Emergent Evolution – a Goethean Philosophy Perspective

Dr Robert Rose

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THE AUTHOR

Dr Robert Rose was the modules leader for Philosophy and Anthroposophy at the University of Plymouth and was a consultant and lecturer there from 1992 to 2012. He has a special interest in the contribution of Goethe's way of thinking to contemporary questions after having spent three years studying in the Natural Science Section at the Goetheanum, Switzerland.

PREFACE AND SYNOPSIS

This book is a modified edition of the final version of a Doctoral thesis submitted to the School of Cultural Studies, University of the West of England, and awarded in December 2007. The small changes consist in a few additions to the text for clarification purposes; and some improvements to the diagrams. The arguments and conclusions remain, however, essentially the same. The stylistics are also the same in that frequent reference is made to 'this thesis', meaning the proposals and argument in this text. It is also necessarily 'academic' in that it is a PhD thesis, but it is my belief that the ideas and arguments can be understood by the lay reader as many of the specialist terms are introduced along the way.

It is interesting that the year 2009 celebrates the 150th anniversary of Darwin's '*The Origin of Species'*. I mention this because when 'evolution' is spoken of, Darwinian evolution is often what is had in mind. As this book shows, however, there is more to evolution than this. Evolution covers not just the biological type, but also physical, psychological, cognitive and social/moral evolution; each having unique characteristics of their own. Evolution, in its most general sense, includes the origin and emergence of all that exists and all that could become. In this sense, it should be the concern of all of us; for it is not only important to know where things have come from, but also where they may go to. **We need to develop a sense of Becoming.**

Philosophy has a particular role to play here in that, through it, it is possible to unearth the 'thought forms' that are used when scientific evidence is considered about evolution. Science, I would suggest, is not just about 'facts' but also the underlying philosophies through which 'facts' are interpreted and, in some cases, even observed. Evolution theory, in particular, I would claim, has long since outgrown the naive view that science is only about 'observable' 'facts'. Despite claims to the contrary, evolution is not a fact; I should say, not **only** a fact, but also a **theory** which can be interpreted from different philosophical perspectives. There is nothing inherently wrong with saying that evolution may be both fact and theory. After all, much of evolutionary theory is based on the presupposition of past events which can no longer be observed and only theorised about, of course based on observable evidence in the present. My view is that

philosophy is theorising at its best and most general, I would claim, because it is able to evaluate the 'ways of thinking', philosophies, behind the most central aspect of evolution, namely **emergence**. Emergent evolution is sometimes called **Creative Evolution** as it addresses the question of how new kinds of things came into being in the evolutionary process. Thus 'creativity' is its central question and, clearly, without creativity, there could be no evolution, not even any change at all. Not only is this true of the past, but creativity will enable the survival and flourishing of all beings on the earth in the future. A philosophy of emergence may help understand this creative process in evolution and how new things emerge.

The background to this research is many years interest in things scientific, particularly the world views expressed in so-called popular science writings. To my observation, it is an interesting phenomenon that when scientists wish to express their philosophical views of the world, they do so not in academic science journals, which are tightly constrained to science reporting and analysis, but in popular books. These books, as I will show, are not mere science, but have many types of implications for culture, in particular, how these scientists understand the world in general and our place in it.

Another aspect to my interest in popular science arises from the fact that the scientists with whom I am in basic agreement, and upon whose ideas I develop mine from a philosophical perspective, draw on the German dramatist, poet and scientist J W Goethe (1749-1832). This, in some ways, is a curious phenomenon because, to a large extent, Goethe is almost entirely ignored in academic science journals and in most philosophy of science literature. I was interested in this, as, for many years, I have also been a keen student of Goethe's scientific works and its implication for our world views and self-understanding.

Goethe, however, didn't live in our time. He also expressed his philosophical ideas in poetic form. His *Aphorisms in Prose* are a case in point. This makes his ideas difficult to assess in today's culture, especially philosophically. It is in this sense, that some popular science writings are important because, in some ways, the 'goetheanistic philosophies of science' present in them can be more readily evaluated. Throughout the following text, therefore, there will

be significant references to Goethe, but the primary literature for investigation will be that of popular science.

This also ties in with my more general interest in the kinds of worldviews which are being mediated to the public. As I will show later, popular science is very widely read throughout the world, it is not only popular in the sense of being written for the lay reader, but is also popular numerically in that millions of people read it. It is also popular because it can act as a mediator between different specialisms: popular science is an arena where scientists go when they want to understand a specialism other than their own. In light of this, I am interested in the contribution of 'goetheanistic philosophy' to the debates in popular science literature, particularly in widespread Anglo-American mainstream publications.

The title of the thesis expresses its main argument: that **Being** and **Becoming** are the two fundamental principles that can explain emergent evolution. The first of these, Being, is built on Goethe's idea that Beings are their own explanation. Being, as a general principle and Beings in the special, are not to be explained by something other than, or outside, themselves. Being and Beings for this conception are unified and fundamental for explanation. Becoming is a further development of this in that it is interpreted as the unified transformations between Actual Being and Potential Being. Another way of looking at this would be to say that Becoming is 'Being in the Process': Being and Beings are not static, they are undergoing continuous change. After this fashion, **the emergent phases that occur in evolution can find their explanation as their own intrinsic forms of reality in the process of Being and Becoming**.

This thesis, then, is an argument against physicalism: **the emergence of the World, in my view, is not determined just by physical reality; it is a layered sequence of unique realities expressed in the appearance of Whole Beings and the Becoming of Whole Beings from out of, and between, Potential and Actual reality.**

To begin with, in chapter 1, I show how scientists' philosophies of emergent evolution are situated in popular science literature. I describe how emergent evolution is usually explained through two

basic kinds of explanation called reductionism and holism. Reductionism is usually expressed as 'the parts explain the whole' and Holism as 'the whole explains the parts'. I show that there are many different ways of understanding this and that such propositions need a deeper understanding. An aspect of this involves considering the dominant form of reductionism, namely physicalism. Physicalism can be viewed as the successor to materialism; but goes beyond this in that it is the fundamental 'objects' and 'processes' of physics which are considered to be the centres of all explanation rather that just motion, extension and mass, as was the case with classical materialism. Physicalism tries to explain the evolutionary emergence of new phenomena through the laws of physics. In contrast, the view called emergentism argues that new phenomena have their own kinds of explanation; and are real unique wholes.

In chapter 2, I argue for a particular kind of Realism. I show that explanations of emergent evolution should be seen as being about reality, that is, about what exists. This is in contrast to nominalism which considers explanation not to be about reality but about being adequate empirically. I try to show that nominalism can only do this on the basis of some reality principle and that due to this that there is a kind of realism implicit in it. If that is the case, then no philosophy of emergent evolution can be completely nominalistic and that realism must be the aim of its explanatory principles. I also argue against the normal sort of Scientific Realism: the view that the only kinds of reality are the actual unobservable entities, laws, properties and causes of physics. I show that this unobservability undermines this position when applied to emergent evolution; and that empiricism is correct in its critique of it: the unobservable cannot be known. I disagree with empiricism, though, when it claims that only the observable can be said to exist. I argue that 'thinkable' Potentialities can be thought to exist if they can be tested out through observation; it is the relationship between the 'thinkable' and the 'observable' which enables us to know reality.

To do this, I show that a diversity of explanations imply a diversity of reality. This is done through showing a holistic relationship between ontology and explanation and method. I will demonstrate that this does not imply accepting realities other than the physical as in any way unscientific.

In chapter 3, I show that a diversity of explanations is either implicitly or explicitly accepted by many scientists and that this implies extra kinds of reality, or being, in addition to the physical. This is in opposition to physicalism. Physicalism argues for a uniformity of explanation, I shall be arguing for a **diversity** of epistemological and ontological explanations. This is a view called pluralism.

In chapter 4, Being or reality, I will also argue, is also inclusive as well as plural / diverse. If applied to emergent evolution, this means that emergence can be interpreted as the appearance of new kinds of reality that include the lower level kinds. Through this, inclusive emergence allows for an increase in the **'depth' of explanations** over evolutionary time and that this gives a degree of deeper explanation to the lower level realities like the physical and the biological. The latest phase, the cognitive/ social phase of evolution, for this interpretation, is the deepest form of explanation and, as it is inclusive of the earlier phases, can be said to give them a deeper meaning. The cognitive/ social phase arguably, then, gives a deeper level of meaning to the sentient, biological and physical phases in addition to their own.

In chapters 5 to 8, I consider also the notion that evolutionary emergence can be explained through a concept of Potentiality. In this research, the Potential is conceived as a 'Creative Whole Over Time', and the Actual as the set of 'Created Parts in Time'. In this, the concept of Becoming is a way of unifying the Potential and the Actual and the transformations between. I argue for a form of emergentism which explains the appearance of realities like the physical, biological, cognitive and social through the idea of potentiality. For each of these cases, I show that they can be explained as potentialities and actualities, being self-creating (autopoietic) and as diversifying. Some differences arise, however, in that the emergence of the physical is about ‘reality in-the-general’; biotic emergence is on the level of the species; whilst that of the cognitive /social includes an element of the individual as well as that of the community.

(1) EXPLAINING EMERGENT EVOLUTION

(1.1) Introduction

The research presented here focuses on the **implicit philosophies of scientists'** present in popular science literature**.** This will be done with particular reference to their theories of knowledge (**epistemologies**) and their ideas of reality (**ontologies**). It explores how these philosophies are applied to the concept of **Emergent Evolution** (Capra 2002 & 1997; Bohm & Peat 1987; Gould 2003; Rose 1997; Wilson 1998). The general argument of this research is that:

> **Potentialities as 'Creative Wholes Over Time', and the source of Becoming, are better kinds of explanation of emergent evolution than those provided by Physicalist Reductionism**.

Ideas of emergent evolution can be found in the theories of cosmological, biological, psychological, cognitive and socio-cultural, evolution. It is about how to explain the emergence of new laws, properties and entities, etc. In its most general sense, **emergence is about 'The New' and how it was created, it is about how to explain the creative process in general evolution**. It is an issue that has also been addressed by philosophers of science (Ayala 1983; Nagel 1974; Popper 1977; Silberstein 1999, 2002).

This thesis, however, concentrates on the implicit epistemologies in popular science writings rather than on the principles of explanation according to the philosophy of science. It addresses the implicit theories of explanation the popular sciences use in their application to emergent evolution, along with the unresolved epistemological and metaphysical problems and questions thrown up by these theories. The thesis also investigates the relationship of such epistemologies to methodology and to a possible metaphysics. Towards the end, the thesis briefly considers some social and moral implications of a new kind of metaphysics of emergent evolution.

In the majority of the text, the investigation will be in terms of the principle explanatory strategies employed in popular science which are **holism and reductionism.**

Reductionism and holism, however, each have a number of perspectives and interpretations. This research tries to show how these perspectives and interpretations affect each other. This, in turn, leads to the many different kinds of explanations of emergent evolution that will be investigated here.

In the further sections of this chapter I will: 1) locate popular science within culture with the philosophical being a part of this; 2) identify fields of emergence and philosophical explanation in popular science. Also in (1.2) I will: 3) map out issues of emergence within the context of the philosophy of science as a preparation for the rest of the thesis.

(1.1.1) Popular Science as Philosophy in Culture

Before I go into the philosophical investigation of popular science literature, a question that could come up at this point is: why research popular science? Is not this popularity a problem in that it makes such a philosophical evaluation untenable? Does not this popularity make the literature base opaque and therefore not worthy of research? My answer is no, because, at a closer inspection, one may see popular science as **philosophising** in **culture** and as such is worthy of research. This answer is deceptively simple, but the reality is far more complex. The reason for this definition is to get away from the idea that popular science is **only simple science**. As I will show, however, a considerable amount of popular science is of a philosophical nature and not merely 'simple science'. Moreover, since it is my proposition that popular science can be found in many different kinds of disciplines of both an academic and a popular nature, it follows that insofar as it ingresses into other cultural arenas, its philosophical problems should come into focus. This research explores, in this sense, the **philosophical** aspects of popular science as a phenomenon that permeates the many 'dimensions' of culture.

It therefore makes sense to briefly consider the **popularity** of popular science, as well as the **cultural domains** and **media** into which the popularity extends, before pursuing its epistemological and metaphysical analysis. It is, after all, in the cultural domains in which the philosophical aspects of popular science have their potential influence and where many of us make sense of science. Such

implicit, and sometimes explicit, ‘philosophies’ need therefore their cultural contexts to be identified.

The scope and possible influence of popular science has been indicated by many researchers. For example, Shermer (2002, p. 489) writes: "Although popular science exposition has a long historical tradition.., never has there been such a market for science books, particularly works written for both professional scientists and general audiences interested in the profound implications for society and culture of scientific discoveries". Citing examples of: Sagan's (1980) book *Cosmos* and the associated television series which was watched by a half a billion people in 60 nations; Hawking's *A Brief History of Time*, which sold over 10 million copies worldwide; and Gould's multiple successes at publishing; Shermer provides some evidence of the world wide popularity of popular science and its potential cultural significance.

From another perspective, Cassidy (2005; 2006) has also shown that popular science has had wide coverage in the media. Focusing on the publication of evolutionary psychology, she has shown that there have been 458 articles in the broad sheet press between 1992 and 2002. Likewise, Dingwall and Aldridge (2006; 2003) have discussed the presentation of popular science based on evolutionary ideas on television.

There are of course many more examples than this. Many popular science books are multiple authored which gives a different picture of the number of popular science publications there are. For example Brockman's (2002) *The Next Fifty Years*; Rose & Rose's (2000) *Alas Poor Darwin*; Aunger's (2000) Darwinizing Culture; Cornwell's (1995) *Nature's Imagination*; Hilgevoord's (1995) *Physics and Our view of the World*, Grafen & Ridley's (2006) *Richard Dawkins - How a Scientist Changed the Way We Think*, are but a few instances. In these publications alone, there are 111 chapters by different authors. It seems to me without doubt that, at least from a numerical perspective, popular science is of cultural significance, but the question is: what is its nature?

Clearly this raises a further question: what **is** popular science and how can we evaluate its cultural significance? To some, however, popular science might mean just 'simple science' and is therefore not

really worth investigating, even if many people do read it. The mere fact of the widespread consumption of popular science does not by itself justify its critical investigation. This, however, invokes the problem of the process of **how** a work of popular science comes about and the specific nature of its **content**. The hidden assumption of this is that the process of popularisation somehow diminishes the worth of a piece of literature. This is something that I challenge. Secondly, some may assume that popular science has nothing else in it but simple science. This I also question.

In the first place, the idea of popular science cannot be dissociated from the issue of the popularisation. This has been researched within the cultural and social studies of science. This is usually investigated under the heading of how scientific knowledge is communicated. To countenance the 'simple science' position would be to subscribe to what has been called "The Dominant View" (Hilgartner 1990). The dominant view claims that the process of communication is a one directional linear model - from academic science to popular science - and is based on the ideas of electronic communication theory established in Shannon and Weaver's (1949) *The Mathematical Theory of Communication* (cited in Lewenstein 1995).

There are, however, other models of how scientific knowledge is communicated and which aid the conceptualisation of popular science. Hilgartner (1990) proposed that the process is two directional, rather than one: "downstream" towards popular books from "upstream" academic contexts; and "upstream" from "downstream" popular contexts (p. 528). This means that not only can one find academic science represented in popular science, but also that academic science has contents derived from popular science. Lewenstein (1995, p. 426) has argued for a "Web of Science Communication Contexts" which he sees a kind of circle or sphere where all forms of communication lead to, and influence, each other. Hall's (1980) model of communication is that of a circuit in which meaning can arise not just from that which is read into a 'text', but also from that which is read out of it, it makes an allowance for meaning arising in the reading subject and being then fed back into the process of communication. Examples of down streaming could be when scientists write their own popular science books, for example Capra (1997, 2002), Dawkins (1992; 2002), Gould (2003),

Weinberg (1993), Wilson (1998). Examples of up streaming could be when popular science content is used substantially in academic journals, for instance Balashov (1992) draws on Weinberg (1977); Bryant (2004) refers to Blackmore (2000) and Dawkins (1976); and Scott (2004) discusses Goodwin (1994), Gould (1989) and Kauffman (1993). These are just a few examples; practically all journals used in this research had references to popular science, no matter the discipline of the journal.

From the perspective of **social domains**, Pels (2003) has considered science, both academic and popular, in a 'social triangle'. This notion breaks the simple directionality of the relation between the popular and the academic and adds the three dimensions of culture, politics and economics. Pels sees science as being embedded primarily within culture, but is influenced by this triangle of relationships that describe society as a whole. In this, the media plays a central role. He does not write specifically of popular science, but it could be suggested that his social triangle is helpful in understanding what popular science is. This may true of his ideas of the processes that intervene between the three spheres: the culturalization of the economy, or the economization of culture; the culturalization of politics, or the politicization of culture; the economization of politics, or the politicization of the economy. In the context of this research, the social triangle may help understand what popular science is and show how it is not just simple science, but has cultural, political and economic implications. From a research perspective, one has to consider not only how culture, politics and economics may affect popular science and its embedded philosophies, but also the reverse: how does popular science affect the way culture, politics and economics are conceptualised and, perhaps, practiced?

There is however, another aspect to consider, namely that of **critical evaluation**. What the above points to is merely an **analysis** of what is there, of what exists, and can be identified in the relationships between popular science and the three social domains. But the question is: how is any of this to be critically evaluated? Broks (2006), however, has also presented an extended understanding of what popular science is. He calls this the "Critical Understanding of Science in Public" (CUSP) which is multidirectional, contextual (social, political and cultural), extends expertise (regarding

'professional' and 'lay'); and is concerned with meaning. The latter of these is the most important for him as he argues "Science, perhaps above all else, is a search for meaning... if we are able to make sense of the world it is because we are able to *make it make sense* to us within our own sense-making environment or culture" (Broks 2006, p. 135).

Most of the above models are about **how** scientific knowledge is communicated, with the exception of Broks who suggests a critical perspective and a meaning perspective. My investigation is about the **what**, that is the **content** of what is presented in popular science and is in this way a complementary approach to a critical understanding of science in public. My research is also concerned with meaning in so far as the philosophy of explanation is also concerned with meaning (Curd & Cover 1999, p. 886).

To answer the question "what is popular science?", therefore, is no easy task as it involves many kinds and layers of meaning that require critical evaluation. Not only is there a large number of authors from different professions who write in popular science (which contributes to the different layers of meaning); there is also a significant number of authors from different **domains** of discipline who also draw on popular science in order to make their own arguments in literature of a different nature. For example, Fukuyama (1999), a public policy theorist, has made an argument for the reconstruction of the social order on the basis of the ideas found in Axelrod (1997) and Dawkins (1991, 1992). Runciman (1998) has discussed and advocated the idea of an evolutionary approach to sociology drawing on Dennett (1995) and Dawkins (1992). The philosopher Peter Singer (1999), in his political argument for a Darwinian Left, made specific references to Axelrod and Dawkins, as has Arnhart (2005) in his proposition for a Darwinian Conservatism, there is even an evolutionary 'third way' in what may be seen as a hybrid of popular science and popular politics published in *Prospect* magazine (Kay 1998). Surprisingly, perhaps, Jonathon Porritt (2006), Chairman of the new UK Sustainable Development Commission, appointed by Tony Blair, has made substantial references to the popular works of Capra (2002) and Dawkins (2002) in his vision for a sustainable future. Likewise, Blackmore and Smyth (2002) have made arguments for a 'systems' approach to

global citizenship, as well as Stoll *et al* (2003) have for a holistic form of education, both drawing on the work of Capra (1997).

From this brief consideration, based on the works of Hilgartner (1990), Pels (2003) and Broks (2006), I propose the following definition of popular science:

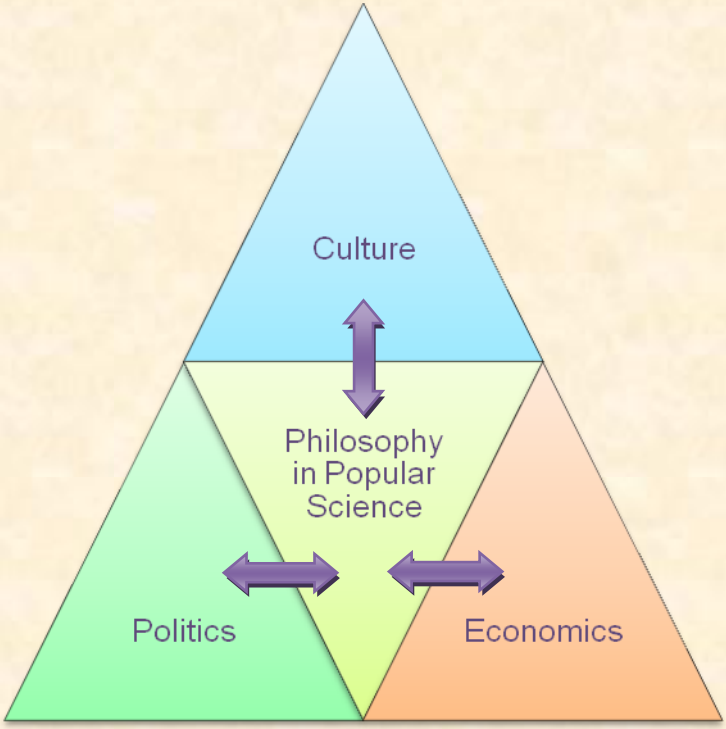
> Popular Science is not just simple science but is truly **multidirectional** (downstream, upstream), **multidimensional** (cultural, political and economic) and **multilocational** (on a continuous scale between the academic and popular) and as a consequence has multiple layers of meaning.

