such is exciting, revealing and penetrating. How many is two lots of two things? Four things! It's obvious. How many is two hundred and thirty seven lots of fifty nine things? Not so obvious, but demonstrably thirteen thousand nine hundred and eighty three with patience and understanding. Given the extended sense of a calculator the right answer is easily found.

Mathematics is a language of common *and* uncommon sense. Mathematical thinking is potentially applicable to any well-defined domain. The phenomenal world is the ultimate domain for applied mathematics because it is the originator of all meaningful concepts. Therefore quantitative science adopts mathematics, the most precise language available to date. Arithmetic is virile in calculators and traditional computer languages like C or APL, but mathematics is especially potent in the form of a computer algebra system such as MATHEMATICA because of its rigorous pre-digested general mode of communication. Likewise Sanskrit is animated in a Sanskrit speaker.

Mathematics provides the syntax in the form of necessary equations and relations, with their sound justification and clear general significance. Science provides the semantics in the form of a dictionary of concepts

having operational and intuitive meanings. Together, as a philological whole, they express the meaning of our world.

Mathematics is very like ordinary language. Numbers behave like nouns, they are the Platonic things with which one deals. Functions act like verbs, having a noun subject and maybe a noun object on which to act, as for example the plus in $1+1$. Operators, such as the integral and differential operators, which modify functions to give other functions, are like adverbs which modify verbs. Theorems relating numbers, functions and operators invoke syntactic rules relating these nouns, verbs and adverbs. Mathematics propounds many precise theorems, or justifiable propositions, relating nouns, verbs and adverbs. Probably all parts of speech have an analogous symbolic rôle in some branch of mathematics. That mathematics is a well-defined language which can be encapsulated in computer software is also very significant and provocative. For computer programmers, mathematics might seem to be much easier to program as artificial intelligence than ordinary language but this is to some extent an illusion since computers are geared to binary numbers by design and only elementary mathematics is normally being considered in the comparison.

The mathematician defines his abstract territory and constructs his provable theorems. Everything is clear in his mind and is well understood. The scientist takes these theorems and applies them to his own particular concepts, calling the result a theory about the nature of the world. The theory can sometimes be used to make predictions which can be tested. If the predictions are verified by observation then the theory can be considered to contain an element of truth about the world. Before the scientist can claim to truly *understand* the theory he must have an intuitive understanding of the original mathematical theorems as well as the scientific concepts with which the theory deals.

Could we program the linguistic structure behind a theory of everything into our brains so effectively that thinking in its terms is figuratively as easy as $1\ 2\ 3$? The standard model of physics is so computationally unwieldy that this is probably impossible for reasonable speed of thought. But mathematical science, in just three hundred years, has managed to reduce almost everything fundamental in the physical world to a single page of mathematical expressions. Hopefully mankind has plenty of time to improve on this. Imagine that some theory, like string theory or the quantum theory of associative lumps, is shown to fit all the available facts. And suppose that the conceptual difficulties behind the need for renormalization of any quantum field theory are removed,

obviated or somehow conquered. Could the enormous paradigm shift involved in digesting this new explanation actually be reflected in a physical cell to cell rewiring of brain neurons, or do we have to wait for generations of evolution to make the necessary transformation before paradoxes become paradigms and incredulity becomes understanding? Should we be satisfied with equipment which translates quantum events into comfortably familiar classical situations, or should we search for real understanding behind superconductivity or superfluidity or supergravity and seek wisdom through that understanding? From an ultimate theory one has the right to expect *ultimate wisdom*.

Physics is fundamentally based on pure clean quantifiable measurable notions. Mathematics is based on clear precise definitions and well-defined relationships. Computers can interpret many mathematical statements and make exact numerical or even functional predictions, very quickly in many cases. Some people can apparently perform amazingly difficult mental arithmetic very quickly too. Why could we not learn to reckon quickly and accurately by programming our responses according to Euclid's algorithm or rather Euclid's *insight*, for example?

Blinking is a fast programmed response. Digesting food is another programmed response. Walking or driving a car is a learnt programmed response. Protein synthesis by genes is a deep programmed response. The fifty thousand or so genes in DNA seem to be the program of life itself. So why can't we imitate the arithmetic and logical unit of a single silicon chip? Of course we could. Somehow. One day. One day the volume under a two dimensional surface function could be intuitively estimated to great accuracy using a procedure based on the insights of integral calculus or functional analysis. After all, every electron, in some analog sense, quantum electrodynamically 'calculates' almost instantaneously. As fourth and fifth generation computer languages refine, simplify and generalise algorithms, procedures and notations, so the way to achieve true intuitive understanding of scientific theories will dawn and start to shed light turning mysterious mathematical incantations into completely transparent self-evident quantum supertruths and manifestly sound quantum supervalid arguments. After all, mathematical science is very young on evolutionary timescales.

The language, which one employs to think colloquially and communicate abstractly with others, reflects one's level of consciousness. Society as a whole, particularly since the advent of television and 'the media', reflects an average level of consciousness which it is very hard for

an individual to break out of, or dissociate from. This *psychic atmosphere* controls the paradigm of understanding. There is little acknowledgement of the possibility of an entirely new paradigm and therefore very little encouragement to change fundamental ideas. But the world is changing rapidly causing more turmoil and hardship than wealth and happiness, and yet some elementary ideas originated by ancient Greek philosophers are still held fast while the ideas of quantum philosophy are almost entirely ignored. Drop your lunch on the floor and we all know how to clean up the mess, but put a false idea into the mind and sometimes, because of lethargy, habit or comfort, it is impossible to remove. We know how to manipulate things external, but for the most part we are not in control of the flow of even our very own thoughts.

So what does the perfect observer think? What language does he use? What does he aim to DO with his life? The language will be that appropriate to the set of intuitions surrounding his theory of everything, with particular bias towards those instruments, extended or innate, with which he habitually operates. His language will probably be of a terse symbolic mathematical form, although ordinary language will necessarily be encompassed as the mode acceptable in certain limited circumstances where low-level reduced or high-level consolidated understanding is the only communicable form. The thoughts of the perfect observer will involve some remembering of the past, some enjoyment of the present and some weighing of the future. But with far more clarity, involvement and vision. The aim of his life must be to share his insight so that the whole world can achieve spontaneous total harmonious ecstasy.

Self-Evident Supertruth

The perfect observer does not habitually function in the arena of questions and answers. He totally understands a theory which quantum philosophically explains absolutely everything. When a problem presents itself, the solution is immediately transparently obvious. He therefore moves straight into action to recover any lost harmony. If he meets anybody who is 'not himself' then the perfect observer attempts to communicate his supertruth. He does not deal in semipropositions, in questions or answers, but in quantum inseparable wholes and in complete unequivocal propositions. He listens, explains, proclaims, directs and loves. His quantum ignorance still leaves him invincible. When he becomes aware of classical ignorance a subtle quizzical extended or innate

observation supplies the necessary information for perfect understanding. The perfect observer is thus a being without classical ignorance. Should a new baby be accused of gross ignorance? No, it is quantum ignorance for which there is no rebuke because quantum ignorance is theoretically necessary and totally rational, and therefore blameless and beyond disdain.

Unity consciousness is the state of mind of the perfect observer who deeply, down to rock bottom, understands this phenomenal world of pure experience. His theory of everything constantly confirms the unity of it. Scientific reductionism allows him to apply his theory to physical, chemical and biological levels of complexity with relative impunity. As it stands at the moment, quantum theory is a predictor. It accepts information from observing equipment and gives a description of possible experience to come. When the full meaning of the wave function, a sort of square root of probability whatever that is, is understood then quantum theory will be more than just a predictive algorithm. The perfect observer, appreciating the full meaning of quantum philosophy, experiences *loopless itness* which transcends problems and solutions, questions and answers. *The theory of everything is a representation of the consciousness of the perfect observer.*

If you meet a perfect observer and talk with them then the more you understand what he/she is saying the more you will become yourself and the more you will become him/her too. He does not take away your self-identity. He strengthens it because you come to realise what you already actually know intellectually, namely that you are absolutely different from and at the same time almost identical to everything else, including monkeys, trees and rocks. The personality is not limited by quantum revelations. It is *harmonized, crystallized and unified*. Thus you become more recognisable, more tangible and more comprehensible. Finding out about the external world is finding out about yourself. The world is the shadow of your potential. You already intuitively know there is only one true observer, and he looks out.

There may be *only one type* of particle in the ultimate theory. There may be *only one particle* in the universe. Therefore, in so far as consciousness is somehow associated with matter, there need be only *one source of consciousness*. Therefore there need be only one observer. One is the perfect observer when one fully comprehends, understands and appreciates what all this means. Then you can interpret THIS ITNESS as perfection.

The perfect observer may begin as a solipsist. However, when he communicates with others he will partially and confusedly identify with their state of mind. If and when the confusion is resolved, he will recognise their mind as his own. Quantum communication, or oneness in interaction, unites subject and object, observing instrument and observed object, into an indivisible unanalysable inseparable whole. Two people who are communicating form an entangled bond which can become so intimate that they become truly inseparable even when apart. *Love is perfect communication.*

This phenomenal world, the integral sum of all durable experience, is everything that has to be explained. When it is understood, everything is understood. Such understanding *is possible.*



STAGE 4

That is That

What is that, knowing which,
everything is known?

Swami Vivekananda



Understand?

THE PROBLEM IS ENTIRELY GENERAL. No particular problem need be cited. We are told that there *must* be a problem, for why then did no man cast the first stone? If one asks a question then a problem has

been raised. Now, according to the scientists, questions can be asked to which no man has the answer. Does everyone therefore not then have at least these problems?

Every real problem must have an intelligible solution. This is scientific faith. Since every problem presses for solution, is one only content when there is no problem at all, since only then do we not need to seek anything? Unless we are to be trapped forever by theoretical difficulties, there must be a sure way out of this apparently imperforate web.

The world of your experience reveals the only world which you know about. This world encompasses everything which exists, as far as you know. This direct experience, whatever it ultimately is, is the source of all problems and the source of all solutions. Therefore it actually transcends problems and solutions, questions and answers. This 'it' can never be other than itself whatever the current opinion, and that is that.

There is a problem. Have faith that there is a solution, and by so doing acknowledge the transcendental source of both. This is it. There can be no question about this, because it transcends questions. Therefore that is that. Scientific method itself has been transcended since this source of all questions is not itself amenable to questioning.

Even given that there seems scope for unending confusion and difficulties, the faithful recognition that quantum explanation is possible leads to the realisation that clarity of mind is the essential weapon. Doubts about this conclusion can only arise if the transcendental argument is not understood.

If we are not enlightened, but believe that enlightenment is possible, then we can take heart because consciousness is all we need and that's that. A conscious individual can never suffer instantaneous lack of wholeness. Physical or mental disability can never be an impediment to the ultimate wisdom.

Whatever that noumenon is, it is definitely itself. That is tautologically true by definition of the semantic significance of the reflexive pronoun, self. Therefore 'that is that' is necessarily true. No problem. That's that.

There is a way out of the question-answer loop. Recognise this presence in the eternal now as the source of both question and answer and by identifying with it transcend the loop. When the transcendental argument is obvious then there can be no doubt about this transcendental itness, and that's that.

