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Worlds Apart?

Can Psychical Research Bridge the Gulf Between Matter and Mind?

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WORLDS APART?

CAN PSYCHICAL RESEARCH BRIDGE THE GULF BETWEEN MATTER AND MIND? [1]

Bernard Carr

ABSTRACT

Many psychical phenomena seem to involve a direct interaction between mind and the physical world, which suggests that any theoretical framework for the subject requires some sort of extension of physics. This is the remit of what is sometimes termed 'paraphysics', in contrast to 'parapsychology', which is biased towards the psychological aspects of the subject. Psychical research will only have come of age when paraphysics enjoys the same academic respectability as parapsychology and this is currently far from the case. This paper discusses the issue of whether physics, in either its present or some future form, will ever be able to accommodate psi. Although some phenomena which are labelled 'psychic' may turn out to be explicable in terms of current physics, I will argue that most are not and that these will require a different physical paradigm from the ones that currently prevail. This is not too implausible, since physics regularly undergoes paradigm shifts. The new paradigm must assign a central role to consciousness and there are already indications that this is a fundamental rather than an incidental feature of the Universe. I will present my own view as to what form the new paradigm might take. This involves a higher-dimensional 'reality structure' which is reminiscent of ideas already invoked by modern physics.

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[1] This article is based on the SPR Presidential Address which the author delivered on 9 May 2002. However, it also draws on material presented in three previous talks to the SPR: "Psi and Physics: Can They Connect?" in 1989, "Psi and the Nature of Reality" in 1995, and "Is There Space for Psi in Physics?" at the SPR Conference in 2001. It therefore goes somewhat beyond the Presidential Address itself. The other talks have never been published, so it seems sensible to present them together. Since the Address was given six years ago, information and references have been updated where appropriate.

INTRODUCTION

Presidential Addresses traditionally assess the current state of the field and anticipate likely future developments. Since this is the first one of the new millennium, it is a particularly appropriate time at which to undertake this task. In some ways the status of psychical research has undergone some remarkably positive transformations in the last few decades, but I will argue that it may undergo an even more dramatic transformation in the *next* few decades and it will certainly need to do so if it is to become a generally recognized branch of science.

The great challenge of psychical research is that some of the phenomena it investigates seem to imply that there can be a direct interaction between consciousness and the physical world, i.e. one that goes beyond the 'normal' interaction between consciousness and the brain. It therefore links two distinct domains: mind and matter. These are the two 'worlds' of my title and they are generally studied by psychologists and physicists, respectively. Even before one introduces paranormal phenomena, there has always been a mutual tension between these worlds—hence the 'gulf' in my title—and this dates back to the Cartesian divide of the 17th century. In particular, there have been different philosophical views about the relationship between them, and about which one is primary, as reflected in the debate between materialists, idealists and dualists. There is also the apparent incompatibility between the 3rd-person account of the world provided by physics and the 1st-person account of our direct experience.

Despite these problems, it seems self-evident that a full description of the Universe must involve an amalgamation of matter and mind. Indeed, I will argue that the crucial significance of psychical phenomena is that, if real, they demand such an amalgamation and necessarily provide a 'bridge'. More specifically, since physics—the branch of science which underlies our understanding of the material world—is currently unable to provide a theoretical framework for psi, the construction of the bridge must involve some sort of extension of physics. Not everybody welcomes this bridge; its construction engenders antipathy from both physicists (who are sceptical of the reality of psychic phenomena) and psychical researchers (who are wary of attempts to explain them in materialistic terms). However, I will argue that this antipathy is misconceived and that such a bridge must eventually be built. With it will come a new paradigm of science, and I believe we can already see clues as to what form this paradigm will take.

The field which attempts to formulate the extension of physics required to accommodate psi is sometimes termed 'paraphysics', in contrast to 'parapsychology', which—historically at least—has mainly

emphasized the psychological side of the subject. Paraphysics bears the same relationship to physics as parapsychology does to psychology. Both are regarded as controversial areas, which many members of the parent groups do not even recognize as legitimate. However, whereas parapsychology has now obtained a fair degree of academic respectability (at least within the UK), paraphysics is still regarded as very heretical. I will argue that psychical research will only have gained proper scientific stature when this situation is remedied and when both paraphysics and parapsychology have equal status within the academic community. Only then can the bridge of my title be constructed.

This paper comprises three parts. The first part puts the subject in a historical and sociological perspective, explains why there is such an aversion to the bridge and argues why it must nevertheless be built. The emphasis of the second part is on paraphysics: it provides a classification of psychic phenomena which is useful from a physicist's perspective, reviews the different physical models of psi which have already been proposed, and concludes that one needs a fundamentally new paradigm to accommodate it. The third part describes my own particular approach to the problem; this involves a higher-dimensional 'reality structure' and I relate this idea to recent developments in modern physics. Each part is rather different in style and would stand on its own. In particular, since the last part is very speculative, it should be stressed that the general considerations of the first two parts do not depend upon its validity. However, a discussion at the end brings everything together.

I will make no attempt to review the evidence for psi. For present purposes, it is taken for granted that at least some psychic phenomena are real and the paradigm presented in the last part is entirely motivated by an attempt to explain them. Although I will review the history of paraphysics, I will say very little about the history of parapsychology, it being assumed that the reader is familiar with this.

Various parenthetical discussions are relegated to appendices. I review the contributions of previous SPR physicist Presidents in Appendix A, describe some relevant personal experiences in Appendix B, and clarify some terms in Appendix C.

PART 1. PARAPHYSICS AND PARAPSYCHOLOGY

This part of the paper discusses historical and sociological aspects of the relationship between paraphysics and parapsychology. The treatment is somewhat superficial and focuses mainly on the SPR, but it will suffice for present purposes. More detailed accounts of the history of the SPR have been given by Alan Gauld (1968) and Renée Haynes (1982).

HISTORICAL PERSPECTIVE

The key figures in the SPR have always included both psychologists and physicists, but their relative prominence has changed considerably over the 126 years since its founding. This can be seen by examining the list of past Presidents, which is fairly representative of both the general membership of the SPR and the field as a whole. Of course, the subject also involves other scientific disciplines — including biology, for which psi processes may be equally fundamental. However, psychology and physics might be regarded as the two poles in the usual 'reductionist' classification of the sciences (discussed later).

Past Presidents have included eleven psychologists: William James (1894–95), Frederic Myers (1900), William McDougall (1920–21), Robert Thouless (1942–44), Gardner Murphy (1949–50), John Beloff (1974–76), Joseph Rhine (1980), Louisa Rhine (1980–81), Ian Stevenson (1988–89), Alan Gauld (1989–92) and David Fontana (1995–98). Although James and Myers played a fundamental role in the early days, psychologists were fairly rare until the 1940s, after which they took centre stage. Today psychologists certainly dominate the field numerically, and the pre-eminence of psychology is implicit in the use of the term 'para-psychology'. Indeed, one of the most striking developments in the last decade has been the extent to which the subject has attained academic acceptability. Currently 82 people in the UK are either studying for or have already obtained a PhD in parapsychology, 22 of whom have gone on to obtain permanent academic appointments in psychology departments, where they give lecture courses and continue to pursue their research in the subject. There are currently ten such departments in the UK. To a large extent this remarkable state of affairs is due to the pioneering efforts of the late Robert Morris, who—as Koestler Professor at Edinburgh—supervised 32 of the PhDs. The cautious approach which characterizes his school has won the subject new-found respect, as emphasized by the fact that in 1996–97 he served as President of the Psychology Section of the British Association for the Advancement of Science.

Past Presidents have included nine physicists prior to myself: Balfour Stewart (1885–87), William Crookes (1896–99), Oliver Lodge (1901–1903), William Barrett (1904), John Strutt—later Lord Rayleigh—(1919), Camille Flammarion (1923), Robert Strutt (1937–38), Frederick Stratton (1953–55) and Archie Roy (1992–95). Brief descriptions of their various contributions to the field, as well as summaries of their Presidential Addresses, can be found in Appendix A. The fact that physicists figured prominently in the first 20 years of the Society—Barrett was one of the founders and four of the first eight Presidents were physicists—perhaps reflects the prevalence of physical phenomena in the séance room.

However, physicist Presidents have been rather sparse since then and there was a gap of nearly 40 years between Stratton and Roy. It is interesting that five of the physicist Presidents have been astronomers, though the significance of this is unclear.

Unfortunately, the study of the paranormal has not gained academic acceptability within physics departments (or any other 'hard' science departments) in the same way that it has within psychology departments. Indeed the study of paraphysics is still academically taboo: the only professional physicist who works on the subject in a UK university is Professor Brian Josephson at Cambridge, and even he does not focus exclusively on the paranormal. Furthermore, no PhDs have been obtained in the subject in UK physics departments—not even in Cambridge. On the other hand, the situation in paraphysics today is really no worse than it was in parapsychology 20 years ago, when Edinburgh was the only active department. In principle, therefore, another 20 years might see an equally dramatic proliferation of paraphysics groups. One just needs someone to do for paraphysics what Robert Morris did for parapsychology.

Of course, many physicists are *interested* in the subject, at least to the extent of publishing articles about it. They number several dozen in the UK and around a hundred worldwide. The work of many of them will be cited in this paper. Even so, they represent only a tiny fraction of the total physics community and their paraphysical work is usually conducted in their spare time. The few professional physicists who are paid to work in the subject are not generally university-based. The only exception I know of is Jim Beichler in the USA, who obtained a PhD in paraphysics from the Union Institute, a well-respected accredited university in Cincinnati, and is currently a physics professor at West Virginia University in Parkersburg. In any case, physicists who speculate in this area—whether or not they have a university affiliation—are liable to be regarded with suspicion by their peers.

On the other hand, there are some positive signs. Despite the situation in university departments, there is evidence that physicists may be more open to the occurrence of psi than psychologists: a survey of US and Canadian academics some decades ago found that 55% of physical scientists thought psi was possible, compared with 34% of psychologists (McClenon, 1982). Another welcome development is that, besides the specialist parapsychological journals, there are now a number of more general science journals which include articles about paraphysics. These include the *Journal of Consciousness Studies* (which in 2003 and 2005 devoted entire issues to parapsychology) and the *Journal of Scientific Exploration*. There are also two electronic journals covering the subject: Beichler's *Yggdrasil: The Journal of Paraphysics* and Lian Sidorov's *Journal of Non-Locality and Remote Mental Interactions.*

THE AVERSION OF PHYSICISTS TO PSYCHICAL RESEARCH

Even in the early days of psychical research, physicists who took the paranormal seriously and tried to link it to physics attracted hostility from their mainstream colleagues. Crookes's publications on the subject were much ridiculed, even though he was a most distinguished physicist and later became President of the Royal Society. His observations of materializations during experiments with Florence Cook were once even attributed to poisoning by thallium — the element he had discovered! Lodge received a lot of criticism for publishing a paper on telepathy in *Nature*, and Barrett's attempts to set up a committee of the British Association to investigate the subject were rejected outright.