In this sense, popular science is a significant component of global culture and is worthy of critical evaluation.

But this research cannot investigate all of this, so the question is: is there some common theme amidst all this? I would argue that one of these layers of meaning in popular science, in addition to the social, political and cultural, etc., is the **philosophical**. In a sense, the philosophy of explanation is a common theme which comes up no matter the specific discipline. Within popular science, one can find scientists' philosophies (Dawkins 1991; Deutsch 1997; Gould 2002; Rose 1997; Smolin 1997; Wilson 1998; etc), as well as those of philosophers (Dennett 1995, 2003; Feyerabend 1995; Grayling 2006; Hesse 1995; Midgley 1995; van Fraassen 1995; etc); sociologists (Benton 2000; Erickson 2000; Nelkin 2000; Shakespear 2000; Sperber 2000); anthropologists (Bloch 2000; Ingold 1998, 2000; Kuper 2000); and cultural and literary theorists (Besley 2006; Carrol 2006; Wheeler 2006). In this way, **the philosophy of explanation is a meeting point for the diverse disciplines represented in popular science and is a key to the competing positions found there.** My primary approach is to try to find out, **from an investigation of popular science texts**, what scientists (and others) are saying about **philosophical explanation**. In other words, this research concentrates on what scientist's explanations mean and makes a critical evaluation of them. I want to take scientists' philosophies seriously.

This may be modelled as follows:

Fig 1.0



The research then treats popular science literature from a philosophical perspective. That is to say, because it is concerned with the **content** of popular science, and because it argues that this content constitutes an **implicit epistemology with metaphysical, and some social, consequences**, the research is 'philosophical'. As such, this research approaches the implicit epistemologies and metaphysics **as** philosophical accounts, regardless of their literature base. In fact, I would suggest that defining the 'philosophical' with a literature base is rather narrow and misleading. As will become clear, scientists have their own ideas and their own ways of doing the philosophy of science. Sometimes this is comparable with philosophy of science literature, sometimes not.

To some, this very idea might seem to undermine the whole investigation. The fact that the literature is 'popular' suggests that it is not to be taken seriously. Such a view is rejected here in favour of

the proposition that it is in popular science that culturally relevant and interesting philosophies of emergent evolution can be found and that it is important to take these philosophies seriously. If then the significant cultural reach of popular science is taken into account, then it becomes clear that it would be culturally negligent to ignore it.

In light of this, I think it necessary to see popular science studies in a broader sense than 'simple science' or even 'science in a cultural context'. Popular science studies should also be about the critical evaluation of the philosophising in popular science, as well as their models of explanation, whether they are implicit or explicit. I shall consider that whilst this literature is popular in terms of expression, i.e., that such literature is expressed in a way understandable to the general public, it is not 'popular' in the sense of being simplistic. That is, popular expression does not imply simplistic content. Of course, one can find both simplistic content and expression in an individual piece of work, but one type of 'popularity' does not follow from the other. In other words, there is some very serious content to be found in popular science.

For popular science studies this means that there is important research to be done on the philosophies of explanation to be found there rather than just with their cultural implications. It seems to me that the impact of culture on science, and the reverse, can only be understood if the implicit philosophies in popular science are also understood. What I am suggesting is that, whilst it is theoretically possible that cultural and political ideas influence explanation, there is also the equally plausible research possibility that there are some important explanations to be found in popular science with regards the 'objects of explanation'. This means that I shall treat the explanations as if they may, or may not, be good explanations of the objects concerned. Consequentially, I propose that the contribution made by this thesis can be found on three basic levels:

1) An identification of the variety of different scientists' views concerning the nature of reductionism and holism and their application to emergent evolution. This primarily consists in a systemic and thorough study of the epistemologies of **scientists**, and compares them to some degree with philosophers of science.

2) A critique of those ideas, showing where they are sufficient or insufficient as principles of explanation and as explanations of emergent evolution, and of the metaphysical problems to which these epistemologies give rise.

3) Some new proposals, in light of the above, for a distinctive form of explanation relevant for emergent evolution. Each of these three levels will be found integrated under the headings of my contribution.

(1.1.2) Emergence and Philosophical Explanation in Popular Science

The next question after 'why popular science?' is 'why emergent evolution?' The answer is that it is also a frequent theme in popular science. No matter what the discipline is, be that cosmological (Davies 1992; Smolin 1997; Weinberg 1993); biological (Dawkins 1991, Goodwin 1994, Gould 2003, cognitive (Boden 1994, 2004, Mithen 1996, 1998); or social (Ingold 1998, Wilson 1998), evolution, the question of emergence comes up. In each case, emergent evolution is about the creative process through which any kind of new 'phase' of evolution comes about. In this sense, emergence is one aspect of what I shall call general evolution:

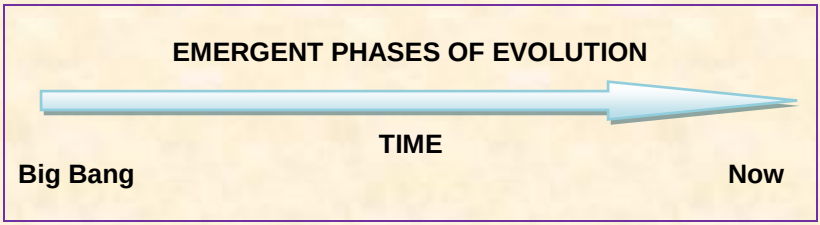
> **General evolution will be conceived here as the emergence of new kinds of phases of reality and their maintenance in existence.**

Clearly, this research cannot be about all of this, so the intention of this section is to derive a model for making a **philosophical analysis of explanation.** To begin, I will briefly summarize emergent evolution and the emergent phases of evolution, giving only indications of the differences of interpretation. I will then try to develop various philosophical issues about the creative processes of evolution which will be addressed in the subsequent sections. Naturally, various positions will be implicit in the picture to be described, but I will leave critical evaluation for later.

Fig 1.1 depicts the creative emergence of various entities, laws and properties in a time sequence. This picture is drawn from current popular and academic accounts of the emergent phases of evolution. It has to be born in mind that the precise nature of emergence is still contentious. The actual time periods are left out of the diagram, as are the detailed descriptions of the development of galaxies, stars, planets and individual organisms, etc. What I attempt to symbolize are the **creative shifts in phase**, that is, when clearly **distinct new kinds of law, entity or process etc., seem to come into existence**. The new kinds of things that emerge will be referred to in this research as **emergents**. It also has to be born in mind that the same kinds of processes of the previous phases are considered to have carried on operating in the new emergent phase.

Each of these distinct phases is designated by a name which seems to encapsulate the new emergent set of attributes which appeared and developed during the phase. The choice of terminology for the phases is mine, but the ideas that fall under them can be found in current literature under different guises. The phases themselves are called various things by different authors. Harris (1991) has referred to emergent phases of evolution as the physical, organic, mental and reflective. Deutsch (1997) has written about the four emergent strands to the fabric of reality: quantum physics, epistemology, evolution and computation. Capra (2002) focuses on the emergence of life, mentality and consciousness and, ultimately, the social. In general the picture of emergent evolution can be expressed as follows:

Fig 1.1



Physicality	**Life**	**Sentient**	**Cognitive / Social**
Gravity, Strong Nuclear Weak Nuclear Electromagnetism Atoms Chemistry Minerals Planets	Organic Forms Reproduction Metamorphosis Genetic Mutation Natural Selection Plants	Consciousness Desire Perception Subjectivity Animals	Knowledge Conscious Self Morality Humans

Clearly the question about the nature of all the emergent phases is vast, and any theory which included all of them would literally be a

theory of the whole universe. Such a theory would have to include all the laws and the theories of all the sciences from physics and chemistry to biology, psychology and anthropology, etc. But the solution to these problems is not the aim of this investigation.

Again, it has to be said that the precise nature of the emergents are not completely agreed upon. In fact some may wish to argue that the phases themselves are nominal. But for now there would appear to be sufficient *prima facie* agreement that these phases have occurred in some form, even though the most important and interesting details have yet to be explained (Weinberg *et al* 1994).

As can be seen from Fig 1.1, there are thought to be four major types of 'emergents': physicality, life, sentience and the cognitive / social that appear in a time sequence in evolution. In the context of popular science, from a philosophical perspective, questions are then raised about the possible explanation of the later phases by the earlier ones. This is usually phrased in terms of reduction. **Reduction is the philosophical problem of how one kind of theory, or law, can be explained in terms of another one**. For example, Runciman (1998) has argued that the social can be explained by the biological; Blackmore (2000) thinks that the cultural and the psychological (the sentient) can be reduced to the biological; Dawkins (1991) and Wilson (1998) believe that the biological can be explained by the physical. There are opponents to these views in each case who claim that each new emergent requires an autonomous explanation (Capra 2002; Harman *et al* 1994; Rose & Rose *et al* 2000). This position is called emergentism or, sometimes, holism (Silberstein 2002).

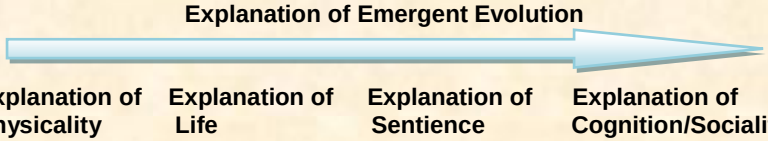
What is common to all the different questions and types of emergence is the nature of **philosophical explanation**. More specifically, the question could be asked: what are **conditions for explanation** for the possible claims for reduction or that an emergent is an autonomous whole? Thus the recurrent debate about **reductionism and holism** is a central convergent feature of many popular science discussions of emergence. More accurately, in popular science literature, **emergence is a test case for reductionism and holism**. Popular science, in this sense, makes a contribution to the ongoing philosophical debate as to which is the better form of explanation.

In this research, the main view that I will argue against is that which is sometimes called **reductive physicalism**: the view that everything is explicable by the physical (Deutsch 1997; Melnyk 2003). With this one sees claims by scientists that the later major emergents are ultimately explicable by the earlier physical phase. As I will show, such a generalisation has many problems connected with it that lead to a false picture of what emergence actually is. For example, it is sometimes assumed that the emergence of life is explicable through the 'physical'. This is done in such a way that the term 'physical' is assumed not to be problematic. But as I will argue, the making of the distinction between 'physical' and 'life', etc., may be a problem in itself, for if one denies the distinction in some way then emergence becomes a question of explaining changes in general reality rather than the emergence of one **kind** of reality from another. It could be that it is the splitting of reality into different 'parts' that is the problem. It could be that a more holistic and pluralist definition of reality is needed. I shall address this in chapter 2.

The philosophical approach to be taken in this research is an analysis of the concepts used in explanation, rather than on the level of scientific detail, but it will consider scientific evidence in so far as it exhibits these general conceptions. The approach taken, as mentioned, in this research will concentrate in the **Theories of Explanation** as they are applied to the problem of emergent evolution. The research considers therefore what it is that counts as an explanation. In section 1.2, I will outline the various possibilities that may count as explanations: is it just the usual concept of law that can be considered to be an explanation or can properties and entities etc., also be new kinds of laws of explanation? In chapter 2, I will explore the possibility that all these are intimately linked and cannot be truly separated with regards to explanation.

This research will therefore evaluate an abstract model of the explanatory principles applied to emergent evolution. As such it will investigate the following model:

Fig 1.2a



In this research, I shall be considering what counts as an explanation as clearly the model depends largely on how this is understood. Philosophers also refer to the so-called Deductive - Nomological (D-N) model of explanation which makes laws the termini of explanation. This is differentiated from the Inductive - Statistical (I-S) model (Curd & Cover 1999; Hempel 1999). I shall try to avoid arguments about the differences between the two and simply refer to the 'law model' of explanation. The law model is usually framed in the following way:

Fig 1.2b

The research conducted here is about the necessary conditions for an **evolutionary** sequence of **explanatory principles** that are required to explain emergent evolution. These principles are about the relationship between **sequences of explanation**. The ontological implications of these will also be considered. What this means in relation to Fig 1.2, is that supposing, for the sake of discussion, there are these four basic kinds of explanatory principles, as proposed by popular science, set into a time sequence, the question is: what are the fundamental epistemological principles through which any one of the phases could, in theory, be shown to be explained in terms of another.

The usual view, which I will describe shortly, is to try to explain all the phases, in an ultimate sense, in terms of the earliest one, that is the physical. There are many interpretations of this 'reductive physicalism' and this thesis is about whether any one of them is justified or if some kind of holistic explanation is required?

In the following, two kinds of emergence are discussed both of which I shall call 'evolutionary emergence' as they are both about a kind of 'unfolding over time'. The first kind may be called developmental emergence in that it is about the emergence of new 'emergents' of an individual. The second kind of emergence is the one that will be mostly discussed and is concerned with evolution in a very general sense and is about the coming into being of the four phases mentioned. I shall treat Darwinian evolution as a more special case of this. I shall investigate the philosophies of explanation behind both these kinds of evolutionary emergence.

(1.2) Emergence in Philosophy and Popular Science

In the above, I introduced the emergent phases of evolution and an abstract model for its philosophical analysis in terms of explanation (figs 1.2a & 1.2b). Here I will consider the ideas of emergence in the context of the philosophy of science and popular science. This is seen as a preparation for the investigation of popular science in the rest of the thesis. I will try to provide a more detailed map of possible positions and arguments in order to furnish a deeper understanding of what reductionism and emergentism (or holism) actually are. Hopefully, this will lead to a greater clarity of the competing positions found in contemporary debates. I will largely describe at this point, leaving the deeper critical analysis and proposals for later chapters.

(1.2.1) Emergence and Reduction: Dimensions and Objects

To understand the questions of emergence and reduction, I would argue, one has to go beyond the simple catch phrases of 'the whole is explained by the parts' (reductionism) or 'the parts are explained by the whole' (emergentism). I shall propose that the problems of reduction and emergence can be better researched from the perspectives of **dimensions** and **objects** (cf Ayala 1983; O'Connor T *et al* 2005; Popper 1977; Ruse 2000; Silberstein 2001, 2002; Van Gulick 2001). The dimensions are: ontological, epistemological and methodological. The objects are entities, causes, properties and laws (see Fig 1.3). From out of these perspectives, a complex map may be drawn and a variety of philosophical **arguments** identified and **positions** located. I shall draw on the above authors, but the overview I shall provide is designed to meet the needs of this research. I shall first describe these in a theoretical way outlining the

logically possible positions that may be taken. I shall leave the identification of particular authors with specific positions until later.

Both reductionism and holism can be applied to each of the three dimensions. This normally generates three fundamental types of debate: ontological reductionism versus ontological emergentism; epistemological reductionism versus epistemological emergentism; methodological reductionism versus methodological emergentism. From these there are some combined positions that I will go into shortly. These three dimensions can, in turn, be applied to the variety of 'objects' of emergence. I would like to depict this in the following table which generates a kind of space of a greater variety of possible positions:

Fig 1.3

Reductionism or Emergentism		
Dimensions:		
Ontological	Epistemological	Methodological

Objects:			
Entities	Causes	Properties	Laws

In the ontological dimension, the issue is about what the world is composed of. Primarily, this is about what kinds of things can be said to **exist**, or exist **fundamentally** rather than **secondarily**. The most extreme form of ontological reductionism would argue that the world is made up of **only** the most fundamental entities of reality

(such as the fundamental particles proposed by physics) and also is determined by the causes, properties and laws that these imply. For ontological reductionism, all emergent phenomena are combinations of, and caused by, **physical** entities. For this position, emergents do not have fundamental existence, only secondary existence. In terms of Fig 1.1, ontological reductionism argues that the phases: life, sentience, cognitive and social; do not have fundamental, or primary, existence, as they are merely outcomes of the **physical**. Ontological emergentism, in contrast, claims that there are more than physical entities, causes, properties and laws and that the later phases have their own distinct fundamental kinds of existence.

For the epistemological dimension, the question is what kinds of ideas are necessary for an **explanation**. For this dimension, explanation does not necessarily imply existence. In popular science, in contrast to the philosophy of science, this is not often discussed in relationship to ontological implications. For example, the concept of 'life' may be a useful explanation, but for some this does not imply that 'life' exists as a distinct form of reality from that of the physical (Mayr 1997). It is thought, for example, that it is logically possible to be an ontological reductionist but at the same time be an epistemological emergentist (Stoljar 2001; Van Gulick 2001). Epistemological reductionism is usually phrased in terms of the possible reduction of one theory or law to a more fundamental one. Epistemological emergentism, on the other hand, argues that there are other kinds of genuinely independent explanations.

The methodological dimension is the **research procedure**. It is a process of how a part of reality, or a kind of theory, can be analysed and synthesised. The analysis consists in the deconstruction of a complex situation to discover the most fundamental parts of reality, or of a theory. The synthesis consists in how these parts are re-constructed into the whole from which they are derived. Methodological reductionism is the process that one has to go through in order to explain something in terms of its most fundamental parts. Methodological emergentism, were there such a thing, would need to argue that in the process of synthesis, explanations may be found on many levels, not just on some supposed fundamental level. Clearly, the methodological and epistemological dimensions are intimately connected and, in some ways, the former is an aspect of the latter. However, as I will show in

chapter 2, a consideration of the procedural aspect of method may help enlighten the consequences for the epistemology and ontology of emergent evolution.

(1.2.2) A Brief History of Emergent Evolution

The philosophy of emergence has a history dating back to at least the 19th century which can be viewed from the epistemological, methodological and ontological, dimensions outlined above. Stephan (1992) connects the beginning of emergentism with the works of John Stuart Mill (1843) and Alexander Bain (1870). Later, in the early 1920s, emergent evolution reached a certain prominence with writers like Alexander (1920), Broad (1923) and Morgan (1923). These early emergentists were primarily interested in ontological questions in that they were concerned with what kinds of things could be said to exist and in what way. Prime examples of emergents included life and mind. The new kinds of "things" that emerge in evolution are called "Emergents" and are distinguishable from "Resultants", the latter of which are those kinds of things that can be explained through "mechanistic interpretation" and "algebraic summation" (Morgan 1923, p. 8). Emergents, on the other hand, are new kinds of things that cannot, supposedly, be explained by either of these.

In general, the early emergentists tried to distance themselves from strict materialism on the one hand, and vitalism on the other. What they tried to argue was that new emergents could arise in evolution and that these were irreducible to the physical base from which they arose. The emergents had the **physical** *as* their **base**, but once having emerged they were irreducible to that base. On the other hand, these emergents were not to be explained through some supernatural, vitalistic, or "extra-natural", Power, but were seen as "natural" (Morgan 1923, p. 2). In this sense, emergentism was an attempt to be "naturalistic" and "physicalist". Today, this view may well have converged with a position called "non-reductive" physicalism as the prime aim was to accept emergence whilst at the same time being scientific (Kim 1992; McLaughlin 1992).

A later stage of the philosophy of emergence began in 1926 with the "Sixth International Congress of Philosophy". This stage lasted until 1961 with the appearance of Nagel's (1961) "The Structure of Science". This phase of the history of emergence coincided with the

appearance and development of logical positivism which lasted from the 1920's till around the 1960's. In this historical context, emergentism was considered from a largely epistemological / logical perspective. I will consider this shortly, but for now it can be said that the discussion was about the logical problem of how one theory could be derived or deduced from another. Nagel put forward some arguments concerning the epistemology of emergent evolution. This involved a consideration of so-called "bridging laws" that linked one kind of theory or law with another. What this consisted in was the two types of potential reduction: **homogeneous and heterogeneous**; and the **conjunction principles** that link the theory to be reduced with the theory to which it is to be reduced.

A further stage of emergentism started with the appearance of "The Self and Its Brain" (Popper & Eccles 1977) which issued in new discussions about the ontological questions of emergent evolution. This period has lasted to this day with many publications in philosophy of science literature (Stephan's paper was in the Beckermann 1992 publication). Later examples, I will suggest, of this might be Beckermann (ed) (1992) "Emergence or Reduction", Cornwell (ed) (1995) "Nature's Imagination", Gillet & Gower (eds) (2001) "Physicalism and its Discontents", Emmeche *et al* (1997) "Explaining Emergence: Towards an Ontology of Levels", Knobe *et al* (2006) "Philosophical Implications of Inflationary Cosmology", Korn (2005) "The Emergence Principle in Biological Hierarchies, Robinson (2005) "Zooming in on Downward Causation", Silberstein (2002) "Reduction, Emergence and Explanation".

In the debates today, both the ontological and the epistemological dimension play a role, and there is a small hint of the methodological perspective having an influence (Rose 1997; Wilson 1998). However, the last fifteen years or so have seen a gradual increase in trying to understand the various kinds of emergents in new ways from an ontological perspective. As described by Van Gulick (2001), this may be a historic development of **extraordinary science** as defined by Kuhn (1962). This period, he claims, may be understood as a testing of the boundaries of **normal science** and the issuing in of a new paradigm. There are two ways in which this has been investigated.

The first is the tendency towards a supposed **"physicalist consensus"** (Papineau 2001). As he describes it, there appears to have been a general acceptance that emergent phenomena, like life and mind, are not special forces, but are rather caused by physical forces; that even when emergent phenomena are accepted, there is a "contemporary agreement on the completeness of physics" (Papineau 2001, p. 32). This is the idea that **ultimately** the only things that can be said to exist are physical things; all emergents are, in various ways, explicable by them.

