The Disembodied Mind

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An Exploration of Consciousness in the Physical Universe

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James C. Austin

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To Alma and Mary Marcia

CONTENTS

THE STORY IN A NUTSHELL

The idea of encapsulating a book into a single passage is here borrowed from Julian Barbour's *The End of Time* (Barbour, 1999). In his *story in a nutshell* Barbour uses Turner's 1842 painting *Snow storm* as a metaphor to illustrate how the dynamics of the universe may be regarded as part of an all-encompassing static reality. The related debate, which has endured since the time of Parmenides and Heraclitus is here extended to include conscious experience. Those scientists who subscribe to the static reality concept refer to our dynamic experience as *the grand illusion*. Barbour is one such advocate and uses the word *illusion* in the same context in his summary. This book offers an alternative explanation that treats our consistent dynamic experience seriously while maintaining an overall static physical reality – there is no illusion. The apparent contradiction is resolved by accepting that conscious agents are separate nonmaterial entities that *dynamically* evolve within the framework of a static physical reality. The earliest reference from modern times that I know of may be summarised by the following famous quote by Hermann Weyl (1949).

> The objective world simply is, it does not happen. Only to the gaze of my consciousness, crawling upward along the life-line of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time.

Hermann Weyl, *Philosophy of Mathematics and Natural Science* [Princeton: Princeton University Press, 1949], p. 116.

PREFACE

At its core this work is about the relationship between conscious minds and the physical universe that they occupy. My interest in theoretical physics began just after I left school in the early 1970s. At that time, like the formative years of most scientists and engineers I assume, I was curious about the underlying principles that underpinned physical reality. However, for a long time I considered consciousness to be something of a side issue, forever irreducible, a mysterious aspect of reality beyond the probe of science.

Like most practical engineers my concerns lay with physical principles at a very superficial level. These limited requirements led to frustration, which prompted me to explore further. However, my limited academic training meant that I would, for many years, follow one blind alley after another. That did not mean that the experience was wasted, far from it, I gained a lot of insight into the workings of general relativity – one of the great pillars on which twentieth century physics is based. As I recall I did acquire a rather geekish reputation amongst my work colleagues regarding my newly found knowledge of the theories formed by Maxwell, Lorentz, Einstein, and Minkowski. On rare occasions conversations would drift towards the deeper aspects of consciousness. Some would agree with me that conscious minds represented a separate aspect of reality while others would, quite aggressively sometimes, insist on the opposite. Even at the level of the layman the polarisation between physicalists and dualists was palpable. The third option of idealism rarely arose, that was a little too deep and sophisticated for us. One interesting observation was a contrast between the attitudes of dualists and physicalists at that layman's level. Dualists displayed an obvious uncertainty in their views realising the mysterious nature of what they contemplated. Physicalists, on the other hand, were less open. They were absolutely certain of their beliefs, anything else was considered irrational and they seemed completely impervious to persuasion. This may be because physicalism is perceived as a rather simpler viewpoint than dualism, requiring less of an ontological commitment and consequently easier to hold on to. This is where I must alert the reader to my own prejudices. I do not call myself a dualist because I cannot rule out a possible truth with some form of idealism at its core. Instead I, shamelessly refer to myself as an anti-physicalist whose certainty in this direction has grown in recent years, not despite my scientific background but because of it. This book is a summary of that personal exploration.

Due in part to the increasing de-industrialisation of the UK during the Thatcher years, I realised that opportunities for non-graduate engineers were diminishing. So in 1990 I left the Michelin Tyre Company at Stoke on Trent in the UK, to attend the University of Keele as an undergraduate at the rather mature age of 32. I still viewed electrical and electronic engineering as a potential future career just as I had pursued it in the previous 16 years. Also my interest in mathematical physics was still very much alive, hence my choice of degree in Mathematics and Electronics. On graduation I immediately undertook a PhD in diagnostic ultrasonics within the Electronic Engineering Group at the same institution under the tutelage of Prof. Richard E Challis, which was successfully examined in 1997. My career since then has consisted of two post-doctoral positions in non-destructive testing interspersed with periods of part-time teaching for the university mainly in mathematics and physics. Despite this rather practical/scientific route my interest in some of the more philosophical topics concerning the foundations of mathematics and physics had not waned.