① Causal Reason: free control of future and past

WHAT COUNTS AS AN EXPLANATION depends on the familiar paradigm. In the quantum paradigm the concept of explanation is so different from that in the classical paradigm that even the solid ground of elementary logic needs some tilling if not completely digging up. Tycho Brahe did something similar for astronomy. By discovering a supernova in 1572 and a comet in 1577 he took astronomy from the perfect unchanging cosmos of Aristotle towards the scientific subject of today. Likewise Einstein, by his general theory of relativity took Euclidean geometry ‘off the shelf of untouchables’ and made it a subject of empirical enquiry.

Quantum Logic

The same sort of adjustment now has to be made to logic. What is the meaning of *or* in quantum logic? If when talking about the future we say that this *or* that will happen then, as with the application of statistics, we have to be careful to determine whether these alternatives are the result of quantum or classical type ignorance. If quantum then the *or* is like that in the statement: ‘an electron goes round one side of a barrier *or* the other’. In this case, mathematically speaking, the *boolean lattice of classical phase space* must be replaced by the *projection lattice of quantum Hilbert space*. One consequence is that in quantum logic there is a new restriction on the application of the distributive law of classical logic. Thus, for example, (A) and (B or C) does not *quantum logically* imply that therefore (A and B) or (A and C), where A, B and C are simple propositions.

This modification of dear logical intuition can offer an alternative approach to confronting, unravelling and understanding the paradoxes of quantum philosophy. Wheeler has recently suggested that all experiments in the quantum realm ought to be formulated as questions which have the answer *yes* or *no*. Quantum theory should then be reformulated as a quantum logical theory based on a binary quantum logical foundation. This has not yet been achieved.

Attempts to return to classical understanding by inventing ‘hidden variable theories’ to restore determinism or locality, or to remove complementary ontology or inescapable ignorance, have been shown to be far more elusive enterprises than Einstein for one supposed. The same is true of a return to classical logic. In 1967 Simon Kochen and E.P. Specker showed that, while it is possible to embed a classical logic inside a

quantum logic, it is NOT possible to embed a quantum logic in a classical one. This seems to necessarily imply that no hidden variable theory underneath a quantum theory could ever allow a return to classical logical foundations. This necessity completes the overthrow by quantum metaphysics of classical metaphysics; of classical *ontology*, of classical *epistemology* and of classical *logic*.

Newtonian physics did not have a threatening influence on discussions of Aristotle's logic because classical physics is a strictly deterministic theory. Questions about the truth value of future events are not considered to be problematic in the way that they are in an indeterministic quantum universe. Strict determinism gives a theory a rigid static deductive feel which is consistent with the essence of Aristotle's syllogistic logic.

Schrödinger's equation, on the other hand, expresses the evolution of rooted probabilities. While the evolution is still strictly causal, the evolving wave function is not a phenomenal known being but a noumenal potentiality; unknowable and insubstantial. Production of the future from the past is not one to one but many to many. The Schrödinger equation encapsulates a *dynamical reason*. Explanation has a dynamic rather than simply static component to it. In an indeterministic fundamental theory there is sometimes no traditional-type explanation of why one thing happened rather than another. Why was Schrödinger's cat not killed? Because the photon did not go through the mirror. This is traditionally acceptable as an explanation. Why did the photon not go through the mirror? NO ANSWER! This is not a sensible question. It is *nonsense* because if you tried to *sense* which way the photon had gone you would destroy the essential quality of the mirror to reflect and transmit the photon with equal likelihood.

Quantum philosophy deems a wave function to be a rooted probabilistic *supertruth* about a system because the wave is a complete, that is a perfect, representation of the state of the system. A quantum logical argument is *supervalid* if the supertrue conclusion follows by dynamical reason, that is by the quantum equation of motion, from the supertrue premises. Given this sort of causal indeterministic scenario, it is not surprising that quantum philosophy hails a new concept of rationality, a new paradigm of explanation, a new meaning of meaning, a new understanding of understanding, a new wisdom.

The new rôle of classical logic might be expressed like this. Heisenberg's uncertainty principle applies to complementary quantities.

The relativistic complement of continuous space-time is the four dimensional dynamical concept of momentum-energy. The uncertainty relation between these two becomes an expression of the phenomenally mutually exclusive alternatives of exact specification of continuous curves and exact specification of deterministic influences. In other words, either the geometry of the situation can be apprehended precisely or the logic of the situation can be exemplified but not both together. So classical geometry and classical logic become, in some sense, complementary domains.

Physics gives a description of possible experience. It does this by way of a quantum theory of noumena, or interphenomena via the wave function. Description of noumena is not possible in ordinary classical language. Even the logic is different. Everything that is classically possible in some classical picture combines to make the quantum conclusion. Mutually exclusive possibilities, like a single electron going one way OR the other round an impenetrable obstacle, *interfere* to give the visible outcome. In particular, the notion of a *tautology* is given content. That which is necessarily true is not as immediately obvious for noumena as it is for phenomena. An electron is still necessarily an electron, but given half a chance it will be an electron plus a photon or a million other things, *all at the same time* when not directly observed.

The originator of quantum tautologies is the quantum theory itself. The theory determines how things can possibly behave, what constitutes information and also what is necessarily true. There is no alternative reservoir of more fundamental coherent truths about reality. In terms of experimental pressure, there is no impetus to improve on quantum theory. Therefore let us simply try to understand what it says; not try to improve it because we prefer the old comfortable foundations, or find fault with it because we don't think we like what we think it might be implying. Let us just try to face it and ask what it means. It can't be nonsense because it's all about sense and it works.

Physicists are finding that they have such profound requirements of a theory of everything that these requirements already almost uniquely determine THE theory of all physics. Since Einstein began to seek a unified field theory, more and more pilgrims have followed the quest. Today theoretical physicists are a long way down the road. Many believe that properties like general relativistic invariance and quantizability *will uniquely determine the* theory of everything. From around 1970 when the bootstrap theory of scattering matrix elements was in vogue, some

physicists have been aware of the possibility of a unique quantum theory of everything. Such a theory would demonstrate that *nature is as it is because it is the only nature quantum logically consistent with itself*. In a sense every statement in such a theory would be a quantum rational tautology by self-consistency. Even the account of what can *exist* would follow, introducing a new kind of determinism, *ontological determinism* as opposed to *dynamical determinism*.

The theory of everything is a representation of the consciousness of the perfect observer. The theory accounts quantum logically for all conscious experience. But it is not a deterministic theory so future experience is not locked into the past or present. There is room for manoeuvre. This accords with our experience. From Newtonian physics we might have expected to feel like a robot; uninspired and obedient. Convinced determinists argue that we *are* robots but by clever tricks our brain makes us feel free. We can do what we want but we can't want what we want. Even if we could want what we want, we can't necessarily want what we want to want. The argument is recursive and inconclusive.

Freewill

You lift your hand. WHY did you lift your hand? Because the muscle contracted. This is acceptable as an explanation. Why did the muscle contract? Because a nerve cell fired. Why did the nerve fire? Because a 'quantum' of neurotransmitter molecules was released by a neighbouring neuron which increased the nerve sodium pump potential sufficiently. Thousands of these cells may be connected to the original nerve cell so the difference between firing and not firing is not simply determined. At best there could only be chaotic determinism. Ultimately there is only quantum probability to account for it. Unlike digital computation and nerve axon transmission, which are designed to be strictly on/off states, the transmission across a synaptic cleft relies on the release of 'quanta' of neurotransmitters. Each quantum contains about fifty thousand molecules so we are getting quite close to the manifestly quantum mechanical probabilistic realm.

Nevertheless we feel in control. The hand did not just rise. A conscious decision was involved. We feel responsible. We see the choice and *choose* without feeling forced into it. Doubtless there are programmed responses brought to bear. We are not necessarily conscious of their influence. However, through it all we feel free and now quantum

philosophy tells us we could in theory be free. Physics predicts a set of possible outcomes. Incorporating all the environmental factors makes it hard to be sure what is quantum and what is classical uncertainty. One would expect, from the Schrödinger wave point of view, that waves from the environment would usually tend to flatten waves of the object and so increase rather than decrease the scope of quantum uncertainty. The actual outcomes resulting from quantum uncertainty are not predictable by any theoretical means. Whatever the outcome, that outcome will be in harmony with the theory. Yet right up to our finger tips we feel in control of many muscles in the body.

One cold day in 1970 Helmut Schmidt put a *real* poor cat in a shed with only a small electric heater for comfort. The heater was turned on and off randomly according to the random emissions from a radioactive strontium source. If the cold cat could freely choose which undetermined outcome to 'actualise' then the heater would presumably go on more than off. Schmidt claimed that the cat was successful at turning the heater on with ninety to one odds against chance. At the Cambridge University Society for Psychical Research Bernard Carr and I tried in 1973 to reproduce these spectacular results in similar experiments with people *willing* lights to turn on in a quantum random circuit built by Tony Hooley. We didn't get any obviously significant results. King Canute couldn't stop the tide either. Nevertheless we all know that as regards our little finger we are able to will it to do many things with one hundred percent success. Why is our will power apparently restricted to our bodies? How is our consciousness associated with our brain? Is it attached to the world outside at all?

Even the perfect observer looks *out*, not down. The quantum theory of everything is a quantum logical account of the flow of his consciousness. There can only be one perfect observer, the one who is looking out, not the ones who are looking in; they are observed. The theory therefore is centred on the perfect observer. There is no consciousness to explain other than his. The others are ultimately identical. So there is no physical connection of consciousness to brains.

We can lift a hand by free choice. We can, at least for a short time, control our lungs by conscious effort. We can also control sufficiently well the final stages of the digestive system - unless we get a big fright! These are all muscular. Not all muscles can immediately be reined into conscious control though. The heart is a muscle which we have little direct control over, luckily for those of us who cannot concentrate long and hard.

Some yogis, however, have claimed to achieve complete mastery over their heartbeat. Each hair follicle has a muscle attached called the erector pili muscle. This is how your hair can stand on end when you think you see a ghost. Could a yogi achieve conscious control over each and every one of these?

Imagine a new microelectronic gadget called a *macromirror*. It is primarily a flat TV screen which hangs on your wall like a mirror. In the centre is a tiny TV camera looking out. When you approach the screen a picture of you is presented on the screen, just like a mirror. But with this mirror you can zoom in or out with the turn of a little knobble. Now focus into a hair on your cheek. Try to gain control of the erector pili muscle using this biofeedback to learn how to move it. Maybe you will do it eventually. The question is, what is happening here? What is connecting to what? What are the limits of conscious control? Can we gain willful control of our genes? Can we directly influence our environment? Mind over matter is undeniable in hand control but where does it end?

Unless, like digital computers, brain function is of an entirely deterministic design, which it does not appear to be, then there will be scope for quantum random influences. These random influences could account for our freedom. How? Well, what is the definition of random? In classical physics there is absolutely no such thing. There is any amount of chaos but only in quantum physics are there events which do not have a rigorously deterministic explanation, such as the precise decay time of a strontium atom. Classical logic says everything has a deterministic cause, quantum logic does not. So there are original motivating events in the brain which have no mechanical *prior necessity* type of explanation. Once these events have been actualised then other events will follow by instrument design with very high probability. I might have considered whether or not to raise my hand, in depth, for three days, but in the event of deciding I am almost certain my hand would respect my decision. The actual determining event is itself not necessarily determined. My free conscious *mind* seems to have made the choice. The free soul is a prime mover.