The second way that emergence has been approached, is that some philosophers, for example Dupré (1993) and Silberstein (2001), and some scientists, for example, Harman *et al* (1994) and Thompson *et al* (1991), have embraced an ontological pluralism and rejected a complete physicalism. The discussions now are usually framed in terms of reductionism, holism, and pluralism, but implied in these is whether or not it is scientific to accept emergents as requiring explanations that are not derived from "the physical". This follows from the fact that reductionism often leads to physicalism, whilst pluralism and holism can imply non-physical explanations. Later, I will investigate what the terms "physical", "reductionism", "holism" and "pluralism" may mean as much depends on this.

Furthermore, during the history of emergence and reduction, the basic criteria for what counts as an important emergent were outlined. These criteria can be looked at from both an ontological and an epistemological perspective. There is a wide spectrum of possible emergents: the physical, life, the sentient, cognition and the social. Each of these can be argued to be properties, laws, causes, entities, etc. But the basic question is: what attributes would these necessitate in order to qualify as emergents? Different authors have made some suggestions for these criteria (Alexander 1920; Morgan 1926; Nagel 1974; O'Connor 1983; Popper 1977), indicating three basic notions:

(1) Unpredictability
(2) Novelty
(3) Levels of Development

Whether or not these are sufficient to describe emergence I will leave open for now, but what can be said is that criteria are used to

distinguish distinct emergents like the physicochemical, biological and conscious. In respect of the evolutionary phases outlined earlier (fig 1.1), the implication would be that each phase of evolution could be a possible unique kind or level. They would be novel features of the universe as well as being unpredictable from the theories of prior stages.

The research presented here will concentrate on the contribution of popular science to the philosophy of emergence. I will argue that it is the philosophies found within popular science that more convincing explanations of emergence can be found and that a re-interpretation of the ideas found there is more likely to provide a more plausible solution to problems of emergence.

(1.2.3) Are Emergence and Reduction Compatible?

In the popular science and philosophy of science literature referred to in the previous section, it is debated if emergence and reduction are compatible. I shall refer to some authors as compatibilists, and others as incompatibilists.

Whether or not one is a compatibilist or incompatibilist depends to a large extent what one considers to be an explanation. In fig 1.2b, it was indicated that the ‘law’ is considered to be the explanation. This, however, assumes that they are separate and distinct from the other possible ‘objects’ of emergence indicated in fig 1.3 and that these cannot also be explanations. So there is a basic question as to whether or entities, properties and causes can also be explanations. Moreover, even when new explanations for emergents are asserted, these are often not considered to refer to reality, either that or the reality they may refer to is ignored.

There are, then, two basic ways in which compatibilism and incompatiblism can be argued in relationship to the above 'dimensions' and 'objects' (fig 1.3). The first way is to separate the three 'dimensions' from each other and consider the ontological, epistemological and methodological as being distinct issues. The second way is to separate the four objects from each other and argue for compatibility on the grounds that, for example, laws are more important for explanation than properties. In this section, I will make an outline of these issues leaving the critique until chapters 2

& 3 where I will also make an argument for the unification of the dimensions on the one hand and the objects on the other.

***

Taking the dimensions of (Fig 1.3) as the first issue, descriptively, these distinctions are important and are to be found in the current debate. As pointed out by Ayala (1974), it is possible to be an epistemological anti-reductionist (another term for an emergentist) whilst being an ontological reductionist. A more recent example is that given by Poidevin (2005) who described how, from an epistemological / explanatory perspective, chemistry may not reduce to physics, from an ontological point of view it might. Likewise, it is possible, as Popper (1974) advocates, to be a methodological reductionist but also an anti-reductionist when it comes to one's world view (ontological anti-reductionism). In popular science, Rose (1997) has argued for an ontological unity with an epistemological diversity. The problem with all of these is that a split between the ontological and the epistemological dimensions cannot be seen as self-evident. This is because, were these dimensions unified, then the diversity of one would imply a diversity of the other: an epistemological diversity would imply an ontological diversity.

In opposition to these, I will argue in chapter 2, that such positions are inconsistent not just from the point of view of the realist aim of science, but also from the realist component of the most current form of anti-realism, or nominalism, namely constructive empiricism (Van Fraassen 1980). I shall try to establish a strong connection between explanation and ontology such that a particular kind of explanation necessitates a particular kind of ontology. If it turns out that the normative aim of science is to provide an account of reality, and if that account is based on a diversity of explanations, then it follows that it is only possible, from a normative point of view, to be an ontological emergentist. Similarly, if there is only one kind of ontology, i.e., physics, then, realistically interpreted, there can only be one kind of explanation. I shall argue that a many to one, or one to many, relationship **between** ontology and epistemology would not be a possibility under a realist interpretation of science. However, a many to many relationship is possible, I will argue.

This distinction between the three dimensions is related to the debate about the descriptive *versus* prescriptive / normative accounts of science and whether or not one should have a realist or constructivist interpretation of emergence (Schaffer 2003). For example, if one is committed to physicalism then an independent "law of life" has to be rejected as having any real reference. If on the other hand an epistemologically independent explanation of life is at the same time admitted, then, as I will argue in chapter 2, this commits one to the belief that explanations do not refer to reality. This is a kind of anti-realism of this explanation. This may be consistent with some aspects of a constructive empiricist explanation of emergence, but not with complete realism nor with the realist element of constructive empiricism.

The problem arises as to the justifiability of the disjunction of the ontological, epistemological and methodological dimensions to the debate on a normative rather than just on a descriptive, level. The question is: what are the roots of such a distinction and how is it related to the more general reductionism and holism debate? I shall discuss this in chapter 2.

***

The second approach to the question of compatibility of emergence and reduction is by separating the 'objects' of (Fig 1.3). This has been considered in a number of ways. Gould (2003, pp. 223/4) has argued the emergence and reduction are not compatible because the emergent **properties** cannot be found on a lower level. For him, therefore, properties can be explanations. But there are others who deny this. Weinberg (1993, pp. 48/9) has accepted that there are emergents but has rejected the idea that emergents are **laws**. In his attempt at compatibility, he created a division between laws on the one hand and descriptive properties on the other. A similar position is held by Mayr (1997, p. pp. 19-22) who argues for the distinctive properties of the living state but claims that they obey the laws of physics and chemistry.

Wilson (1998, p. 297/8) is also a 'compatibilist'. He argues this by making a division between **laws** and **entities**. So, for him, the laws of physics have fundamental existence, whilst stars and social institutions are secondary. For this conception, emergence and

reduction are compatible because laws **produce** the entities which have new, emergent, features. Another compatibilist position is that proposed by Balashov (1992) and Kim (1992): that there is an ontological dependency of emergent **entities** on more fundamental **entities**. Likewise, Melnyk (1995, 2003) has argued that emergent **properties** are realisations of physical **causes**. Silberstein (1998, p. 468), in opposition, has argued that emergent properties have causal capacities, thereby rejecting the division between properties and causes.

In each of these cases, there is a question about the division between, *versus* the unity of, the objects of emergence. In chapters 2 and 3, I will put this to question and argue for a unified, holistic, approach to the objects of emergence. This will provide one argument for the idea that emergence is a refutation of reductionism.

(1.2.4) Is the Epistemological Dimension Relevant?

The question of compatibility can be considered entirely within the epistemological dimension, but does it have any ontological implications? The epistemology of reduction and emergence is not a prominent theme today; it has largely been superseded by ontological discussions and may even be considered to be largely irrelevant (Silberstein 2002). However, as I will argue in chapter 2, if the dimensions can be seen in a unified way, then the epistemological dimension has considerable importance. There I will argue that if the epistemological and the ontological are a unity, then what follows for one follows for the other. If a diversity of epistemological explanations are needed for emergent evolution, then a diversity of ontological explanations are also needed. As a taster consider this quote: "Our thoughts can't be explained directly in terms of physics, even though our minds consist in nothing other than exceptionally complex molecular machinery" (Runciman 1998, p. 8). There are many aspects to this, but at this juncture it is important to note the distinction made between what is required for explanation (the epistemological dimension) and what exists (the ontological dimension). This distinction is significant for Runciman as he goes on to argue that there is a need for a diversity of explanations, but only the physical can be said to exist. But if my argument in chapter 2 is correct, then this cannot be held. Hence a consideration of the epistemology of reduction and emergence may

be useful as it could have consequences for the ontological dimension.

The epistemology of emergence and reduction is about the opposing positions of epistemological emergentism (pluralism and holism) and epistemological reductionism. Usually this is framed in terms of the purely logical relationship between laws or theories. This is meant in terms of the relationship between the law to be reduced (the reduced law) and the law that it is reduced to (the reducing law). Nagel (1974) and Ayala (1983) have proposed what they consider to be the necessary and jointly sufficient conditions for epistemological reduction. I shall refer to this as the logic of reduction and emergence as it can be considered, temporarily, without any ontological implications. This is sometimes referred to as the "Theoretical-derivational" model (Silberstein 2002, p. 85). In order to demonstrate the reduction of a theory T 2 to T 1 Nagel and Ayala argue that the latter has a more inclusive **scope of application** within a common framework. This **inclusivity** is meant in the sense of being applicable to more objects of emergence. In addition to this, they claim that **derivability and connectability** are the necessary and jointly sufficient conditions to show the reduction of one theory or branch of science to another. These notions can be defined as: □

> **Derivability**: if laws and theories of a secondary science can be derived as logical consequences from the laws and theories of the primary science, then the former may be said to be explained by the latter. Contrarily, if a law cannot be derived from another one, then it may be autonomous and therefore support emergentism.
>
> **Connectability**: No terms can appear in the conclusion of a demonstrative argument that do not appear in the premises. There must be a bridging premise that establishes the connection between the terms of the primary theory and the terms of the secondary theory. If no bridging premises can be found, then emergentism may be possible.

> **Inclusivity**: a law may be said to be reducible to another one if the reducing law has a greater scope of application which includes the reduced law. If the overlap of inclusion is not complete and if extra inclusive explanations are required, emergentism is supported.

Ayala claims that the condition of connectability is necessary in order to establish a link between the distinctive terms of one science with another in which they do not appear. To demonstrate connectability, the terms of the theory to be reduced have to be defined, or re-defined, in terms of the reducing theory. For example, the reduction of thermodynamics to statistical mechanics required the definition of terms such as temperature by means of such terms as kinetic energy. Also, the reduction of theories and laws of genetics to physicochemistry need terms like gene and chromosome to be defined by terms like hydrogen bond and nucleotide. These he sees as possible epistemological reductions.

To develop the logical conditions of reduction further, the above ideas have to be considered from the perspectives of homogeneous and heterogeneous reduction (Nagel 1974; Friedman 1982). Homogeneous reduction is where two theories share the same conceptual categories; heterogeneous, or inhomogeneous, reduction is where a theory contains a concept or set of concepts not found in the other. The logical issue at this point concerns whether it is possible to carry out a reduction within the same kinds of categories, as well as between different kinds.

The argument from logic is quite simple: if there are essential concepts necessary for explanation present in the proposed reduced theory, that are not present in the supposed primary theory, then reduction is impossible. If there is a justifiable heterogeneity of concepts present, then, from a logical perspective, explanatory reduction cannot occur.

The question then is how could this be applicable to the debate over the creative principles of evolution? What this seems to suggest is that if an emergent needs different kinds of explanatory categories, then it is not reducible. This follows for the criterion of derivability

outlined above: if there are categories of explanation required for an emergent that are not derivable from a supposed primary law, then it is not explicable by it and may be autonomous. This must be set in contrast to the situation where the emergent has homogeneous concepts. This suggests that reduction is in some cases possible.

What this would mean is that if unique explanatory categories of the individual phases of evolution could be established, then the theories of each phase would be contentually wholes, but within which intra-category reductions, or, better, unifications, could occur. It may be that life, sentience and cognition have independent contents from the physical with homogeneous unifications possible on each level.

It may be thought that these epistemological perspectives have little ontological significance. In fact, as indicated earlier, this is a hidden, and unjustified, assumption to reductive physicalism: that explanations of anything other than the physical are entirely epistemological, not ontological. I will try to show, however, in chapter 2, that a realist stance entails ontological implications from epistemology. If this is linked to chapters 3, 4 and 5 to 8, where I will argue for pluralism, holism and potentialism respectively, then I will show that it is also possible to have pluralism, holism and potentialism in ontology too.

(1.2.5) Ontologies of the Creative Base

The majority of philosophers today accept the idea that emergence has occurred in some form or another, in fact emergentism, of the most innocuous kind, can be thought to be the majority position (Kim 1999). Although I don't agree that this is really the case on a fundamental level, I think it may be said that emergence is largely accepted together with a 'physicalist fundamentalism' (Cartwright 1996). This shows itself in particular when the base, or source, of emergence is the question. Not unlike a combination of Aristotle's (1992) 'material cause' and 'efficient cause', this is the question of what it is that emergents emerge from.

Such a question cannot be separated from the more general issue of what one considers to exist. The mentioned 'physicalist fundamentalism', in brief, is the idea that only the physical can be claimed to exist. According to this ontology, the cultural, social, life,

etc., only exist to the extent that they are complex forms of the physical. They do not have their own kind of reality. This is another way of looking at the so-called 'physicalist consensus'.

Physicalism today is considered to be an ontological rather than a methodological doctrine, it does not claim that all sciences should use the same methods as the physical sciences, which was the case with logical positivism (Oldroyd 1986). It is also not to be identified with materialism, which is a more narrow position that focuses on motion, extension and mass (Stoljar 2001). Rather, physicalism is the idea that on its most fundamental level, reality is composed of and determined by those objects defined by physics (Papineau 2001, p. 1 & p. 30). Physicalism is usually the natural position of ontological reductionism as the most fundamental parts of any object are thought to be its physical parts. This is more often as not referred to as "reductive physicalism". The question is how could this position work in principle?

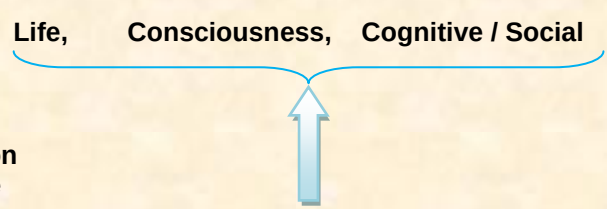
If then emergent evolution is considered, the answers to these questions are framed in terms of the background ontologies of the explainers and these are frequently expressed in terms of a commitment to physicalism. For example, this has been advocated by Kim:

> emergentism presents the world not only as an evolutionary process but also as a *layered structure* - a hierarchically organised system of levels of properties, each level is emergent from and dependent on the one below. (Kim 1992, p. 122)

This view sees emergence as being dependent on lower levels of structure or in evolution. With this definition, emergent properties are not causally independent but are effects of more fundamental causes, in other words they lack any kind of causal efficacy.

The kind of emergents described by Kim is a form of what I shall call **physicalist emergentism** (PE). In this interpretation, physical entities are non-emergent bases from which (material cause) and through which (efficient cause) the emergents come to be. This could be modelled in the following way:

Fig 1.4



The arrows indicate the direction of emergence. For physical emergentism, the creative base is the set of all physical entities, causes, properties and laws. Looked at like this, emergents like life, consciousness and cognition are emergents with regard to the fundamental physical reality. In other words, for physicalism, life, consciousness and cognition are emergent properties **of** the physical base, in fact they are assumed to have arisen **from** the physical. Kim (1992, p. 122) calls this the thesis of 'Ultimate Physicalist Ontology'. For physicalist emergentism, emergents can only arise when the appropriate physical base conditions are present (Artigas 1991; Rohrlich 1988).

There are two basic problems with this view which I will return to in chapter 2. The first is the one that has already been addressed namely the unjustified assumption that the explanations other than of the physical do not refer to reality. If physicalist emergentism argues that everything emerged from the physical, and there is nothing other than the physical, then it is committed to the idea that the emergents **are** physical (Crook & Gillet 2001; Melnyk 2003). But so far there has been no convincing argument that if explanations are needed for the emergents that they do not refer to reality. Secondly, If there is nothing other than the physical then the emergents would, necessarily, be required to be re-defined as the physical. This, as I will argue in more detail in chapter 2, is not a justified move. The physical itself is also diversity, with a variety of irreducible laws, so why not merely accept that reality in general is also diversity?

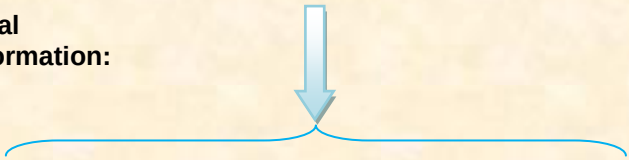
* * *

Interestingly, it is largely in popular science that a different approach to emergence from physicalism has been proposed. It is a group of

views I will call **potentialist emergentism** (or metaphysical emergentism) (Aristotle in Ackrill 1992, p. 143). These views are usually, but not unequivocally, incompatible with the usual form of reductive physicalism. I will go into this in much more detail in chapter 5. There are a number of different terminologies and interpretations of this and I shall later review a few of them.

Bohm and Peat (1987), Davies (1992), Goodwin (1994) and Harré (1993) advocate a kind of potentialist emergentism which is a part of a world view that accepts that ultimate reality is in a metaphysical domain. I shall model this in the following way:

Fig 1.5



I think it needs to be mentioned at this point that I want to treat metaphysical emergentism as different from the kind realism found in contemporary science. Scientific realism (Papineau 1996), is a form of physicalism that is concerned primarily with the emergence of observable phenomena from unobservable physical entities like electrons or genes. In essence, it is a view that accepts the existence of all the laws and entities, etc., postulated by science. More often as not this is discussed in the context of physics. This position does not see the process of emergence as being from 'that which is beyond the physical' as might be implied by the word 'meta', but from the physical to the emergent phenomena.

Scientific realism is also usually, with some exceptions, 'actualist' in nature and is about how emergents emerge from actual, but unobservable, objects. Actualism is usually set in opposition to potentialism. Metaphysical emergentism can be interpreted as a form of potentialism and is about 'that which is beyond the physical' and tries to explain how phenomena come into being *simpliciter* (see Aristotle in Ackrill 1992, p. 143). Scientific realism is an approach that tries to explain the emergence of new phenomena from the

physical, not that which is beyond, or behind, the physical. Such realism is really about how something new is constructed from **pre-existing** physical realities not with how something is brought into existence as such. I shall return to this distinction in Chapters 2 & 5.

The views of Bohm & Peat, Davies, Goodwin and Harré, have in common the idea that the ultimate, or fundamental, reality transcends that of the physical that we normally associate with the concerns of the natural sciences. For physicalist emergentism, which usually is a form of scientific realism, the process of emergence is from the physical to the physical. For metaphysical emergentism, on the other hand, the creative process is from the transcendental potential to the physical. In a sense, for most kinds of potentialist emergentism in popular science the transcendental potential can be interpreted as generating the immanent. I will address this in more detail in chapter 5.

One of the difficulties with current interpretations of metaphysical emergentism, however, is that the role of the 'actual' is usually downplayed and it is the potential that is the sole source of emergence in evolution. Whilst this may be the case for some circumstances, I shall argue that the actual has an important role to play if emergence as a whole process is taken into consideration. I shall argue this from chapter 5 onwards. In order then to analyse the problem, without any prior commitments, I will consider in this research the following model:

Fig 1.6

1) Creative Base (as Potentialities)
2) Transformations
3) Emergents (as Actualities)

I will argue in chapters 5 to 8 that potentialities can become actualities and that actualities can become potentialities. In this way potentialities can be conceived as being interactive in the whole process of emergent evolution.

(1.2.6) Types of Argument in Emergence and Reduction

In this section, I will identify the four basic kinds of arguments applied to the above dimensions and objects of emergence: elimination, identity, mereological supervenience and nomological supervenience. I shall not make a substantial critique at this point, preserving this for chapters 2 & 3, where I do this in the context of my own proposals. These types of argument can be applied to both the epistemological and ontological dimensions, but I will treat them as similar as the problems they raise are essentially the same for the realist position I will advocate (see Silberstein 2002; Van Gulick 2001). In this, I shall argue for a strong identity between epistemology and ontology in chapter 2 as part of my argument against reductionism and for emergentism and holism.

Elimination is considered to be a form of reductionism that can be applied to entities, causes, properties and laws (Churchland & Churchland 1995; Kemeny and Oppenheim 1956). In ontology, it is the idea that some object of emergence can be simply eliminated in favour of another one. Examples of this might be the 'vital force' espoused by some 19th century biologists, which was eliminated and replaced by Darwin's theory (Mayr 1997); or the mind which some are trying to replace with meme complexes (Blackmore 2000; Plotkin 1997). In epistemology, elimination would consist in the eradication of one kind of explanation for another. Non-elimination, on the other hand, may be used to support ontological and epistemological emergentism. If an emergent cannot be eliminated from our ontology or our explanations, in favour of the physical, then emergentism starts to look possible. Popper (1977) has referred to this as the 'residue problem'.

I do not doubt that elimination is a theoretical possibility; however, it does not address the case when an explanation is accepted as necessary for an emergent. Many popular science writers accept the need for explanations other than the physical, but, as shown, without any necessary ontological implications. Elimination also leaves untouched the implications for ontology when such explanations are regarded from the perspective of **realism**. If, for example, one is a realist, then any explanation that is not of the ‘physical’ requires the postulate of reality beyond the physical.