Notwithstanding my scientific background in the late 1990s, I realised that it had one glaring weakness, a lack of any formal training in quantum theory. Previously, conversations with fellow contemporary undergraduates who were reading physics as a principal course alerted me to the prevailing state of affairs that conflicting interpretations of quantum theory were still hotly debated. In my naivety I had thought that these issues had been put-to-bed decades earlier. As a consequence I took an interest in the emerging field of quantum computing, which was an obvious way in for an electronics engineer. I had previously read many texts on quantum theory even up to the point of being able to solve basic quantum mechanical problems. But it was not until I had purchased a copy of the well-known text by Nielsen and Chuang (2000) that a deeper understanding of quantum theory really developed. Other texts that greatly influenced my thinking were Barbour's *the End of Time*, (Barbour, 1999) and latterly *The Physical Basis of the Direction of Time* (Zeh, 2007).

Coupling this with general relativity my attention was drawn to Hawking's black hole evaporation mechanism and its consequences for preserving unitary evolution and a possible solution to the information loss paradox. In this I had formed the view that black hole event horizons do not form in a finite coordinate time, a view confirmed by other works (Suggett, 1979; Barcelo *et al*, 2006; Vachaspati *et al*, 2007; Mersini-

Houghton, 2014). With a belief in unitary evolution, I began to form ideas relating interpretations of quantum mechanics with those of consciousness around 2003. These included the realisation that physicalism is completely incompatible with the Everett (many worlds) interpretation (an interpretation most popular with researchers in quantum computation and quantum cosmology), and consequently one may speculate that supporters of other interpretations did so because of their innate physicalist leanings. It was when I considered publishing these ideas that my searches lead me to the works of Albert and Loewer (1988) and EJ Squires (1993). Upon reading these articles I admit to feeling a little deflated that I could not be the first to publish such an idea. Albert and Loewer had beaten me to it by some fifteen years. My career would continue to tick along with part-time teaching, my own researches and the occasional project in non-destructive testing. At the same time I was encouraged that my ideas were supported in published works.

During the period, 2004-08, I was privileged to have worked with one of the great scientists of the twentieth century, Prof. Peter H. Plesch. Together we worked on his last article (Plesch and Austin, 2008) before his passing in 2013. My partner, Alma and I had visited Peter and his wife, Traudi on a number of occasions while they lived at their last address in Northampton. As I recall during one visit, I noticed a number of issues of the journal *Paranormal Review* on a side table in Peter's study. It was obvious to me that rigorous scientific enquiry into paranormal events was just another of his many interests. We had had many discussions about Peter's other interests including classics, particularly Roman glass of which Peter and Traudi possessed an impressive collection. Topics in classics were quite often discussed given that Alma is a graduate of classics herself. Indeed, it was on an earlier classics trip to Sorrento, organised by the Head of Classics, Mr Richard Wallace at Keele in 1991, that Alma had met Peter, and it was through Alma that I came to know Peter myself. Although we had many stimulating discussions on various topics it is to my everlasting regret that I never broached the subject of his interest in the paranormal.

Peter's interest in the paranormal was not mentioned again until his funeral in 2013. It was during a eulogy spoken by one of his former colleagues that the logic of such an interest was questioned. Alma and I had attended Peter's funeral with another good friend of ours, Mr Mark Wiggin. Alma and Mark were Foundation Year students at Keele during the academic year 1989-90, and Mark had taken a short chemistry module taught by Peter during that year. As far as I know that was the only contact Mark had had with Peter. Despite this Peter had left a deep impression on

Mark. It was during our journey from the funeral that I mentioned Peter's interest in the paranormal. This is a topic that Alma and I were perfectly open with, but not Mark, who it turns out, is an ardent physicalist. What had struck me about the eulogy was that the word *logic*, a word so often misused, was quoted with reference to Peter's paranormal interest. I pointed this out to Mark who was not persuaded. My parting shot, as I recall, was that he (Mark) should 'google' *Wigner's Friend*, a reference to an extended form of the Schrodinger's Cat thought experiment, the idea being to pinpoint conscious agents within such a scenario.

The discussion was not resurrected again until a few months later when we discussed one of Terry Pratchett's books *The Science of Discworld IV: Judgement Day* (Pratchett, Stewart and Cohen, 2013), in which the authors strongly asserted their physicalist views on page 39. Mark was still not persuaded by arguments that certain interpretations of quantum mechanics not only admit but also demand some form of dualism. I forget Mark's exact response but the words *new age* were in there somewhere. On reflection I believe it was unfair of me to use quantum mechanical arguments to persuade a friend who is not a scientist and confesses to being somewhat maths phobic. It was at this point that I made the decision to research this problem with a view to writing this book. The way I read it Mark and I agree to differ on this point. He has since read a working paper of mine, but just says, *I still don't agree*. Fair enough! We still remain good friends and he is fun to be with at our regular reunions.