Many physicists remain antagonistic towards parapsychology in the present age. In 1979 a symposium on psi and physics was hosted by the American Association for the Advancement of Science. This attracted intense opposition from John Wheeler, who attempted to eject the Parapsychological Association from the AAAS with the battle-cry "Drive the pseudos out of science . . . Where there's smoke, there's smoke" (Wheeler, 1979). At the time I happened to be a guest of Wheeler in the Department of Physics at the University of Texas in Austin, but discretion got the better part of valour and I did not voice my disagreement too strongly! More recently, Gerard 't Hooft, who won the Nobel prize for physics in 1999 and runs an anti-parapsychology website, has stated ('t Hooft, 2000):–

> Modern physics seems to offer leeway to the paranormal. As a theoretical physicist, I must assert most emphatically that this leeway is only apparent. There is absolutely no way one can explain the paranormal in this fashion.

The aversion of some physicists to parapsychology was vividly illustrated some years ago by a furore involving the SPR's Nobel Laureate, Brian Josephson. In September 2001 the Post Office issued a set of stamps commemorating the centenary of the Nobel Prize, with one for each of the six subject areas in which the prizes are awarded. This was accompanied by the publication of a brochure in which various UK laureates— including Josephson — were asked to provide a brief commentary on the area involved in their discovery, together with a look to the future. Josephson used this oportunity to suggest that quantum theory may one day lead to an understanding of telepathy and the paranormal:–

> Quantum theory is now being combined with theories of information and computation. These developments may lead to an explanation of processes still not understood within conventional science, such as telepathy, an area where Britain is at the forefront of research.

This provoked some hostile responses. An article in the *Observer* on 30

September contained an onslaught from the physicist David Deutsch, who dismissed Josephson's claims outright:–

> Telepathy simply does not exist . . . The evidence for its existence is appalling . . . The Royal Mail has let itself be hoodwinked into supporting ideas that are complete nonsense.

Although Deutsch is a renowned quantum physicist, his brash dismissal of the evidence for telepathy makes one wonder to what extent he has studied this or indeed read much about the subject at all. Other sceptics soon joined the fray. In the same *Observer* article the previous year's physics Nobel Laureate, Herbert Kroemer, declared "Few of us believe telepathy exists, nor do we think physics can explain it". Then, on Radio 4's *Today* programme, Josephson did battle with James Randi, who (though not a physicist himself) declared that "trying to explain ESP with quantum mechanics is the refuge of scoundrels".

Why does such hostility arise? One obvious factor is doubts about the strength of the evidence and the fact that—according to an influential paper by Irwin Langmuir (1989)—parapsychology shares some features of pathological science. He lists these as follows: (1) the maximum effect is barely detectable; (2) many measurements are necessary because of the low statistical significance of the results; (3) fantastic theories are constructed contrary to experience; (4) criticisms are met by *ad hoc* excuses; and (5) the ratio of supporters to critics rises to nearly 50% and then gradually falls to zero. I will not try to rebut Langmuir's argument here but merely refer readers to the influential books by Richard Broughton (1981) and Dean Radin (1997).

Apart from this, there are probably three reasons why physicists tend to have an inherent prejudice against the possibility of psi. First, many of them reject psi because they feel it would be incompatible with physics. Thus, after his brief foray into metal-bending, John Taylor (1975) remarked:–

> There is a clear contradiction between science and most supernatural phenomena . . . The entire edifice of physics would have to be reconstructed from the ground up if it had to embrace psi phenomena.

In this context, of course, one must distinguish between what is *compatible* with physics and what is *explicable* by it. Many psi phenomena may be irrelevant to physics, and even telepathy might be if one adopts a dualist philosophy in which mind–mind interactions do not reduce to brain–brain interactions. The problem is that many psychic phenomena *do* involve an interaction with the physical world, and furthermore appear to violate such cherished notions as causality.

The second reason why many physicists are antagonistic towards psi is the implied threat to reductionism. There are many branches of science (e.g. psychology, neurophysiology, biology, chemistry, physics) and for most purposes each of these may be regarded as self-contained,

with its own language and conceptual framework. However, according to reductionism, they are logically interdependent and form a hierarchy in which the fundamental concepts and laws at each level can be explained in terms of those pertaining at the lower one. This is indicated in Figure 1. Physics is at the bottom of the hierarchy, which implies that it is the most *fundamental* branch of science. The reductionist therefore claims that everything can ultimately be reduced to physics.

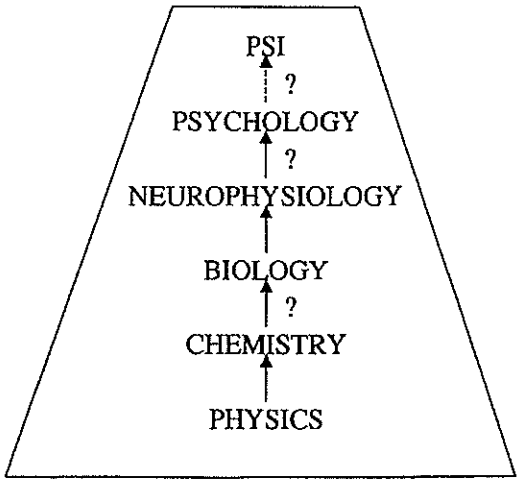

Figure 1. Scientific Reductionism. This shows the reductionist chain which is supposed to link the various branches of science, the entire edifice ultimately being based on physics. Several links in this chain are controversial (as indicated by the question marks) and the inclusion of psi at the top (as indicated by the broken arrow) is entirely tentative.

Of course, many links in the reductionist chain remain controversial. For example, many biologists do not believe that all of biology can be reduced to DNA, and many psychologists do not accept that all mental processes can be explained in terms of neuronal activity. Nevertheless, it is clear that the reductionist outlook is very influential from a sociology of science perspective. In fact, some forms of psi would not necessarily be incompatible with reductionism. They might even be regarded as an extra step in Figure 1, as shown by the broken arrow at the top. However, other forms of psi (e.g. those pertaining to survival) would seem to throw doubt upon the reductionist claim that the mind can be understood entirely in terms of brain function (Kelly et al., 2007). It suggests that there is a *downward* as well as *upward* direction of influence in Figure 1. Thus psi threatens reductionism at a fundamental level.

The third reason for physicists' antipathy to psi is that many psychic phenomena involve *consciousness,* and physicists have long been uncomfortable with attempts to incorporate even normal aspects of consciousness (let alone paranormal ones) into physics. This is because the contents of consciousness are intrinsically private, whereas physics deals with what is in the public domain. (Consciousness may still be studied scientifically from the standpoint of social anthropology but that is a separate issue.) Brian Pippard, for example, even though he is open to the possibility of psi, has argued that consciousness will be forever outside the domain of physics (Pippard, 1988):–

> If the existence of these phenomena is doubtful, it is because the evidence is scanty and often of dubious provenance, it is not because they cannot be invoked in physical terms. They involve, after all, a class of system beyond the scope of physical theory—that is to say, conscious human beings. I do not say consciousness is not at this time understood from the laws of physics—I say it cannot be so understood.

Certainly physics in its *classical* mechanistic form cannot incorporate consciousness. This was appreciated more than a century ago by William James (1890), who stressed the incompatibility between the localized features of mechanism and the unity of conscious experience. Although the classical picture of physics has now been replaced by a more holistic one, and there are some indications that the new physics *can* include consciousness, we will see that this is controversial.

It is not only physicists who are uncomfortable with consciousness. Even some psychologists have been keen to banish any reference to it. Nearly a century ago, the behaviourist John Watson (1910) declared:–

> The time seems to have come when psychology must discard all reference to consciousness; when it need no longer delude itself into thinking that it is making mental states the object of observation.

Indeed, since parapsychology was itself born in the behaviourist-dominated period, it might be argued that it was strongly influenced by it. Although attempts by behaviourists to extend mechanism to the mind have now been rejected, a mechanistic outlook still persists among many physicists and this probably contributes to their discomfort with consciousness. The philosopher Daniel Dennett (1978) is even more forthright:–

> Consciousness appears to be the last bastion of occult properties, epiphenomena and immeasurable subjective states — in short, the one area of mind best left to philosophers, who are welcome to it. Let them make fools of themselves trying to corral the quicksilver of phenomenology into a respectable theory.

Most physicists would not share this extreme view, but they would still argue that the focus of science should be the objective world, with the subjective element being banished as much as possible (i.e. it should be concerned with the 3rd person rather than the 1st person account of the world). Fortunately, there are now a growing number of physicists interested in the general area of consciousness studies (Hameroff et al., 1996 and later volumes), though most remain sceptical about psi.

THE AVERSION OF PSYCHICAL RESEARCHERS TO PHYSICS

It is not only physicists who oppose attempts to link psi and physics. Several prominent psychical researchers are equally uncomfortable with the idea. To quote the late John Beloff (1988):–

> The attempt to reconcile physics and parapsychology is misguided. Asking for an explanation of the mind–matter interaction could only lead to an endless and profitless regress.

In fact, in pointing out the alternatives to the paraphysical approach, Beloff goes even further and suggests that psi may be completely anarchic, in the sense that it obeys no laws at all. This would exclude it from the domain of science altogether. Of course, one could always go half-way, accepting that psychic interactions conform to laws which can be studied scientifically but denying that they are part of physics. In particular, this would be compatible with Beloff's dualist view, in which mental and physical phenomena are simply disconnected. This is fine if minds only observe the physical world *passively*. However, some psychical phenomena seem to require minds to influence it *actively* and the laws that govern this interaction must then surely involve physics.

Nevertheless, many psychical researchers share Beloff's scepticism. Some indication of the source of this prejudice comes from Carroll Nash (1986):–

> In the sense of being independent of space, time and physical causality, psi is non-physical. Physical causality presumes transmission of energy over time and space between the interacting bodies . . . psi's apparent independence of physical causality suggests that, for it, cause and effect may be simultaneous. That psi is not a physical force in the classical sense is indicated by the failure of metal chambers and Faraday cages to prevent its occurrence.