Identity is a case where we can accept the existence of an emergent but see it as identical with something else, usually the physical, from the ontological perspective. This does not require that an emergent be eliminated. Examples of this might be the supposed identification of heat with kinetic molecular energy (Friedman 1982) or the identification of light with electromagnetic radiation (Churchland and Churchland 1995). The demonstration of a non-identity, either from an epistemological or an ontological perspective can be used to support emergentism of either kind.

Identity has the problem that it has to show how it is possible to re-define one kind of thing in terms of another. I shall address this in more detail in (2.3), but it can be said at this point that, taken to an extreme, this would lead to all scientific terms being of an identical kind (epistemologically) where there would be no diversity of terminology, or explanation. This is a position that is either not accepted by many scientists, as I will show in chapter 3, or can be shown to be unjustified. From an ontological perspective, identity would lead to the idea that reality is only of one kind, usually that of the physical. Again, as I will show in chapter 2, the physical is also a diversity so why not simply see reality in general as being so too and avoid many of the over-generalised attempts at reduction that one often finds in literature? This is not an argument against reductionism in total, but what one often finds are discussions about the 'physical' with the assumption that it is only one kind of thing.

Mereological Supervenience is the idea that the **properties** of the whole are determined by the intrinsic properties of the parts. An example of such an intrinsic property could be the charge, say of protons and electrons, and the way that this determines chemical bonding. This idea sometimes crops up under the guise of **ontological dependency** (Balashov 1992). From an epistemological perspective, it is sometimes argued that one kind of explanation supervenes on another, more basic, one. If it can be shown that there is at least some degree of independence of a kind of reality or of an explanation, then a kind of **mereological emergence** gains some support.

One of the difficulties with this kind of argument is that it assumes that if mereological supervenience can be shown, then other kinds of additional explanations are not necessary. Clearly, however,

dependency does not imply sufficiency: were one to demonstrate dependency, epistemologically or ontologically, this does not mean that no other explanations are needed for the emergent properties.

Nomological Supervenience is notion that the **laws** of a more basic level, of reality or explanation, determine those of a higher level. This is usually interpreted as arguing that the laws of physics fully determine those of other levels of reality or explanation. It can also be applied to other levels of reality, for example in attempts to explain the human mind in terms of the lower level biological laws (Aunger 2000). This kind of argument could more precisely be called **nomological reductionism** as it really saying that all emergents are determined by the laws of physics, or by some other lower level. I shall show, however, that the idea of nomological supervenience could be used to support the notion of emergent laws, i.e. a kind of **nomological emergence**.

The problem with this is the same as that for mereological supervenience: dependency does not imply that no other explanations are needed. If for example, the laws of electromagnetism are dependent on the heat state of the universe, as is currently believed, this does not mean that these laws are reducible to the laws of heat; it only means that they are **partially** explained by them in terms of the unfolding of the universe. However, a partial explanation is not a sufficient explanation and neither is nomological supervenience.

I shall return to these arguments in chapter 3 and show that in the context of popular science they provide a basis for an emergentist position.

(1.2.7) A Typology of Positions

In consideration of the above dimensions, objects and arguments, a variety of different positions can be identified:

Reductive Physicalism is the position that accepts the idea that only the physical exists. In its extreme form this means that only physical entities, causes, properties and laws are believed to exist. There are two basic versions of this, the first is called **currentism** as it is based on the current ideas of physics; the second is **futurism** as it is determined by what a future physics might discover (Crook &

Gillet 2001). In chapter 2, I shall return to this, where I show the incoherence of the distinction.

In a more moderate form, reductive physicalism can accept the existence of emergent properties, but not entities (Rohlich 1988) or laws and causes (Kim 1999). This latter view is sometimes called **realisation physicalism** as it interprets emergent properties as realisations of physical laws or causes (Melnyk 2003).

Nonreductive Physicalism is a combined position of ontological reductionism and epistemological emergentism. It agrees that there is a variety of explanations, but that this has no ontological significance (Van Gulick 2001). For this position, even if a new explanation, say of the mind, is needed, this does not mean that the mind is a new kind of entity, cause, property or law in an ontological sense.

Ontological Emergentism argues that the world has a diversity of kinds, levels, entities, causes, properties and laws. There are two basic kinds of this; the first is **ontological pluralism** which argues for new kinds of reality that can emerge (Dupré 1993; Popper 1977). The second sort is **ontological holism** which argues that emergents are levels and not just new kinds (Harris 1991). As an emergentist position, ontological emergentism is not compatible with reductive physicalism as the latter only believes in the existence of one kind of reality, namely the physical. A third position, **ontological dialecticism**, is a combination of pluralism and holism as it argues for different kinds and levels of reality being able to affect each other (Sperry 1994).

Epistemological Emergentism is an emergentist view that argues that there is a variety of kinds and levels of explanations, not just physical ones. Epistemological emergentism is also of two varieties, the first is pluralist in explanation whilst the second is holistic. These may be called **epistemological pluralism** and **epistemological holism** respectively. Epistemological emergentism is sometimes convergent with nonreductive physicalism if combined with ontological reductionism. However, it can also be unified with ontological pluralism or even be neutral concerning ontology.

Two further positions will also be discussed in this research, that of **Actualism** and **Potentialism** (Davies 1992; Dawkins 1992; Goodwin 1995; Harré 1993). Actualism in the context of the philosophy of emergence is the idea that new emergents arise from out of that which actually exits. Usually this notion is implicit in the majority of positions, but when combined with reductive physicalism, it means that emergents like life, consciousness, etc., are supposed to have emerged from a series of actual physical states. In contrast, potentialism may be used to explain the emergence of everything, including the physical, from out of a potential reality. I shall consider potentialist explanations in chapters 5 to 8.

(1.3) Preview

In the following thesis, I will make a critique of reductive physicalism and nonreductive physicalism. I shall argue that a form of potentialism is a more coherent kind of explanation of emergent evolution than other kinds as it unifies pluralism and holism with a concept of creative potentials. This is a further development of, and is in basic agreement with, other authors, like Bohm, Goethe and Goodwin. I will put forward some new ideas concerning the philosophical aspects of this approach.

From the examples given above, it can be seen that the explanation of emergent evolution is far from being agreed upon. Whilst many accept the existence of emergent phenomena, the majority of scientists see this as an emergence **from** the physical. What this research tries to do is address what this can possibly mean from the perspective of the **principles of explanation**.

In chapter 2, I begin the study by providing a new account of explanation which I sum up with the title 'Being – A Whole Explanation and Method'. Through this, I investigate the claim that new explanations imply new kinds of reality or Being. This involves consideration of the relationships between ontology, epistemology and method in explanation and how they affect each other in explanations of emergent evolution. As I reject the division between the three 'dimensions', and the division between the 'objects' of emergence, I shall argue that extra explanations imply extra Being. In this way, I argue for a holistic account of explanation in its application to emergent evolution.

In chapter 3, there will be an exploration of the content of explanation I will investigate whether or not this can be considered to be uniform, as is the case with ultimate reductionism or diverse as with pluralism. I will argue here that pluralism is a better model of explanation for emergent evolution.

In chapter 4, I will further argue that, in addition to the diversity of explanations, there are also higher levels of explanation relevant to emergence. These higher levels give deeper meaning to the content of the lower levels. In this way, emergent evolution is explained as a process of increasing meaning as the world evolves, contrary to the convictions of reductive physicalism.

In chapters 5 to 8, I will explore the structure of explanation from the perspective of the law model of explanation. As laws are sometimes considered to be potentialities they will be investigated with special reference to the **potential - actual** perspective of metaphysical emergentism. I shall argue for a view that I call Potentialism. I will formulate Potentialism as a kind of Holism which tries to explain emergent evolution through the notion of **Creative-Wholes-Over-Time**. I will use the term **Becoming** to express the unity of the relationship between potentiality and actuality.

Through this I will try to show that emergence and reductive physicalism are not compatible. Instead, I will argue for a form of holistic pluralism which proposes that emergent evolution is better explained as the coming into actual existence of diverse and holistic kinds of reality from out of the world's potentialities.

(2) BEING - A WHOLE EXPLANATION AND METHOD

(2.1) Introduction

In this chapter, I will argue for a holistic approach to the relationship between methodology, ontology and epistemology in **explanation**. I will consider the implications of this for evolutionary emergence. I try to show how these 'dimensions' of explanation can be unified in the concept of 'Being' and which can lead to an extended pluralist understanding of a realist emergentism. Through this I argue that: **Being is a Whole Explanation and Method**. This provides a framework for the later chapters through which each of the emergent phases of evolution (fig 1.1) may be explained as new kinds of reality.

In chapter 1, I showed that reductive physicalism tries to explain the later emergents of evolution through the physical. I also showed that nonreductive physicalism, in contrast, argues that there are other kinds of explanation, but only the physical can be said to exist. Both of these positions hold a common assumption: that the three 'dimensions' of explanation in its application to emergence outlined in Fig 1.3 can be split apart. I shall challenge this assumption and provide a different starting point for explanation in its application to emergent evolution.

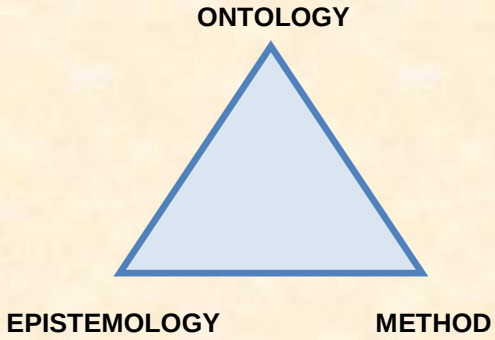
This can be looked at on two basic levels. The first is that holism and reductionism can be applied to particular areas of research, in this case emergent evolution. The second is the way the research itself has been conducted and presented. More often as not, the three dimensions of emergence, the ontological, the epistemological and the methodological, have been investigated reductionistically by being analysed as three separate dimensions and seen in isolation from one another. Ruse (2001), Ayala (1983) and others have accepted these distinctions to the extent that it is believed to be possible to be a holist concerning explanation but a reductionist in methodology and ontology (Popper 1977). A particular example of this is that some physicalists think it acceptable to have explanations that are 'holistic' but that reality can only be considered to be physical or material (see Gould 2003, p. 223; Rose 1997, p. XI). As Silberstein has claimed:

> Epistemological emergence does not have any obvious implications; but ontological emergence does.
>
> (Silberstein 1999, p. 185)

> One may accept ontological reductionism but reject epistemological reductionism, and vice versa, likewise ontological emergentism and epistemological emergentism.
>
> (Silberstein 2002, p. 81)

I would call this a reductionist approach to the whole problem. By separating ontology and epistemology, and also methodology, one is implicitly assuming that their relationships do not matter. In contrast, this research looks at the relationship between them. Consider the following diagram:

Fig 2.1



The most usual approach to applying this triad of relationships to a particular problem is to split them up and ask three logically distinct questions: is ontological reductionism (or holism) possible; or epistemological reductionism; or methodological reductionism?

What I will be arguing is that this splitting of the three dimensions assumes that a reductionist **methodology** can be applied to the research itself. I argue, however, that a holistic and pluralist method is necessary. In this it is the **relationships** between the three dimensions that matter. Rather than examining each dimension separately, I will consider how they affect each other. Put differently,

this research does not just consider what the three dimensions are in and of themselves, but what they are to each other. I will show that this approach avoids seeing the three dimensions as isolated as would be done by a reductionist approach.

In 2.2, I will try to show how a reductionist method leads to accepting only the physical as real and hence to physicalist emergentism which rejects the reality of the later phases of evolution. I will argue, in contrast, that holism combined with pluralism in methodology allows for the possibility of a pluralist and holistic ontology of emergent evolution. Reductive method, on the other hand cannot even allow for this as a theoretical possibility. Just to emphasise, at this point I am only discussing the **conditions for holistic realism**, I am not debating each of these issues for themselves but in their relationship to each other.

In 2.3, I will argue that, for a holistic realist, explanation and ontology are unified. This means that if there is a diversity of laws of explanation, then there is a unified diversity of reality. That is, a holism and pluralism together. I will also show that the concept of the 'physical' is not well defined hence the idea of 'emergence from the physical' is dubious. I argue that 'Being' is a better starting definition as it allows for other kinds of emergence other than from the physical.

In 2.4, I will further discuss the epistemological conditions for accepting potentialities as real. I shall argue that one condition for something to be a good explanation is that a **holistic unity of reason and perception is necessary**. The reason for making this argument is that, in chapter 5, I will try to argue that the emergents can be explained as each proceeding from their own potentialities and not merely from the physical. If potentialities can be given a good epistemological grounding; and if they can be interpreted as good explanations; then as explanations imply reality for the holistic position presented in this thesis, they can be considered to be realities.

(2.2) Being - a Whole Method

The first aspect to the problem of how emergent evolution is to be explained is that of method. Often there is a hidden assumption that method does not affect ontology. This is evident in popular science literature, where methodology is frequently mentioned, but not often discussed in much detail (Gould 2003, p. 201; Plotkin 1997, p. 91). With one particular author, the methodological dimension is claimed to have nothing to do with their own form of reductionism (Weinberg 1993, p. 42) What this absence implies is the assumption that the dimension of methodology does not affect the ontological and epistemological dimensions, and vice versa. What I will show though is that the way method and ontology affect each other cannot be ignored and that a better way of explaining emergent evolution is based on a holistic method that is sensitive to different levels of reality or being.

In this section, I will investigate method as a relationship between **analysis** and **synthesis**. This will focus primarily on how the two terms are used in popular science literature, rather than how they are defined by Kant (1990, p. 48). I will consider analysis and synthesis in relation to two things 1) concepts and 2) practice. For example, analysis can be understood as the separating, or dividing, of a concept / theory into smaller components, like understanding mass as being a part of the law of gravity; but analysis can also be interpreted as the separation of the variables of an experiment that leads to the 'discovery' of parts, like when electrons are supposedly present in electron diffraction experiments. The reductionist method consists in this analytic process in so far as it focuses on the separating of whole concepts, or objects, into their corresponding parts. Synthesis, on the other hand, is in a sense the opposite of analysis in that its concern is with the unifying of the parts of concepts, or of objects, into wholes. What these mean, however, is far from clear in the current literature as will be shown in the following discussion. As I will show, there are some important questions as to whether or not analysis and synthesis, as aspects of method, have any explanatory or ontological implications.

When reductive analysis is applied to emergent evolution, I will show that it tends to split up evolution into separate parts and gives priority to the earliest. This is the physical phase of evolution. As a

consequence, a pure reductive method arrives at a reductive ontology, this is reductive physicalism.

I intend to argue here, however, that:

> **Method should be the holistic unity of analysis and synthesis that is sensitive to different kinds of reality / Being.**

In a sense, Being itself should be the method. Being in this way is a holistic concept that circumscribes the appropriate method. If one were to argue, on the other hand, for a reductionist method from an *a priori* perspective, then our ontology is inevitably going to a reductionist one. As a consequence of the holistic method I will argue for, however, I will show that a unified pluralist view of reality becomes possible.

I will develop my ideas on the basis of Goethe's holistic approach to scientific method and Nature. There are two basic reasons for this. Firstly, some science writers who I agree with to some extent, Bohm (1987), Goodwin (1994) and Harman (1994) make some important references to Goethe as a precursor to their thought. Secondly, I have done some study of Goethe myself and wish to acknowledge this.

***

Goethe was a holist when it comes to the relationship between method and ontology. He considered experience and experimentation as 'parts' of a greater 'whole' that was Nature. For him, these 'parts' only made sense in the wider context of the whole of Nature. There is a considerable amount to be learned from Goethe, especially in connection with debates about reductionism and holism. At this point I will show how Goethe interpreted the relationship between method and reality, or 'Nature' as he put it. He expressed this most succinctly in his essay "Experiment as Mediator between Object and Subject" (Koepf H H & Jolly L S 1978, p. 25). I will first allow Goethe to speak for himself and follow this with my interpretation in the context of this research:

> The value of an experiment lies above all in the fact that whether simple or complex it can be reproduced at any time... Yet, admirable as the single experiment in itself may be, it is only in conjunction with others that it attains its proper value... *I make bold to say that one experiment or several together prove nothing at all, and that there is naught so perilous than the desire to confirm some statement by experiment directly. I say the most pernicious errors have arisen precisely inasmuch as the danger and inadequacy of this method have been overlooked....* So saying, I implied that I consider its *indirect* use none the less beneficial... In living Nature, nothing happens that is not united with the whole. Granted that our experiences only *appear* to us as isolated facts and that the same applies to our experiments, this does not mean that they *are* in Nature isolated.
>
> (Goethe, in Koepf HH & Jolly S L 1978, pp. 29-32)

At first sight, it may be thought that Goethe was against scientific method and experimentation. But I interpret him to be against the use of isolated experience and experimentation. It was the **isolatedness** that troubled him, not the use of experience and experiment. I see this as a kind of Holistic Method in his science. This becomes clear later in the quote when he refers to things in Nature being united with the whole. For Goethe, Nature is the whole, and any experience or experiment should only be seen as an isolated aspect of the whole of Nature and that one should be very careful about any deductions one makes that are based on such isolated instances. He saw experiences and experiments as giving important information about Nature, but that it was Nature that was the whole and the experiments and experiences that were the parts.

Goethe's method was the opposite of what is the case with the contemporary reductionist methodology that analyses, either in thought or in practice, the whole of Nature into isolated parts (experiments and experiences). Instead, he thought we should understand the parts as proceeding from the whole of Nature. Goethe was against what may be called **reduction by isolation**. This is in effect the process by which reality is **methodologically** analysed into parts and through which it is given a reductionist **explanation** and reductionist **ontological** status.

This is an important aspect of this research as the physicalist approach to emergent evolution is based on isolated experiments. For example, much of modern cosmology is deduced from experiments concerned with particle physics. It is from ideas associated with these that the whole reductionist edifice is built up, that everything around us today was ultimately created by, and is composed of, the parts that we call fundamental particles, and of course the fundamental forces. But if what Goethe believed is true then there is no guarantee that Nature is actually composed of these particles / parts today let alone in the distant cosmic past. To assume that this is the case is to fall to what I shall call the **Isolatedness Fallacy (IF**). This is similar to the 'fallacy of misplaced concreteness' which "consists in neglecting the degree of abstraction involved when an actual entity is considered merely in so far as it exemplifies certain categories of thought. There are aspects of actualities which are simply ignored so long as we restrict thought to these categories (Whitehead 1978, pp. 7/8). On the basis of Goethe, who preceded Whitehead, I want to develop this to include not only that which is **ignored in thought**, but also that which is **created in reality** through the isolation process.

The IF is the idea that the phenomena that are produced within an isolated experiment or experience, are assumed to exist prior to the experiment, i.e., in Nature. A simple example will show this. It is well known that if you apply a small force to the surface of a bowl of water, for example by flicking, small droplets of that water will appear. Someone who was subject to the IF would believe that the droplets existed actually in the water prior to the 'experiment'. I doubt that anyone would actually believe this. One could say that the droplets existed potentially in the water but not actually.

From a Goethean perspective, one may take this view of particle physics and the reductionist approach to the whole of cosmological evolution. Under this explanatory framework, fundamental particles may have a similar sort of existence as water droplets. No doubt this is a more complex concept, but, from a holistic position, reductive physicalism is susceptible to the IF to the extent that it is dependent on particle physics and any other kinds of deduction derived from isolated experiments. Not only that, but what the empirical evidence seems to suggest, from a Goethean perspective, is that the experiment may actually **create** the particles.

If this is true, and interpreted more generally, then each of the different phases of emergent evolution: physical, biological, cognitive and social, may equally be interpreted as 'droplets' of the evolutionary process, i.e., relatively isolated 'parts' of the whole that we can call general evolution (see section 1.1.2 for a definition of general evolution). We may interpret these 'parts' as derivatives of general evolution or of Nature as Goethe called it. **By this conception, reduction of the later phases, the cognitive and social, to the earlier ones, the biological and physical is an invalid method as they are all derived parts of a whole**. If one wants a methodological beginning to explanation, then I would suggest that it is this whole that could provide the starting point, not the one physical part that reductionism wants.

But there is another aspect to Goethe's method that can be derived from the above quote. This is the question as to how we are to understand those parts that arise in experience or experiments. For a Goethean approach the parts can only be properly understood in the context of nature as a whole. From a methodological perspective this implies that the method has to conform to nature, rather than impose on nature. This interpretation of method led one Goethe researcher to say of him "Goethe's view... always takes its manner of observation, not from the mind of the observer, but from the nature of the thing observed" (Steiner 1978, p. 7). Another way of putting this would be to say that method needs to 'attune' to the being, or reality, under consideration (Bortoft 1996). If this is the case, then method needs to be sensitive to the different kinds of beings or the kinds of realities that we seek to understand. This means that the simple analysis and synthesis of reality may not always be appropriate and needs to be complimented by an awareness of new levels and kinds of reality that may be present in the methodological process.