There does seem to be some evidence that mind can influence chance away from average odds. Experiments on psychokinesis are often frowned on by the academic establishment because they think they know the answer already. Nevertheless, a few careful experiments have been done. Working under pseudonyms, P.Duval and E.Montredon found that a mouse in a cage could either *determine by psychokinesis* which side of the

cage to electrify or else *know by clairvoyance* which side was to be electrified next, depending on your interpretation of the fact that their mouse could avoid the side being randomly electrified with odds against pure chance of a thousand to one. Other experiments have been done with cockroaches, mice, gerbils, cats and humans which obtain good odds against chance. If we had just the very slightest control over the quantum wave function of our brain we would be able to effect *large* muscular changes. If we were able to control *even just slightly* some near fifty-fifty synaptic transmissions in our brain then we could thus achieve at least the degree of control over our bodies which we normally exhibit.

Can we achieve total freedom over the superstate? This is quantum logically allowed simply because it could happen. Of course one can only *decide* something if no one can contradict, or counter-decide, it. Two observers can make different decisions about the state of something only if it is impossible for them ever to disagree over facts. Such control would spread over a very wide non-local range. Objects which had previously interacted with something else would afford greater power for influence than others because all objects with which they had already interacted noumenally, that is without phenomenal manifestation, would also be under some entangled control. This is the scope of quantum omnipotence.

The perfect observer, who understands by reduction all science, will recognise the scope for control that he has and thereby learn its mastery. Goodness of spirit, or intention, is a mark of intelligence while evil is a mark of stupidity. Therefore the perfect observer as a free soul will be good. He will use his perfect freedom to the good. His spirit will be magnanimous, his attitude will be holy. He will embody the holy spirit. His will will be the divine will. He will agree with the disposition of another perfect observer. The holy spirit, or a selfless disposition, reflects the harmony of thoughts and actions of the perfect observer.

If there is conscious free control in the world then and only then can there be deep responsibility, deep justice and deep ethics. Otherwise they are the superficial social constraints as viewed by materialism. Politics, from the point of view of nth cousin identity, flows from the recognition that scrupulous fairness to others is actually scrupulous fairness to oneself. Egotistic selfishness results from misunderstanding and confusion.

The word 'conscious' derives from Latin *con* meaning WITH, *scio* meaning I KNOW. Animals have knowledge. Are they conscious? Do books and computers have knowledge? Take a human apart to the point where everything is removed which is not essential to some basic

communication with the outside world plus consciousness. What remains? Ordinary self-consciousness would not be conceivable without some kind of neuron loop in the brain because it requires recourse to some sort of prior knowledge to effect the reflective nature of self-consciousness. Nevertheless a kind of *loopless itness* consciousness is conceivable for this dismembered monad even without neuron loops, although communication responses by this stage would probably appear uninteresting from a normal psychological point of view. Now put the human back together again. If you can do that then you can probably create totally artificial humanoids, identical in every respect to a real person but made in the medical laboratory. There can be no reason to suppose that these artificial humans are not conscious while we natural ones are. Consciousness did not need to be put in explicitly, so where did it come from? Then again there is no way that you can be sure that any other person is conscious. Intelligent behaviour is not enough. It can be artificially mimicked. Neither does senseless behaviour prove lack of consciousness.

Brains organise memories by various means; short term, long term and associative storage. Brains govern processing of information by various systems and chemical actions; visual, auditory, sensory-motor, cognition and language. But they do not, as physical lumps of meat, have any more to say about consciousness itself than does a T-bone steak. Mental function, yes; mind structure, yes; consciousness, no. The world-wide telephone network may be a good physical analogue to the neural network but as a classical physical system it cannot sustain consciousness itself.

In quantum philosophy there is only *one* consciousness. How could there be a consciousness of which you are not aware? It would not be consciousness. Consciousness has to be experienced directly to be deemed conscious. Although Copernicus took away the central rôle of the Earth in astronomical terms, quantum philosophy puts you, the observer, at the centre of the stage, at the heart of the story, at the ever present origin of the ever present universe. The theory of everything is a representation of the consciousness of the perfect observer. In this theory, everything is noumenal potentiality unless it is phenomenal which means conscious which means actually experienced, felt, known, perceived, observed, made aware or otherwise directly seen by the one and only consciousness. This is it and that's that.

② Conscious Evolution: programming of instinct

RATHER THAN BLIND EVOLUTION, consider that each step in the evolution of life was made consciously and then programmed into automatic response, layer by layer. *Life was designed and built by understanding.*

Imagine learning how to drive a car. The steering wheel, gears, clutch, accelerator and breaks all have to be manipulated in coherent wholeness. They have to be worked in conjunction with one another, in a particular order, at a particular time. It takes a lot of practice, like swimming, or walking, until you can do it without thinking about the controls. Once you can do it automatically then you can drive forever more. In the same way, all instincts might have been learnt by conscious effort rather than by blind classical randomness. Artificial intelligence *models* that programming: it does not reproduce the conscious intelligence. You could teach a robot how to drive a car but it wouldn't get very far without considerable logical improvement to car function or the highway code because interaction with other cars is basically intelligent conscious mental communication between drivers. The robot could approach human dexterity of purpose only with *open programming*, or with an aware mind in control to understand the multitude of unknowns, rather than the *closed programming* of a loop in which the unimaginative, thoughtless, mindless, unconscious robot always eventually resides.

As conscious life extended its senses, it flexed its forms of perception and categories of understanding. First reacting physically and then chemically and then biologically to a ray of light - even an individual photon - intelligence extended the optic nerve from the central nervous system and programmed the constructive steps genetically thus passing the advance on to the next generation, or 'refreshment'. Understanding formed a bulb on the end of the nerve making it more and more sensitive to light. Hundreds of thousands of generations later, bit by bit, understanding built a lens onto the retina and gave it focusing controls. All this was done by consciously *understanding* the natural situation through a deep primitive developing conscious mind. Rather than nothing being learnt through inheritance of acquired characteristics, practically everything except the odd lucky accident was ultimately learnt by consciously acquiring new intelligent - since originally consciously understood - characteristics.

Once upon a time the black man was hardly accorded even consciousness by the arrogant white man. Then monkeys and now dogs and cats are hardly credited with conscious awareness. But there is only one consciousness and even humble bumble-bees exhibit that resulting appearance of very *intelligent behaviour*. Therefore they should be seen as reflecting awareness of a sort. They won't win Master Mind because their forms of perception and categories of understanding are very different to ours. Their understanding is so very different from ours that they are hardly going to have a comprehensible 'specialist subject' either, and their general knowledge will be of a different sphere altogether. But they still have a mind.

Life-Forms

Hypothesize that life forms choose *balanced* senses. As they built their 'telescopes' and 'mass spectrometers', so to speak, they chose a fairly balanced mix of complementary physical extensions. If they developed a *position* sensor then they would be likely at the same time to develop an *impulse* sensor because developing one without the other would produce an unbalanced integrated view. For example, the eye can use the lens controls to accurately pinpoint *position* but without eyeball movement muscles and head rotation, *velocity* is very difficult to judge. Both together they constitute a well balanced useful *complementary* pair of instruments.

That both realms of complementary concepts are thoroughly mixed up in ordinary language reflects this precise sensual balance through which we experience nature. Unnatural, or contraptional extension of the senses, which has really accelerated since 1500, can cause manifest imbalance and has thus revealed quantum language which respects complementarity.

Make another hypothesis. Considered as an integrated collection of measuring devices, life forms *maximise certainty*. In other words life forms try to develop a whole set of complementary pairs of apparatus. Hearing, sight, taste, touch, smell: what is missing? Eyes to see radio waves might require an arm span of five hundred yards for the complement to be meaningful, therefore other considerations leave one generally satisfied with visible light. The hexagonal structure of bees' eyes quite probably invokes grid refraction giving quantum coherent effects which allow them to see a whole lot better than one would expect from a classical analysis.

Possible extensions into nuclear realms are entirely ignored in chemical or biological discussions which consider only the gravitational (bone and muscle) and electromagnetic (nerve and chemical) forces. From a long, conscious evolution, one has perfectly integrated *sense*, both in terms of the ‘five senses’ making a whole set for normal potential experiences, and in terms of giving complete ‘meaning’ from an understanding, or basic theory, which has developed alongside, and in close association with, development of the internalised, on-board, extended senses. The hypothesis of conscious evolution suggests mind over body can extend to heartbeat, digestion, even genetics if the layers of programming are unfolded and the original conscious control is resumed.

Layer upon Layer of Programming

Where did we all come from? Monkeys ‘made’ man, fish ‘made’ monkeys, amoebae ‘made’ fish and a molecular soup ‘made’ amoebae. To be slightly more precise, life has been evolving ever more rapidly for the last three or four billion years. From a molecular soup, containing at least hydrogen, carbon, nitrogen, oxygen, sodium, phosphorus, sulphur, chlorine, potassium, calcium and iron compounds, developed, probably after many unsuccessful and many continuing attempts, the first self-reproducing carbon based life form, the *universal ancestor* of life on Earth. A billion years later this intelligent manifestation had developed into algae and then into slimy photosynthesising organisms. After another two billion years, or about one billion years ago, multi-cellular life was being built, making jellyfish, worms and molluscs. By five hundred million years ago fish had formed. Everything was painstakingly constructed on the sound foundation of previous generations and immediate *experience*. As time went on, life gradually diversified and development accelerated. By four hundred million years ago land plants had begun to take hold. Within sixty million years the Earth was well covered with dense vegetation. Amphibians left the water and took to the land. By two hundred million years ago, reptiles and the first mammals had taken shape. In the last sixty million years there has been explosive evolution of mammals.

The first hominoids probably existed five million years ago. Having vocal chords, they surely had some sort of linguistic communication, as do many other lower species from whales to birds. One million years ago the Stone Age began. *Homo erectus* learnt to make simple stone tools and use

fire. By the beginning of the Bronze Age, thirty thousand years ago, agriculture had begun and the first towns had been built by *homo sapiens*. Twelve thousand years ago the Iron Age began. All the Indo-European languages can be traced back to a common primitive language that flourished six thousand years ago. In the last ten thousand years there has been exponential growth of ‘culture’, manifestly built by conscious choice and determination using advanced mental powers. A relatively short time ago man’s intense creativity and incessant activity seems to have abandoned to oblivion the deep memory of his modest origins from muddy soup.

Formation of Deterministic Structure from Naught

Where did the molecular soup come from? Where did the *Earth* come from?

In the beginning, says this quantum fable, there was just the origin of octonionic space. All eight axes were wrapped tightly into a jelly-ball point. Without classical explanation, by quantum tunnelling to another topological configuration, the jelly-ball assumed the form of a quaternionic knot, or *quot*; a sort of doubly-knotted four dimensional torus in eight dimensions. Although topologically stable, the *quot* began dynamically to compactify, or infurl, two of the four quaternionic dimensions while four of the eight octonionic dimensions began to dynamically unfurl. Within a finite instant, the *quot* had assumed the form of a knotted rigid relativistic string in an expanding four dimensional space-time.

As space expanded, the string stretched and the tangled knots tightened. The tension and bending soon became unsustainable so the string shattered into a host of little stringy loops congregating around the site of the old cosmic string. In a trillionth of a second some loops took on the quantum state of a quark, others of a lepton and yet others of other fields. Within a few minutes of its beginning, the expanding universe was filled mainly with photons, electrons, neutrinos, hydrogen nuclei and helium nuclei.

Eventually electrons combined with nuclei to form atoms. The photons no longer interacted much with the electrically neutral atoms and therefore decoupled. These photons remain to this day as a low energy microwave background filling all space. The distribution of atoms would be more concentrated in regions where the cosmic string had been. Therefore the distribution of microwave radiation should reflect this

original non-uniform distribution. In 1992, data from a radio telescope on a NASA satellite first detected deviation of the microwave background from absolute uniformity.