J. B. Rhine was sceptical of a physical theory of ESP for similar reasons. In fact, the claim that psi has been demonstrated to be space-independent and the significance of the Faraday cage experiments are both debatable. But in any case, I believe Nash's reaction—and perhaps Beloff's antipathy—derive partly from a misunderstanding of what is entailed in the term 'physics'. Although the sort of old-fashioned physics associated with materialism could not accommodate psi, a new type of 'extended' physics might still do so.

Another cause of antipathy may be the misapprehension that paraphysicists wish to describe *all* aspects of mental experience in terms of physics, thereby embracing reductionism. Thus physicists are uncomfortable with paraphysics because it threatens to destroy reductionism, while psychical researchers are uncomfortable with it because it threatens to support reductionism! However, even in the context of 'normal' processes, few people would claim that *every* aspect of mental experience can be reduced to physics. For example, 'secondary' qualities (colour, taste, emotional assocations, etc.) may always transcend it. So it may only make sense to try to extend physics to incorporate those 'primary' features of psychic experience which involve the sensorial contents themselves (e.g. the geometrical features of an apparition rather than its emotional impact).

Finally, of course, it should be stressed that many parapsychologists are not so much antipathetic to physics as uninterested in it. For example, the only physical aspects of psi covered in the most recent edition of Harvey Irwin's classic textbook (Irwin & Watt, 2007) are those concerning its mediation. This reflects the different backgrounds of psychologists and physicists. They are interested in different types of questions about the world. Also, discussions of physics can appear arcane to non-specialists. As Renée Haynes remarked in her (unpublished) review of my 1989 lecture:–

> Dr Carr's research is deep, extensive and thorough. His arguments are muscular, his conclusions are most carefully worked out. The result should not be left as a single cataclysmic experience of a single audience, the isolated impact of one thunder and lightning downpour, dazing a large proportion of those present.

I'm not sure how fair her remarks were—Renée certainly had a blind spot about physics, so it was perhaps unsurprising that she found my talk hard to follow—but doubtless she was not alone in her reaction. If a final theory of paraphysics is ever discovered, it may not be easy to convey to non-physicists. This article will therefore try to avoid technicalities.

REASONS FOR CONNECTING PSI AND PHYSICS

Science assumes that the world is governed by natural laws, and psychical research will only become acceptable to the rest of the scientific community if psychic phenomena are also subject to such laws. The purpose of psychical research should therefore be to demonstrate that natural law can be extended to include psi and not to throw the ball back into the court of the 'supernatural'. If psi turns out to be anarchic, as suggested by Beloff, this aim may be forlorn, but one should at least give it a try. Also chaos theory and non-linear dynamics have taught us that what appears anarchic at one level may turn out to have a discernible pattern at another level.

Now an essential feature of any branch of science is that it must involve some theory to explain the observations, so if psychical research is to qualify one needs a theory for psi. This is why understanding its properties is more important than just accumulating statistical proof of its existence. Even before the founding of the SPR, Augustus De Morgan (1863) remarked in the preface to his wife's book on Spiritualism:–

> Never has any way been made by observations alone. Facts have sometimes started a theory; but until sagacity had conjectured, divined, guessed, surmised what they pointed to, the facts were a mob and not an army.

More recently, Henry Margenau (1985) urged:–

> No amount of empirical evidence, no mere collection of facts, will convince all scientists of the veracity and the significance of your reports. You must

> provide some sort of model: you must advance bold constructs . . . in terms of which ESP can be theoretically understood.

There are several historical precedents for this. For example, Alfred Wegener's idea of continental drift was not accepted for several decades because there was no theory to explain it. Although it is not inevitable that a theory for psi has to come from physics (rather than biology, say), it would seem most natural to use the model of the world which already exists and has proved so successful. Also, we have seen that most scientists adopt a reductionist view, so—regardless of whether this is correct—it seems unlikely from a sociological perspective that psi will ever be accepted by mainstream science until it is founded on a theory which connects with physics. Certainly physicists themselves will not accept psi until this happens (Chari, 1977; Feinberg, 1974).

If the first reason for incorporating psi into physics is that it may be good for psi, the second reason is that it may be good for physics. Radin (1997) makes this point very forcefully:–

> Physicists who have retained some humility in the face of nature's mysteries are interested in psi because it implies that we have completely overlooked fundamental properties of space, time, energy and information. Specifically, psi suggests that the conventional boundaries of space and time can be transcended by the ephemeral concept of the 'mind'.

Indeed one of the reasons physicists figured so prominently among the early membership of the SPR was that they saw in psychic phenomena evidence for some new type of physics (Noakes, 2004). For the history of physics is full of the inexplicable becoming explicable and studying anomalous effects nearly always leads to useful insights. Thus new phenomena should be welcomed by physicists, even if they are not at first explicable theoretically. For example, it was only several years after its discovery that superconductivity could be explained. Nevertheless, history shows that phenomena which occur only rarely are often received sceptically at first. A good example of this is ball lightning, which was studied by Lord Rayleigh in the 1890s but not acknowledged to be a real phenomenon until the 1960s. On the other hand, it must also be cautioned that new phenomena do sometimes turn out to be spurious (e.g. N-rays).

Now there can be no doubting the success of physics within its own terms. Particularly impressive has been its progressive unification of the different forces of nature, as illustrated in Figure 2. Indeed many people have proclaimed that the end of physics is in sight, in the sense that our knowledge of the fundamental laws and principles governing the Universe is nearly complete. They argue that we are on the verge of obtaining a 'Theory of Everything' (TOE). This description may seem pretentious, because one is really only purporting to have a final theory of *physics*, but we have seen that this may indeed extend to 'everything'

if one adopts a reductionist view. On the other hand, physics also seemed close to a complete theory in the 1890s, before the revolutions of relativity theory and quantum mechanics overthrew the classical paradigm, so one should be wary of this claim.

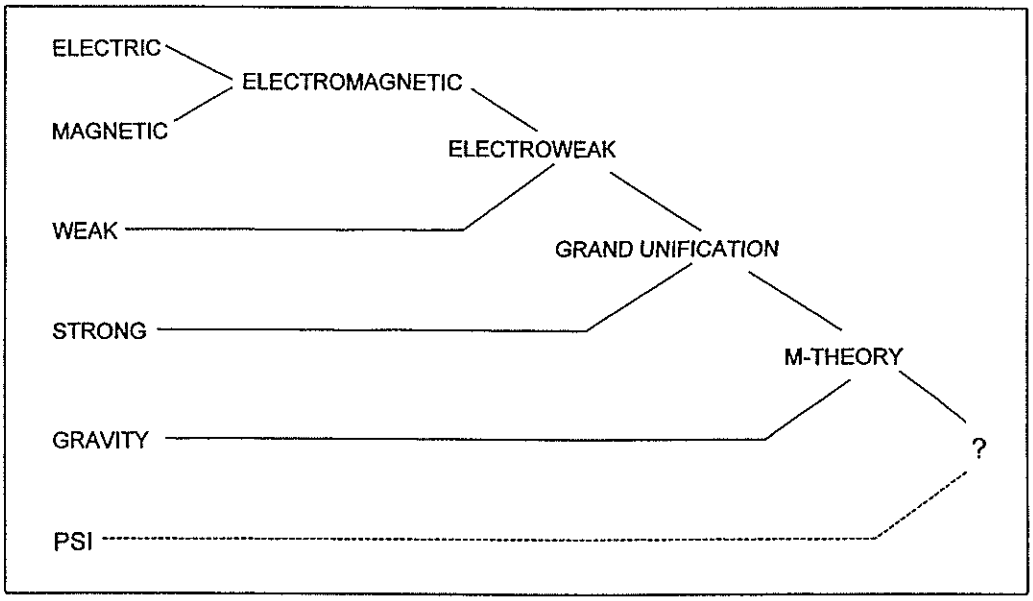

Figure 2. Unification of Forces. This shows the successive steps (left to right) by which physics has attempted to unify the known forces of nature. Electroweak theory has been experimentally confirmed but Grand Unification and M-theory remain theoretical constructs. Possibly psi requires the existence of some further 'force', which is still to be incorporated within the unification (as indicated by the dotted line). However, the concept of a force is part of the current paradigm, so this is not inevitable.

One feature of the Universe which would seem to refute the claim that physics is close to a TOE is the existence of consciousness. We have seen that many physicists regard this as being outside the domain of physics. However, this attitude is not universal and other physicists are equally uncomfortable with attempts to formulate a TOE without any reference to this. Thus Roger Penrose (1992) anticipates that "we need a revolution in physics on the scale of quantum theory and relativity before we can understand mind", while the linguist Noam Chomsky (1975) asserts that "physics must expand to explain mental experiences". It is certainly conceivable that some future paradigm of physics will make an explicit link with mind. We cannot be sure that such a paradigm would accommodate paranormal phenomena — certainly neither Penrose nor Chomsky would advocate this—but one cannot exclude this possibility. If it does, it remains to be seen whether psi involves some new form of 'force', which might eventually be unified with the other forces. This is why the bottom line in Figure 2 is only dotted, with a question mark at the end. It is also unclear where psi would appear in the reductionist

chain of Figure 1—above psychology (as indicated by the broken arrow) if it is solely a feature of evolved minds, above neurophysiology if it can be explained in terms of brain processes, or above biology if it is a feature of life in general.

Perhaps the most important reason for wanting to incorporate psi into physics is that many people claim that recent developments in physics already make this possible. The fact that the physical world has turned out to be much weirder than common sense would suggest has led some people to argue that there might well be room for the sort of phenomena studied by parapsychology. To quote Arthur Koestler (1972):–

> The unthinkable phenomena of extra-sensory perception appear somewhat less preposterous in the light of the unthinkable propositions of modern physics.

Indeed, Part 2 of this paper will review the many attempts to explain psi in terms of physics explicitly. The general conclusion is that physics is still not weird *enough* to accommodate psi, but that some of these attempts may well be relevant.

Despite these arguments, antipathy to paraphysics is clearly still strong. We therefore face a dilemma. The prime challenge of psychical research is that it needs to link mind and matter. Yet paraphysicists—the people who try to provide this link—find themselves shunned not only by mainstream physicists (who regard the paranormal with scepticism) but even by parapsychologists (who are generally uninterested in such questions). In the next section, to help combat this prejudice, I will present some general arguments—from physics itself—for believing that mind may be a fundamental feature of the Universe.

IS MIND FUNDAMENTAL OR INCIDENTAL?