What this suggests in the context of emergent evolution, is that the simple analysis into the most fundamental parts and the synthesis into some kind of whole merely on their basis may not be so easy. This simple isolating / dividing / slicing of a whole into parts in time and space, I propose, would lead to giving priority to the smallest parts in space and the earliest parts in time. This would be basically the position of reductive physicalism which gives fundamentality to the smallest and the earliest, namely the physical. The other

emergents, life, sentient, cognitive / social are then explained as complex syntheses of the physical, not as realities in themselves. But if the approach of Goethe is more appropriate, then the method will be sensitive to the different kinds and levels of reality when it meets them. Through this the physical is just one analysed part of the whole as are the other emergents. Each of the emergents may then be discovered to be equal parts of the 'Whole Over Time' that we may call evolution. Evolution would not then be just an outcome of a complex and pre-existent physical process, but could be interpreted a whole from out of which the four phases emerged. As I will argue in the later chapters, this 'Whole Over Time' can be conceived as a unity with an internal diversity that generates the emergent phases of evolution. By this account, monism can be made compatible with pluralism.

Seen like this, it is arguable that scientific method affects ontology. If one has the reductionist preconception that the isolated experiments and the produced isolated phenomena have an existence independently of the experiment, then one will have reductionist ontology as a result of a reductionist method that was informed by reductionist ontology in the first place. On the other hand, if a more holist coupled together with a pluralist approach is taken, in the style of Goethe, Nature is the whole from which parts / particles were produced. Emergent evolution then begins to be holistic and pluralist rather than reductionist. At least one could say that such a method would be better than a mere analytic reductionist one because it allows for the possibility that other kinds of realities may be found other than the reductionist's definition of the physical. Reductive physicalism, on the other hand, cannot even allow a diversity of realities to be discovered because of its assumption of the completeness of physics (see chapter 1) (Papineau 2001, p. 32).

In the following, I will consider this in more detail and in relation to contemporary thinkers, but instead of referring to 'Nature' I will use the terms 'reality' or 'Being' or 'Beings' depending on whether or not they are used to refer to universal existence or particular kinds of existence (Heidegger 1973 p. 22) . But this is still in tune with a Goethean approach.

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Bohm's approach is a kind of method of thought which aims for holism. For him, parts have emerged from a whole, but he thinks this whole cannot be known. As such, he slices the whole from the parts through his method, which ends up having an element of reductionism in it. He discusses what he calls 'fragmentation' and argues that in the end:

> what should be said is that wholeness is what is real, and that fragmentation is the response of this whole to man's action, guided by illusory perception, which is shaped by fragmentary thought... So what is needed is for man to give attention to this habit of fragmentary thought, to be aware of it, and thus bring it to an end. (Bohm 1998, p. 7)

I see this 'fragmentary thought' as another example of a one-sided analytic method that tries to slice up reality into parts and then give them fundamental existence. Whether or not we should bring this to an end, or see it as one part of a whole process, I shall leave open for now. But what I would like to suggest at this point is that the awareness of this 'fragmentary thought' is an important aspect of methodology in the sense that if our thinking is fragmentary then this may affect our ontology of emergent evolution. In Bohmian terms, evolution is what is real as it is the whole; the physical could be seen as a 'fragment' of this whole as are the other emergents, none of which, at this juncture, can be said to have priority.

On one level, I agree with Bohm that the greater reality is the whole, as this is consistent with my earlier argument, but my difference from Bohm lies in how the whole is known methodologically. For Bohm the whole is a ground from which thought and thing can be derived, it is an "undefinable and unknown totality of flux" (Bohm 1998, p. 55). Bohm thinks that therefore the correspondence between thought and thing has no meaning and that "reflective correspondence implies knowledge, while the ground (the whole) is beyond what can be assimilated in the content of knowledge" (Bohm 1998, p. 55). Whether the whole is what Bohm says or not, I shall not argue at the moment, but what is clear from his own proposition is that it cannot be known. The research conducted in this thesis, in contrast, is aimed at understanding a whole that can be known, not one that can't. In this sense, what I am trying to do is adhere to at least one aspect of scientific method in that I am trying to understand a whole

which can be known. Bohm, it would appear, seems to reject science at this point and give fundamentality to that which cannot be known and I wonder how it could be even possible in principle to ascribe the only true reality to the unknown. Whatever the case, it seems rather unclear to me what kind of methodology one would need in order to establish that the realities that we do know 'emerge' from an 'unknown totality of flux'. We would have to **know** how the **known** arises from the **unknown**. I don't know how one would do this or even if it is really possible.

Another aspect of Bohm's view that I question is that he assumes that the correspondence between thought and thing (I presume here that he is referring to the correspondence theory of truth) has no meaning *because* "both thought and thing are abstracted from the total process" (Bohm 1998, p. 55). What this presumes is that the content of thought and of thing somehow becomes different due to the process of abstraction. Hence, because the correspondence theory of truth is based on the notion that the content of thought (theory) is the same as the content of thing (reality) that it refers to, it can no longer be valid. But the same problem arises here as above: by what method could one know this? But the fact is that Bohm considers the 'total process' as 'undefinable and unknown', so he can have no method through which he can show that the process of abstraction changes the content of thought and thing.

In contrast to Bohm, I propose, in keeping with the correspondence theory of truth, that the content of theory and thing can be considered to be the same, or identical. This allows a whole to be known even if theory and thing are abstractions from it. For scientific knowledge of a whole to be possible at all some significant degree of similarity of content of thought, thing and whole needs to be present. In this way the fragmentation, that Bohm rejects, between knowledge and reality can be avoided. Bohm on the other hand brings about a fragmentation, through his 'method of thought', between thought and thing on the one hand, but more importantly between 'the whole' and thought / thing on the other. I would argue that if we aim to find wholeness through our method, then this kind of fragmentation could be avoided by having something like the correspondence theory of truth, where whole, thought and thing form a unity. We need a scientific holistic method that allows for the possibility that knowledge

and reality are aspects of a whole, anything less is the methodology of fragmentation.

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Rose (1997) recognises the value of reductionist method, but argues that we need to show great caution regarding any theory (explanation) that may be inferred by it. I will show though that, to a degree, there is an element of reductionism in his method that leads him to split explanation from ontology. One can see this in his argument for an epistemological diversity with an ontological unity. I would claim that were there no split, from a holistic point of view, a diversity of explanations implies a diversity of reality. I will consider here the methodological influence of such positions. From a methodological perspective Rose says:

> First, and perhaps foremost, there is reductionism as a methodology... We find it easier to understand the phenomena we wish to study if we can hold them relatively isolated from the rest of the world and alter potential variables... Reductionist methodology simplifies, and enables one to generate seemingly linear chains of cause and effect... reductionism works - or at least, until now it has been made to seem to work... But living systems are not simple: they involve many interacting variables... So if one is not careful, the simplifying constraints that the methodology offers soon cease to be helpful supports to theory, and instead become straightjackets... if we are not careful to remember that what happens in the test tube may be the same, the opposite of, or bear no relationship at all to what happens in the living cell, still less the living organism in its environment... reductionism is not enough when I come to interpret my own experiments. (Rose1997, pp. 77-78)

What is important to note at this point is the association of the idea of isolation with the reductionist method. Rose, however, is not a reductionist even though he accepts some of its methodological virtues. He rejects both ontological and epistemological (explanatory) reductionism and proposes a diversity of explanations under a monistic and materialist, framework (Rose 1997, p. XI).

Rose draws no methodological conclusions from the example he himself gives, namely that what may happen in the living cell may have nothing to do with what can happen in an experiment. In fact, if he was consistent, he would come to the same conclusion as Goethe: that ideas derived from isolated experiments should take their meaning from nature as a whole and not the reverse. This would have given him the beginnings of a holistic method and this is what I shall argue. Furthermore, I will show that Rose also neglects to consider the synthetic process that occurs in scientific method in addition to the analytic one that he refers to.

As can be seen, Rose argues for reduction as simplification in methodology. This he interprets as a process through which a complex phenomenon is reduced to a simpler one in order for it to be explained. As a consequence, he also argues for an ontological unity but with epistemological diversity. He sees the latter as a variety of different languages which describe an ontological unity.

What he is arguing for, I would claim, is only an artefact of a reductionist method that emphasises the analytic process within explanation alone; it does not enter the ontological dimension: one entity has many different aspects to it which can be analytically discriminated, but it is still only one reality. Were his method to enter ontology, then the elements arrived at through analysis would be considered to be realities, not just explanations. This is why Rose may be called a 'nonreductive physicalist' because it is a joint position of epistemological pluralism with an 'ontological monism'.

Rose's method, because it is not ontological, misses out on the possibility that a single being may well have different strata of reality within it. Such a being would be a diversified unity and not some homogeneous unity. If this is the case, then one could only consistently argue for a diversity of epistemologies which have a corresponding ontological diversity. In the example he gives of a frog jumping away because it has seen a snake, the frog's fear could be regarded as a psychological stratum of the frog's reality, its biochemical, behavioural activities as other strata. Of course they jointly form the frog’s unity, but are necessarily diverse.

The interpretation is quite different when, through a holistic method, the concept of Whole is put first. Just suppose we accept the terms

of his discussion, for example that frogs can actually experience fear, etc. If one says that a frog is a whole, then the frog as a whole can be analysed into the dimensions of the psychological, biochemical and the behavioural. One might say that these are emergent phenomena from the 'whole' Being, in this case being a frog. There is no sense in which these **make** the frog what it is, such a claim would be fundamentally reductionist, rather they are analysed 'parts' if you like of being a frog, the Being 'frog' produces them rather than the other way around. It is the Being 'frog' that binds its different dimensions into a unity.

One of the problems with Rose's (1997, pp. 80-82) view is that he misinterprets the concept of Identity on the basis of his method. This shows itself again in his discussion of the identities of the morning star and the evening star. This was the problem that the evening star and the morning star were both thought, at one time, to be different planets. Eventually they were both shown to be Venus. Rose uses this to show how different descriptions (epistemology) can in fact be of one kind of existence (ontology). Through this he is led to his epistemological diversity with an ontological unity.

On the one hand, I agree with Rose that there is an ontological unity, but I differ from him in that I consider there to be a diverse reality *within* it. The difficulty with his interpretation is that he argues that the morning star was shown to be identical to the evening star. But this was not the case. The evening star and the morning star were both shown to be Venus at different times. **They are 'analysed' parts of the whole that is Venus**. Through the holistic method of putting the whole first, the identity of Venus can be argued to be on the level of Whole Being, not on the level of the observed instances. The different descriptions were of actual instances of Venus at different times and 'places'. Rose focuses on the observed rather than the observable. But the observable goes beyond the momentarily observed in that it includes all instances of that which can become observed. Thus the identity of Venus (Being) lies not in some abstract epistemological / explanatory principle but in real existence. This is under the condition that Being is understood from a potential as well as actualist perspective. Venus / Being is then understood as a potentiality to become actual instances (see chapter 1). This yields an ontological pluralism **within** an overall ontological

unity: the different descriptions are of the plural realities of one Being, in this case Venus.

How this pluralism unified with monism works out, as I will show in later chapters, will depend on the being under consideration. In the case of something like a physical field, or a fundamental particle, this may turn out to be a homogeneous unity with the plurality being that of accidental properties. On the other hand, for a being like a frog, we may have a heterogeneous unity with its implied internal diversity with no reduction (Nagel 1974).

Another result of this more holistic methodology is that our ontology enables Potentialism to unite the transcendental and the immanent into a broader conception of being (see ch 5 for this broader conception). Being through this method is partly defined by the holistic unity of transcendence and immanence, and, more broadly, by the potential and the actual. Reductionist methodology, on the other hand, can only arrive at ontology of finite and observed actual parts.

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Wilson has another interpretation of method based on analysis and synthesis. He is a reductionist but also gives the appearance of supporting a form of holism. He claims that his concept of explanation is best understood under the framework of consilience. This is basically an epistemic position that has ontological consequences for the understanding of the interrelationships of the sciences and the humanities.

There is, however, some indeterminacy in Wilson's position. On the one hand he claims that reductionism is the cutting edge of science, but on the other hand he also seems to acknowledge higher level laws and properties. So it is a fundamental problem as to what his actual position is:

> The cutting edge of science is reductionism, the breaking apart of nature into its constituent parts... It is the search strategy employed to find entry points into otherwise impenetrable complex systems... reductionism is the primary and essential activity of science. But dissection and

> analysis are not all that scientists do. Also crucial are synthesis and integration... Behind the mere smashing of aggregates into smaller pieces lies a deeper agenda that also takes the name of reductionism: to fold the laws and principles of each level of organisation into those at more general, hence more fundamental levels. Its strong form is total consilience, which holds that nature is organised by simple universal laws of physics to which all other laws and principles can eventually be reduced. This transcendental view is the light and the way for many scientific materialists (I admit to being one of them), but it could be wrong. At least it is an oversimplification. At each level of organisation, especially at the living cell and above, phenomena exist that require new laws and principles, which cannot be predicted from those at more general levels. (Wilson 1998, pp 58/59)

What can be seen from this quote is that Wilson is still a methodological reductionist despite some apparent claims to the contrary. He talks of the 'breaking apart of nature', a form of isolating process, that Goethe warns against. Whilst he acknowledges both the analytic and the synthetic processes, he does not include all the levels of explanation on the way back up to the whole. His synthesis is really reductionist as it only recognises the laws of physics as being fundamental due to the fact that they are the last objects after "the breaking apart of nature". His position then is another example of reductive physicalism as the synthesis is under the framework of the laws of physics. Consequently, a view like his can only support a form of physicalist emergentism.

One can see here how Wilson's prior commitments to physicalist ontology infect his methodology: because of it he ignores the possibility that other laws of explanations may exist on higher levels. This is a biased methodology. I propose that methodology should be ontologically neutral. What I mean by this is that if one defines methodology as a means to discover and explain what reality is then it should not assume any particular reality principle: one cannot assume the absolute truth of the thing that you are trying to establish.

I would argue that a holistic method in contrast should be ontologically neutral in regards to that which it considers fundamental

or derivative. In this sense, the idea of Being becomes useful. The initial and intuitive understanding of a Being as such is merely the starting point for the two processes of analysis and synthesis that lead, ideally, to an integrated understanding of the Whole Being. Now just suppose that one accepted the physicalist position. As one went down the levels of analysis and then proceeded upwards through synthesis, one would be forced to ignore the levels of reality that are not accepted by physicalism. That is, one's ontological commitments would filter out those levels of reality in the process of synthesis. This then would lead to a position identical to Wilson's: his ontology has infected his methodology to such an extent that it is an inevitability that he would end up with the ontology that he wants. But there is no justification for allowing ontology to prejudice methodology in this way as it is the method that allows you to find the appropriate ontology.

From the perspective of Being, methodology has to conform to the nature of the being under investigation: if we are to understand Being, then the method has to be sensitive to when new explanations are necessary. Now as I argue for a realist interpretation of explanation this means that the method must fit to Being in order to understand it. This is not an *a priori* commitment to a fixed form of method, as is the case with Wilson, but approaches Being from the nature of the Being itself. Put differently, when one analyses being one has to do it in accordance with the nature of that being. It is the same for the synthesis process: one cannot assume that the laws of physics are the only form of reality that are present in Being. The synthetic aspect of method must also be sensitive to when new explanations are necessary during the process of unification. In this way one can be led, in principle, to a diverse but unified ontology. As I will show in chapter 3, a diverse ontology can be argued for and therefore method should be sensitive to this even if it is only in theory to begin with. Wilson's position, and all forms of physicalism, cannot even allow for diverse ontology as they reject it from the beginning of their method.

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In summary, I would like to propose that Being is the original Whole from out of which the parts were methodologically derived and then re-unified. As was shown in the above, reductionism falsely argues

that the whole from which the parts were **methodologically** derived in the first place is **ontologically** produced by these parts. In this sense, its ontology is a consequence of its methodology. But if its method has been wrongly conceived then its ontology is bound to be wrong.

Let me take a simple example, a watch. We use the word 'watch' to designate a 'whole' that fulfils a given function. This then can be analysed into its various parts; this can be done conceptually or by taking it to pieces. This could then be synthesised, for example by being re-constructed. But how is this to be done? If one were to be merely given the parts, without any concept of the whole watch, the synthetic process would be impossible: one can only put it back together again if one has the holistic concept 'watch'. But we had this concept in a simple form in the first place before the analysis, this latter gives the details, the parts of the one Being 'watch'. So there needs to be another idea for the understanding of the original whole that is not an analytic process.

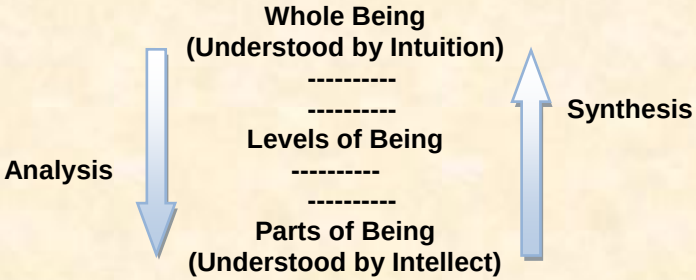
After Goethe I will call this Intuition. For Goethe, Intuition was the grasping / understanding of the whole in relation to its parts where: "Dass Allgemeine und Besonderer fallen zusammen, dass Beonderer ist dass Allgemeine, unter verschiedenen Bedingungen erscheinend (The General and the Special fall together, the Special **is** the General that appears under various conditions)" (Goethe J W 1982, Band 5 p. 368) (My translation and emphasis). This concept of intuition is not to be confused with that of Kant's (1990, p. 65) "empirical intuition" which only gives access to appearances, which is called "sensuous intuition" by Bergson (1998, p. 360). As Borftoft (1996, p. 87) points out, Goethe's idea of intuition is where the "One is seen reflected in the many" and are not mere generalisations of the particular. In that sense, Goethe's idea of intuition is more akin to a unification of Bergson's concepts of 'sensuous intuition' and 'supra - intellectual intuition' (Bergson 1998, p. 360).

There are two aspects to this Intuition that seem important in the contexts of emergent evolution. This first is the pre-analytic intuitive understanding of the Whole Being, like for example when we understanding what a whole, like a plant or a car, is without understanding all the parts and their relationships (Bochemühl 1986). The second aspect is the post-analytic understanding of the whole

Being after the synthetic process. During the synthetic process the different parts could only be put together in the right way if they were in accord with the whole Being 'watch'.

It may be recalled from chapter 1 that each of the dimensions may have various interpretations, reductionist, holist, and pluralist. The method that I am proposing therefore can be seen as an attempt to unify holism and pluralism into what may be called 'emergentist methodology' (I shall usually refer to this as holistic method as this can also be interpreted as including pluralism). I shall model this in the following way:

Fig 2.2

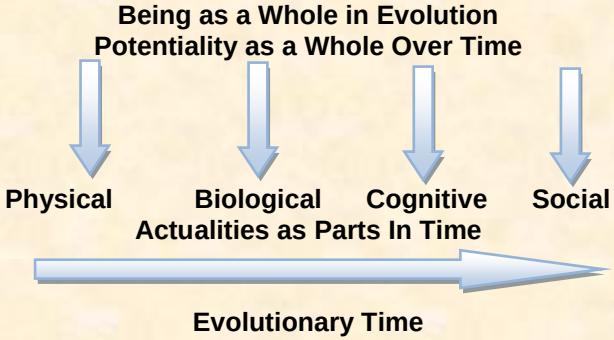


As can be seen from the diagram, the grasping of the parts derived from analysis I have called Intellect and the grasping of the whole, before and after synthesis, 'Intuition' (Edelglass & Maier 1992; Bortoft 1996). Both of these serve a particular function in methodology and have an influence on ontology. If one were to use only the analytic process of the Intellect, then inevitably one is compelled to accept ‘parts first’ ontology; wholes will be seen as being determined and explained by the parts. This is a view that culminates in reductive physicalism. Its contrast is the notion that pre-analytic Intuition should be given priority. The consequence of this view is that parts only have meaning in terms of wholes (Capra 1997). The view that I am arguing for is that Whole Being has ultimate priority but that the right method unifies the analytic and the synthetic, the Intellect and Intuition. This is a consequence of a Whole Being methodology in conjunction with Whole Being ontology.

These ideas can be applied to emergent evolution in a variety of ways. If we consider how the method can influence explanation and

ontology, we may arrive at an understanding of how reductionism tries to explain how the later emergents arose from the actual physical. Consider the following picture in comparison with Figs 1.1, 1.2a and 1.2b where the most general aspect of emergent evolution was depicted:

Fig 2.3



From the point of view of method, reductionism would analyse evolution into these different 'Parts In Time'. It slices up 'Being as a Whole in Evolution' into Parts In Time through the analytic method, then it gives priority to the earliest, the physical, and assumes that all the later emergents have emerged from it. Reductive physicalism then has the problem of how to synthesise these physical parts into a Whole. This is another example of the 'isolatedness fallacy' or 'fragmentation' described earlier. Furthermore, if ultimate physicalist ontology influences it, it can only lead to the view that the analysed physical part is the fundamental one as it is the one that comes first in time (I shall return to this in chapter 5 where I show how reductive physicalism is based on causes being in the past). In this way the later phases are then assumed to have emerged from the physical.

From a holistic perspective, however, each of these emergent phases can be interpreted as equal parts that have emerged from the whole that is evolution. The holistic method is sensitive to these different parts as diverse forms of reality, or Being, and tries to unify them into a whole. It also is sensitive to the possibility that new forms of reality may emerge in the future and allows for this to be unified into a greater whole. In this way, the holistic method argued

for here interprets the Whole that may be called evolution as more than the sum of things that have emerged so far.