Not only the atomic distribution, but also the galactic distribution should reflect the position of the original cosmic ball of knotted string. Places where large tangled knots began to tighten should locate the seed for superclusters of galaxies. Smaller internal links forming parts of knots could likewise seed clusters of galaxies. The Milky Way has been found to reside in a knot-like distribution of two dozen galaxies.

An individual galaxy starts, according to this parable, as a broken length of string. The ends of an open relativistic string must travel at the speed of light and quickly wrap round the centre of mass before completely disintegrating, leaving a spiral galaxy. When the string disintegrates into atoms, gravitation draws the atoms into large spherical pockets of gas. If the ball is large enough gravitational pressure heats up the centre and initiates nucleosynthesis. Energy is released as light making this new *star* shine.

If the star is sufficiently large, once enough of the hydrogen has synthesised into helium, then hydrogen and helium will synthesise into lithium and then into beryllium. This process of nuclear fusion continues to form shells of heavier and heavier atomic nuclei within the star. At transition stages in this process massive turbulence can take place inside the star. This turbulence may cause an eruptive prominence from the core bringing with it material from surrounding shells. If ejected faster than the escape velocity, once free of the strong influence of stellar gravitation, the material will condense into roughly spherical drops containing a mix of materials from the stellar shells. Our Sun is made of debris from past supernova in which very heavy elements were manufactured. These elements would have collected in the Sun's core.

Into the centre of this 'drop' tends the most dense material, like liquid nickel and iron, further out are layers of silicon and aluminium, while on the surface floats the chemical 'scum'. The compounds forming the outer layer are composed of molecules such as lithium fluoride, sodium chloride, calcium oxide and silicon dioxide. These compounds formed when chaotic turbulence caused the harmonic shell layers to mix when they were forcefully ejected from the star. There would also be streaks of inert elements such as gold. Such a crust cooled and the compounds crystallised to form the rocky surface of our Earth. Water vapour and other trace gasses condensed into seas. Internal turbulence caused continental

drifting, folding and cracking. Earthquakes and volcanoes were very common occurrences.

Water (H₂O), possibly produced when the oxygen layers passed through the outer stellar hydrogen gas, dissolved some mineral salts and chemical reactions formed carbon dioxide, ammonia, methane, ethane, propane, ethylene, propylene, methanol, ethanol, propanol and many more complicated carbon based molecules. In some such way appeared the original molecular soup from which we eventually developed. Some say we got here as soon as we could!

The Earth came from a star and we came from the Earth. Therefore which is deeper, the star or the Earth or us? The Earth will spiral into the Sun one day. If the Sun is more essential, more fundamental, more basic, more *it* than the Earth then is this a catastrophic or a glorious moment? A rock is dead and yet we who are essentially rock are alive. What is the vital difference? Complex organic chemical structure. Organisation. We are organised rocks. This would be an insult to one who takes a dim view of rocks. But if you can see in a rock the essence of the universe then matter comes alive and it is a blessing to be identified with the very truly real.

Today we claim to understand, to know and to feel. Yesterday we understood, knew and felt too. Why say *our* actions are intelligent while those of ancient generations were unconscious? Why credit random mutation with the advance when it was intelligent experiment and intentional determined design. One day soon the discoveries of today will be clearly written into our genes. Will future generations give us no credit for *being* either? A pattern is laid for conscious recall to the beginning, the task is to appreciate and act from that depth of being.

③ World History: the strong influences

IN THE LAST TEN THOUSAND YEARS, since farming began, much of the change on the surface of the Earth has been effected by man. Five thousand years ago the first *civilizations* began. Civilisation was initiated several times. Some faded, and some flourished. For the most part these civilisations developed independently and were indifferent to external influences, except for the occasional invasion by a neighbour. From this new *social* foundation the pace of change accelerated further.

By the year 1000 four major civilisations had emerged; Western European, Islamic, Indian and Chinese. All were based on a subsistence agriculture and derived power from wind and water, and from animal and human muscles. Each society was based on traditional patterns and seemingly unquestioned routines.

By 1500 a new age of human *world* history had begun. Europe already had long established land trade links with China but had only just discovered the Americas by ship. In 1522 the globe was circumnavigated. Struggles in one civilisation became entangled with struggles in another and wars took place on a larger scale. The main instigator of this new pitch of turmoil was Europe. The world began to be Europeanised. People became more alike. Their dress, mode of government, assumptions and ideas began to converge on the European standard.

Up until 1750 most people still thought the world would go on as it had. But it was on a new wave of relentless and accelerating transformation, invigorated by theoretical and applied science. European power through scientific know-how, with resulting wealth and influence, dominated. In 1800 most communities throughout the world were still self-governing. By 1900 the *British* Empire alone had consolidated its hegemony in about one quarter of the globe through decisive advantage in military technology. Russia and China remained the most unaffected. North, Central and South America, Australia, Africa, the Far East and India had all suffered European colonization.

The 20th Century

In 1911 there was a revolution in China which overthrew the last emperor after four thousand years of imperial dynasties. Russia, from its Slav origins over one thousand years before, was still a feudal state in 1900, but its frontiers had been extending. Predictable collision between

Europe's Austro-Hungarian Empire and Russia sparked off the First World War in 1914 as a result of a complex European alliance system. To fuel the four year Great War, national economies shifted industrial production to armaments. This induced a depression in Europe and North America between 1929 and 1935. Reeling from the conflict, Russia suffered civil war after the communists seized power in 1917. In Europe fascist military dictators gained power in several countries as a result of the economic hardship and political uncertainty. The democracies tried in vain to resist this ominous development.

The undefeated German army rose again with ambitions to occupy Western Russia. Japan sided with Germany against Russia. In 1937 Germany occupied Austria and Japan attacked China. German fascist expansion continued while the British and French democracies and Russian communists strenuously endeavoured to maintain peace. When Germany invaded Poland in 1939, Britain and France reluctantly declared war on Germany. Thus started the Second World War. After six years of fighting, the democratic powers to the West and the communist power to the East eventually managed to defeat the Germans in May 1945.

Meanwhile a surprise attack by Japan on Hawaii in 1941 brought America into the war. Eventually Japan was forced to surrender when America dropped two *atomic bombs* in August 1945, the very first atomic bomb having been tested just one month before. Fighting had spread to almost every continent and ocean. Over fifty million people died in the Second World War, half of them Russians.

Interfering Civilisations

We are experiencing a GIGANTIC COLLISION as powerful civilisations meet the industrialised, modernised West. Less powerful civilisations are also experiencing the turbulence as they get caught in the wake of the storm of the last two hundred years. Apart from a few weeks, since 1930 there has been major fighting somewhere in the world. Since 1945, terrorism apart, there have been over three hundred significant military engagements in Central and South America, the Middle East, Africa, China and the Far East, in the disintegrating Soviet Union and now in Europe itself. Currently there are about twenty four wars being waged on Earth. Awe-struck by *'the bomb'* and *'the money'*, undeveloped countries are torn apart in the race to *'Westernize'*. The interference

phenomenon from the interaction between Europe and China is yet to begin in earnest.

The world has never been so fragmented. Two thousand years ago there were a number of quite distinct and separate civilisations, each homogeneous in itself. These are all now steeped in ideas and techniques from the West. Those attempting to cling onto their traditional ways are progressively finding it more difficult to survive. Non-western societies like Iran are appearing in the Western mould although they are often burdened with internal conflict, large debts, rising populations, inaccessible or dwindling natural resources, natural disasters, unstable food supplies and poor basic education. While the 'by-definition' attractive *ideas* of wealth and luxury have been avidly consumed and digested through television, advertisements, tourism and general hearsay, it has been too hard to find the courage to explain to former colonies that the new Americans took all the resources they wanted from the Red Indian who had come from Siberia ten thousand years earlier, and Europe extracted much wealth from her Empires.

On the other complementary hand, a single unified world civilisation has never been so real. There is a forum, the United Nations, where the one hundred and seventy or so world states can exchange ideas with minimal language barrier. Unfriendly invasions have given way to friendly holiday visits. English is spoken somewhere in every city in the world. Westernization is a manifestly happening reality everywhere. Many Indians in India still imagine that Britain is something like Brahmhaloka, the highest heavenly planet, and many Jamaicans in Jamaica believe the United States is practically Paradise. In a sense they are right.

Because even the major civilisations are in the melting pot and because many countries have *chemical, biological and nuclear weapons*, the world is now a very dangerous place for *everyone*. The Cuban crisis in 1962 almost led to nuclear exchange between America and Russia. Any serious threat to the integrity of a nuclear power is, if history is anything to go by, likely to lead to nuclear retaliation. The financial markets reflect all this uncertainty. The fortunes of whole countries, such as Mexico, can bob up and down at the hands of the big computerised money dealers. Mercy is deemed light when weighed with profit. Balance sheets replace humane considerations. Economics is regarded as the scientific barometer of *value* and vast personal riches pretend to be fair game for all.

The Psychic Atmosphere

When one looks closely at a bee hive, or steps back to see some ants at work, or looks upwards to see a flock of birds, there one sees harmonious societies where all appear to understand their rôle and fulfil it in co-operation with the others. Co-operation is every bit as essential as Darwinian or Thatcherite competition. Picking up a gregarious ant one sees a tiny, almost extraterrestrial creature with eyes to see and limbs to grapple and climb. Within his brain is associative memory storage and optical image processing. He has a mind. Each cell of his body displays remarkable intelligence. For example, it has been discovered recently that cells do not die, they self-destruct when it is to the advantage of the whole organism. This utilitarian behaviour of cells displays a marked similarity to behaviour associated with conscious understanding. Cells seem to truly understand their rôles.

Under the microscope we see the mark of *consciousness* in a single cell. With the naked eye we see the mark of *mind* in the entire ant. Standing back we witness the mark of a *psychic atmosphere* of integrated minds at work in the ant society. To acknowledge and appreciate this psychic atmosphere, and the complementarity between hierarchy (competition) and democracy (co-operation), and the nature of nth cousin politics, whereby chimpanzees' DNA program is 99% identical to ours, is the immediate OBLIGATION of leaders and followers everywhere.