Since the Enlightenment, the prevailing scientific view has been that the Universe—and everything within it—behaves like a giant machine, completely oblivious to whether consciousness is present. Recent advances in brain research and artificial intelligence suggest that even the mind may be a machine, and this may be part of the prejudice that psi is impossible. For if free will is an illusion, how can one wilfully influence a physical system? In recent decades, however, there has been a reversal in this view and various arguments now suggest that mind may be a fundamental feature of the Universe rather than an incidental one. This may not directly help to explain psychic phenomena but it does perhaps break down the prejudice that they cannot be real.

One context in which mind has crept into physics is through the *Anthropic Principle.* In its weak form, this just points out that the existence of observers imposes a selection effect on when and where we exist in the Universe. In its (more controversial) strong form, it claims that there are unexplained coincidences involving the physical constants

(e.g. the dimensionless numbers which describe the strengths of the four forces) which are required in order that conscious observers can arise (Barrow & Tipler, 1986; Carr & Rees, 1979). One possible interpretation of the Strong Anthropic Principle is that the Universe is just one member of a huge ensemble of universes, called the 'multiverse' (Carr, 2007a), in which the constants vary. In this case, we necessarily inhabit one of the small fraction of anthropically-tuned universes. (Indeed, one multiverse scenario involves the same higher-dimensional theory of physics which I will invoke later to explain psi.) In any case, this suggests that mind may not be entirely irrelevant to the functioning of the Universe.

Another context in which mind may appear in physics involves quantum theory (Squires, 1990). This shows that, on a microscopic scale, matter does not behave like a machine at all. Particles—instead of being localized like billiard balls—are described by a wave-function, and this introduces a new level of randomness and acausality into the world. Quantum theory may also impinge on the mystery of consciousness. Studies of quantum phenomena convinced Louis de Broglie (1963) that "the structure of the material Universe has something in common with the laws that govern the workings of the human mind". Although opposed to psychical research, Wheeler (1977) has inferred from quantum theory that "mind and Universe are complementary", while Bernard d'Espagnat (1983) claims:–

> The doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and with facts established by experiments.

This impression arises because in quantum theory the wave-function which describes any physical system evolves smoothly in accordance with Schrödinger 's equation until a measurement is made. At this point the wave-function is said to 'collapse' to a state which corresponds to a possible result of the measurement. There is some controversy as to what causes this collapse, or what it means, but some people have proposed that consciousness is involved (Stapp, 1994; Walker, 2000; Wigner, 1979). This is a crucial part of most attempts to relate quantum theory to psi.

Other people assume that quantum-mechanical weirdness does not persist on macroscopic scales and simply cancels out for biological systems. Thus John Hopfield (1990) claims:–

> Contrary to the expectations of a long history of ill-prepared physicists approaching biology, there is absolutely no indication that quantum mechanics plays a significant role in biology.

And Murray Gell-Mann (1995) asserts that "no vital forces are needed for biology or self-awareness". There is thus the cherished hope that mechanism will survive at the level of the brain itself. However, recent advances in neuroscience may be incompatible with this hope: Stuart Hameroff (1994), and also Hameroff and Penrose (1996), propose that

quantum effects may occur via microtubules, while Jeffrey Satinover (2001) argues that large-scale quantum effects may be captured and amplified by the brain, so that it no longer behaves deterministically. The connection between quantum physics and neuroscience has been recently reviewed in an important paper by Jeffrey Schwartz and colleagues (2005). The question of whether quantum effects can explain psi is addressed later.

PART 2. CAN PSI AND PHYSICS CONNECT?

This part of the paper first classifies psychic phenomena in a way which is useful for the purposes of paraphysics. It then reviews various physical models for psi and concludes that one needs a new paradigm to accommodate it. Finally, it indicates what general features such a paradigm might be expected to have.

CLASSIFICATION OF PSYCHIC PHENOMENA

As stressed by David Rousseau (2002), there are many ways of classifying psychic phenomena. First, it is important to distinguish between *psychic* and *anomalous* phenomena. Although some parapsychologists prefer the latter term, this is confusing because physicists often discuss anomalies which have nothing to do with parapsychology (e.g. cold fusion). This issue has been discussed by Beichler (1998a), who argues against the label 'anomalous'. The usual semantic convention is to regard psychic phenomena as the subset of anomalous phenomena associated with psyche or life, although both these terms are somewhat vague. With this restriction, it will be useful to divide psychic phenomena into the four classes summarized in Table 1, although it should be stressed that the examples given there are neither definitive nor exhaustive. Liudmila Boldyreva and Nina Sotina (2002) give a somewhat related classification.

- The first class comprises those *alleged* psychic phenomena which are delusional, in the sense that they result from the mind's innate tendency to see patterns in random data (Blackmore & Troscianko, 1985; Hood, 2006). I will also include phenomena which are the result of fraud or conjuring in this category. It is impossible to give examples of this class without causing offence, but I have tentatively listed pyramid power, the Bermuda triangle and psychic surgery. This selection reflects my own bias (and may be wrong) but I think everybody would agree that *some* psi phenomena are spurious, even if—due to our different 'boggle' thresholds—we disagree on which ones. Were it not for this disagreement, one could dismiss Class-1 phenomena from the remit of psychical research at the outset.

Table 1

Classification of Psychic Phenomena

CLASS 1	CLASS 2	CLASS 3	CLASS 4
Pyramid power Bermuda triangle Psychic surgery Conjuring	Kirlian photos Firewalking Some EVP? Anomalies?	Psychokinesis Clairvoyance Precognition Telepathy?	Hypnosis Multiple personality Hallucinations Transpersonal

1/2	2/3	3/4
Loch Ness monster UFOs Human combustion Crop circles	Dowsing Poltergeists Psychic healing ITC	Apparitions OBEs/NDEs/DBVs Past-life memories Mediumistic

This table classifies (purported) psychic phenomena into four categories. Class 1 are delusional. Class 2 are real but probably explicable by current physics. Class 3 are inexplicable by current physics but apparently involve an interaction with the physical world. Class 4 are purely mental and may have no relevance to physics. Phenomena lie on the boundary of neighbouring classes either because their classification is uncertain or because they may involve a combination of effects. The 2/3 and 3/4 boundaries are expected to evolve with time, as indicated by the arrows. The phenomena inside the double-border are the ones most relevant to paraphysics. All the entries (especially in Class 1) are tentative and reflect my personal bias. The list of phenomena is illustrative and not intended to be complete.

• The second class comprises phenomena that are real but have a simple explanation within the current physical paradigm, despite some people's attempts to endow them with paranormality. I would tentatively include Kirlian photography (a corona discharge effect) and fire-walking (a thermal conduction effect) in this class. Some electronic voice phenomena (EVP) may result from the misinterpretation of normal terrestrial radio transmissions or other indistinct sounds (Ellis, 1975, 1978; Keil, 1980), though advocates would claim not all of them. There is an explicit connection with physics here—indeed any psychical investigator needs to be sufficiently familiar with physics to recognize Class-2

phenomena when they arise. Since the distinction between psychic and anomalous phenomena is somewhat blurred—the connection with psyche is not always clear-cut and sometimes amounts to no more than the *belief* that mind is involved—a number of anomalous phenomena might also be included in this class.

Some phenomena may be regarded as being on the Class 1/2 boundary because there is uncertainty as to their status. For example, the Loch Ness monster and similar exotic creatures may not exist at all but, even if they do, they presumably have a standard zoological explanation. Likewise, even if some UFO sightings are explained by extraterrestrial visitations, this is more relevant to astronomy than parapsychology. (If these phenomena do not occur on a physical level at all, but are akin to apparitions, they might still be relevant to psi; in this case, they would need to be reclassified, but I am taking the simplest interpretation here.) If accounts of spontaneous human combustion are vindicated, this may have a purely biochemical explanation. If crop circles are explicable by some combination of hoaxes and meteorological effects, they also would be included in this class.

- The third class consists of phenomena which are inexplicable by current physics — and whose reality is therefore controversial — but which nevertheless seem to involve an interaction with the physical world. One would clearly include psychokinesis (PK) in this class and one might also include clairvoyance and precognition if perception of the physical world is assumed to require some signalling mechanism. If minds are generated by brains, as assumed by reductionists, then telepathy would also be included. The emphasis on *current* physics in this definition is, of course, crucial, since one might hope that the boundary between Class-2 and Class-3 would gradually shift as physics advances (so that 'paranormal' phenomena become 'normal'). This is the significance of the arrow on the 2/3 boundary in Table 1.

Even within the context of the physical paradigm which prevails at a particular time, people will disagree on where the 2/3 boundary comes. An extreme sceptic would regard all psychic phenomena as Class-1 or Class-2, and even people more favourably disposed to the paranormal might like to relegate some of them to Class-2. For example, some people attribute dowsing to electromagnetic effects (in which case it is Class-2), whereas others attribute it to clairvoyance (in which case it is Class-3). Some phenomena could be associated with both Class-2 and Class-3 effects. For example, poltergeist effects may involve a combination of natural factors (like geomagnetic or seismic activity) and recurrent spontaneous psychokinesis (RSPK). Likewise psychic healing (as opposed to psychic surgery, which has a more dubious provenance) and some forms of complementary medicine may involve a combination of some unexplained physical interaction (Class-3) and psychosomatic effects

which (from a reductionist standpoint) would be regarded as Class-2. I also include Instrumental Transcommunication (ITC)—a broader term than EVP—on the 2/3 boundary (Cardoso & Fontana, 2005; Fontana, 2005; Senkowski, 1995). Finally there are a wide range of spiritualistic effects (materializations, apports, spirit photographs, etc.) and magical phenomena (Roney-Dougal, 1991), which clearly involve physical manifestations if real. However, these are not listed explicitly in Table 1.

- The fourth class consists of phenomena which are purely mental, in the sense that they may involve no *direct* interaction with the physical world at all—except perhaps via the brain if one takes the view that all mental experiences are generated by the brain. The existence of this category is not intended to preclude a reductionist view, although Edward Kelly et al. (2007) argue that it may. I include what they term 'rogue' phenomena, such as hypnosis, hallucinations and multiple-personality manifestations, in this class. Although such states may not be psychic *per se*, they have all come under the scrutiny of psychical researchers at various times because they are sometimes *associated* with psi. Indeed, the whole domain of transpersonal psychology might be included in this class, since there is clearly an overlap between psychic, religious and mystical experiences (Carr, 2007b; Daniels, 1998, 2005; Wilber, 1995).