Later, on further reflection, I realised that justification in dualism did not require the Everett interpretation, indeed classical relativity was enough when we consider that non-material minds are localised in time at a particular instant. In effect my past and future exist yet I only exist in my present. In classical general relativity of course there is only one unknown but predetermined future, which is incompatible with free will. Free will is only regained when we invoke the Everett interpretation.

This work is not intended for the lay reader but assumes a modest mathematical knowledge. It can be very exasperating when one opens an interesting text expecting to find an explanation to something in mathematical form, only to find that it is not there. An example is Barbour's *End of Time*, when he refers to *that damned equation*, referring to the Wheeler-DeWitt equation of quantum gravity that is not explicitly shown. This is because it may not have been appropriate for Barbour's intended readership. At the other extreme the last four (quantum gravity) chapters of *General Relativity: An Einstein Centenary Survey*, Eds Hawking and Israel (1979), are heavily mathematics laden, yet there is not one mention of the Wheeler-DeWitt equation, which is central to quantum gravity. That is because knowledge of it is implicitly assumed. In this work I hope to bridge that gap by explicitly stating equations accompanied by appropriately detailed explanations. That way it will appeal to readers with a mathematical inclination while, at the same time, providing a text readable by a slightly wider audience. In my view Zeh (2007) and Penrose (2004) do this rather well. This is not intended as a criticism, authors consider their intended readership. It has been said that every equation in a book halves its potential sales. Although I have some sympathy with this view I do not think it is really all that bad. Mathematical statements, where appropriate, convey very precise ideas not easily expressed in words. With sufficient explanation this book will hopefully convey its ideas clearly enough for the moderately technical reader. I am minded that I have set myself a difficult challenge. In the end only you, the reader, can be my judge.

I am indebted to many for the support I have received in the writing of this book. It is often the case that one may proof read one's work many times and still leave deficiencies due to over-familiarity or carelessness. It is therefore useful to have someone detached to independently read through the text thereby detecting errors that would otherwise be missed. For this I am grateful to my long-term partner Mrs Alma Wood, Dr Steven J Payne, and Prof. Roger M Whittaker. I am especially grateful to Mr Mark Wiggin whose stimulating discussions spurred me on in the research that led to this text. I am equally indebted to Mr David Wood for alerting me to the work of Michael S Gazzaniga that is featured in the penultimate chapter and I also thank Mr Dennis Wilton and Dr Philip Emery for valuable advice concerning the publication process. Lastly I should not forget Jasper, my ginger and white domestic shorthair cat who features in figure 6.3, and I should make it clear that no animals were harmed during the preparation of this work. Specialist software packages used for the production of illustrations were DazStudio 2.3.3.146 for the front cover, figures 4.9 and 5.2, QCAD 2.00 for figures 6.4-5, and GeoGebra 5.0.413.0-d for figure 11.1.

JCA
University of Keele
November, 2019.

SELECTED NOTATION

Logical connectives

$\wedge$, And

$\vee$, Or

$\neg$, Not

$\Rightarrow$, Implies (as in $A \Rightarrow B$ says *A* implies *B* or *B* follows from *A*)

$\Leftrightarrow$, Two-way implication. Also "iff" (if and only if)

$\vdash$, "Turnstile" symbol same as $\Rightarrow$ but where the left hand side is a conjunction of many premises with a single label, or possibly an overall context.

Set theory

$\forall$, Universal operator (for all)

$\exists$, Existential operator (there exists)

$\in$, Membership (as in $a \in A$ says *a* is a member of *A*)

{ }, Elements of a set enclosed by

$\subseteq$, Subset

$\subset$, Strict subset

$\cup$, Union

$\bigcup_{i=1}^{\alpha}$, Union of indexed terms from 1 to α

$\cap$, Intersection

$\bigcap_{i=1}^{\alpha}$, Intersection of indexed terms from 1 to α

$[a,b]$, (a,b), $[a,b)$, $(a,b]$, Intervals: including end points, excluding end points, including *a* excluding *b*, excluding *a* including *b* respectively