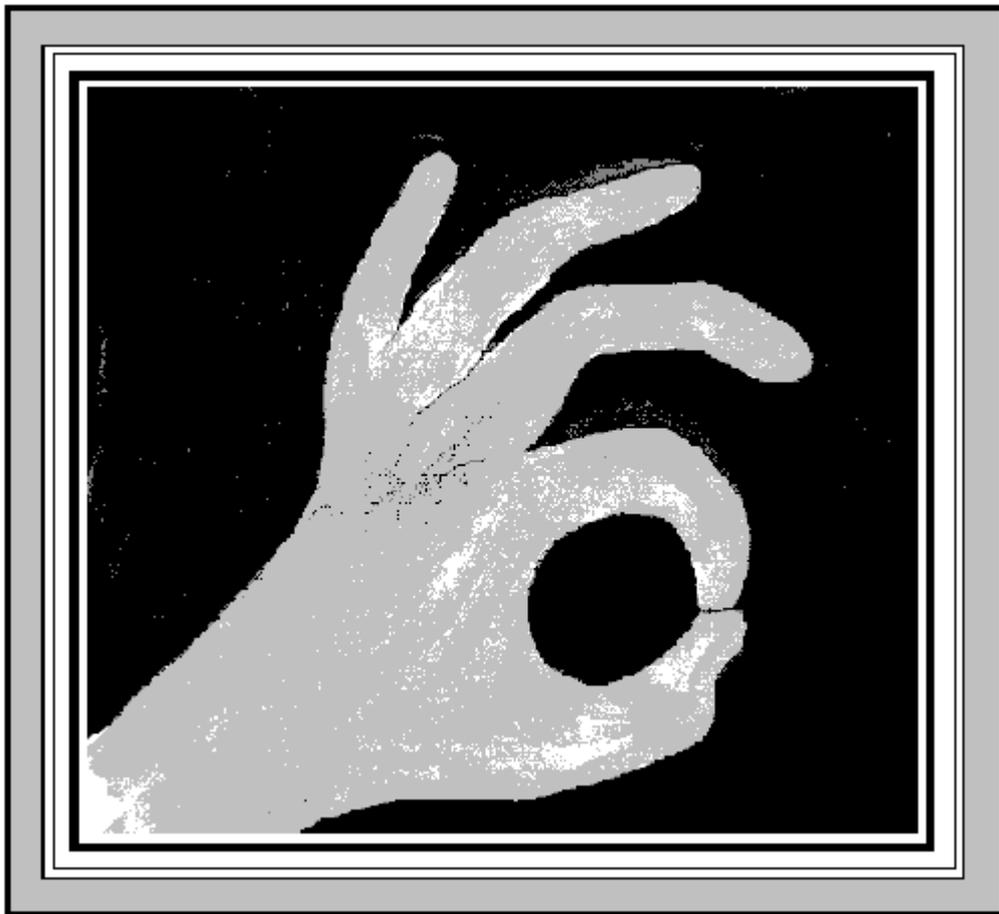


STAGE 5

0

There are those who attempt to control their destiny,
and those who allow destiny to control them.

Robert Beckman



Yes!

WHO CREATED GOD? If that is a sensible question then it has a meaningful answer. The source of both a question and its answer is ultimately this conscious experience. Therefore this conscious experience

itself transcends all questions and answers and that is unquestionably final, so that's that.

Having fully realized this Zen satori, what could one say? One can't ask a relevant question because one has gone beyond questions. All thoughts by this stage must be complete self-evident propositions. Prior to this, the more semipropositions (questions) that are dissolved by answers, the greater the depth, or height, of consciousness. However, even simply remembering can raise questions. Only undisposed sans-instinctual unreflecting clear and totally participative observation with entirely emphatic or imperative utterances could be consistent with this depth of consciousness. What more can one say? O!

Man has learnt to think in terms of written language. This limits thought and alters consciousness. O God, are you incomprehensible then? O God, my feeble understanding is a tangled web with many loose ends, each of which terminates with a profound question! Nothing is problem-free! The web of language, its grammar and vocabulary, ties everything together, but not without loose ends, not without unresolved problems! O God, all one can say is O!

What does the perfect observer think? Is he stumped by deep difficulties when confronting others? Does he rack his brains constantly to help lift the veil of māyā from others eyes? Does he stick out like a lemon in a bucket of oranges, or does he blend into the background like one of those oranges in that very bucket? Does it take one to know one? Why should it? Isn't it obvious? Does he need to think at all? Deep action follows deep thought. O.

Kurt Gödel proved in 1930 that *all* consistent axiomatic formulations of any reasonably complicated theory include undecidable propositions. Having been depressed in stage 1 with the Gödelian realisation that there is huge potential for problems, having had hope restored somewhat in stage 2 by seeing the depth of known solutions, and then having transcended both, including scientific method itself, in stages 3 and 4, let us now encounter ecstatic problem-free total joy in stage 5.

When you transcend problems and solutions then you don't need to reflect. You are not that little-ego consciousness. *You are superman/wonderwoman.* You yourself experience THE ONENESS OF THIS PHENOMENAL VIBRATION. O.

❶ Psychotropic Conquest: Experiment with mind!

ANTHROPOLOGISTS DELIGHT IN IDENTIFYING some custom or belief of a primitive society which is held in extreme awe, reverence, or veneration by that society but which seems incomprehensible, and hence ridiculous, to the arrogant Western mind. For example: who needs totem poles, rain dances, lingams, idols, witch doctors or yashmaks? And who needs skin marking, neck stretching, foot binding or skull shrinking? The secrets or tightly held *taboos* of a society arouse particular curiosity and glee. But for all its long-standing derision of foreign customs and its emancipated self-image, the West too has its taboos about which it is extremely sensitive. When we Westerners come across societies which do not possess *our* taboos then our reaction turns from jest to indignation and even outrage. In Sri Lanka, I once met a Buddhist monk, Seelawansa Thera, who had been living in a cave near Kandy for twenty eight years, since 1949. Then the new authorities came along and demanded that he remove the ant hill from inside his cave and put a door on the front. This he reluctantly did *for them*.

Psychoactive drugs are a current *bête noire*, but we have not always been so self-righteous. The British government, in the first *opium* war of 1839-42, *forced* the Chinese, who officially discouraged drug-taking and had no great need for other European imports, to accept voluminous imports of Indian opium in exchange for tea, silk and porcelain which were in great demand in Europe at the time. After the end of the Second World War, the Japanese government encouraged the use of *amphetamines* to increase industrial productivity. Both policies led to widespread drug dependency in the Far East.

For many years *psychoactive* drugs have been outlawed in Western society. Furthermore, the West has *insisted* that the ban extends to the rest of the world too. In *India*, where it had been customary for Hindus to smoke *hemp*, it became illegal. In the *West Indies* where it used to be common to see an old woman smoking a pipe of *ganja* or drinking ganja tea, it is now a serious crime challenged openly only by the righteous Rastafarians. The *Red Indians* who chewed *peyote* cacti in religious ceremonies also had to stop the practice.

Advocation of mind altering plants and chemicals has been a Western taboo over the last thirty years. Some professional psychologists at Harvard University were *imprisoned* for experimenting on their own minds with lysergic acid diethylamide (*LSD*), a chemical whose psycho-

active effect was discovered by accident in 1943 by Albert Hofmann. One of those psychologists, Timothy Leary, concluded that prior to taking LSD his body had been deficient in this substance, rather like Christopher Columbus and his sailors were deficient in vitamin C. Now customs officials all over the world stop at nothing in their crusade to detect psychoactive substances. Not wanting to miss an opportunity, the US Army gave LSD to American soldiers without their knowledge to see if it could be 'useful' as a new type of mind-destroying psychopharmacological weapon. It did cause distress but was not as incapacitating as the leaders had hoped so they lost interest.

There is considerable blind disapproval of psychoactive drug taking but there is not much discussion of the *psychological effects* of mind altering drugs. The subjective effects cannot be legitimately discussed without someone having direct personal experience and that experience is emphatically *illegal*. Hence the media silence on this crucial issue. All behavioural tests on animals, such as experiments which administer large doses of LSD to rats and note twitching responses, are USELESS as regards understanding the *mental* effect of the drug, at least not without a good psychophysical theory. In the absence of such a theory, nobody can properly discuss the action of a psychoactive drug without actually taking it *themselves*. They can describe the type of behaviour induced or the order of visible addictiveness or even the effect on the brain neurotransmitter system, but the actual central issue, the most relevant and direct phenomenon, they cannot know and therefore cannot meaningfully discuss. How can you explain blueness to a blind man. This is not just a contingent lack of knowledge. It is quantum ignorance; the noumenal value of an observable in the absence of observation. Everyone has to discover blueness for themselves. O.

If a drug has an obvious mental effect deemed 'good' by the user then psychological addiction may mean nothing more than an eager wish to continue use. We are all totally addicted to oxygen, water, vitamin C, ...and will fight for them. O! So what *is* the EFFECT, and why is it of interest? Some drugs are, of course, toxic and dangerous and should never be taken except by prescription under the supervision of a medical practitioner. However, under the influence of LSD, which cannot be obtained legally and therefore has extra dangers associated with it, people talk of having their mind *expanded*, of having their perceptions *heightened*, of new unexpected *higher levels of consciousness*, of *superconsciousness*, of *religious experiences*, of *revelations*, of *enhanced*

cognition and of *increased* intelligence. People claim *better* concentration, *better* short term, long term and photographic memory and *greater* clarity of thought. They say they have *improved* brain power, *improved* learning ability and *better* correlation between the left and right hemispheres of the brain.

Obviously some intoxicating drugs have the opposite effect but it would seem that at least cannabis, psilocybin, mescaline, LSD, and dimethyl tryptamine (DMT) can have *mind expansion* properties without being physically addictive. This is exactly what is needed if man is to survive through the twenty first century. One ought to be intelligent enough to want to be more intelligent - wise, not clever. Without an efficient reliable way of increasing the intelligence of large numbers of people then it is likely, if past experience is anything to go by, that the nuclear war, started in 1945, will not end in Japan, but will continue with everything from the new *micro-nukes* and *mini-nukes* up to monstrous H-bombs when a nuclear power finds its back against the wall. O!

If anybody knows a way to enhance their intuition or otherwise improve their mind then this information should NOT be repressed by taboos or legal enforcement. In Western society people are taken to be well unless they have particular distressing medical or psychiatric symptoms, like a runny nose or an irrational fear. In other societies the perception is very different. In Indian society one is only considered to be truly well when one achieves enlightenment, *samadhi*, Heaven on Earth. In other words the normal condition is seen as an illness. We conceited Westerners who think we know practically everything of any great significance that anyone knows actually can't perceive mental condition very well at all. If it is not a behavioural nuisance we minimise its importance.

Normal behaviour springs originally from thought. So really the quality of thought is central to the quality of society. We don't know how to recognise real intelligence. We can test memory quite well, but IQ tests are often useless when applied to the unwesternized. Clear-headedness is too subjective to be quantified by any known measure at the current stage of development of brain science. Neither hard-headed scientists, nor zealous lawyers nor policemen, nor self-righteous clerics, nor politicians, know much more about mind or consciousness than anyone else. It's like an elephant at the zoo who takes a sniff at an onlooker and says to himself "Pooh, that poor clean blighter can't have much smell sense!"

It is probably stupid to take heroin. Many argue the dangers of drug abuse. Children can have access when parents can not! The authorities are right to be cautious but other 'approved' forces are actually more perilous. Drugs should not be taken lightly. They should be investigated carefully and seriously with a genuine scientific approach. Is the school playground the best place to conduct research in psychopharmacology? These chemicals might be the only tool that man can employ to assimilate the scientific developments quickly enough to avoid disastrous applications of science and obliteration of humanity along with most other advanced life too. When Russia armed Cuba off the coast of the USA, America was prepared to risk nuclear war and the nuclear winter that could have followed. Now the US is arming Taiwan off the coast of China. Perhaps China is equally resolute and justified in its condemnation!

While the European Community is considering making all vitamin supplements available only by prescription, America might be beginning to temper slightly its extreme stand on drugs because of pressure from AIDS victims to allow mail imports of some unapproved drugs. Many new psychotropic drugs are being discovered which have verified *beneficial effects* on the brain and mind. Substances such as pyrrolidone derivatives, fipexide, vinpocetine, hydergine and vasopressin are legal in many non-Western countries. Prozac (floxetine) is marketed as a drug that can make you 'better than well'. It is called a neurological smart bomb of cosmetic pharmacology, a subject still in the Stone Age.