Many psychic phenomena—for example, apparitions, death-bed visions (DBVs), out-of-body experiences (OBEs), near-death experiences (NDEs), past-life memories and mediumistic phenomena—are placed on the 3/4 boundary rather than in Class-4 itself, because it is unclear whether or not they involve an interaction with the physical world (the defining feature of Class-3). The issue here is not the validity of the reports—nobody doubts that the *experiences* are genuine—but their *interpretation.* Is one really out of one's body in an OBE and is one really remembering a past life in hypnotic regression? This relates to whether the experiences on the 3/4 boundary are *veridical.* The problem is that the distinction between Class-3 and Class-4 is fuzzy, since we do not know for sure what is entailed in the terms 'physical world' and 'purely mental'. While it is clear that there is no room for the contents of mind in the classical world-view, I will argue later that most psi experiences require the existence of some form of 'space', in which case one might hope that the domain of physics could eventually be extended to incorporate this. Therefore I would contend that at least some 'mental' psi phenomena may transpire to be Class-3. In this case, as indicated by the right arrow in Table 1, the 3/4 boundary will eventually penetrate into what is presently regarded as Class-4. This might be regarded as corresponding to a change in the Cartesian boundary between matter and mind (Beichler, 2006).

It should now be clear that the psi phenomena which are relevant to paraphysics are the ones classed as 2/3, 3 and 3/4, so these are bounded by a double-border in Table 1. The crucial question is how far the 2/3

boundary will eventually penetrate into what is currently regarded as Class-3. However, an important caveat should be made here. For if there is a paradigm change, one might anticipate the 2/3 boundary undergoing a single large shift rather than a sequence of small ones. The change involved could then be so radical that the nature of physics might itself change. I would therefore advocate introducing a new term, 'hyperphysics', which is more general than paraphysics since it does not only have implications for psi. In this case, one might want to regard the final limit of the 2/3 boundary as the transition between physics and hyperphysics. Another interesting question is how far the 3/4 boundary will eventually penetrate into what is currently regarded as Class-4. This relates to the eventual status of reductionism; if all mental experiences can ultimately be reduced to physics (or at least hyperphysics), then Class-4 would disappear altogether, although still subjectively defined.

PARADIGM SHIFTS AND THE HISTORY OF PHYSICS

The history of science shows that the prevailing model of physical reality regularly undergoes paradigm shifts (Kuhn, 1970). The paradigm determines the sort of picture one has of the world, the type of questions one asks about it and the experiments one performs. Much scientific progress is made within the context of a particular paradigm, but eventually anomalies arise and these result in a crisis which ultimately leads to the adoption of a new one. During the crisis, a variety of new theories will be advanced. The upholders of the old paradigm will try to resist these but eventually they die off and the new paradigm takes hold. I will now briefly summarize the successive paradigms of physics. Although my treatment is simplistic from a historical perspective (i.e. it does not include dates and it makes no reference to paradigm shifts in other branches of science), it will suffice for present purposes. I also interpret the term 'paradigm' rather loosely and avoid the (controversial) issue of how big a change has to be to qualify for this appellation.

- The first paradigm was the classical *Newtonian* one, in which the physical world is regarded as a 3-dimensional continuum, with solid objects moving according to Newton's laws of dynamics. Time is absolute, in the sense that it flows at the same rate for everyone, and there is also an absolute space associated with inertial (non-accelerating) frames. Objects attract each other through the force of gravity, although the paradigm does not explain *why* that force exists.
- The next paradigm, *atomic theory*, arose from developments in statistical physics and thermodynamics. These showed how the interactions of billions of atoms lead naturally to the observed macroscopic laws and how the structure of the atoms themselves provides an understanding of chemistry. The new paradigm also contained the laws of

electricity and magnetism. In particular, it showed that light consists of electromagnetic waves travelling through an 'ether', which naturally was identified with Newton's absolute space.

- The advent of the next paradigm, *special relativity*, demolished the idea of the ether and showed that space and time are not absolute but part of a spacetime continuum (called Minkowski space). Thus a consistent picture of how different observers perceive the world requires that it be 4-dimensional rather than 3-dimensional, the fourth dimension being time, and material objects corresponding to worldlines in spacetime.
- The next transformation came with *general relativity*, which showed that spacetime is curved in the presence of matter, like a surface in a higher-dimensional space. This explains the origin of gravity geometrically. It gives different predictions from Newton's theory of gravity but the differences are only large for a strong gravitational field (e.g. for a black hole). General relativity also forms the basis of cosmology, the branch of physics concerned with the structure of the Universe in the large.
- Paralleling these developments in macroscopic physics was the paradigm shift associated with *quantum theory*. This showed that microscopic objects can simultaneously behave like waves and particles. Measurements always interfere with systems in some way and this leads to the Uncertainty Principle. In particular, a particle cannot simultaneously be ascribed a position and velocity, which means that the concept of a worldline (underlying the spacetime description of relativity) can only be an approximation.
- The *Kaluza–Klein* proposal arose out of attempts to give a geometrical explanation of electromagnetic interactions, analogous to the geometrical explanation of gravitation provided by general relativity. Kaluza–Klein theory suggests that the Universe is 5-dimensional; the fifth dimension is wrapped up so small that it cannot be observed directly but its existence neatly explains the laws of electromagnetism. Strictly speaking, this does not yet qualify as a paradigm (since it is not universally accepted) but it certainly would do so if it were confirmed.
- Modern extensions of this idea propose that all interactions between elementary particles can be accounted for by invoking further wrapped-up dimensions. For example, in 'superstring' theory the total number of dimensions is 10, so one has a 4-dimensional 'external' space and a 6-dimensional 'internal' space. There were originally five different versions of superstring theory, but recent developments suggest that all of these are part of a more embracing 11-dimensional picture called *M-theory* (where M stands for 'mother' or 'magic' or 'mystery'). A recent variant of this idea suggests that some of the extra dimensions may not be compactified after all but extended. In this case, the physical world can be regarded as a 4-dimensional 'brane' in a higher-dimensional 'bulk'. (This proposal will be discussed in more detail later.)

• The final — and as yet incomplete — paradigm shift is associated with *quantum gravity*, the attempt to unify general relativity and quantum theory. According to this paradigm, the notion of space breaks down on scales less than 10^{-33} cm. It must be regarded, not as a smooth continuum, but as a sort of topological foam. Quantum gravity effects must also dominate whenever classical physics predicts 'singularities' (i.e. points of infinite density), such as arise inside a black hole or at the beginning of the Universe.

This brief history of paradigm shifts shows that the 'ultimate reality' revealed by modern physics is very different from the sort of reality experienced by our normal senses, which only provide a very incomplete picture of the world. Indeed, as emphasized by Arthur Ellison (2002), one can regard successive paradigms as providing a sequence of mental models, each of which is progressively removed from common-sense 'materialistic' reality. Thus atomic theory removes our everyday notion of solidity, relativity theory destroys our intuitive ideas of space and time, quantum theory shows that reality is fuzzy, unification theories reveal dimensions of which we have no direct experience, and quantum gravity goes beyond space and time altogether. Since the ultimate nature of reality can only be appreciated intellectually, it is ironic that many physicists play down the significance of mind. There is also the puzzling feature that the world is understandable by humans at all.

A BRIEF HISTORY OF PARAPHYSICS

Physical theories of psi inevitably reflect the physics of their time. An excellent review by Beichler (2001) divides the history of the subject into what he terms the pre-scientific, early-scientific, middle-scientific and late-scientific periods. In the pre-scientific era (before 1850) he highlights higher-dimensional theories of spirits (More, 1671) and the idea of animal magnetism (Mesmer, 1814). These proposals, although primitive, might be regarded as precursors of modern hyperspatial and electromagnetic theories. The early-scientific period (1850–1930) covers the first decades of the SPR and saw attempts to relate psi (including the possibility of survival) to a new force (Crookes, 1871), thermodynamics (Tait & Stewart, 1875), a fourth dimension (Zöllner, 1880) and some form of semi-physical 'metetherial' world (Myers, 1903). The middle-scientific period (1930–1970) saw developments of these approaches but mainly by non-physicists.

Beichler regards the late-scientific period as starting with the acceptance of the Parapsychological Association into the AAAS in 1970. Four years later, James Beal and Brendan O'Regan declared the emergence of the new science of paraphysics in an influential volume edited by Edgar Mitchell (1974), although the term itself goes back well before that.

This was also the year in which *Nature* published a landmark paper by Russell Targ and Hal Puthoff (1974), describing their investigations into the physical aspects of psi under the auspices of the US-Government-funded 'Stargate' programme.

The same period saw several other edited volumes on the subject (Mishlove, 1975; Puharich, 1979; Toben, Sarfatti & Wolf, 1975; White & Krippner, 1977), as well as the founding of two dedicated journals: *The Journal of Paraphysics* and *Psychoenergetics: The Journal of Psychophysical Systems.* Although these continued to be published into the next decade, progress slowed in the 1980s, when the hopes for a quick-fix theory seemed to fade. The terms 'paraphysics' and 'paranormal' also became tainted by association with the New Age movement, so when Robert Jahn established the PEAR group at Princeton in 1979, he used the term 'anomalous' rather than 'paranormal'. Nevertheless, as described in Part 1, the burgeoning interest in consciousness studies and developments in particle physics in recent decades have rekindled interest in the subject.

CONNECTING PSI AND PHYSICS: GENERAL CONSIDERATIONS

In deciding whether psi can connect with physics, we first need to decide which Class-3 phenomena we are trying to explain, since some clearly present a greater challenge to theorists than others. This raises the question of whether there are different *levels* of psi, requiring increasing modifications to physics. For example, one might assume that macro-PK poses more of a challenge than micro-PK because more energy is involved; and that precognition is more problematic than clairvoyance, and retro-PK more problematic than PK, because they involve time as well as space displacement. There is also the question of whether mind–mind interactions (such as telepathy) are fundamentally distinct from mind–matter interactions (such as PK) or whether they are aspects of a single unitary phenomenon (Roe, Davey & Stevens, 2003; Stevens, 2004; Storm & Thalbourne, 2000; Thalbourne, 2004), an issue which has prompted a number of experimental studies (Roe et al., 2005).