Numbers

$\mathbb{N}$, The set of all natural numbers $\{0,1,2,\cdots\}$

$\mathbb{Z}$, The set of all integers $\{\cdots,-2,-1,0,1,2,\cdots\}$

$\mathbb{Q}$, The set of all rational numbers $\{p/q : p,q \in \mathbb{Z},\ q \neq 0\}$

$\mathbb{R}$, The set of all real numbers

$\mathbb{C}$, The set of all complex numbers, topologically $\mathbb{R}^2$

Infinity
$\aleph_0$, Countable infinity
$\aleph_n$, Suspected higher orders of infinity following from the general continuum hypothesis ($n > 0$)

Vectors (column-vectors): $\mathbf{r}$, $|\ \rangle$, x^a

Covectors (one-forms or row-vectors): $\langle\ |$, x_a, also e.g. $\dfrac{\partial}{\partial \mathbf{q}}$

Derivatives
$\dfrac{dy}{dx}$, Ordinary derivatives (e.g. of *y* with respect to *x*)
$\dfrac{\partial z}{\partial x}$, $\dfrac{\partial z}{\partial y}$, Partial derivatives, where $z = z(x, y)$, also $z_{,a} \equiv \dfrac{\partial z}{\partial x^a}$ etc.
$\dfrac{\delta}{\delta \Phi}$, *Partial* differential operator with respect to configuration space variable, $\mathbf{\Phi}$
∇, $\dfrac{\partial}{\partial \mathbf{x}}$, $\dfrac{\partial}{\partial \mathbf{q}}$, $\cdots$ *Vector* derivative operator (actually a covector); e.g. $\dfrac{\partial}{\partial \mathbf{x}} = \left(\dfrac{\partial}{\partial x_1}, \dfrac{\partial}{\partial x_2}, \cdots \right)$

and the Laplacian operator
$\nabla^2 \equiv \nabla \cdot \nabla = \dfrac{\partial^2}{\partial x_1^2} + \dfrac{\partial^2}{\partial x_2^2} + \cdots$
$A^a{}_{;b} \equiv A^a{}_{,b} + \Gamma^a{}_{bc} A^c$, Covariant derivative of the vector with components A^a on a curved manifold
$\Gamma^a{}_{bc}$, Connection coefficients defined in section 4.4

Integral etc.

$\int(\ )dx, \int dx(\ )$, Integral operators

$\sum_{i=1}^{N}$, Sum of indexed terms from 1 to N

$\prod_{i=1}^{N}$, Product of indexed factors from 1 to N

Brackets

$\langle E \rangle$, Expectation value of E

$\langle \mathbf{v} | A | \mathbf{v} \rangle$, Scalar from matrix, A, pre-multiplied by a row-vector and post-multiplied by its Hermitian conjugate, see section 6.2.2.

$[x, y] \equiv xy - yx$, Commutator

$\{x, y\} \equiv xy + yx$, Anti-commutator

$|\phi|$, Modulus (magnitude) of vector quantity ϕ

Binary operations

$\cdot$, Scalar (dot product) between vectors

$\times$, Vector (cross product) between vectors

$\otimes$, *Tensor* product between matrices of any shape

$d(a,b)$, Topological metric *distance* between a and b

Miscellaneous

tr , Trace: sum of all entries in the leading diagonal of a square matrix

Δx, Change in x

$\square$, End of proof

GLOSSARY

Base space	The space in which a system of separate parts resides. In most cases this is the three-dimensional space in which we live.
Born rule	This says that probability of a configuration is the square-modulus of the wave function for that configuration.
Boson	A particle with integer spin. Here the basic spin unit is the Dirac-Planck constant, $\hbar = h/(2\pi)$.
Category mistake	A misunderstanding of a concept that we are dealing with. For example we are making a category mistake if we treat a pair of gloves as a separate entity from either the left hand, or the right hand glove.
Chaos theory	The study of gross and consistent features exhibited by chaotic systems. Such systems are deterministic so given exactly the same initial conditions a system will always evolve the same way. Thus chaos is not randomness.
Configuration space (C-space)	Space of relative positions for independently adjustable parts/particles of a system. Absolute configuration spaces, as opposed to relative configuration spaces include translational (linear) and rotational degrees of freedom.
Decoherence	The appearance of wave function collapse due to the appearance of a correlation between a system and the outside world. The word derives from the departure of a quantum state from coherence at a measurement event.