Many nutrients and micronutrients have been identified as being essential foods for health. Hence the popular Health Food Shops. Nevertheless, it may be that we are being consistently and litigiously starved of a sort of 'neuron oil' or 'cell lucence' which facilitates the existence of, and enhances the free flow of clear thought. Only trace amounts of certain psychotropic substances may be necessary to correct a wide-spread brain malfunction through starvation. One kilogram per day could be sufficient for the whole population of the UK. After much animal testing, the only obstacle to practically free supplies is ideological. No thought is given by governments to integration of understanding or unification of personality. The popular imagination is obsessed with uncontrollable vice and violence and with terrifying madness and horrific death. This is symptomatic of the dangerous times in which we live, not of responsible experimentation with mind.

Hindu Vedic Philosophy

Raja Yoga is a MENTAL SCIENCE of religion. The Vedic philosophy behind it is more like quantum philosophy than Newtonian materialism. Its central notion of unity does not lead to an unbridgeable impasse between consciousness and brain, between psychology and neuroscience, between mind and matter. Instead raja yoga gives a recipe for *samadhi* or superconscious enlightenment, for *nirvana* or final absorption into the divine, for *heaven* or joyful reunion in paradise. Raja yoga declares that when you step beyond thought and intellect and all reasoning, then you have made the first step towards God. O! Buddhism talks of being freed from the cycle of birth and rebirth. Christians ought to prepare to immediately face God directly. O God!

The essential method of raja yoga sounds very simple. Find a posture in which you can repose effortlessly for a long time; hence the whole field of *hatha yoga* or posture fitness. Now take a breath and say *O*. As the breath runs out, the mouth closes and the vibration becomes *mmm*. When the sound is completely gone take a new breath and repeat, enjoying the pure vibration which is the gate to ecstasy. The sacred word *Om* (ॐ), pronounced as in 'home', can be called silently to oneself, any time, anywhere. The vibration is a subtle thread permeating *everything*. Eventually there is no *mmm* just *O* without end because this vibration is everything. Matter is energy says relativity, and energy is vibration says quantum theory. Therefore material reality is quantum vibration.

When the mind has been freed from taking various forms then the self is identified with everything; the sensor and the sensed are one. With the cessation of all secondary mental activity, including devised intentionality, then the mind retains only unreflected impressions. *Samadhi*, or freedom through perfect superconsciousness, is achieved. That manufactured something called knowledge is transcended, not lost.

According to the Vedic theory of *Om*, the sum total of impressions can live on in the mind. The sound of *Om* loosens these *samskaras*, or mental preconceptions, or tendencies, and liberates the mind from their domination. Brain science has discovered that exposure to different sounds can result in auditory pathways being differently tuned in young children. For example, Spanish speaking children have formed channels in the brain which resonate at about four hundred cycles per second, the dominant frequency of Spanish. In the case of English speakers, the resonant frequency is found to be about one thousand cycles per second

because the average frequency of English is higher. Although most apparent in early life, neuron cells *can* be disconnected and reconnected. Otherwise it would be impossible for an English speaking adult ever to be able to learn to hear Spanish properly. It is therefore possible to believe that *Om* may actually help neurons to reconnect, making the mind more transparent.

Although Patanjali said that *progress is swift for the extremely energetic*, apparently the vast majority of yogis do not achieve samadhi in their lifetime. Yogis have spent eighteen hours a day in meditation, without final success. Could it be that we are mixing up acting with actuality? *Don't do this to become that but will do this when are that!* Does one become a yogi by doing yoga postures and exercises or is this the way one instinctively acts when approaching enlightenment. Does one become more holy by praying to God or does one instinctively talk to God when holy enough to recognise the mighty presence?

The Vedas mention a plant called *soma* whose juice was used in sacrifices. There has been debate about what soma really is. It has been suggested that soma is Fly Agaric, a psychoactive mushroom. Soma is believed by many to be hemp which has been traditionally used by Hindu monks in their religious quest. In 1973 the Dali Lama agreed that LSD *might* be of use in the pursuit of nirvana. So perhaps the way to succeed in the religious quest is by taking control of the tide and then calming the water. After all, without food one would expect to die. The wine used in communion does not lead naturally to abuse and wine can help wedding feasts and friendly encounters.

A sick experiment with rats taught one rat a maze, emulsified its brain and skimmed off the ribonucleic acid (RNA). The RNA was injected into another rat who then learnt the maze significantly faster, thus demonstrating that memories had been transferred. Perhaps future university degrees will be bought in the form of an injection of (preferably cloned) emulsified professors' brains! Neuroscientists no longer believe that intelligence is determined strictly by genetics. Nature is not so mechanical and unintelligent. The brain is fluid not solid, active not placid, *alive not dead*. Where, if not here, is life?

The Federal Drug Administration still has no category for drugs that IMPROVE COGNITION in normal healthy people. But that does not mean that there isn't one. The new neuroscience technologies already have irrefutable evidence for those who will transcend the taboo and countenance it.

In the West, physical science has developed over the last two and a half thousand years from the works of Pythagoras, Aristotle, Euclid and Archimedes. In the East, mental science has been developing for just as long from the words of Vyasa, Patanjali, Kapila and Buddha. Could it be that what the West knows scientifically but can't feel, the East knows intuitively but can't explain: **THERE IS AN INDIVISIBLE UNITY IN PHENOMENA WHICH CANNOT BE SURPASSED.**

Contenders for a quantum theory of everything have not been around very long. If any one of these is correct then there is no reason why it cannot be entirely grasped intuitively, eventually. That intuitive understanding would be a *quantum rational* mystical experience. Future physics may require courses in meditation, memory implants, fitness training courses and digestion of psychotropic food to facilitate intuitive understanding of fundamental concepts such as four dimensional space-time or the complex wave function of quantum states. If quantum philosophy is to be taken seriously then MIND has to be accorded its rightful place as the vast beyond that lies within.

Experiment with mind! Sit quietly doing nothing! O!

② Loopless Itness: Be without time, now!

WHAT IS THE RELATIONSHIP BETWEEN MIND AND BRAIN? Computers have been developed by analogy with the mind-brain complex, so what is the computer analogue? Software is like an intelligence telling a brain what to think. Software is composed of programs which are lists of information and instructions to the hardware. Hardware is like a body made of a brain plus external senses. The essential senses are the keyboard for input from, and the Visual Display Unit (VDU) for output to, the computer operator. The brain analogue is the Central Processing Unit (CPU) and at least two different types of memory. The CPU is like a single neuron cell where information is added and subtracted, multiplied and divided, pushed and popped. Two types of memory are Random Access Memory (RAM), or long term memory, and the general registers, or short term memory.

The program resides in RAM. Individual instructions are passed to the CPU on the *data bus* when requested. Inside the CPU is a fused microcode program, usually written by the chip manufacturer and permanently hardwired into the CPU chip. This microcode program interprets the incoming program instructions and determines what to do next. Examples of what it might do next are: get the next instruction; add the contents of one register to the contents of another and put the result in a third register; move the contents of one register into another; read a character from the keyboard into a register; write the character in a particular register onto the VDU; get an instruction from RAM at the address given by the contents of a register.

As long as a computer is switched on and working it is running a program. For much of the time the computer is waiting in a program loop, listening for keyboard input by the operator. This loop is a small subset of program instructions which checks if anything has been typed. If something has been typed then the CPU exits the loop and goes to another part of the program. If nothing has been typed then the CPU goes back to the beginning of the loop and asks again (and again) if there has been any input. This is the alert or *ready state* when the computer is not busy computing but is waiting for a command from the operator. This is the usual state of most small computers.

To what extent does this software-hardware computing machine model the mind-brain complex? Obviously it is a pale reflection although it can mimic stereotyped algorithmic thinking with lightening speed and

magnificent accuracy. The computer probably best models, not the whole neural network, but a SINGLE NEURON CELL. A living body is made of billions of replicated cells each specialising as one cell of some particular organ. The cell outer membrane regulates the passage of certain materials into and out of the cell. Nutrients are allowed to enter and waste material is allowed to leave. This is like a connection to a power supply. Substances for use elsewhere in the body are also allowed to leave and certain substances or physical stimuli from outside are allowed to enter. These are the cell outputs and inputs. The nucleus is the control centre of the cell which governs cell behaviour by means of protein synthesis. Analogous to microcode, DNA in the nucleus regulates protein synthesis and these synthesised proteins then regulate all the major functions and activities of the cell.

All cells in the body can communicate slowly with one another via blood cells. In the case of a NERVE CELL, or *neuron*, its distinctive function is to transmit or *fire* an electrical impulse along its axon, which is essentially elongated cell cytoplasm. A neuron can fire many times a second. The electrical impulse causes the release of some particular *neurotransmitter* from the axon terminals. The activity of most neurons is controlled by the effects of neurotransmitters released from adjacent neurons. These neurotransmitters, of which at least fifty different examples have been identified, are the outputs and inputs of neurons.

The CPU is like the nucleus of a neuron cell. The microcode is like the DNA. The data bus leading from the CPU is like the axon and dendrites. (Axons are unlike the data bus in that they are unidirectional. This gives them a rectifying property even at radio frequencies. Axons in the laboratory have actually been shown to resemble silicon diodes in that they can be used to receive radio signals.) The neurotransmitters are like the program instructions (or operator commands) and system responses going to and from the CPU. Many psychoactive substances closely resemble certain neurotransmitters, for example DMT and LSD resemble serotonin. RNA in the cell seems to be used for short term memory. Long term memory seems to be established by axons suitably connecting themselves to other neurons.

Recently it has been discovered that the *inorganic gas* nitrous oxide (and possibly carbon monoxide too) acts as a pervasive neurotransmitter which can influence cells outwith the immediate vicinity of the source cell. This is the closest indication yet of a quantum foundation to mind whereby overall brain patterns can be controlled by the well defined quantum states

of *simple* chemicals. From another angle, Penrose is investigating the possibility of coherent quantum effects in the *microtubules* inside brain cells producing large-scale quantum-coherent oscillations.

If every computer in the world was connected to a thousand others directly through the data bus then this would still only model a tiny piece of a single human brain which has about a hundred billion neurons, most of which connect via synaptic junctions to thousands of other neurons. Nevertheless this computer network might be a reasonable classical model of the brain *if* the connections between computers could be relatively easily swapped around at the behest of a software program, like telephone connections at the telephone exchange. INTERNET and the World Wide Web are getting there slowly.

Through this computer *analogy* we can imagine what might correspond to various mental events or activities. An *idea* might correspond to the firing of a neuron or set of neurons by a particular neurotransmitter. An *impression* might be firing by way of an external physical stimulus, like a single photon on a retinal rod or cone nerve cell. *Knowing* a fact might correspond to having a particular subnetwork loop of connections which relate the neuron firing *ideas* and *impressions* together in an appropriate way. *Thinking* might correspond to passage and change of ideas along chains of neurons. *Reflecting* might be thinking in large loops of neuron connections which occasionally involve connections with subnetworks representing facts. Such electrical loops must generate our recognition of passage of time of the order of seconds. *Understanding* might mean making associations, or loose connections, between large groups of subnetworks representing various facts.

One major application of the conscious brain is to *plan the future*; both strategic planning of the long term future and tactical planning of the short term immediate future. When a big business plans a large project it often uses a computer to assist. In particular, a project coordinator may use Critical Path Analysis (CPA), on a model network. Each milestone in the project can be represented by a node in the network and each activity linking events can be represented by an arc drawn between two nodes. When all the major dependencies in the project have been thus represented, the result is a more or less complicated network with a definite unidirectional temporal flow imposed upon each arc, reminiscent of the action of a silicon diode.