Most paraphysicists would probably agree that one should try to obtain as unified a description of psychic phenomena as possible, without invoking a new feature of physics for each one. This would correspond to the 2/3 boundary in Table 1 progressing in a single big step rather than a lot of little steps. Indeed, the introduction of the single term 'psi' (although very loosely defined) might be thought to anticipate that. In particular, it is important to have a unified description of psi as it appears in the laboratory and in the field. For example, there has been a large amount of laboratory work on micro-PK (the influence

of psi on a system which is intrinsically probabilistic), with associated theoretical attempts to explain this in terms of quantum effects. However, there has been relatively little attempt to apply these models to the much more dramatic macro-PK manifestations which arise in (say) poltergeist cases. Indeed, some theorists seem to accept micro-PK but remain sceptical of macro-PK, although one might hope that these phenomena are two extreme forms of a single psychokinetic interaction. A similar dichotomy arises when we consider ESP. In laboratory experiments, we do not usually know which 'hits' are due to chance and which are due to psi—indeed some theorists have argued that no transmission of information need be involved at all (Lucadou, 1995). However, it is hard to see how such a model can be extended to some real-life situations (e.g. crisis apparitions), in which genuine information seems to be conveyed. Likewise, one might hope that presentiment effects observed in the laboratory (Bierman & Radin, 1997; Spottiswoode & May, 2003), involving precognitions of a fraction of a second, somehow relate to spontaneous premonitions, involving much longer timescales. Since the study of laboratory psi was prompted by observations in the field, it seems unsatisfactory to reject the latter and explain only the former.

Next one needs to decide which psi process is most *fundamental*, and there are differing views on this. Supporters of Observational Theory (discussed below) would argue that all psi can be explained in terms of observation-induced collapse of the quantum wave-function (which might be regarded as PK). On the other hand, proponents of Decision Augmentation Theory (DAT) attribute psi to precognition (May, Utts & Spottiswoode, 1995a, 1995b), as do some models relating psi to neuronal patterns in the brain (Taylor, 2007). There is a similar controversy over the relative roles of clairvoyance and telepathy in ESP. At one extreme, it has been argued that clairvoyance is the primary phenomenon, with telepathy being attributed to clairvoyant scanning of the agent's brain-state. At the other extreme, it has been proposed that telepathy is primary, with clairvoyance being explained in terms of (precognitive) telepathy with the future state of the mind of the person who confirms the target. (It is because of this ambiguity that the term General ESP or GESP is often used.) This also relates to the controversy over the relative roles of the agent and percipient in ESP, an issue addressed by one of my own experiments (Carr, 1983).

It is important to distinguish physical *theories* of psi from physical *dependencies* of psi or physical *consequences* of psi. As regards the dependencies, various physical influences have been claimed to modify the efficacy of psi—for example, geomagnetic effects (Persinger, 1985; Wilkinson & Gauld, 1993) or local sidereal time (Spottiswoode, 1997). However, this may just reflect the sensitivity of the psychic organ (e.g. some part of the brain) to such influences and may have nothing to do

with the mechanism of psi. On the other hand, geomagnetic effects could still be relevant to the mechanism if one attributed psi to extremely low frequency radio waves, a topic well reviewed by Harvey Irwin and Caroline Watt (2007). In the context of micro-PK experiments, there is also the possibility (Stevens, 2005a) that geomagnetic effects may directly influence the Random Event Generator (REG). Sometimes—as with the claim that sound of a particular frequency can produce apparitions (Tandy, 2002)—it is not clear whether the physical effect is triggering psi or some non-psychic process (like a hallucination). As regards the consequences of psi, ESP may trigger various physical reactions in a subject—such as an electrodermal response—even if this is not recognized consciously. But again this may have nothing to do with the mechanism.

On the other hand, some physical features of psi clearly have important implications for its nature. For example, it has been argued that the presentiment effect may reflect some form of time-symmetry effect (Bierman & Radin, 1997) and a similar idea arises in attempts to link precognition (*pre*call) with memory (*re*call) (O'Donnell, 2006). This touches on a profound puzzle: even though our conscious experience of the world entails a time-asymmetry, all the equations of physics are time-symmetric. In particular, the solutions of wave equations may involve both 'retarded' and 'advanced' parts (corresponding to propagation along the future and past light-cones, respectively). Although the latter are usually rejected as being acausal (in the sense that they would allow the present to affect the past and the future to affect the present), nothing in known physics precludes them. Indeed, one formulation of electrodynamics explicitly invokes the existence of advanced waves (Wheeler & Feynman, 1945). What is particularly exciting is that quantum experiments now provide a possible way of searching for them (Cramer, 2006) and a whole session was devoted to this topic at a recent AAAS meeting. If retrocausal effects were demonstrated, this could have profound implications for psi.

Also of theoretical relevance is the suggestion that the outputs of REGs in micro-PK experiments may contain 'signatures' specific to the individuals trying to influence them (Berger, 1988; Radin, 1989). Indeed, Paul Stevens (2005b) has designed a special 'signature detection unit' and claims to have found such effects already. Although this interpretation is not completely secure, if it were confirmed, it would support the notion that psi involves the transmission of a *signal*. This could suggest a simpler type of ESP experiment, in which the subject picks up the psychic 'call signal' rather than the message itself (Stevens, 2004).

Another interesting issue arises in the context of the sort of micro-PK experiments carried out by the PEAR group (Jahn & Dunne, 1987). It is usually assumed that micro-PK operates by shifting the mean of a supposedly random distribution, and this seems to be indicated by at

least some meta-analyses (Dobyns et al., 2004; Radin & Nelson, 2002). On the other hand, the meta-analysis of Fiona Steinkamp et al. (2002) gives a much weaker effect, which may support the suggestion of Fotini Pallikari (1998) that — over sufficiently long runs (including control periods) — there is no shift in the mean but merely a 'gluing' effect, whereby micro-PK enhances the clustering of both hits and misses. She claims to find evidence for this 'balance effect' from a fractal analysis of existing data (Pallikari, 2001). A subsequent meta-analysis (Bösch et al., 2006) also gives no shift in the mean, although this has been disputed (Radin et al., 2006). Pallikari's claim is controversial but, if confirmed, it would imply that micro-PK is not simply a force. In this case, macro-PK is either spurious or has a completely different explanation (despite the desirability of a unified model). For example, the sort of rotating force field invoked in metal-bending (Hasted, 1981) and RSPK outbreaks (Roll et al., 1973) can have nothing to do with this. Pallikari also relates the balance mechanism to the model of pragmatic information proposed by Walter von Lucadou (1995).

It should be stressed that the balance effect does not constitute a full theory of psi, since it does not explain how the interaction with consciousness actually arises. The same criticism could be levelled at many other purported theories of psi. This emphasizes that there are different *levels* of explanation. In particular, one must distinguish between physical and psychological levels of explanation. There is a large literature on psychological theories of psi and this is very relevant to its experiential aspects (Irwin & Watt, 2007; Wilson et al., 2004). For example, there has been much interest in whether sensory models (Irwin, 1979) or memory models (Roll, 1966) best explain ESP, and in the 'psi-mediated instrumental response' model (Stanford, 1974, 1990) or 'first sight' model (Carpenter, 2004). Parapsychologists are also interested in identifying the personality characteristics of subjects who score highly in laboratory experiments. However, none of this may have any bearing on the more fundamental question of how ESP works. Sometimes, of course, it is not clear whether a feature is physical or psychological. For example, does the decline effect reflect the fact that subjects get bored or does it relate to the balance effect (Pallikari, 2003)?

Finally, in producing a physical theory of psi, we need to decide whether we are demanding a new paradigm of physics or merely tinkering with the current one. It is natural to start off by trying the second (less radical) approach, and there are many reviews of 'tinkering' models (Beichler, 1998b, 2001; Chari, 1977; Dobyns, 2000; Rao, 1977; Rush, 1986; Stokes, 1987, 1991, 1997, 2007). However, the danger is that one will end up grafting so many extra bits onto the old paradigm (like adding epicycles to the Ptolemaic model of the Solar System) that it becomes hopelessly complicated. There is also the problem of *testability:*

there are actually many models for psi and, by adding enough bits to the standard paradigm, one can doubtless explain anything. However, a crucial requirement of a scientific theory is that it should be *falsifiable* (Popper, 1959) and, as emphasized by Douglas Stokes (1991), many paraphysical theories are inadequate in this respect.

Later I will argue that one needs a new paradigm to explain psi, although there is some ambiguity as to how radical a theory needs to be in order to be assigned this status. Nevertheless, it will be useful to start off by reviewing less radical approaches, since some aspects of these may still feature in the new paradigm. The discussion below, influenced by the earlier review of Joseph Rush (1986), groups theories of psi into three general categories: field or signalling models, quantum models and higher-dimensional models. A more comprehensive (and more critical) discussion of the theories in each category is provided by Stokes (1997).

FIELD OR SIGNALLING MODELS

Many paraphysical theories can be viewed as 'signalling' models, in the sense that they involve the transmission of information or energy via some sort of particle or field (these concepts being linked in modern physics). Often the field involved is already part of the current paradigm. This includes, for example, explaining ESP in terms of electromagnetic waves (Becker, 1992; Kogan, 1968; Persinger, 1975, 1979; Sinclair, 1930; Taylor, 1975; Vasiliev, 1976) or neutrinos (Ruderfer, 1980). It also includes explaining PK in terms of electrostatic forces (Lucas & Maresca, 1976; Roll, 2003). Models which explain precognition in terms of tachyons (Feinberg, 1967) or advanced waves (Costa de Beauregard, 1979; Feinberg, 1975; Puthoff & Targ, 1974) or wormholes (Toben, Sarfatti & Wolf, 1975) might also be regarded as being within the current paradigm, even though they involve rather exotic aspects of it. Even more extreme are models which adopt the spirit of the current paradigm but invoke particles like psitrons (Dobbs, 1967) or psi waves (Joines, 1975) with the specific purpose of explaining psi. All these approaches might be regarded as tinkering with the current paradigm.

Although it might seem natural to attribute some psi processes (e.g. remote viewing) to signalling, a serious criticism of all these models is that our bodies have no obvious transmission or reception organs (Braude, 1979). If psi works like a mental radio, there is also the problem of encoding and decoding the signal (Beloff, 1980). Indeed, the claim that psi does not attenuate with distance (while questionable) may be incompatible with any information-theory approach (Frieden, 1998), an argument made forcefully by John Palmer (1978):–

> Generally speaking, the experimental evidence indicates that ESP can occur at great distances and does not decline with distance. These findings do not fit

> well with most hypotheses that physical energies mediate the transmission of extrasensory information. Indeed, the information transmission model may itself be erroneous.

However, as discussed below, even if signalling models cannot work in four dimensions, they may still be viable in higher dimensions, since the viewer and the viewed may become contiguous in the higher-dimensional space. This is a crucial feature of my own proposal.