Differential operator	An operator based on a derivative which is the slope of the graph of a wave function in a given direction, say time or any direction in space.
Dualism	The doctrine that mind has a separate existence from matter, from the dual concepts of mind and matter or mind and body.
Eigenstate	A classical physical state, one that might be expected as a result of a measurement or observation.
Eigenvalue	A numerical value associated with an operator. A single operator may have many eigenvalues.
Empiricism	The view that science begins with gathering data and progresses to the detection of patterns which eventually form new hypotheses and theories.
Energy	The capacity to do work (force times distance). A conserved quantity stored as kinetic (moving) or potential (stationary) forms.
Entanglement	A combined quantum state of two systems in which individual states for each system cannot be defined.
Epistemology	Pertaining to knowledge. For example the square-modulus of the wave function represents the probability of a specific configuration (Born rule). In epistemic interpretations of quantum theory the wave function/probability is merely knowledge, it has no objective existence.
Eternalism	The view that physical reality is made up of events and that all events, whether past, present, or future exist. Events effectively exist *outside of time*.
Fermion	A particle with odd-half integer spin in the same units as bosons. Fermions include baryons (making up atomic nuclei) and leptons (electrons and neutrinos).

Hamiltonian	An expression for the total energy of a closed physical system, generally expressed as kinetic energy plus potential energy.
Hausdorff manifold	A geometric manifold, e.g. a surface, which can curve smoothly but does not branch.
Idealism	A monistic view that reality ultimately consists of mind. Matter emerges from the mind as opposed to the other monistic view, physicalism, where mind emerges from matter.
Lagrangian	A non-conserved energy parameter defined as kinetic energy minus potential energy.
Matrix	An operator written as a rectangular array of numbers. Heisenberg's original quantum mechanics used matrices of potentially infinite size making the formulation impractical for most applications.
Microtubules	Macromolecular tubular strucures forming the cytoskeleton of neurons. These are formed from α/β-tubilin dimers that may be described as "kidney" shaped structures each with two lobes. The lobes may be close or far apart and these represent distinct states which can be in a quantum superposition.
Minisuperspace model	Amodel in quantum gravity in which the configuration space is idealised to a small and therefore managable number of dimensions.
Modal theories	Interpretations of the measurment problem as proposed by van Fraassen (1981) in which sytems possess a *dynamic* state that may be, and a *value* state that actually is. Non-local hidden variable theories fall into this category.
Non-locality	The ability of a wave function to exist across large expanses of space for multi-particle systems, and to exhibit instantaneous decoherence across large distances.

Ontology	Objective: objectively real, having an objective relationship with other physical entities.
Operator	A non-numerical mathematical object that generates a numerical quantity when acting on a wave function or state vector.
Orchestrated decoherence (Orch *D*)	The realisation of one configuration of microtubules against other possibilities. The associated wave function does not collapse, instead a nonmaterial mind transitions from being uncertain as to which state it will finally experience, to selecting a particular state.
Orchestrated objective reduction (Orch *OR*)	A collapse of the wave function, orchestrated by a material mind, associated with configurations of microtubules forming the cytoskeleton of neurons in the brain. The wave function collapses to a state associated with a choice being made.
Phenomenal time	Time as we experience it–experienced duration. This is an entirely distinct concept from physical time as viewed by those who study relativity theory. It is proposed that phenomenal time is a function of the mind.
Physicalism	Sometimes called monism or materialism, this is the doctrine that mind emerges from, and is therefore part of matter – the physical world is all that exists.
Presentism	The view that only the present exists. The past is merely remembered in the present and the future is yet to come.
Probability	A variable describing the likelihood of a given event whose value lies between zero and one. Zero is the impossibility limit i.e. it can never happen, whereas one is “dead certainty” that it will happen.

Quantization A procedure for converting a classical model for a system into a quantum model. Energy, momentum, and angular momentum variables are replaced by factors proportional to differential operators in time and distance respectively.

Quantum gravity A quantum theory (see quantum mechanics) where configurations or states of a physical system include the geometry of the base space, where gravitational fields are distortions in the geometry of space-time.

Quantum mechanics A conceptual framework (meta-theory) in which definite classical states of a physical system are replaced by a wave function that can be spread over a range of different states or configurations. Mathematically it is a sub-branch of linear algebra.

Qubit Short for quantum binary digit. Any quantum system having two classical eigenstates.

Rationalism A view of science that prioritises the formation of postulates from which theories are deduced. Theories are subsequently tested against observational or experimental data.