One job for the computer is to calculate when it is best to start each activity, taking into account all the resources at the company's disposal

and the specific deadlines to be met. While the project is underway, changes in network node connections are made as seems appropriate to tactical planning. The whole network can be divided into subnetworks which can be recognised in terms of the overall strategic plan. CPA is thus appropriate for project planning using time analysis and resource scheduling. By monitoring, updating and interpreting the computer output correctly, the implementation of the project can be controlled effectively and the project ought to be completed dead on time.

Thus the thinking, knowing, understanding *and planning* mind might be *physically* comprehensible in terms of the neural network of the brain. This model suggests a mind-to-brain reductionist theory whereby mind is ultimately explained by matter, through dynamics and structures. Neuroscience can be reduced to bioscience then to chemistry then to physics. But can *psychology* really be reduced to neuroscience? What about consciousness? How can consciousness ever be reduced to matter in motion. For classical matter, that reduction is *categorically impossible*. The theory of consciousness as an epiphenomenon of the brain would only be tenable if consciousness was a new emergent property not reducible to matter in motion. Knowing, thinking and understanding are empty vacuous concepts without consciousness at their heart. Intelligent behaviour can sometimes be imitated artificially by computers but genuine intelligence necessarily involves consciousness.

Penrose interprets Gödel's theorem to imply that *understanding* can not be encapsulated by *any* computational procedures.

Quantum Philosophy

We can, in principle, analyse on a chemical constituent basis the detailed makeup of any other human being. In so doing we do not expect to discover anything other than a molecular or atomic substratum. However, in quantum principle, this analysis can not be performed on oneself because there will come a time when dismantling oneself further will snuff out the required awareness and eliminate the dexterity essential to the analytic process. These limitations cannot be removed to an arbitrary degree of accuracy. *Consciousness cannot be analysed by the usual scientific procedures*. Instead introspection is absolutely essential.

Thus *oneself* is categorically different from others. One can be objective about oneself only up to a point. Consciousness makes the difference. One looks out. The whole world centres about this present

consciousness. From the point of view of classical science, that is a trifling, albeit necessary, detail. For quantum philosophy it is a vital recognition. Why the eye cannot see itself. Why the finger cannot point at itself.

As physical theory has evolved from Newton's classical mechanics, to Maxwell's electrodynamics, to quantum mechanics, to quantum electrodynamics, and to the standard model, there has been not only a unification of physical forces but also a *unification of ideas*. The move towards a theory of everything is a move towards *a single grand general idea*. Where once there was diversity and difference, when seen with ultimate clarity, there is unity and identity. The standard model introduces new unifying concepts like colour charge, weak isospin and weak hypercharge. These concepts remain partially mysterious, like electric charge, until the theory is fully understood. Since they are deep and powerful unifying concepts, when fully understood these ideas *must* play a central rôle in the meaning of life itself.

At the deepest levels of thinking *all* ideas become closely associated. When the biological cell nucleus is suitably adjusted, and the brain cells are suitably reconnected to reflect an understanding of the theory of everything, then deep thinking should involve the entire brain and every other cell in the body too. Looking out, one further involves a unified inseparable world. This integrated transparently comprehensible world reflects THE unifying idea described by the theory of everything. It's when you are unwell that transparency goes and you really start noticing your body.

At a certain level of comprehension, one is a biological being made of billions of interacting cells. The basic phrenological structure of the mind is reflected in neuron groups and their interconnections. Memory and thinking both have physical correlates. Speed of axon transmission, around a hundred metres per second, determines reaction times and implies typical minimum processing times of the order of fractions of a second. Appreciation of durations of time of this order stems from neuron loops and their electromagnetic characteristics.

At a deeper level of comprehension, living form rests on precise, identically replicated, cellular, chemical, and possibly undiscovered sub-nuclear, structure. The chemical level can be mistaken for a classical thermodynamic domain based on deterministic substructure. Chemical synthesis is reliably reproducible and chemical reaction is a comfortable concept for the materialist. Body clocks such as heartbeat and neuron

firing can be related to entropy of matter in motion for their accurate definition of time mensuration. Neurotransmitter chemicals must have some intimate correspondence with basic ideas. They may somehow represent archetypal ideas.

Deeper still are the nuclear and subnuclear levels for which quantum field theory is the most appropriate language. At this level of comprehension there are very few components, and the very concept of analysis into definite ontological parts becomes progressively more meaningless. There is the electron field which can account for almost all non-gravitational aspects of the chemical and biological levels. There are three (QCD) colours of *up* quark field and three colours of *down* quark field. These six fields co-operate to provide the substantive framework around which chemical and biological activity adheres. A proton, most of the time, consists of two up quarks and one down quark. A neutron consists of two down and one up. There is intense electrical contact between coloured and uncoloured levels. At the (QCD) coloured level the photon field (light) is dominated by gluon fields. A virtual photon field holds the molecular body together. A virtual gluon field holds, for want of a better term, the astral (or subnuclear) body together. If *seeing is believing* in the light of day, then *sticking is being* in the astral plentitude!

If *the theory of everything is a representation of the consciousness of the perfect observer*, then the quark field approaches the representation of the foundation of unity consciousness, the source of all understanding. Time in this realm can find direction from effects which violate charge conjugation and parity *both* together. Such processes have been observed. By the CPT theorem mentioned on page 60, these processes violate time reversal symmetry and thus offer an arrow, or preferred direction, to time. When gravitation is included in the reckoning then another arrow to time appears from the curvature of space-time. Since the universe is expanding, local curvature is on average decreasing. Thus, like entropy, it can be used to give an arrow to time. Once time has a direction, memory becomes a possibility. While DNA is one manifestation of a deep memory unfolding over months and years, millennia and epochs, it is conceivable that the astral body also has memories accessible in trillionths of a second. Nuclei have recently been observed spinning at a thousand trillion revolutions per second, and there is plenty of scope for other ways of storing information at the coloured quark level.

In many ways we *are* our memory. We obtain our self image by identifying with our biological memories. Even when we are born we

of this single entity. This cosmological origin has to be understood without resort to the concept of time. Therefore the description applies *always*. The world is elaborated round this origin. Realising it, *here and now*, is timeless wisdom. Loopless itness.

Mind is associated with grey matter. Looking out on the world, one sees people with brains which correspond in detail to their minds. They are a reflection of oneself. They are an essentially identical *image* of the self. Lower forms of life reflect deeper levels of oneself. Rocks reflect the inorganic chemical level of understanding. When the mind is cleared of confusing day-to-day dross, one is ready to feel nuclear. O. All quarks in the universe reflect quantum identically that single unique quark about which the perfect observer controls quantum reality. This phenomenal here and now experience of the subject-object whole is *it* when recognised as almighty soul. Science gives a precise comprehension, however mathematical or abstract, of the unobservable noumenon behind a phenomenon. The theory of everything is a perfect representation of this real phenomenon plus that ideal noumenon. The theory of everything offers, through unified ideas, a great degree of control of this phenomenal reality.

Molecular medicine is flourishing. Atomic medicine is in the Stone Age. Nuclear medicine has hardly begun at all.

③ Godship: Fulfil selfless purposes!

WHO IS THE HIGHEST BEING? Human kind? Our cats and dogs probably do not regard us as more highly evolved forms of life because they do not have the same language, or the same categories of understanding as us, although their forms of perception are clearly very similar. The thought could hardly cross their minds in that guise. Could there then be a higher life form looking at us in much the same way as we might look at an ant? Since we devised the evolutionary theory being applied here, we therefore know what to look for and can say with some conviction that Homo Sapiens is the most highly evolved species on Earth. There could be a higher life form looking at us from another planet or another solar system. As far as we currently can tell with the few resources which we can apply to this question, there is not.

What then is the nature of our apparently special position? Does it mean that we can understand the whole cosmos while a dog has no chance? Or does it just mean that we can understand somewhat better than a monkey and a lot better than an ant? Quantum philosophy concludes neither of these. A conscious being appears embodied. The body is endowed with a complete set of senses as *intentionally* developed over time. The mind holds an associated understanding. Taken together perception and comprehension make perfectly good sense. If the senses are extended in any arbitrary way and the understanding is adjusted or developed to maintain total comprehension, then that too is perfect sense. If this can be achieved by man, then dogs or cats or ants can achieve it too. No absolute distinction can be drawn between species as regards potential depth of understanding.

What then of man's special position? He is like a parent entrusted with the care of children. By his relatively greater breadth of applicable knowledge, man dominates the animals. This has in the distant past gone hand in hand with greater depth of understanding, but not any more. Most wild animals are wiser than most people because people have lost clear contact with their origin. We possess huge amounts of objective information but have practically lost conscious control and mental power over the body. For those with self-control, death is a *decision*.

Materialist philosophy says that ultimately mind control is an illusion and therefore not worth effort which is rather to be expended on more tangible pursuits. Talk of meditation or contemplation is regarded with suspicious aversion. Prayer is tolerated in the modern world, in

moderation. The Westerner generally reviles mysticism because he sees it as the very antithesis of science. In fact it is the complement of science. Authentic mysticism does not encourage but rejects and ultimately dispels incomprehensible mystery, sorcery and secrecy. Science should not blind but enlighten. The goal of science is actually reduction to self-evidence. The same is true of mysticism. Both say, “Don’t believe blindly.” Science without any mysticism yields obscure algorithmic pragmatic knowledge. Mysticism without any science is powerless. Mystical science should reveal clear practical wisdom.

Quantum Religion

The word ‘religion’ means BINDING TOGETHER. Quantum binding is the ultimate binding because it makes a seamless whole. Quantum religion binds God and Nature inextricably and inseparably.

During the time that an object is in interaction with another object, the two objects are essentially one. This essential unity, as in an EPR state described on page 12, can last indefinitely even when, from a classical point of view, the interaction ceased long ago.

During the time that an object is in interaction with a *measuring instrument*, the two classically separate components again form an indivisible quantum whole. The instrument might well have a memory and therefore might not necessarily be consciously observed until long after interaction has classically said to have ceased. But when the instrument, or anything else physically connected either directly or indirectly, is *actually observed*, the interaction between that material thing and one’s body joins both together in an indivisible quantum unity. Thus all observable nature is only known by being *united* quantum physically with one’s brain.

Quantum description of this sort is necessary to properly understand the interaction between a microscopic object and a measuring instrument. However the relationship between measuring instrument and observer’s body is comprehensible at the classical level because an action far greater than Planck’s constant is usually involved in the interaction. This makes classical explanation meaningful to a good approximation. Classical explanation is still meaningful *within* the brain down to the level of nerve impulses in axons which involve millivolt potentials that are comprehensible in Maxwell’s electrodynamical terms and don’t immediately demand quantum electrodynamical terms.

At the chemical level of neurotransmitters released at the axon terminal, or *synapse*, quantum description again becomes essential. Quantum identity of these chemicals provides a physical representation of the meeting of minds. At this level independent ego dissolves. This is the limit for introspective psychoactive chemical experiments.

The electronic level of description represents identity of all atomic and molecular level structures and interactions. At this quantum electrodynamic level ALL current medical, biological and chemical notions are subsumed and superseded. This level of intuitive understanding, although encompassing the overt reproductive purpose of life, is not yet full enlightenment because the electrical level is controlled by the nuclear level.