In Fig 2.3 above, I used the expression 'Being as a Whole in Evolution' and linked it with the idea of potentiality. In the context of methodology discussed in this section, the Potential perspective is understood as the Whole that comes before and after analysis and synthesis. As I will show in a later section, we can become aware of these Potentialities through inner perception as laws, we can then test them out through outer perception. The holistic method consists in discovering the diverse set of connections between the two through analysis and synthesis and being aware of the diverse kinds of explanation present in reality. What I will show in chapter 5, however, is that a more appropriate concept for this is that of Becoming. I will argue that Becoming can be used to explain how evolutionary emergence can be interpreted as a set of transformations between the Potential and the Actual.

(2.3) Being - a Real Whole

I showed in the last section that methodological reductionism slices up reality into parts and gives priority to the earliest part, namely the physical. There are two basic ontological consequences of this. The first is that the emergents that arise after the physical may be considered to be unreal. The second is that these emergents may also be interpreted as secondary in some way to the physical. I will argue that neither of these can hold up and that a broader definition of reality is necessary if emergence is to be explained. I shall introduce here the idea of 'Being' as 'that from out of which' the emergents of evolution emerged (Aristotle in Ackrill 1992) as an attempt at a broader definition of reality.

This component of my argument is the proposal that science should aim to be realist about all the emergent laws of evolution. By doing this I shall be denying the distinction between ontology and explanation referred to in Fig 2.1. I shall use the word 'Being' to denote a holistic concept about this 'universal' realism. This is in contrast to physicalist emergentism which makes the fundamental reductionist assumption that all later emergent phases should be ultimately explicable in terms of that special part of reality called the physical. I will propose a holistic **starting** point for science, namely that science aims to understand "all that exists" (Harman *et al* 1994, p. 387). I shall use the word Being to denote this idea of "all that exists". Being is in this way a holistic idea as it aims to include "all that exists". What this means more precisely I will describe in the following.

To be a realist, from a prescriptive perspective, I argue, means to be a holistic realist which means that **if** extra explanations other than the physical are needed, as I will show in chapter 3, then these explanations refer to what exists, that is to ontology. So to be a whole realist, the notion that extra explanations are required for emergent phenomena like life, sentience, cognition and sociality, implies a broader ontology than that posited by physicalism, they have to be accepted as having real existence or Being. My view is an ontological pluralism of the laws of explanation (see Dupré 1993).

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Sometimes physicalism appears to make arguments that are primarily ontological but with an implicit denial that extra explanations to the physical refer to reality. Typical examples of this are as follows:

> The most fundamental form of reductionism is *ontological* reductionism, sometimes referred to as materialism (or physicalism by some philosophers of biology). Ontological reductionism is now virtually the universally held position in science. This is the view that **all things are physical things and nothing else**... There is no... force or property of life beyond a very complex organisation of chemicals which is described by the laws of chemistry and physics.. the mind is not some non-physical essence... no matter how complex that connectivity, the mind and the brain are just chemistry and physics There are simply no dualist psychologists in existence - nobody thinks that what psychologists study is some kind of immaterial spirit... The same argument runs with regard to culture. Culture is the most complex thing in the known universe.. But culture is not some sort of non-physical essence... it is all chemistry and physics [But] what is thought of as more complex and less fundamental is being explained in terms of the less complex and fundamental.
>
> (Plotkin 1998, p. 89 / 90)(My emphasis)

> What is important about being a methodological reductionist, and here we see a meeting with ontological reductionism, is that there is denial that the [existence of complex] order represents a new kind of thing or substance. The order exists, it is not unreal, but it is not a thing in the way that a molecule is a thing. To think otherwise is to get one self into that way of thinking which gives existence to such nonuseful entities as those already mentioned life forces... the reductionist is not saying it is wrong to talk about entities on the macro level... [But] he or she does not want to keep adding ontological richness to the world. (Ruse 2001, p. 79)

What is interesting about these quotes is that anything that is not physical is denied fundamental existence. Emergents like life, mind and culture are not considered to have their own kind of existence in

addition to the physical, rather they are merely complex organisations of the physical. Taken like this, this means that they are not thought to be fundamental in explanation. Rather, the physical is the only thing that is taken to truly exist and be a fundamental explanation. The second problem with this is that it is all dependent on an over-generalised concept of the physical and the difficulty with that is that the physical is a diversity: it has a variety of different principles within it that are all considered to be physical. In other words the physical is not uniform, so a simple reference to the 'physical' is not sufficient at any attempt at reduction. I will return to this shortly.

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The first problem with the above position is that is leads to an anti-realism of all the emergents after the physical and this assumes that a split can be made between explanation and ontology. It may be recalled from chapter 1, that Runciman (1998, p. 8) thinks that the social and the cultural require their own explanations, but that these explanations do not refer to an autonomous kind of reality. I shall challenge this here in preference for a holistic approach that unifies explanation and ontology.

A problem for physicalism is that many scientists wish to be realists. What this means in the context of this research is that what explanations refer to is what is supposed to exist. The explanatory laws of electromagnetism, for a realist, refer to what exists. In this sense, the realist makes no distinction between the dimensions of explanation and ontology; they are a unity (Churchland & Hooker 1985). Anti-realism, on the other hand, can live with a distinction between ontology and explanation, in fact to a large extent it is defined by it: explanations are deemed to be good if they are empirically adequate, they do not have to refer to reality directly (Papineau 1996, Van Fraassen 1985).

The trouble is that physicalism is a realist philosophy that accepts the reality of the physical, but the emergents like life, sentience and cognition / sociality are not thought to have their own *intrinsic* kind of reality. They are either unreal, or are mere combinations of the physical. This attitude commits physicalism to a realism of the physical and an anti-realism of the later emergents. Normally, this

might be considered to be an inconsistency: either one is a realist, or an anti-realist, about all explanations.

At this point I want to raise the distinction made between the normative and the descriptive approach to the philosophy of science. I would claim that it is entirely consistent to be a realist and an ant-realist from a descriptive perspective but not from a normative perspective. For example, it is possible to deny the existence of unobservable particles, but all this means is that one is an anti-realist concerning some aspect of current theory. This is taking the descriptive perspective. From a normative point of view, however, the split between explanation and ontology cannot be accepted. This means that reductive physicalism, if it has realism at its foundation, cannot, from a normative perspective, consistently argue for a realism of the physical and an anti-realism of the later emergents. Normatively, either one aims to be a complete realist, or a complete anti-realist of the laws of explanation.

Consequently, I argue, to be a normative realist, means to be holistic realist. This argues that extra explanations other than the physical are needed, as I will show in chapter 3, **then** these explanations refer to what exists, that is to ontology. So to be a holistic realist, the notion that extra explanations are necessary for the emergent phases of evolution, like life, sentience, cognition and sociality, implies a broader ontology than that posited by physicalism, they have to be accepted as having their own kind of reality of Being.

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The second problem is that the 'physical' is not a uniform concept. If one looks at physics, there are many different kinds of laws and entities seen as being aspects of the physical: the laws of electromagnetism are different kinds of laws from those of gravitation. Even if some 'Theory of Everything' were to be invented, there would still need to be some explanation as to how they became different over evolutionary time. Similarly, electrons and protons are not the same kind of entities either. So when the 'physical' is spoken of, which of these is supposed to be the locus of reduction? When scientists make the claim of reduction, which laws or entity has to be specified otherwise the process is hopelessly vague. Unfortunately,

they often do not do this. Consequently, the explanation of an emergent phenomenon through the 'physical' cannot be justified.

Another aspect to this is that the 'physical' is often used to deny, or relegate, the existence of the laws and entities that are not physical. In the quotes from Plotkin and Ruse, it was asserted that what is not physical either does not exist or its 'existence' is relativised. This can be seen, for example, when Ruse referred to 'life forces' as nonuseful entities. He argued this on the basis that 'life forces' are not things like molecules are. The trouble is, this way of thinking can be applied to anything and as such one would have to see molecules not as things either and therefore not of any use. If one follows the reductionist principle of finding the smaller parts, a molecule also is supposed to consist of parts, which in turn also consist in parts. Take the water molecule it is supposed to consist of two parts: hydrogen and oxygen, which are composed of electrons and protons, the latter of these is composed of fundamental particles. And who can say if that is really the end? Does this mean then that nothing really exists, or that the laws governing on a higher **physical** level than a supposed ground zero are nonuseful? I do not think anyone would argue this as it cannot be justified for **explanatory** reasons: each of these 'levels' play an important role in explaining reality. If that is the case within physics, there is no reason that this could not also be asserted for those aspects of existence which are deemed as nonphysical.

This is also true when one considers the fact that physics is about different **kinds** of laws and entities as well as different **levels**. A photon is not the same kind of entity as a proton, the former is a particle of massless radiation, and the latter is an entity of mass and charge. After all no one would want to deny the existence of photons merely on the basis that they are not mechanical. The physical is diversity and there is no compelling reason that existence / Being more generally cannot be diversity on another level. Referring back to Plotkin, there is no reason why the psychological and the cultural cannot be seen as extra kinds or levels of Being just as photons and protons are. If we need them as useful explanations, they can also be interpreted as aspects of reality.

I shall argue then that the general concept of Being is a better starting point for explanation. The first idea I will put forward is that

of Being as a Universal. By this is meant "all that exists" after Harman *et al* (1994). That is, Being is a holistic, or universal, concept of everything that exists. As a **starting** point for scientific ontology, it is non-specific. **The concept of Being only becomes specific thorough the scientific process**. It is also an ontologically neutral concept in that no specific ontology is assumed at the beginning. Therefore as a starting point for science, it does not assume physicalism. The aim of science, through this approach, that is based on Being, therefore, is to specify what Being is, i.e., to **discover** what Being is, and not **assume** what it is, as is the case with Ultimate Physicalist Ontology. By my definition, as I will argue in more detail in chapter 3, Being is the Whole and the Physical is a 'Part' of it.

The idea of Being avoids the presuppositions of physicalism and postulates that science is about what exists, whatever it is. It therefore circumvents the problems of the two versions of physicalism, namely Currentism and Futurism. The two problems associated with these are often referred to as Hempel's Dilemma (Crook S & Gillet C 2001, p. 331). There are two aspects to this. Currentism is the view that 'the physical' should be defined in terms of the current principles of physics. Futurism is the notion that 'the physical' should be defined in terms of the future principles of physics.

The main problem with Currentism is that it excludes future new physical principles. For example, had Newtonian physics been seen as the definitive principles of the physical, then quantum theory would have been excluded from such a definition. Similarly, relativity theory would have been excluded and anything else that was not already a part of Newtonian physics.

With Futurism the problem is different. Futurism allows for new discoveries to become part of the definition of the physical, but there is no principal reason why **anything** could not be part of the definition. Thus Futurism is so indefinite that the physical could mean anything. The physical under this conception cannot be a specific principle and would have no internal differentiation. For Futurism all the sciences from physics through biology to the social would have to be defined as being about the physical. The problem then is that what we now call physics would have to be re-defined as

something else with more specific principles of explanation in order to give it a subject specific definition. This is not a desirable thing for science as one would then have to find differentiating concepts for the various types of physical, so little would be achieved as no reduction could be spoken of and one would be back to the same problem but with different names.

The consequences of this dilemma for emergent evolution, is that physicalism has no grounds. If physicalism believes that emergent phenomena are explicable ultimately by the physical, but if the physical cannot be specified, which it cannot by Currentism or Futurism, then it cannot even hope to explain anything. Physicalism as an absolutist philosophy, i.e., a philosophy that claims to be able to explain everything in terms of the physical, cannot work.

Crook and Gillet (2001) have proposed a solution to this problem which re-formulates physicalism as **philosophical** materialism. Their approach has many aspects, but I will address one which makes the whole of their argument seem implausible. They agree that physicalism as a **scientific** principle is doomed; they accept that Hempel's dilemma cannot be overcome if one takes the explanatory principles from science. They suggest a shift from a scientific approach to a philosophical one, i.e., to **speculative metaphysics**. Many arguments follow from this shift, but I will not go into them as the change in stance itself is very questionable. The move is questionable because a purely speculative approach to understanding the world has no empirical basis. One could imagine any kind of ontology, but if there was no means of testing it, then one kind of ontology cannot be chosen in preference over another. I would argue that if two or more ontologies are **empirically identical**, for example they were all able to make the same predictions, then there is no means to choose one over the other. At best, one could end up with a consistent thought structure, but there would still be no means to differentiate it from another consistent thought structure **unless** it had some empirical references. But if it did have empirical references, then it is not a purely speculative metaphysics and would become, in effect, science. If this were to happen, sooner or later Hempel's dilemma would take effect.

In order that one ontology may chosen over another, I think we need to find a way of unifying metaphysics with an empirical base of some

kind. This is another attempt at providing a holistic unity of ontology and 'scientific' epistemology (see fig 2.1). The solution I suggest would be to re-define the meaning of 'science' as: **that process through which Being is discovered and theorised**. This definition would be in keeping with the Goethean approach outlined in (2.2), it would be empirical in accordance with Being and it would be philosophical in that the idea content could be theorised about. In so far as the first aspect of this would provide the empirical content, it would avoid Hempel's dilemma altogether as Being is not a physicalist concept. It is a universal ontological concept waiting to be filled in by the discoveries of science, whatever they may be. Instead of a physicalist science we would have just science. Science would aim to understand Being whatever it turns out to be and not assume that everything will be physical or be explicable by the physical. A science of Being is a relatively presuppositionless science which discovers, and does not assume, what the dimensions of Being are. One of these dimensions will no doubt be the physical, but it will probably be only one dimension amongst many.

A consequence of taking Being as the real starting point for science is that explanations that are not physical in the narrow sense of the term are not to be seen as unscientific. In the above quotes by Plotkin and Ruse, there was the background concern that the acceptance of something like a 'life force' is interpreted as being unscientific, even as being 'mystical'. The main problem with such a designation is that it is based on the assumption of physicalism, that for an explanation to be scientific it has to be a physicalist or materialist one. One often sees this even amongst those of a more holistic and pluralist persuasion (see Gould 2003, p. 223; Rose 1997, p.XI). However, I have shown physicalism cannot be justified and that Being is a better starting point for scientific research. Science from this point of view is not just physical science, or even biological science, it is a generalised science of 'all that exists'. Under this conception, the discovery of **necessary explanations** is nothing mystical; it is just the aim and practice of science. If, for example, someone were to discover an explanation of some aspect of culture that is not a physicalist explanation, this does not imply any kind of mysticism, it is simply an explanation of what is, whatever that may be.

In the context of emergent evolution, Being provides a relatively assumption free starting point for the understanding of the emergent phases and will at least allow for the possibility of existence being explained in more than the principles of the physical. But so far, it is only a starting point.

(2.4) Being - Known as a Whole

There is another perspective of Fig 2.1 that needs addressing, namely how the epistemological components of theory and observation affect the ontology of emergent evolution. The focus will be on the **epistemic** conditions that enable a potentiality view of emergent evolution, i.e., potentialities as creative Wholes Over Time (see chapter 5). This is in contrast to a reductionist epistemology which would reject potentialities because they are not observable. Consequently, I need to provide an epistemological argument that allows for ontology of emergence from potentialities.

My approach is not an argument for the rightness or wrongness of any epistemic position; rather it is to show the consequences of accepting a particular epistemic stance for explanations of emergent evolution. I will show that a reductionist approach to epistemology leads to a reductionist ontology of emergent evolution. I will argue, in opposition to this, for a holistic mode of epistemology that culminates in a holistic ontology. My own particular position is what I have called Metaphysical Empiricism and will be contrasted with Constructive Empiricism and Scientific Realism. I will indicate here, to be consolidated in chapters (3) and (5), that Metaphysical Empiricism leads to an explanation of emergent evolution based on the idea of potentialities as Creative Wholes Over Time.

***

So the question is: why not reject the reality of potentialities; and with it potentialist emergentism, on the grounds that they are not observable? Why not be an anti-realist of the potentialities interpretation of evolution? My answer is that it is not possible to be one in a holistic sense. From a holistic perspective potentialities can be given as good an epistemological grounding as observable actualities and consequently considered to be real.

The most current form of so-called anti-realism is **constructive empiricism** (CE) (Curd & Cover 1998; Churchland and Hooker 1985; van Fraassen 1985). This is the view that rejects the existence of the postulated entities in the theories and laws of science on the grounds that they are unobservable. What is meant by this is that entities like electrons and other sub-atomic particles cannot be claimed to exist according to CE. Similarly, the past and

the future fall under this concept of the unobservable. *Consequently, as potentialities may be deemed unobservable, CE would have to reject their reality*. What matters, for CE, is that theories and laws of explanation are empirically adequate:

> But acceptance of a theory does involve some belief, and when it comes to opinion of empirical matters of fact - what the actual and observable **world is, was and will be like** - it is reasonable only to turn to science... we should present an empiricist theory of knowledge... based on experience... *experience can give us information about only what is both observable and actual*... experience discloses to us no more than what has *actually* happened so far. Hence, any observable structure is one which, in today's scientific world picture, fits inside the absolute past cone of some space-time point... theories tell us stories which go way beyond the limits of experience... and hence establish the distinction between truth and empirical adequacy.
>
> (Van Fraassen 1985, pp. 247- 253)(My emphasis)

What seems clear from the above quote is that what counts as real, for CE, is the **observable** and **actual**. Only those aspects of theory and laws which can become observed, or have observable consequences, can be considered to be real. In other words, van Fraassen is not an anti-realist in a complete sense, only in regards to those things which are unobservable. Those things which go beyond experience, or the observable, for CE, cannot be said to exist. A theory, for CE, is empirically adequate in respect of its observables. So CE needs a form of realism to substantiate its empirical adequacy.

It may be recalled that in the previous section that I argued that we need a Being-based empiricism in order to chose one ontology over another. This, in my view, is one of the positive strengths of empiricism in that it gives a base through which observation (and possibly some kinds of introspection), of some kind, provides the content through which one theory can be preferred to another. My view, however, goes beyond the usual kind of empiricism in that it makes an epistemological argument for the reality to which a theory refers to *as a potentiality*. I am arguing not only for the reality of the content given by empiricism but also for the reality of the potentiality

that a theory refers to. In order also to differentiate my position from Scientific Realism, which accepts the reality of unobservable entities and laws, etc., from which observable reality has emerged, I propose that:

> **A theory can be seen as a potentiality that expresses the relationship between observable actualities.**

My position can be derived from a particular problem with the concept 'observable' in that it also goes beyond the actual and observed instances. If some object that exists is said to be observable, I would argue that this is not just an epistemological concept. Being observable, it seems to me, is also ontological attribute, a disposition of an object to become observed. That is, an object is not just observed in the actual and finite moment, but can be observed over many instances in space-time. So if the observable can be said to exist, then that existence goes beyond the actual and also includes the possible. The possible may not be observ**ed**, but it is obser**vable**. What is observed is one instance of the observable.

I would claim that to be a holistic realist one has to accept the existence of 'the possible' as potentialities as well as actual observable instances. The realist component of CE substantiates this through its requirement of empirical adequacy and it **has** to have this realist component otherwise it would have no means to know if a theory was adequate. Hence, complete anti-realism is impossible.

Otherwise, I agree with CE: unobservables cannot be known to exist. But this view must not be seen to be anti-realist. Rather it is a form of realism that merely rejects the existence of the unobservable. It does not reject the unobserved, i.e., in finite moments of observation, but it does accept the existence of those aspects of laws and theories that could **become** observed, that is those aspects of laws that transcend finite moments in space and time but that could become observed. This is another way of looking at holistic realism in that it accepts the reality of both the possible and the actual. In fact it must hold that reality, existence, Being has to have these two dimensions otherwise it cannot be understood as a whole. Being from this perspective is the holistic unity of the Potential and the Actual. Through this revised form of empiricism, the Potential is

corroborated through the observable and actual and does not assume the existence of something until it can do so.

Concerning emergent evolution, the problem is that neither Scientific Realism (SR) nor Constructive Empiricism can provide an explanation. In the case of SR, it accepts the idea of the metaphysical as real, but it postulates it as unobservable. As has been said "nearly all contemporary philosophers of science accept that science aims to literally describe an unobservable world of micro-particles and intangible waves... constructive empiricists... conclude that for this reason we would be wrong to *believe* any scientific theories" (Papineau 1996, p. 4). Hence, according to CE, SR cannot be a theory of knowledge as the unobservable cannot be observed or known. Hence, an argument for the creative emergence of new wholes through the agency of the unobservable entities postulated by physicalist emergentism cannot be made, according to CE. Whether such entities exist or not is one thing, but what is for sure is that they cannot be known to exist, they can only be inferred.

Constructive Empiricism has a different problem in that its epistemology is rigidly bound to finite actualities, i.e., the observable instances of the moment and hence its ontology is only about momentary existence. Theories, for CE, do go beyond the limits of experience, but they are merely inner phenomena of the human mind, they do not exist in the world. Due to this, CE can have no explanation for emergent evolution as the past, or any fundamental entities in the past, cannot be observed. Therefore, the emergent entities and phenomena of the observable today cannot be explained through the unobservable past. This is, of course, considered from an ontological perspective.

So, if neither Scientific Realism nor Constructive Empiricism can give an epistemological basis to the ontology of emergent evolution, then what can? In the next section, I will put forward a view that I shall call **Metaphysical Empiricism** that accepts some aspects of both and rejects others. But in doing so creates the epistemological conditions for a potentialist ontology of emergent evolution.