There are also many theories which invoke some form of *biophysical* field, even though the status of such fields is questionable from a physicist's perspective. Mesmer's early ideas on animal magnetism and vitalistic fluids might be included in this category. More recent proposals include biofields (Burr & Northrop, 1935), 4-fields (Wasserman, 1956), biotonic fields (Elsasser, 1958), eidopoic fields (Marshall, 1960), psi fields (Roll, 1964), bioplasmic fields (Inyushin, 1968) and biogravity fields (Dubrov, 1977). Unfortunately, none of these approaches has gained general acceptance among paraphysicists and all of them have been criticized on the grounds that they are *ad hoc* and unfalsifiable (Chari, 1977; Stokes, 1997). On the other hand, the link with biology is important and reflects the growing interaction between physicists and biologists in orthodox science. It also raises the issue of whether psi is involved in some forms of complementary medicine (Walach, 2000) and in reincarnation cases (Stevenson, 1997) and whether it is a feature of mind alone or life in general.

QUANTUM MODELS

We have seen that quantum theory — which for present purposes we regard as part of the current paradigm — provides at least some scope for an interaction of consciousness with the physical world. It also completely demolishes our normal concepts of physical reality, so it is not surprising that some paraphysicists have seen in its weirdness some hope for explaining psi. Indeed, E. H. Walker (1984a) has argued that *only* quantum theory can explain psi:–

> This must lie at the heart of the solution to the problem of psi phenomena; and indeed an understanding of psi phenomena and of consciousness must provide the basis of an improved understanding of quantum mechanics.

Jahn (1982) also takes this view, arguing that consciousness has two complementary aspects: one particle-like (localized) and the other wave-like (non-localized). However, merely invoking qualitative similarities with quantum effects does not constitute a proper explanation.

The most concrete realization of the quantum approach is 'observational theory' (Houtkooper, 1977, 2002; Millar, 1978; Schmidt, 1975; Walker, 1974, 1984b), according to which consciousness not only collapses the wave-function but also introduces a bias in how it collapses. In this

picture all psi is interpreted as a form of PK which results from the process of observation itself (i.e. there must be some kind of feedback). For example, clairvoyance is supposed to occur because the mind collapses the wave-function of the target to the state reported. This process can even explain retro-PK (Schmidt, 1976), since it is assumed that a quantum system is not in a well-defined state until it has been observed. Another feature of observational theory is that the brain is regarded as being akin to an REG. Thus an ordinary act of will occurs because the mind influences its own brain, and telepathy occurs because the mind of the agent influences the brain of the percipient. Of course, there is still the question of *how* consciousness collapses the wave-function (Stapp, 1993). One possibility is to modify the Schrödinger equation in some way (Lucadou & Kornwachs, 1976).

Observational theory has the virtue that it can make *quantitative* predictions. For example, one can estimate the magnitude of PK effects on the basis that the brain has a certain information output (Mattuck, 1976, 1984) and the results seem comparable with what is observed in macro-PK effects. On the other hand, observational theory also faces serious criticisms. One can object on the grounds that psi sometimes occurs without any feedback. For example, Beloff (1988) has pointed out that there are pure clairvoyance experiments in which only a computer ever knows the target. One can also question the logical coherence of explaining psi merely on the grounds that one observes it (Braude, 1979) and there are alternative models for retro-PK (Bierman & Houtkooper, 1975). Finally, David Bohm (1986) has cautioned that the conditions in which quantum mechanics apply (low temperatures or microscopic scales) are very different from those relevant to the brain.

Nevertheless, many paraphysicists back some form of quantum approach (Costa de Beauregard, 2002; Jahn & Dunne, 1987; Oteri, 1975; Sarfatti, 1975). Some proposals exploit the non-locality of quantum theory, as illustrated by the famous EPR paradox (Einstein, Podolosky & Rosen, 1935). An atom decays into two particles, which go in opposite directions and must have opposite (but undetermined) spins. If at some later time we measure the spin of one of the particles, the other particle is forced instantaneously into the opposite spin-state, even though this violates causality. This non-locality effect is described as 'entanglement' and Bohm (1951) tried to explain this in terms of hidden variables, which he invoked as a way of rendering quantum theory deterministic. Experiments later confirmed the non-locality prediction (Aspect et al., 1982) and thereby excluded at least some models with hidden variables (though not Bohm's). Indeed, John Bell, who played a key role in developing these arguments (Bell, 1964, 1966) and was much influenced by Bohm's ideas, compared the non-locality property to telepathy. Einstein made the same comparison, although he intended it to be disparaging!

Although quantum entanglement has now been experimentally verified up to the scale of macroscopic molecules, it must be stressed that it is not supposed to allow the transmission of *information* (i.e. no signal is involved). For example, attributing remote viewing to this effect would violate orthodox quantum theory. Theorists have reacted to this in two ways. Some have tried to identify what changes are necessary in quantum theory in order to allow non-local signalling (Valentini, 1991, 2002). For example, Josephson and Pallikari-Viras (1991) have a model in which entanglement can be utilized biologically. More generally, Jack Sarfatti (1998) has argued that signal non-locality could still be allowed in some form of 'post-quantum' theory which incorporates consciousness. He regards signal locality as the micro-quantum limit of a more general non-equilibrium macro-quantum theory (cf. Bohm & Hiley, 1995). The relationship between micro and macro quantum theory is then similar to that between special and general relativity, with consciousness being intrinsically non-local and analogous to curvature. His model involves non-linear corrections to the Schrödinger equation and may permit retrocausal and remote viewing effects (Sarfatti, 2002).

Others accept that there is no signalling but invoke a 'generalized' quantum theory (Atmanspacher, Römer & Walach, 2002) which exploits entanglement to explain psi acausally. This is also a feature of the model of pragmatic information (Lucadou, 1995; Lucadou & Kornwachs, 1980), which interprets psi effects as meaningful non-local correlations between a person and a target system. This model may account for many of the observed features of psi, including the difficulty of replicating psi under laboratory conditions (Lucadou, Römer & Walach, 2007). It may also be relevant to homeopathy (Walach, 2000).

Radin (2006) has argued that entanglement is fundamental to psi. This is because he regards elementary-particle entanglement, bio-entanglement (neurons), sentient-entanglement (consciousness), psycho-entanglement (psi) and socio-entanglement (global mind) as forming a continuum, even though there is an explanatory gap (and sceptics might argue an evidential gap) after the second step. If the Universe were fully entangled like this, he argues that we might occasionally feel connected to others at a distance and know things without use of the ordinary senses. This idea goes back to Bohm (1980), who argued that there is a holistic element in the Universe, with everything being interconnected in an implicate order which underlies the explicit structure of the world:–

> The essential features of the implicate order are that the whole Universe is in some way enfolded in everything and that each thing is enfolded in the whole.

This implicit order is perhaps mediated by psi (Pratt, 1997). Most mainstream physicists regard such ideas as an unwarranted extension of standard quantum theory, but one clearly needs some sort of extension if one wants to incorporate mind into physics.

There are various other quantum-related approaches to explaining psi. Some of these exploit the effects of 'zero point fluctuations' (Puthoff, 1989) or 'vacuum energy' (Laszlo, 1993). This is a perfectly respectable physical notion, so it is not surprising that some people have tried to relate this to the traditional metaphysical idea that there is some all-pervasive energy field which connects living beings (eg. chi, qi, prana, élan vital). Indeed, Puthoff (2007) views the zero-point-energy sea as a blank matrix upon which coherent patterns can be written. These correspond to particles and fields at one extreme and living structures at the other, so some connection with psi is not excluded. He writes:–

> All of us are immersed, both as living and physical beings, in an overall interpenetrating and interdependent field in ecological balance with the cosmos as a whole, and even the boundary lines between physical and metaphysical would dissolve into a unitary viewpoint of the Universe as a fluid, changing, energetic information cosmological unity.

A related proposal is that the radiation associated with zero-point-energy might be identified with 'subtle energy fields' (Srinivasan, 1988). These allegedly involve some form of unified energy of such low intensity that it cannot be measured directly (Tiller, 1993). In the electromagnetic context, this idea was introduced to describe the quantum potential (Aharonov & Bohm, 1959) and may be relevant to Bohm's implicate order.

Although these ideas might be regarded as being on the fringe of the standard paradigm, the recent discovery that 70% of the mass of the Universe is in the form of 'dark energy'—most naturally identified with vacuum energy—is stimulating interest in this sort of approach. For example, Sarfatti (2006) has a model which associates both consciousness and dark energy with the effects of vacuum fluctuations, although he does not explicitly identify them.

It should be cautioned that the literature in this area comes from both expert physicists and non-specialist popularizers, so it is important to discriminate between them (Clarke & King, 2006). Although quantum theory is likely to play some role in a physical model for psi, my own view is that a full explanation of psi will require a paradigm which goes beyond standard quantum theory. Of course, nobody understands quantum theory anyway, so claiming that it explains psi is not particularly elucidating—it just replaces one mystery with another one (Clarke, 1996). Also, many of the above proposals already deviate from standard quantum theory, so this raises the question of how radical a deviation is required in order to qualify as a new paradigm. In my view, most of those mentioned above are insufficiently radical and one needs a new approach —perhaps of the kind envisaged by Bohm—that can explain *both* psi *and* quantum theory. One also suspects that the new paradigm will incorporate the idea of retrocausality discussed earlier, since proposed tests of this all involve some form of EPR effect (Cramer, 2006).

HIGHER-DIMENSIONAL MODELS

The space perceived by our ordinary senses is clearly 3-dimensional. However, even before relativity theory introduced the idea of time as a 4th dimension, it was popular to invoke an extra dimension of space as an explanation of paranormal phenomena (Rucker, 1984). Indeed, Henry More's book *Enchiridion Metaphysicum* associated spirits with a 4th dimension as early as 1671, although his contemporary John Wallis regarded this as "a monstrous invention, less likely than a chimera". Less mystical treatments of the 4th dimension—some of which were later influential in the development of general relativity—were presented in the 19th century by such eminent mathematicians as Moebius, Gauss, Riemann, Helmholtz and Clifford. However, the mystical connection resurfaced in what Beichler terms the early-scientific period, when the astronomer Johann Zöllner (1880) invoked a 4th dimension in order to explain some of the spiritualistic phenomena of the medium Henry Slade. Unfortunately, his career was destroyed when Slade was later revealed to be a fraud.

The mystical implications of an extra dimension were explored further (at least by analogy) in 1884 when Edwin Abbott described the effects of a 3rd dimension on the inhabitants of a 2-dimensional world in his book *Flatland* (1983). The idea of a 4th dimension was also championed by Charles Hinton, who coincidentally worked in a patent office in Washington at the same time as Einstein worked in one in Berne. His 1880 book *What is the 4th Dimension?* was subtitled *Explaining Ghosts*, and his 1885 book *Many Dimensions* explicitly claimed that minds extend in the 4th dimension (Hinton, 1980). Although Abbott and Hinton were really popularizers of ideas developed earlier, they were very influential in generating public interest in the topic. Indeed, the period from 1890 to 1905 was a golden age for the 4th dimension and spirits in unseen hyperspace were particularly popular with clergymen. A. T. Schofield's *Another World* (1888) put God in the 4th dimension, while Arthur Willink's *The World of the Unseen* (1892) put Him in an infinite-dimensional space! The idea also influenced literature: Oscar Wilde's *The Canterville Ghost* (1891) lampooned the 4th dimension, while H. G. Wells's *Time Machine* (1895) presaged the idea of time as a 4th dimension.