Space-C A timeless generalisation of space-time. This is the product of C-space and base space. Space-time is considered a subset of space-C where time is an ordered sequence of appropriately foliated base space configurations.

State vector Equivalent to the wave function. Each configuration is represented as a basis vector. Therefore all basis vectors with non-zero probability contribute to the state vector.

Sui generis Of its own type. Referring to hypothetical special forces in biological systems that have physical effects but originate from a non-physical source.

Supervenience	Dependence: to say that “the mind supervenes on matter” is to say that “the mind depends on matter”. If we qualify that by saying that “the mind depends on matter for its existence”, this is ontological supervenience.
Token minds	Minds thought of a separate independent entities, as opposed to *type* minds considered to be *reflections* of the same entity.
Turing test	An artificial intelligence system will be deemed to have past the Turing test when a human in conversation with it is unable to distinguish its responses from that of any other human.
Uncertainty principle	A law from quantum mechanics that says that pairs of associated variables cannot be measured simultaneously with arbitrary accuracy. Such pairs are e.g. position and momentum, time and energy, angular position and angular momentum. Such pairs are known as canonically conjugate pairs.
Unitary evolution	The quantum mechanical version of classical determinism.
Wave function	An object with one or many numerical components dependent on generalised coordinates of the configuration space. When the number of numerical components is many this may also be called a state vector.

CHAPTER 1

INTRODUCTION

It is said that consciousness is the most mysterious aspect of reality, and that all of the other great questions that science strives to answer pale into insignificance compared with this problem. Does the nonmaterial mind exist or are we just mere matter? All religions both ancient and modern believe in a soul or a nonmaterial mind separate from physicality, with conscious capacity and the power of volition. But can the conscious part of our minds really survive death? If it exists the soul has the faculty to experience many things including that other great mystery of reality–time. But is subjective time the same as physical time? If on the other hand, nonmaterial minds do not exist and we are just parts of the wider material universe, then we are relieved of the burden of answering these questions. If they do however, then do all humans and other animals have associated nonmaterial minds, or are some of us just mere automata? I could say to you that I am conscious, but you only have my word for it. How would you know otherwise?

This work is focused on this most mysterious aspect of reality–the mind and its consciousness of the physical world. In ancient times the mind was regarded as something separate from the reality that we immediately experience. More recently in the age of science the idea of a nonmaterial mind remained that, it resisted any kind of investigation that may lead to reliable results. At present, notwithstanding our evident monumental progress in other areas, we are little wiser today. Eminent philosophers in history have attempted in-depth studies of consciousness, yet its nature remains stubbornly illusive. It is what David Chalmers (1995) has dubbed *the hard problem*.

A small first step towards the wisdom we seek is the realisation that consciousness is not an object. It is a property of an object, the mind. More specifically consciousness of another object may be thought of as the mind's *contact* with it. Treating the mind as an *object* indicates that we accept the independent existence of other's minds–you are not alone. This is not intended to conflict with the traditional term, *subject*. The two terms are not mutually exclusive they are just used in different contexts–the mind is objective but its experiences are subjective. One may ask the question what the mind actually is. No one has been able to show that it is reducible to anything more fundamental. So it is better to enquire how it relates to the rest of reality, which is amenable to scientific investigation.

We may make inroads towards the resolution of the mind-body problem by considering three course-grained viewpoints that have come to the fore over recent centuries. Taking religious beliefs through the ages one imagines a view of the mind as a completely separate entity from the rest of objective reality. This is *dualism*, the idea that reality consists of two substances–matter and mind. Personally I know of no religion, ancient or modern, that does not support dualism in some form. The antithesis of dualism is *monism*, where the two components, mind and matter, are merely different aspects of the same thing. However, monism comes in two forms. The first and most obvious is the view that matter is primary and that mind is emergent from it. This view is sometimes known as *materialism* although this can be confused with dialectical materialism in situations where the corresponding contexts overlap. In our context it is more illuminating to use the term *physicalism* as a synonym for the primacy of matter viewpoint. Most debates about the nature of mind, today and in the past, centre on the dualism-physicalism dichotomy. And in this work that is, for the most part, where the focus lies. Physicalism, or *scientism* as it is sometimes called (Tart, 1998), is a more recent viewpoint and essentially evolved from observation and discovery of patterns of behaviour within the objective world. This pursuit is today what we call science, and because science is closely associated with rationality, then so is physicalism. The result is that nowadays physicalism has a very large if not a majority following amongst scientists and philosophers of science. A term often used by philosophers who subscribe to physicalism is to say that the mind *supervenes* on matter. This is like saying that the mind depends on matter for its existence. Evidence against this viewpoint has emerged in recent decades.