***

In contrast to constructive empiricism, which only allows the reality of those things which are observable, Bohm advocates two forms of perception: outer perception through the senses, and inner perception through the mind. Outer perception is that through which we become aware of the things of the senses, through eye, ear and touch, etc. Inner perception through the mind is, for Bohm, that through which we become aware of the theories we hold about nature; it is essentially an activity of thought. Clearly, an epistemology similar to Bohm's has conditions that allows for the reality of potentialities, whilst constructivism does not. An epistemology similar to Bohm's is more inclusive in this sense, whilst constructive empiricism is exclusive.

For Bohm, cognition is a part of real Being, is in many respects inseparable from real Being. This act of cognition, again, consists in unifying the inner and the outer, both of which are integrated in Being, or reality. Knowledge, for Bohm, is the unification of the inner and outer contents of human consciousness and are aspects of real Being. Rather than mind, or thought, being a mere epiphenomenon, or only that through which we become aware of theories, for Bohm, mind is a part of the process of reality. This can be seen when Bohm further argues:

> The fact that objects so generally respond in harmony to such action suggests that everything must likewise contain something at least basically similar to ratio, and that this is what makes it possible for the world to be intelligible to human beings. Thus, intelligence, which includes creative perception of ratio, and intelligibility are not two separate and unrelated qualities, but rather **aspects of a single overall reality**.
>
> The fact that there is such an intimate relationship between human intelligence and the intelligibility of the universe can be understood in terms of a notion, commonly held during the Middle Ages, that each person is a microcosm, and thus stands as an analogy to the whole cosmos. This would explain how such a person could, through intelligent perception of ratio, produce analogies to whatever exists in the universe and even to the universe itself. For if this person already *is* an analogy to all this, then looking outward

> and looking inward will be two sides of one cyclic activity in which any aspect of the totality can in principle be revealed.
> (Bohm & Peat 1987, p. 149)(My emphasis)

Bohm's epistemic stance is significant for this research as it provides a foundation for an epistemology of emergent evolution based on potentialities. Rather than merely arguing for a correspondence theory of truth, Bohm also appears to argue for, what I shall call, a correspondence theory of reality. The correspondence theory of truth is based on the premise that theories, to be truthful, must correspond to something observable: there is some kind of likeness between what is theorised and the reality that is observed. Bohm's correspondence theory of reality, on the other hand, is the idea that if theories correspond to what can be observed and acted on in reality then there must exist something in the world that is like the theory, or in the theory that is like reality. This is fundamentally his argument for the existence of something in the world that is comparable to reason. This seems to me to be a revival of the medieval debate between realism and nominalism concerning the existence of Ideas, or Universals as they called them then. In chapter 5, I shall link this 'reason' in the world with an ontology of potentialities, but for now I am only considering the epistemological conditions for them.

What is interesting for the purpose of this research is that Bohm's definitions of knowledge do not fall readily into either the empiricist or the realist camps. For Bohm, reason exists both in human beings and in the cosmos, we would seem to know this through "looking inward" to the reason in our own minds, and through "looking outward" to the reason embedded in the world and revealed through our actions.

***

It may be recalled that, in section 2.2, I argued against one aspect of Bohm's method in so far as it affected his view of our knowledge of wholes. I argued for a scientific view that wholes are knowable. I will further argue here that, as I conceive potentialities as 'wholes over time', that these are also knowable. The question then is how? I shall make some more criticisms of Bohm, but I will take some aspects of his view in a positive way in that I agree that knowledge of reality is through inner **and** outer perception. It is just that I consider

that potentialities can be actually known through this dual process. As a result, the epistemology I argue for provides a *knowledge* condition for a potentialist interpretation of emergent evolution.

The only problem that I have with Bohm's view expressed above, is that it does not prove what it sets out to do. Namely, that it does not prove that the contents of inner perception, i.e., laws and theories have a corresponding reality in the outer world. What his argument shows is that there is something in laws and theories similar to something in the outer world that can be *observed* and how they respond to our actions (which, it should be added, is also observed). In other words, his correspondence theory of reality is really about the relationship between the laws we can be aware of through inner perception and the things we can be aware of through outer perception and action. But his aim was to show that within the outer world there exists something that is like reason; i.e., there is something like reason in the world that is like reason in the mind.

Due to this, Bohm's epistemological argument would be susceptible to refutation from an empiricist's perspective. Empiricism, after the fashion of van Fraassen, would have to reject the existence of the implicate order, as it would also reject the existence of potentialities, on the grounds that they cannot be observed. That is, they cannot be objects of outer perception so they cannot be considered to exist. As I have shown, Bohm's argument only shows in effect a correspondence between theory and observation, between inner perception and outer perception. So all an empiricist has to say is that outer perceptions is all that can be said to exist, there is nothing in the outer world that corresponds to reason itself. If so, there would be no argument for a theory of emergent evolution based on the Implicate Order or potentialities.

One would need a different kind of argument to justify a Bohmian position. As I have shown earlier, empiricism has to have an element of realism in order for it to demonstrate the empirical adequacy of theories. Normally, it would accept the idea that those aspects of theory that can become observable can be said to exist. What it would not usually do is consider the existence of laws themselves before they become observable. I would argue though that it is reasonable to accept the idea that these laws have some form of existence in the human mind before they are tested out

through observation. The question is: does there exist something in the outer world that is like them?

In order to argue that there is, there is a further point that needs to be made about the character of laws as they are within the human mind. I will show that laws in the mind are a particular kind of potentiality and that they correspond to potentialities in the outer world. It is fairly well accepted that laws and theories go beyond observed instances. Recall the quote from van Fraassen about how theories say more than experience (this section). This "going beyond experience" I will take as a necessary component of being a theory or a law because to deny this would mean that science is a mere description of what has already happened. The main point being that we rely on theories to go beyond the finite instances that are observable to include events and predictions that could *become* observable. As such, theories need to have many, perhaps infinite, possibilities within them. In other words, for the mind, theories and laws are potentialities of what can become.

How, then, can we come to potentialities in the outer world? Part of the problem is that the ability to predict events in the world could be interpreted as a merely epistemological process that had no corresponding outer reality. This would be a position accepted by constructive empiricism. But if predictability is interpreted in a holistic way this cannot be assumed. I argue that predictability relies on the fact that it is a holistic concept that spans between epistemology and ontology. If one takes the example of projectile motion, to predict where an object will go relies on the idea that the object has the potential to be somewhere, anywhere, else other than where it is in the present moment. One could not make a prediction if this was not assumed. But this potential to be somewhere else is not a finite observable thing in the moment; rather it is in effect infinite. In this way the outer world also goes beyond the finite moments too, but outer perception only shows us the isolated parts-in-time that constructive empiricism focuses on. **The potentiality of laws in the mind can be argued to correspond to potentialities in the world**. In Bohm's terms, inner perception shows that which corresponds to the implicate order that lies 'behind' the outer world accessible to outer perception. In this sense, it is reasonable to accept the idea that there is a holistic unity between laws as they

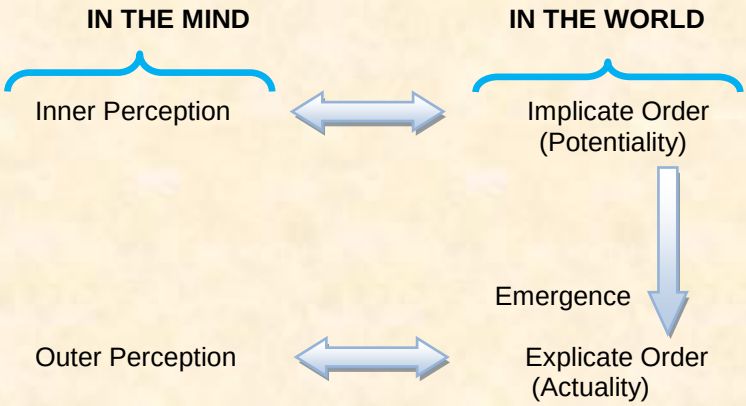
appear in the mind and laws as potentialities in the outer world. Prediction relies on this relationship.

***

As will be shown later, this inner and outer aspect to knowledge is vital for the founding of the concepts of potentiality and actuality. In order to provide an epistemological basis for this, I have argued, in this chapter, that Metaphysical Empiricism unifies both 'thinkability' (inner perception / reason) and 'observability' (outer perception) and is preferable to Scientific Realism and Constructive Empiricism in explaining emergence. In chapters 5 to 8, I will argue that all the emergents of evolution emerge from their own potentialities, not from the physical. For now I would like to suggest that the explicate order is comparable to that revealed through outer perception (actualities), whilst the implicate order is similar to that shown through inner perception (potentialities), that is, through reason. The question then is what exactly is the relationship between Bohm's presentations of the implicate and explicate orders on the one hand and this dynamic relationship between inner and outer perception on the other?

It would appear from the above presentation that Bohm's arguments are the beginning of the epistemological foundations for a realism of the generative and implicate order. And that the generative / implicate order and the explicate order are two sides of a **unified** reality. In a sense, Bohm's view is the beginning of a **Holistic Epistemology united with Holistic Being**. Rather than a mere correlation between the theories in the human mind and the sense perceptible world, as is the case with the contemporary realist position, Bohm's view leans strongly toward the medieval form of realism: the implicate and generative orders really exist, they are not merely mind events. I have linked these with the concepts of potentiality and actuality respectively. I shall model this in the following way:

Fig 2.4



Reality or Being, in Bohm's conception, is the unity of the implicate and the explicate order. We come to know the implicate order through inner perception, the explicate order through outer perception. Evolutionary emergence based on this epistemology will be explained later in terms of transformations between the Potential and the Actual (see chapter 5).

The position that I will be taking is similar to Bohm's. I have used Being as the central concept in this section, in chapter 5, I will focus on the idea of Becoming. Together Being and Becoming, I will show, provide a better explanation of emergent evolution. For now, my concern is with giving a plausible basis for the **epistemology** of Being in emergent evolution. What the above exposition shows is that from a Bohm perspective, reality, or Being, is approachable from two perspectives, the inner and the outer. However, what is revealed are not two separate worlds, as it would be for a one-sided Platonism, but are two aspects of one world or reality. I shall just call this one reality **Being**. **Being, under this conception has a potential / implicate component and an actual / explicate component**. Goethe had different names for these, he called them the Archetype (the General) and the phenomena (the special instance), but they were unified in Being.

In light of the above proposal about knowledge and reality, I argue for a new view of emergent evolution within its framework. I will show how it is fundamentally a better view than that proposed by reductive physicalism. The epistemic position proposed here differs from Constructive Empiricism (CE) in that it accepts the existence of potentialities, but it also accepts that aspect of CE that requires laws to be tested out through outer observation; it also differs from the majority position of Scientific Realism in that it denies the knowability of unobservables as 'actualities' or instances in connection with outer perception. For Metaphysical Empiricism, we can become aware of potentialities through inner perception but their existence has to be justified in connection with outer perception, i.e., through actualities.

(2.5) Conclusion

In this chapter, I have argued that a holistic approach to the relationship between epistemology, ontology and methodology is important for an understanding of emergent evolution. The reductionist methodology splits them apart which eventually leads to a reductionist explanation of emergent evolution. Such a view considers the later emergents as either unreal or being mere combinations of the physical. I have argued against this in preference for recognising the new explanations refer new kinds of reality. I have also argued for a form of holistic epistemology that can accept potentialities as real.

(3) BEING *EXTRA*

(3.1) Introduction

The main aim of this chapter is to make an argument for pluralism. In the first instance, this is meant in an epistemological sense, but secondly also in an ontological sense. I show that extra explanations are necessary in order to explain emergent evolution. As I have shown previously that if one is a holistic realist, and if one accepts that extra explanations are needed, then this necessarily means that extra kinds of being are implied. This follows from the idea that, for a realist, explanations are about reality or Being. An associated thesis is that if theorists accept that extra explanations are necessary, other than physical ones, and if they want to be realists, then they have to accept that extra realities are implied, even if they do not want this. I will show both these theses. Such a view resonates with Goethe's idea that the method of understanding a being should be drawn from the being itself: "Goethe's view... always takes its manner of observation, not from the mind of the observer, but from the nature of the thing observed" (Steiner 1978, p. 7).

One of the main problems, however, of the reductionism / holism debate in popular science, is identifying the nature of either. As will be shown below, there is a variety of both of these. First, however, it has to be noted that some authors disavow naive reductionism and accuse others of treating them as 'straw men' (Dawkins 1991, p. 13; Dennett 2003, pp. 19/20). So the question then is: is there really a reductionism worth being against? I will show that there are indeed quite a few of the non-naive type.

If one considers again Fig 2.2, once one accepts that there are different levels to emergence, then there arise four logically possible positions which can be seen from both the epistemological and ontological perspectives. The first is that of **reductionism** where the lower levels in some way explain the higher levels. The second is that of **holism** in which the higher levels explain the lower. The third is **pluralism**, which may also be called innatism, where each level explains itself. The fourth and final possibility is **dialecticism** which also could be called interactionism, where each level helps explain the other, whether higher or lower. The fourth is distinct from the third position because pluralism does not imply an interactive element of explanation. Within each of these there are some

important variations for which I have invented some terms. I tabularise these as follows:

Fig 3.1

Reductionism:	Consilient Reductionism	(Wilson 1998)
	Ultimate Reductionism	(Weinberg 1993)
	Hierarchical Reductionism	(Dawkins 1991)
	Complexification	(Barrow 1991)
	Unification	(Dennett 1995)
	Consequentialism	(Deutsch 1997)
	Ontic Dependency	(Balashov 1992)
Holism:	Ultimate Holism	(Capra 1997)
	Nested Holism	(Sheldrake 1990)
Pluralism:	Consilient Pluralism	(Gould 2003)
Dialecticism:		(Rose 1997)

I will argue that each of these can be used to support a form of explanation that unifies them to some extent. Each of these positions can be shown to have positive and negative aspects. I will show that reductionism, on the positive side, enables one to find lower level explanations where necessary; on the negative side reductionism denies that the higher levels have their own explanations. Holism has the opposite attributes, it recognises that higher levels have their own explanations, but the lower levels do not. Pluralism in the positive sense, accepts that each level has its own explanation, but on the negative side, it does not see the need for interaction between the levels. Dialecticism does recognise this but has no means of explaining how the wholes can explain the parts if the parts explain the whole.

The following discussion revolves around whether or not emergents need their own explanations. If it can be show that emergents do require this, then at least epistemological reductionism has failed. This follows from my discussion in chapter 1 where I showed that if an explanation has unique conceptions within it, then it cannot be reduced.

Another aspect to this is what is it that actually counts as an explanation? As shown in Fig 1.2b, this is usually considered to be the law in law model of explanation. The law is also sometimes referred to as 'theory'. By this account, if an emergent is considered to be an outcome, or an instance, or an effect, of a law, then it is not considered to need its own explanation. Were that the case, then reductionism may be possible. If on the other hand, an emergent is claimed to need its own explanation, then it follows that epistemological pluralism is the more coherent account.

I will argue that a way to accept the positive and reject the negative in the various interpretations of reductionism and holism is through the concept of Being. I will show, in this chapter, that the following arguments can be used to support the idea of **Being *Extra*** (ontological pluralism). The arguments here are partially dependent on those in chapter 2 where I argued that, for a holistic realist, epistemological pluralism implies ontological pluralism. If one is not convinced by this, then this chapter can be seen as an independent argument for epistemological pluralism with some additional arguments for ontological pluralism. I will make links between the epistemological and ontological dimensions as I go along.

Developing my argument from the above four kinds of positions, I will argue:

In (3.2): Part Being needs Wholes,
In (3.3): Whole Being needs Parts,
In (3.4): Each Being is a Whole,
In (3.5): Being is Together.

I will show each of these to be aspects of that kind of ontological pluralism that I advocate.

***

(3.2) Part Being needs Wholes

Many reductionists seem to think that 'parts' do not need 'wholes' when it comes to explanation. I will argue the reverse and that this implies extra Being.

***

Wilson argues for what he calls 'consilience', but nevertheless he is still a reductionist which can be seen from the following quote:

> The central idea of the consilience world view is that all tangible phenomena, from the birth of the stars to social institutions, are based on material processes that are ultimately reducible however long and tortuous the sequences, to the **laws of physics**... I know that such reductionism is not popular outside the natural sciences... So let me hasten to dispel the profane image that causes this reaction. As the century closes, the focus of the natural sciences has begun to shift away from the search for new fundamental laws and towards new kinds of synthesis - "holism," if you prefer - in order to understand complex systems... The strategy that works best in these enterprises is the construction of coherent cause - and - effect **explanations** across levels of organization... No compelling reason has ever been offered why the same strategy should not work to unite the natural sciences with the social sciences and humanities. The difference between the two domains is in the magnitude of the problem, not the principles needed for the solution.
>
> (Wilson 1998, p. 297/98) (My emphasis)

Even though he makes an acknowledgement of holism, this is of a particular sort. Wilson's form of consilience is a synthesis of the laws of physics, he does not really accept the possibility that laws of another kind may also be necessary for explanation. It is in this sense that Wilson is really a supporter of reductive physicalism. This is obvious from the last line of the quote where it is claimed that no extra principles are actually needed.

If the propositions in this paragraph are compared what he said earlier "At each level of organization... phenomena exist that require new laws and principles" (Wilson 1998, p. 59), they are in complete contradiction to each other. In the first he claims that new laws and principles are needed for higher levels of organization; in the second he says that no extra principles are needed to unify the natural and

social sciences. Clearly, he cannot have it both ways. So which one is it?

First, I will consider the question merely from the perspective of explanation. The field of emergent evolution is a significant test case for a view such as Wilson's. As outlined in (1.1.2), the logic of the problem is how it explains one phase in terms of another. Considering fig 1.2a, if it is accepted that each of the four kinds of explanation *are* four different kinds of explanation how can it be argued that reduction to another explanation is possible? For example, it is fairly well accepted that there was a phase in evolution when there were no living, sentient or cognitive processes. This was a phase when only the laws of physics were prevalent, together with physical properties. It was only later that 'life' emerged, that is reproduction, inheritance and adaptation came into being. Before a certain point in evolution these are thought not to have existed. From the point of view of **explanation**, then, new biological 'laws', i.e., the principles of explanation, are needed to understand emergent 'life'. So what is fairly certain, new principles of explanation, new laws of life are needed in addition to the laws of the physical to explain the evolving world.

If this is denied, as Wilson does, then one would be forced into being an anti-realist about the laws of life. Wilson would no doubt claim that the laws of life are a 'special case' of the laws of physics. But from an explanation perspective I propose that the 'special case' concept implies the need for extra explanations to those standard laws which we call the physical. 'Life' as an explanatory principle is not contained by the Currentist definitions of physical laws and as we have seen (section 2.3), Futurism is too indefinite to be of any real use. I would argue then, that the laws of life are distinct and are therefore autonomous explanatory principles from those of the physical.

As I am also convinced that science should aim to be realist, then my argument implies an extra kind of **reality** called 'life'. The laws of Life for a realist are the observable processes that biologists call reproduction, inheritance and adaptation; these are not reducible to the laws of physics. Nor are these 'laws of Life' anything mystical, they are simply necessary explanations of what exists. If this is true of the laws of life, why not other higher level laws of cognition and

sociality? If new and relatively autonomous laws of life emerge in evolution then there is no principle reason why others cannot emerge too and have relatively autonomous laws of explanation and reality.

Another connected point to this is that in Wilson's (1999) book, no real argument is found that unifies the social sciences, psychology, etc., with any of the laws of physics (see p. 228 where he claims this is possible). Wilson in the whole of his book makes practically no detailed reference to any one, or set, of them, except by vaguely referring to 'the physical'. In effect this means that he can do without them. What he does do is try to explain the higher levels in terms of evolutionary biology. This is a tacit admission that the explanatory principles of biology are in effect autonomous from those of physics. As such there is no point in calling biological laws 'physical laws' in either the Currentist or Futurist sense. So if there can be autonomous biological laws, could there also be autonomous ones for the social sphere too?

What this suggests is that 'parts' need 'wholes', this is especially the case when living organism are considered - they are Beings whose physical parts need 'life' as an explanation.

***

In the above, frequent references were made to the laws of physics as being the most fundamental in explanation. But the problem is that the laws of physics also have similar questions about holism and reductionism. So a simple appeal to the laws of physics will not do. After all they are not a uniformity they are a diversity too.

In physics, a similar kind of reductive reasoning to that of Wilson can be found. I shall call this stance **ultimate reductionism**. Weinberg (1993), for instance, has distinguished between the "levels of why" and the "arrow of explanation". These he sees as converging in the conceptions to be found in particle physics. He can be seen as arguing for a kind of **downward direction** of explanation. Weinberg argues:

> The experience of the last 150 years has shown that life is subject to the same laws of nature as is inanimate matter... In principle, no obstacle stands in the way of explaining the

> *behaviour* of other people in terms of neurology and physiology and, ultimately, in terms of physics and history. When we have succeeded in this endeavour, we should find that part of the explanation is a program of neural activity that we will recognize as corresponding to our own consciousness. (Weinberg 1994, p. 25)

> even though chemistry survives to deal with such problems in its own language and concepts, still there are no autonomous principles of chemistry that are simply independent truths, not resting on the deeper principles of physics (Footnote).. by elementary particle physics being more fundamental... it is closer to the point of convergence of all our arrows of explanation. (Weinberg 1993, p42/43)

The argument from the 'logical order of nature' (p. 35) is where the laws and properties of particle physics are more **comprehensive** than other scientific laws; and the 'arrow of explanation' converges on the current laws of fundamental particles, with the arrow of explanations of human behaviour and consciousness in these terms (principles). He claims that the form of reductionism that comes closest to his is "Theory reductionism, which is the explanation of a whole theory in terms of a more **inclusive** theory" (Weinberg, 1993, p. 42) (My emphasis).