Most of these ideas fell by the wayside after Einstein formulated his theory of special relativity in 1905. Einstein showed that the 4th dimension really does exist but that it is time and not appropriate for the more exotic purposes envisaged above. However, in the following decades, there were various attempts — mainly from non-physicists — to use Minkowski space (or some extension of it) to explain psi. For example, this featured prominently in the theosophical tradition: P. D.

Ouspensky associated the 4th dimension with mystical unity as early as 1908 and developed this idea further in subsequent works (Ouspensky, 1920, 1931). A book by Whateley Smith (1920)—later Whateley Carington —associated survival with Einstein's 4th dimension, while J. W. Dunne (1927) introduced extra time dimensions (an infinite number of them) to explain the flow of consciousness and dream precognition. His approach was later discredited by C. D. Broad (1953), who nevertheless introduced his own model with just two times. There were also attempts to link the mind with extra dimensions (Dobbs, 1965; Hart, 1965; Price, 1955; Smythies, 1956; Whiteman, 1967) and these models are discussed in more detail later.

In the late scientific period, more mathematical models have been offered by physicists themselves. In particular, a series of papers have studied 8-dimensional models, in which one complexifies the four coordinates of space and time. Indeed, this model has also been proposed in standard relativity, as a way of unifying the equations of Newton, Maxwell, Einstein and Schrödinger (Newman, 1973). The paraphysical application of this idea seems to have been proposed independently by Russell Targ et al. (1979) and Elizabeth Rauscher (1979, 1983), and has recently been reviewed by them (Rauscher & Targ, 2001, 2002). On the other hand, Michael Whiteman (1977) has invoked a 6-dimensional model, with three real times, claiming that this incorporates the Maxwell and Dirac equations. A similar model has been proposed by Burkhard Heim and this is alleged to explain elementary particle masses (Auerbach & Ludwiger, 1992), although variants of this model allow up to 12 dimensions. There is also a 12-dimensional model with three complex space and three complex time dimensions (Ramon & Rauscher, 1980). All these extensions of relativity theory suppose that points can be contiguous in some higher-dimensional space even though they are separated in ordinary spacetime. This contiguity is supposed to explain how events at remote locations or times can be present in consciousness. Indeed, this idea goes back to Gertrude Schmeidler (1972), who invoked folding in higher dimensions to explain some features of psi.

A rather different higher-dimensional approach is to invoke an extra *spatial* dimension. The idea of a 5th dimension was introduced within physics in the 1920s by Theodor Kaluza and Oskar Klein in their attempt to provide a geometrical description of the unification of gravity and electromagnetism. It did not attract much attention at the time but, in principle, a 5th dimension can take on the same role as that attributed to the 4th dimension in the pre-relativistic period. For example, there have been attempts to use a 5th dimension to link parapsychology with UFOs (Brunstein, 1979) and with the manipulation of spacetime curvature by 'biogravity' fields (Toben, Sarfatti & Wolf, 1975). John Ralphs (1992) claims that (what he terms) a 4th dimension (but is

really a 5th dimension) can explain such diverse phenomena as spirit communications, movements of objects through space and time, clairvoyance and dowsing. More recently, Julie Rousseau (2001) has revived Zöllner's proposal that phenomena such as teleportation, apportation and materialization could result from interactions in the 5th dimension. The strongest advocate of the 5-dimensional model of psi is Beichler (1998b) and his approach is discussed in more detail later. He has also provided an excellent account of the history of the 5th dimension in orthodox physics (Beichler, 1999).

By invoking enough dimensions, one can doubtless explain anything. However, like the biofield models, these proposals are subject to the criticism that they are unfalsifiable and do not make quantitative predictions. Also, like the quantum models, they come from a combination of specialist physicists and non-specialist popularizers, so discrimination is required in assessing them. Nevertheless, as a result of the rising interest in Kaluza–Klein theory, there is no denying that the idea of extra dimensions has now taken centre-stage in modern physics. Although there is a debate within the physics community as to whether these higher dimensions have physical significance or are just a mathematical artefact (Woit, 2006), they are of obvious interest to paraphysicists.

THE NEED FOR A NEW PARADIGM

Although all of the above approaches may be relevant to a final theory of psi, my own view is that a full explanation will require a paradigm shift which goes beyond them and perhaps combines them in some way. Even though some psychic phenomena might be amenable to explanation within the current paradigm, I do not believe all of them can be, so the new paradigm must incorporate psi in a more embracing way than any of the particular models described above. Beichler (1998a) also takes this view:–

> Parapsychology is littered with hypothetical structures to explain the psi process, or some features of it, but no comprehensive theory . . . Either psi does not exist or psi is so fundamental that it is intimately interwoven into the very fabric of reality.

Indeed, he argues that the conditions for a paradigm shift are already present and that psi could be the catalyst in promoting it. But what sort of paradigm shift would be required to accommodate psi? In Beichler's view, it must go beyond quantum theory and general relativity, since both of these are semi-classical, in the sense that they inherit some features of the classical paradigm. (He argues, rather perversely, that quantum theory inherits more classical features than general relativity.) I would agree with this, although it is hard to believe that quantum theory—or at least some deeper theory on which it is based—will not

play some role. Whatever the new paradigm, it is likely to be sufficiently radical to provoke a dispute over whether it should be classed as physics, which is why the term 'hyperphysics' may be more acceptable.

One ingredient of the new paradigm may be a transcendence of the usual ideas of space and time. Indeed, as illustrated by the previous quotation from Palmer, many people reject physicalistic models at the outset precisely because psi seems to exhibit this property. However, this rejection is premature since the transcendence of space and time already arises in physics itself in the context of quantum gravity. Indeed, it is possible that the long-sought unification of relativity and quantum theory will itself play a role in the new paradigm. The proposal that quantum gravity may be relevant to the collapse of the wave-function already hints at this (Penrose, 1994). The transcendence of space and time also arises in the contexts of more radical proposals: for example, in Rupert Sheldrake's model of 'formative causation' (Sheldrake, 1981, 1988) and Jung and Pauli's model of 'acausal synchronicity' (Jung, 1985; Koestler, 1972).

Another crucial ingredient of the new paradigm must presumably be consciousness, although it should be stressed that many psi processes may be *unconscious* and Beichler (1998a) has argued that 'life' is the more relevant ingredient. We have seen that there is some indication from physics itself that consciousness is a fundamental rather than incidental feature of the Universe. This idea arises explicitly in the writings of Bohm (1980), who argues that quantum theory introduces a mind-like quality into the Universe. In his holographic model, there is a unity of consciousness, a greater collective mind with no boundaries of space or time:–

> All this implies a thorough-going wholeness, in which mental and physical sides participate very closely in each other. Thus, there is no real division between mind and matter, psyche and soma.

Bohm achieves this by introducing a quantum 'superpotential' (corresponding to a new sort of force) and this also allows an organizing principle, which is rather similar to Sheldrake's morphogenetic field. But how can one incorporate mind into the picture explicitly? In the next part, I will argue that the invocation of higher dimensions (i.e. more than the four usually envisaged) is necessary. However, it is not the *existence* of the higher dimensions which constitutes the new paradigm—that is already accepted by string theorists—but rather the association of those higher dimensions with mind.

This is not a new idea, since we have seen that people have long attributed mental experiences to higher dimensions. For example, Whiteman (1986) has argued that the whole domain of mystical experience can be accommodated in a higher-dimensional approach, and Heim (1988) has made similar claims. However, I believe developments in

physics within the last decade make this idea particularly promising. A number of physicists have emphasized this (Bockris, 2005; Bryan, 2001; Pavsic, 2001), but perhaps the most mathematically sophisticated attempt to connect matter and consciousness through these developments comes from Saul-Paul Sirag (1993, 1996). The key to his approach is group theory: he associates the hierarchy of consciousness with the hierarchy of what mathematicians term 'reflection spaces'. In particular, an important role is attributed to 7-dimensional reflection space, which is a symmetry group of one of the Platonic solids. It may be true that the extra dimensions of string theory were anticipated by Theosophy (Phillips, 1995) and Kabbalah (Lancaster, 2006), but only now is the time ripe for a paradigm shift.

PART 3. PHYSICAL SPACE, PERCEPTUAL SPACE AND HIGHER DIMENSIONS

In this final part of the paper, I will argue that the existence of psi requires one to reassess the divide between matter and mind, famously introduced by René Descartes in the 17th century as a way of delineating the domain of science. This not only provides the bridge between matter and mind promised by my title; it also extends the domain of legitimate science. I will present a model in which (in some respects) the material world becomes mind-like and the mental world becomes matter-like. It would be premature to describe this as a new paradigm (since it is not generally accepted) but it certainly entails the sort of shift of perspective that might be required of a new paradigm. Although the intention is to provide a theory more closely related to physics than metaphysics, the discussion will inevitably have implications for issues which have been the focus of philosophical debate. It will also involve the use of terms (such as material, physical, mental, perceptual, real, etc.) which are inherently ambiguous because they have been used in a variety of ways by different authors. Appendix C therefore clarifies the way in which such terms are used here.

PHYSICAL AND MENTAL SPACE

All of us inhabit two worlds: there is the material world, which is studied by science, and the mental world, which we encounter in our sense-perceptions, memories, dreams and various altered states of consciousness, including certain psychical and mystical states. In the present context, I refer to all of these mental experiences as 'perceptions', although some people use this term more narrowly. Of course, there are many other (non-perceptual) aspects of mind, but we do not focus on these here. As illustrated in Figure 3, comparing the status of a material

and John Smythies (who has engaged me in correspondence about higher-dimensional models for some 30 years). For useful feedback on an earlier draft, I am also indebted to Alan Gauld, Brian Josephson, Fotini Pallikari, John Poynton, Jack Sarfatti and Paul Stevens. For editorial improvements and great patience in dealing with my many changes, I am grateful to David Ellis and Chris Roe. Finally I would like to thank my late SPR colleagues—Arthur Ellison, Maurice Grosse, Monty Keen, Ralph Noyes and Arthur Oram—for their friendship and insights.

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