That said it would be a mistake to completely ignore the other form of monism, even though it is not really the focus of this book. Turning physicalism on its head, and effectively saying that matter supervenes on mind, we arrive at this alternative viewpoint. This says that mind has primacy over matter, a viewpoint that has become known as *idealism*, because it is the world of ideas, objects in the mind, which is primary. If we eventually discover that physicalism is not part of the truth then it may be that, although reality appears dualist, it is at root ideal. In other words dualism may just be a first step on the way to idealism. This is the reason I prefer not to focus too much on idealism, let this book represent one step of many from mere appearances towards a deeper reality.

As modern science evolved from the late seventeenth century the domain of matter where the soul could exist, narrowed markedly. During the eighteenth century it became accepted that the source of human and animal behaviour within the objective world, the brain, was the only site from which a nonmaterial mind could exert any kind of influence. Therefore it was considered that biological systems were somehow special. From the middle of the nineteenth century the laws of physics were considered completely deterministic, so a nonmaterial mind could exert no influence there.

Throughout the late nineteenth and early twentieth centuries the sciences leading to the reinforcement of physicalism–biology and neuroscience, and the emergence of relativity and quantum theory were contemporary. The latter sciences were marking the beginning of a new paradigm, whereas the former were still developing rapidly as new technology became available. For physicalists there did not seem to be a problem. New discoveries in biology only served to reinforce their view. Physicalism was associated with rationality, therefore for ardent physicalists, dualism or any other alternative view was considered irrational. Biologists, neuroscientists, and physicists did not work in isolation, and physicalism was prevalent amongst the physics community also. However, in order to arrive at the truth we need to dissect our own experience of reality with due diligence.

A significant aspect of experienced reality is time. A major feature of the early twentieth century paradigm shift was the decline of *presentism* – the view that only the present exists. This was because it was seriously challenged by relativity. Prior to this the debate between presentism and *eternalism* – the view that past, present, and future exist on an equal footing, had rumbled on since the pre-Socratics. Now with the emergence of relativity, science was cutting through the presentism/eternalism debate like a scalpel, yet still no alarm bells rang in the physicalist's camp. Yet why should they? Scientists in the early twentieth century were mainly concerned with their specialist fields. Their intense focus meant that science progressed rapidly, while some of the deeper meanings of their discoveries were temporarily overlooked.

Things got even more complicated with the arrival of quantum theory. Results from the double-slit diffraction experiment, simply did not make any sense when set against the backdrop of classical physics. There was the formal part of quantum theory, which accurately predicted the double-slit results with repeatable experimental outcomes. What more could you ask? But the theory had no coherent interpretation. A little over a decade later the Nazis were on the rise in Europe and before long the world was plunged into war. Scientists were too busy with their part in the war effort on both sides to be concerned with the deeper meanings of quantum theory–it just worked. The sentiment was: *shut up and calculate*, even though this literal statement may not have been quoted until much later.

The first indication to emerge that there might be something wrong with the physicalist's viewpoint appeared in a book by Hermann Weyl (Weyl, 1949), although it is possible that Sir Arthur Eddington had something to say on the topic also. This is the now famous quote by Weyl that appears in *the story in a nutshell* at the beginning of this book. For convenience it is repeated here,

> The objective world simply is, it does not happen. Only to the gaze of my consciousness, crawling upward along the life-line of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time. (Weyl, 1949, p116).

This immediately leads to a very simple argument opposing physicalism. If you are not persuaded by physicalism but are in conversation with someone who is, then simply ask them to think of an event in their past, they do not need to tell you what it is. When they answer in the affirmative then merely suggest that that event still exists, but that they are not there anymore–that is it. They have identified part of their physical aspect where their nonmaterial mind is now absent. The main feature of relativity is the four-dimensional block space-time continuum. It is eternal with past, present, and future existing in a *contemporary* sense. Note the deliberate use of the present tense. The problem however is that it does not explain the very strong feeling of free will, and that we make our own future. In classical relativity the future is completely predetermined, and this does not sit well with many, particularly non-physicalists.