With or without any special constraints on a physical system, the most likely behaviour of that system is the behaviour involving least action. This is THE FUNDAMENTAL CONTINGENT PHYSICAL PRINCIPLE in science. Quantum indeterminism allows, in general, a range or distribution of possible behaviours. Many things are impossible. For example, an electron cannot have a different rest mass. Those sort of miracles can not happen, even quantum mechanically. Many things are possible, but most are very unlikely. A cup of water could spontaneously boil, taking heat from the surroundings. The Earth could suddenly stop rotating, transferring all of its angular momentum to matter on the surface which would all fly off at a tangent. These events are perhaps possible but very very unlikely. Matter could spontaneously develop from chemicals into higher and higher life forms as matter is supposed to have spontaneously developed from quarks and electrons into planets and rocks. But is this likely? Life *could* be a giant accident. Everything could have spontaneously appeared yesterday, memories and all, but this is NOT the most rational explanation.

I can lift my hand! If the wave function at the nuclear level can be controlled, however slightly, by will power (spirit), then likely behaviour at the molecular level could be significantly adjusted. The electromagnetic interaction between quark and electron may then be brought to bear to influence molecular behaviour. Neutrons could decay into protons changing the atoms in the molecule into atoms of a different element. A proton could disintegrate into three jets of baryons, one jet from each constituent quark. Nuclei could disintegrate in some other possible but generally unlikely way by quantum tunnelling. More subtle influences from the nucleus on the outer electronic structure could make the

difference between chemical reaction and no reaction with a neighbouring molecule. In this way the development of life could have been consciously designed and implemented. All levels outside the nucleus may be regarded as extended senses; equipment manufactured for the purpose of integrating and interpreting more and more complicated signals from ‘the classical outside’.

If you had been looking through a telescope for eighteen months it would be easy to forget that you are actually sitting in the attic of your house. And that you could just turn your head and see a cosier world. Similarly our bodies are our *transparent* outer instruments which can be put aside. O. The less transparent they are the more unwell we are. When perfectly clear, there is no ego in the way. O.

Description at the quark level is not so much about building blocks as essences. As there need be only one electron in the universe, so there need be only one of each flavour and colour of quark. Quark control therefore represents cosmic control of all quarks (essentially the one quark) in the universe.

Ultimately both quark and electron fields emanate from string, or lumps, or some other ultimate entity which itself initially emanated from a singularity, or the origin of octonionic space, or whatever the cosmogony of everything decrees. At this level of description, all space-time and matter is absolutely identified. Einstein’s gravitational field equations already identify matter with space-time curvature. Since the origin of space-time-matter is without time, its description is not only valid at the moment of creation of space-time-matter, it is valid always. In particular, it is valid NOW.

These levels of description correspond to levels of consciousness when the theory of everything is understood intuitively. Words such as transcendental consciousness, cosmic consciousness, superconsciousness and *unity consciousness* have been given to different levels of awareness experienced in raja yoga. The word yoga itself comes from the same Sanskrit root as yoke and means to join or *unite*. The whole ‘external’ world is a manifestation of this level of consciousness. A brain is a reflection of a mind. A brick is a manifestation of cosmic consciousness. The whole phenomenal physical world is a manifestation of the unity consciousness of the perfect observer. Any consciousness is essentially that unity consciousness. All are essentially one, and that one is named God. Krishna, Buddha, Christ are all essentially the same personality, as are, essentially, a wise king and a good pauper. The sacred taboo of

orthodox Christianity is the Hindu teaching that the purpose of life, the universe and everything is for one to realise godship oneself. If not part of truth, what are we?

Sociable Vocations

In very ancient pre-animal times some deep understanding was reached that there should be a division of rôles between male who would fecundate and female who would bear fruit. Once, before flowers, there was no such distinction. This fundamental work arrangement eventually brought physical and mental differences between man and woman all in the interests of routine, daily, seasonal and future life.

The modern division tends towards economic class (or knowledge) division between skilled, and unskilled labour. Less and less is muscle power, which was required of men in the past to obtain food and construct shelter, needed today when pushing a button can lift a bridge. Women too can just about have test tube babies that are put in an oven and then given to a robotic 'loving' nannie. Hormone therapy can further narrow the distinction between the sexes, as every athlete knows. Genetic engineering may one day, in the not too distant future, manufacture a unisex *oman*. Is this any help towards the goal of unity consciousness? Probably not.

There are those who seek wisdom and those who pursue selfish goals. Only with wisdom can you master destiny. Everyone must be accorded freedom consistent with fairness to others, according to nth cousin identity politics wherein if my cousin is sad then I am sad. Everyone must be given every possible help and encouragement to be fully and truly themselves, and to understand their life and fulfil their purpose - to concieve and realize their ideal.

Ancient grand projects involving very many man-years of labour include construction of the Pyramids in Egypt, of Stonehenge in England and of the Great Wall in China. Modern grand projects include the exploration of space, the mapping of all the genes in DNA and the quest for the theory of everything. But like the button which can lift the bridge, the modern grand projects can progress without vast expenditure of society's most precious yet most squandered resource, manpower. They are not so demanding of involvement. Indeed practically all of mankind is *excluded* from these élite endeavours, unlike those ancient grand projects which doubtless involved a large fraction of the whole society's effort.

The present demanding awful and awesome project is the arms race, as has doubtless been the case at other times in history.

It is unlikely in the near future that most of us will want to devote our lives to selfless goals. Nevertheless, in the foreseeable immediate future most people, whether selfish or unselfish, *will* have to be physically involved in servicing the daily needs of their society.

One key to world prosperity is access to affordable resources. Hence the prosperity of Europe after colonization. With cheap material resources and scientific know-how, society can provide cheap quality nourishment and medication, cheap effective housing, cheap efficient transport and cheap useful appliances. Therefore all willing hands ought to be encouraged immediately to help their geographical region or country to supply the rest of the world with those ecologically sound or renewable resources which they can produce cheaply locally. Willing hands should be encouraged to manufacture and supply, according to need, good cheap standard modular goods and appropriate services. The whole social system ought to be organised and administered in a free whilst fair manner, at minimum knock-on cost, because at least their vocation ought to be a calling. Unfortunately this grand project is unlikely to take hold before further nuclear conflict has brought First World Man to his senses because currently aggression is rewarded and the personality of Christ is jeered.

The Five Propositions

Without curiosity mankind would neither progress nor survive. The drive to ask questions is fundamental to discovery, learning and *living*. Questions are verbal manifestations of problems. All life experiences problems, the most pressing being verbalised as “Where is some food?” All life is, in some very general sense, inquisitive. Materialists would argue that this is an automatic response, needing no deep sense of awareness, like one billiard ball (famine) causing another billiard ball (foraging) to act law-likely accordingly. Quantum mechanics as well as classical chaologists agree that there is tremendous scope for, not just one, but a wide variety of possible responses to real stimuli. The quantum philosopher witnesses his own experience and recognises consciousness as the essential ingredient for understanding questions and divining answers.

In the mathematical theory of light, red corresponds to a wavelength of around a thousandth of a millimetre. This number is not redness itself but quantitatively *represents* redness. Theories are not facts but *represent* the world. What they are representing is, like redness, ultimately some conscious experience. Problems have their origin in consciousness.

There is a Problem

There is a Solution

This is It

That is That



Given consciousness, there is no end, in principle, to the possibility of asking questions in our causal world because one can always ask “Why?” Amazingly it turns out that even the most abstruse questions can, when properly posed, eventually be answered satisfactorily. Problems are actually found to have solutions. This discovery drives man on in his scientific search for the meaning of life, the universe and everything. Certain questions, which seemed sensible classically, are in every sense (feeling and meaning) *not* sensible quantum mechanically. Nevertheless quantum science still substantiates the faith that *sensible questions have meaningful answers*. Even huge generalities, which supply answers to many questions at once, can be induced.

Answers, whether particular or general, arise from conscious effort. An answer is not an answer until it is appreciated consciously. Although solutions can be programmed algorithmically in retrospect, genuine consciousness is required in the original acquisition of the appreciation of and the final understanding of the conclusion to a question. Consciousness is the essential origin of solutions.

The most immediate reality, this conscious, phenomenal, eternally present experience, integrates all sense; impressions and meanings. *This* (waving hands everywhere and pointing), *whatever it is, is the source of the problem and the source of the solution*. The certainty of here-and-now impressions, plus their significance as given by the theory of everything, is this ultimate thing or *itness*. At least if not reflecting, one is perfectly clear about this: *one is perfect sense!*

Having an answer so general that all possible questions are answered enables one to transcend questions and answers, problems and solutions. By experiencing the manifest wholeness of phenomena with deep understanding, problems and solutions are transcended. At this depth of consciousness one performs consciously but unselfconsciously because problems are solved directly so that reflection is hardly necessary.

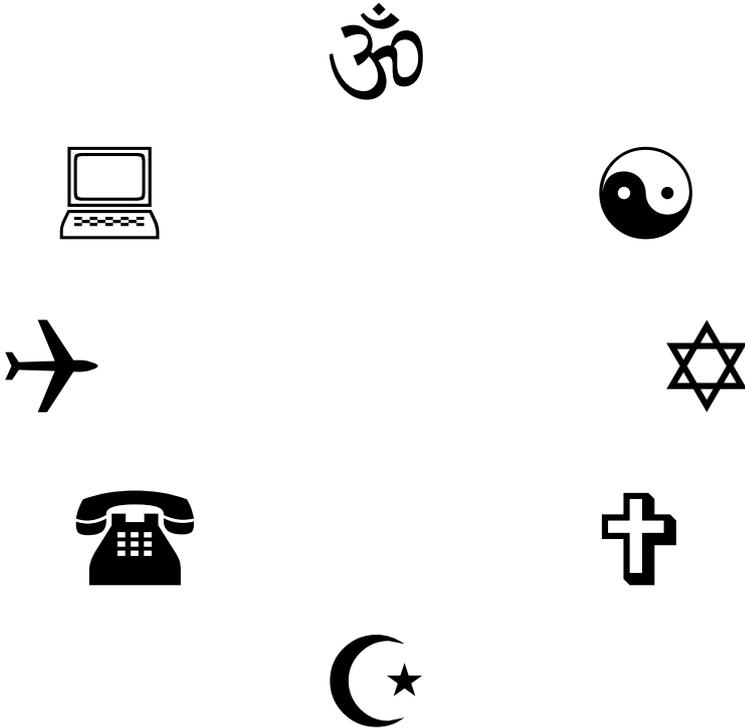
Since no insoluble problems arise, having the theory of everything at hand, the resulting consciousness entertains no doubts, which result from confusion rather than ignorance. When ego is dissipated and the sensor identifies physically with the sensed then the whole cosmos is understood as a manifestation of his cosmic consciousness, as his brain manifests to another an everyday mind.

When one dies and the chemical order is eventually eroded, there remains cosmic consciousness. When nuclear matter is destroyed there remains unity consciousness. This invincible consciousness is the

UNITY CONSCIOUSNESS AND THE PERFECT OBSERVER

sustainer of all. Wisdom is not silence. If you have a moment, enchant from O to O to o to o to o to o to . , WITH TOTAL RAPTURE AND JOYFUL ASTONISHMENT, BORDERING ON ACCUTE SHOCK, as Ptolemy or the ‘Three Wise Kings from the East’ or Kepler or Einstein may have gazed at the heavens.

“He to whom the eternal word speaketh is set at liberty from a multitude of opinions.” If *there is a problem*, loop until the penny drops.



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