That began to change in 1957 when a new article (Everett, 1957) appeared. In the previous years since the emergence of quantum theory, the interpretation that was generally accepted became known as the *Copenhagen interpretation*. This is not regarded nowadays as particularly rigorous. It just said that when a quantum state was measured, the associated wave function collapsed to a classical eigenstate. There was no specification of the wave function ontology, nor was there a defined mechanism describing the collapse. It was just a convenient way to connect the weirdness of the quantum state to the classical reality of our immediate experience. In 1957, the proposal was that the wave function encapsulated the whole of physical reality and remains unaffected by the measurement process. This is all that Schrodinger's formulation of quantum theory entails–quantum theory does not predict any collapse mechanism. The 1957 article was titled: *"Relative State" Formulation of Quantum Mechanics*. Its author, Hugh Everett III, was bold enough to follow through and apply quantum theory as it was, to the macroscopic world without any extra assumptions. This ultimately entailed that all of the possible histories to the future of a measurement event would continue to exist but we would only experience one. The eigenstate that you do experience is merely a matter of perspective–it is where you are in a space of configurations.

The relative state formulation does exactly what it says, it enables one physical state to be expressed in terms of another, just as relativity enables space-time coordinates of one inertial frame to be expressed in terms of another. There is no mention of the popular designations, *many-worlds interpretation*, or *parallel universes*. These terms were coined later in order to make clear to a lay public the idea of similar realities running unseen but concurrently with ours. The problem with these descriptions is they convey the false notion that these *many-worlds* are discrete, they are not. They differ only by particle and field configuration at any instant. The same can be said of distinct points in time throughout a given history. Therefore the appropriate manifold on which to map all configurations is a configuration space, or C-space. In this work, C-space is treated as a continuum and for all practical purposes it has infinitely many dimensions. C-space is what John Archibald Wheeler referred to as *superspace*. It encapsulates the entire history of our *universe* as well as the complete histories of all other possible *universes*. By envisioning the history of our universe as a continuous ordered set of instant configurations, we begin to see all other universes as similar sets of configurations that are not on our particular timeline. But they are related by the fact that they all occupy the same C-space continuum–one world, which is infinitely larger than anything we are even cosmologically accustomed to. Another way of looking at it is to say that quantum mechanics does for C-space what relativity does for space-time.

Further, subsuming general relativity into quantum theory provides a unified framework, namely quantum gravity, which determines how the wave function depends on any configuration. We do not have a complete theory quantum of gravity yet because we do not have sufficient data describing the physics near the Planck scale ($\left(\hbar G/c^3\right)^{1/2} \sim 10^{-35}$ m). However, the important point is that C-space is static and eternal, and moreover physical time is subsumed within it. This leads us to two postulates on which this work is based. The first, which is generally agreed by mainstream physics community reads:

P I **Eternalism: Physical reality consists solely of a timeless wave function over a universal configuration space.**

This asserts the static nature of reality and that time is emergent. The second postulate is equally important and addresses the subjective nature of our experience, this reads:

P II **Experience: Our conscious dynamic experience of the world is real.**

It seems likely that many physicists would regard postulate *P II* as being most contentious. This would be because they take seriously postulate *P I*, which asserts that the whole of reality, including us, is a root static. In this context the "us" in the previous sentence refers only to our physical aspect, and may lead one to speculate that those making such an assertion are persuaded by physicalism. Physicists so persuaded often describe our dynamic experience as the *grand illusion*. However, those taking such a view, many of whom are eminent scholars in their own fields, would do well to remember that everything they have ever learned, including their own historic contributions, have come to them through the filter of their own dynamic experience. To call this an illusion strikes me as the intellectual equivalent of cutting one's own throat. The real illusion is the appearance that the physical world is dynamic–it is not. And yet our dynamic experience persists, the Sun rises and sets every day as the Earth turns on its axis. We experience the weather in all its forms, our movement and that of others. And we dynamically experience the gaining of new knowledge. If this is an illusion then the reliability of any newly gained knowledge must surely be called into question. The consistency of our dynamic experience makes it the most powerful piece of empirical evidence that we possess, especially given that all other such evidence is dependent on it.

This work is presented in two parts. Part I concerns science and scientific methodology, which is dedicated to the justification of the eternalism postulate, *P I*. The experience postulate *P II* we take as self-evident. Part II is more concerned with the mind and how it relates to the physical world. What follows is a brief description of each chapter and how to get the most from this book.