Given that one accepts that Weinberg is not a naive reductionist, there is still a problem of whether or not this can work with reductions between different types of theory. For example, can human behaviour and consciousness be **completely** explained through the principles of physics without recourse to any other explanations whatsoever? I do not think he wants to say this. But if he doesn't, then it means that extra explanations are needed. It is difficult to see how his view could work even in principle. Either it is possible to explain the whole of one theory in terms of another or it isn't. If you believe it is, then you are an ultimate reductionist, if you don't then you are not a reductionist. It is not possible to have it both ways...

Even one of the examples he gives suggests that this form of reductionism is not possible. He describes the relationship between research done in particle physics and condensed matter physics: "Condensed matter physics will doubtless eventually solve the

problem of high-temperature superconductivity without any direct help from particle physics" (Weinberg 1993, p 46).

The question is: can condensed matter physics be explained **exhaustively** in the terms, conceptions, principles, of particle physics? Obviously they may play a very significant role in such an explanation. But this begs the question of whether or not explanation itself can be conceived only in terms of the most common elements or the *substantive* components necessary in the explanation of an entity. Clearly, if it is true as Weinberg admits, that condensed matter physics will solve its problems without any help from particle physics, then it would contain extra explanations. Hence there is no complete reduction in this case.

If this is true, what likelihood is there of "explaining the behaviour of other people... in terms of physics and history" as he claims in the first quote above. All that his argument adds up to is that there is a component of explanation on the level of the lower parts, but I would add that these parts need extra explanations on the level of the whole. In this case, that would mean on the level of the whole human being.

A better approach, as outlined earlier, would be to use Being as an epistemological and methodological concept that is gradually changed into an ontological concept. If Weinberg is taken at his word, then even in the area of condensed matter physics extra kinds of Being need to be posited. It is no good appealing to the idea of ultimate future reduction if condensed matter physics can do without particle physics. If, on the other hand, Being was seen as a research idea, then extra Being can be assumed on the basis of explanatory necessity: if extra explanations are needed, then you need extra Being and this implies extra laws of explanation.

***

A distinct kind of reductionist argument is that used by Dawkins. Dawkins has characterized his own approach to explanation as **hierarchical reductionism** a kind of **one step down explanation** where:

> The hierarchical reductionist... explains a complex entity at any particular level in the hierarchy of organization in terms of entities only one level down the hierarchy; entities which, themselves, are likely to be complex enough to need further reducing to their own component parts; and so on... the kinds of explanation which are suitable at high levels in the hierarchy are quite different from the kinds of explanations which are suitable at lower levels... But the hierarchical reductionist believes that carburettors are explained in terms of smaller units... which are ultimately explained in terms of the smallest fundamental particles... But another kind of question is **how [a] complicated thing came into existence in the first place**... Just as 'big step reductionism' cannot work as an explanation of mechanism, and must be replaced by a series of small step-by-step peelings down through the hierarchy, so we can't explain a complex thing as *originating* in the single step. We must again resort to a series of small steps, this time arranged sequentially in time...
>
> The kind of explanation we come up with must not contradict the laws of physics. Indeed it will make use of the laws of physics, and nothing more than the laws of physics. But it will deploy the laws of physics in a special way... That special way is Darwin's way.
>
> (Dawkins 1991, pp. 13-15) (My emphasis)

Rose (1997) has argued strongly against this view claiming that Dawkins' form of reductionism will not work:

> Dawkins' precipice is a slippery place on which to stand. He may wish to descend only a little way down the cliff. Yet having launched himself over the edge, it is extremely hard to see how he can avoid being dashed against the rocks... What principle allows them to decide the level at which the elimination ceases? (Rose 1997, p. 88)

I concur with Rose, in Dawkins' case, hierarchical reductionism just will not work. In the end it is a form of ultimate reductionism which he rejects. The argument that 'indirect' reductionism is different from 'direct' reductionism is not true. This is clear from the transitivity of

the following argument. Let X, Y and Z represent levels of explanation. If X reduces to Y, and Y reduces to Z, then X necessarily reduces Z. There is simply no way that one-step reductionism can prevent itself from becoming an ultimate reductionism which would have to explain everything in terms of its smallest parts, i.e., the fundamental particles. That is, culminating in Weinberg's position. Unless, of course, criteria could be found for stopping at a particular level. But if that is the case, why speak of the reduction of a hierarchy of levels, i.e., by making use of the laws of physics and nothing more than the laws of physics?

But having a stopping point could work in some cases if the concept of Being is used. That is Being as a Holistic concept. Being can give a natural stopping point for some forms of explanation. This is not meant in a reductionist sense, but as a way to prevent the endless levels of regress that are implicit in ultimate reductionism. The example of the car engine that Dawkins gives is an interesting one as he seems to think that explanation can go all the way down to fundamental particle level. But this cannot work as Rose and I have argued. But it is possible to stop on the level of the parts of the car like spark plugs, etc., if the concept of Being is used. This is because the concept of Being 'car' has a kind of binding concept that requires that one does not go down beyond a particular level. The level, in this case would be the normal macroscopically observable properties used in classical mechanics. Sub-atomic particles simply do not come into it.

Furthermore, the concept of Being as in this case 'car' requires an explanation beyond that of any of its given parts. The Being concept involves its function that cannot be found in any of its parts except in so far as that function has been embedded there in a top down manner. In other words, the parts have to fit the function of the holistic concept of 'Being a car', otherwise there is no point in those parts being there. In other words, the parts need the whole.

***

Complexification is another form of argument for physicalist reductionism. In this case, what appears at first sight to be an acceptance of emergent phenomena as being irreducible, turns out to be a re-definition of them in physicalist and reductionist terms:

> these examples teach us that if reductionism means that all explanations for complexity must be sought at a lower level, and ultimately in the world of the most elementary constituents of matter, then reductionism is false. Instead, we might expect to find novel types of complex organization, at each level, as we go from the realm of quarks to nucleons to atoms to molecules to aggregates of matter... Life... is a classical example of what can occur when a sufficient level of complexity is attained. Consciousness appears to be a manifestation of an even more elaborate level of organization. (Barrow 1991, pp. 140/1)

The examples that Barrow gives are those of the nature of Life and Consciousness. Clearly, Barrow is not a reductionist on the level of *organisation*, for him each level of organisation needs a new kind of explanation: life and consciousness are examples of new levels of organisation requiring new explanations. But the problem with this is that it seems to split epistemology from ontology. Were one to accept new explanations imply new realities, as argued in chapter 2, then one could not just assert the reality of new organisations of the physical: life and consciousness could be new kinds of realities and not mere levels of organisation. In this sense, Barrow is an epistemological emergentist and an ontological reductionist, with some concessions made for the reality of organisation (but of the physical). He sees life and consciousness as complex organisations (or re-organisations) of physical entities like quarks, atoms and molecules, etc. Is this sufficient for explanation? In order for this view to be successful, he would have to show how concepts applicable to apparently emergent processes are explicable in terms of complex arrangements of purely physical concepts. In most cases this would involve the re-definition of terms like life and consciousness into the terms of physical theory.

But one could wonder if this is really feasible bearing in mind that the laws of physics are of a very particular type and secondly what would the epistemological grounds be for explaining observations of what seem to be one type of thing in terms of another? But as I showed in (1.2.4) such an epistemological reduction is impossible for genuinely heterogeneous terms. This follows from the principles of derivability and connectability as outlined by Nagel (1974) and Ayala (1984).

For example, it is not possible that the reproduction of biological **forms** could ever, in principle, be explained **only** through the terms used for explaining of electrostatic bonding on the atomic / chemical levels, however complex the arrangements. From an ontological perspective, a further reason is that the existence of electrostatic bonds does not differentiate between the living and the non-living, they are present in minerals and plants alike. Ontologically, some differentiating principles are required.

However, just as the car needs the level of function to help explain its parts, the living organism needs 'life' as an explanation in addition to the physical. Considering this the other way around, the physical parts need the 'life' element of explanation to make the whole explanation.

***

Deutsch holds a similar position to Barrow in that emergent phenomena are interpreted as 'physical' except he is what may be called a **consequentialist** as he considers emergents to be consequences of the laws of physics (Deutsch 1997, p. 28):

> I have warned against the reductionist assumption that emergent phenomena, such as life, are necessarily less fundamental than the microscopic physical ones. Nevertheless, everything I have just been saying about what life is seems to point to its being a mere side-effect at the end of a long chain of side-effects. For it is not merely the **predictions** of biology that reduce to, in principle, to those of physics: it is, on the face of it, also the **explanations.**.. the great explanatory theories of Darwin (in modern versions such as that propounded by Dawkins), and of modern biochemistry, *are* reductive. Living molecules - genes - are merely molecules, obeying the same laws of physics and chemistry as non-living ones. They contain no special substance, nor do they have any special physical attributes. They just happen, in certain environments, to be replicators.
>
> (Deutsch 1997, p. 176) (My emphasis)

> if we understand *knowledge* and *adaptation* as structure which extends across large numbers of universes, then we

> expect the principles of epistemology and evolution to be expressible directly as laws about the structure of the multiverse. That is, they are **physical laws**, but at an emergent level. (Deutsch 1997, p. 345) (My emphasis)

First Deutsch accepts that emergent phenomena, like life, evolution and epistemology may be expressed as **laws**, but then regards them to be either reducible to physical laws or that they may be defined as physical laws. In a sense, Deutsch appears to bridge the two physicalist positions of Currentism and Futurism. He distinguishes the **predictive** and **explanatory** components of theories and claims that both these aspects of the laws of biology and epistemology are reducible to the corresponding aspects in the physical laws. Biology and epistemology are merely emergents that are consequences of physical laws.

But there is the same problem as with Barrow: what justification is there for claiming that the laws necessary to explain the emergents are **physical** laws? That is, in terms of the laws of physics currently accepted? If we accept life and epistemology to be emergent laws, i.e., having additional **explanatory** laws to that from which they are supposed to emerge, what sense does it make to claim that they are reducible through both prediction and in explanation? If an emergent phenomenon is a law, then it has an independent explanatory function from that of the physical base from which it is supposed to have emerged. In that sense, the claim that epistemology and evolution are laws is an argument for extra explanation and, I would suggest, extra reality. The ascription of 'physical' to them is not necessary, because to do this merely shifts the meaning of the term 'physical' towards something indefinite. This Futurist element only confuses what is needed for explanation, which is to have specific laws about specific phenomena. So if specific laws are needed for evolution and epistemology, then it is arguable that these are extra realities to that of the physical. In other words, they are Extra Being.

What is interesting is the way Deutsch plays down the concept of replication, for him it is something that 'just happens'. By doing this he makes the idea of replication of very little explanatory value, and just asserts that living molecules obey the same laws of physics and chemistry as non-living ones. Of course they do. The trouble is though that you cannot explain the 'living' without the concept of

replication - it is a distinctive explanatory principle from the explanatory principles of the physical. And as I have shown in chapter 2, it is reasonable to accept that extra explanations imply extra reality, this suggests that the need for a concept of replication implies a reality. This reality could simply be called 'Life'.

From an explanatory perspective, the concept of Being can help solve these problems as it unifies all of these emergent 'parts' into a synthetic whole and prevents the need to reduce everything to the physical. With the concept of Being as an Explanatory Principle, the laws / principles of epistemology, evolution, chemistry and physics would all be on equal footing. In other words, the laws of physics would not be needed to be interpreted as the termini of ultimate reduction; they would be one set of 'parts' for the explanation of whole Being.

From an ontological perspective, it could be argued that one finds human beings in the world that have these perspectives to them: Human Beings actually are, amongst other things, epistemic, evolutionary, chemical and physical Beings. Put differently, epistemology, evolution, chemistry and the physical are emergents from Being, and are each irreducible. Each are parts that need whole Being.

***

It is also possible to see reduction as a kind of **unification** process. In this the theories to be reduced seem to maintain their own integrity, but are brought under the umbrella of a broader explanatory framework. This has been advocated by Dennett (1995):

> I'm sure Weinberg would agree. But in their eagerness for a bargain, in their desire to explain too much too fast, scientists and philosophers often underestimate the complexities, trying to skip whole layers or levels of theory... In itself, the desire to reduce, to unite, to explain it all in one overarching theory, is no more to be condemned... Darwin's dangerous idea is reductionism incarnate... The most common fear about Darwin's idea is that it will not just explain but *explain away* the Minds and Purposes and Meanings we hold so dear. People fear... they will cease to

> exist... this cannot be a sound fear; a *proper* reductionist explanation of these phenomena would leave then still standing but just demystified, united, placed on a more secure foundation. (Dennett 1995, p. 82)

Is this reduction? In chapter 1, I outlined the law model of explanation (see Fig 1.2b) in which the law explains the outcome or instance. Now if, as Dennett argues, the concepts of one level of a theory are not explained away, they cannot be mere outcomes of laws, they must be explanations in their own right. Otherwise if one is asserting they are mere outcomes of laws, then they are explained away. It is not possible to have it both ways. If, however, the levels of theory are explanations and if they are left standing, for example theories of Mind, Purposes and Meaning, what actually is meant by saying that they are explained by others on a, perhaps, lower level? Unification does not seem to be reduction in any meaningful sense; it merely subsumes, rightly or wrongly, more specialised levels of theory under a more general theory.

More generally, if there is a unifying theory, which leaves other explanatory conceptions still standing, it cannot really claim to explain any more than their common, not their unique, features. If there are unique explanatory conceptions 'still standing', then these are additional components of explanation.

I would argue that the unifying principle is Being. Humans are unified in Being; they have minds, purposes and life and ‘parts’ of their Being. They have life in common with other living beings, certainly, to understand Human Beings the ideas of Darwinian evolution are simply not enough, if that were the case, and if Darwinian evolution was the **common** principle, then there would be no means to differentiate people from plants. The concept of Being sees life / evolution as a 'part' to human existence, but minds and purposes are parts too. As argued above, life and minds, etc., are **all** emergent 'parts' from Whole Being. No reduction is actually necessary. The parts need the whole Being.

***

Another kind of reductionist argument is what I shall call **ontological dependency** which can be seen as an example of nomological

supervenience (chapter 1). This has been encapsulated succinctly by Balashov:

> It is now commonly agreed that the reductionist position is not to be identified with *naive* reductionism (see Ayala [1983]). Unlike the latter, *methodological* reductionism does not question the qualitative novelties of a complex system with respect to its constituent elements. That the system is not an 'arithmetic sum' of the elements is quite obvious. It is argued at the same time that the emergence of qualitatively new properties can *in principle* be explained in terms of its elements' properties and their laws of interaction provided they are properly studied. It is claimed also that science must look for such explanations... the correct methodological strategy consists in a relentless search for more and more fundamental explanations... if we take up the position of methodological reductionism, then biological (and all other) laws are derivatives of the truly fundamental physical laws...
>
> the predicate of fundamentality maybe granted to some law only provisionally.... what is important is that all the time the 'ground floor' of the hierarchy of laws is in view. By this we mean that the present 'most' fundamental natural laws are regarded as being **ontologically independent**, while the respective scientific laws are regarded as being irreducible to the more general ones until there is hard evidence to the contrary. (My emphasis) (Balashov 1992, p. 348-350)

His argument is based on the notion of "explanation in principle" and has two components: 1) terms or concepts of element's properties and 2) laws of interaction. These are supposedly sufficient to explain the qualitatively new properties that emerge in a system. All other laws are then regarded as derivatives. But this appears to be an admission that there is something irreducible about an emergent property; how are they supposed laws of interaction to be understood? Why not just say there are new levels of laws and properties and have done with it? Also, it is not clear from his argument what principle of derivation he is talking about: logical, physical? His approach is another example of physicalism from another perspective.

The ascription of fundamentality Balashov advocates is based on the idea of **ontological independence**: the idea that if a law or property can exist independently of others, then it is a more **fundamental** law or property than those that require the existence of other types. I shall argue though that the laws of physics themselves are ontologically dependent on Being. For Balashov, the laws of physics are seen as ontologically independent because they do not need the existence of the laws of life, consciousness and cognition in order for themselves to exist. The reverse does not seem to be true however: life and epistemic processes for instance, do appear to need the existence of physical and chemical processes in order to unfold their own existence.

This begs the question: is explanation aimed only at what seems to be the most ontologically independent laws and properties? If we accept for now that the laws of physics are the most ontologically independent, and in that sense more fundamental, does this mean that we need no extra explanations for life and consciousness? Explanation I would argue must include not only those explanations that appear to have greater ontological independence, but those explanations that have various kinds of dependency - being a dependent law does not imply that it is not an extra law to the supposedly independent physical laws.

In addition, Balashov's claim is based on a cosmological argument which assumes, with good reason, that 'the physical' existed before life and consciousness, etc., and that life and consciousness are ontologically dependent on the physical. But to explain the emergents, I would argue, one needs to understand ontological dependency not just from the perspective of the antecedent physical 'parts', but also from the point of view of the new emergent whole. Take for example the physical dimension of a living organism. I would argue that its physical dimension is subsumed and determined to some degree by the 'life principle'. Nutrition is a case in point where, for example, the healthy development of a living organism requires that 'the physical' is subject to the 'life' of the organism and serves that life.

Seen from the perspective of Whole Being, the **internal** physical component of the organism is ontologically dependent on its life

process. This does not refute Balashov's view concerning the **external** physical level, but it does mean that explaining from the perspective of the emergent living organism itself shows the question of ontological dependency to work the other way around. What my argument indicates is that for all beings and levels above the physical, the internal physical can be dependent on those higher levels. More importantly, it is the emergents we are trying to explain, not their antecedent, and external, physical parts. From the perspective of the emergents themselves, the physical parts are ontologically dependent on the Whole Being. Parts need Whole Being.

(3.3) Whole Being needs Parts

An extreme form of holism would deny that a lower level of explanation explains itself. But I will argue here that wholes also need parts.

***

In opposition to reductionism, Capra has argued for a kind of **ultimate holism** which sees wholes as more than the sum of their parts, and that the parts themselves acquire their significance only in terms of the whole:

> According to the systems view, the essential properties of an organism, or living system, are properties of the whole, which none of the parts have. They arise from the interactions and relationships between the parts.... the nature of the whole is always more than the sum of the parts... The properties of the parts are not intrinsic properties, but can be understood only within the context of the larger whole. Thus the relationship between the parts and the whole has been reversed. (Capra 1997, p. 29)

Capra attempts to reverse the direction of explanation. Instead of the whole taking its explanation from the parts, or lower levels, the reverse is claimed to be true. But is Capra's position subject to a similar objection, but in reverse direction, to that applicable to Dawkins'? At what point do you stop going up the levels, the universe as a totality? If this is the case how could it ever be

known? Again, what would be the criteria for stopping at a particular level?

The idea of Being is again useful in this respect as it can provide a binding concept for preventing the process of explanation going on forever upwards and not having any intrinsic meaning to each level. The point I am making is not that going up further levels cannot give additional explanation, rather that the concept of Being can establish the meaning of a particular level and avoid Capra's absolutism in the upward direction. So for example, if Capra's view was true, then individual humans would only have meaning in terms of society as a whole. But the concept of Being would provide a point for the inclusion of meaning that is unique to *individual* human beings which then may have additional meanings from society. In this case, the concept of Being is of the kind called *primary substance* which is more informative than *secondary substance* (Aristotle 1992, p. 7). In the context of this research, the individual human being, as Being, is the more 'informed' as it also gives the species 'human' as well as the genus 'animal'. By this way of thinking, the 'social' is a general aspect of human Being, whilst the 'individual' is the more special.

The notion of fundamentality also has been challenged by Capra. He has argued that the ideas of fundamental laws, principles, building blocks, etc., are based on the metaphor of knowledge as a building. Instead, he advocates the metaphor of knowledge as a network:

> In the new systems thinking, the metaphor of knowledge as a building has been replaced by that of a network... an interconnected network of concepts and models where there are no foundations... was formalized by Geoffrey Chew in his 'bootstrap philosophy'... The bootstrap philosophy not only abandons the idea of fundamental building blocks of matter, but accepts no fundamental entities whatsoever - no fundamental constants, laws, or equations. The material universe is seen as a dynamic web of interrelated events. None of the properties of any part of the web is fundamental; they all follow from the properties of other parts... the phenomena described by physics are not any more fundamental than those described by, say, biology or psychology. They belong to different systems levels, but

> none of these levels is any more fundamental than others". (Capra 1997, p. 39).

But if we take the 'bootstrap' metaphor further there still seems to be a problem. If there were no foundation at all, in this case a boot and the holes through which the laces are passed, why would not the whole conceptual network simply come apart?

In my view Being gives Knowledge foundations, even if the different components are interdependent and mutually irreducible. But this depends on what is meant by foundations. Capra has argued for a shift from objects to relationships and that "the relationships are primary" (Capra 1997, p. 37), but is this not also a form of fundamentality, a fundamentality based on relationships rather than objects? I would argue that relationships are a kind of 'Being Together'; this is a kind of holistic concept that unifies at least two beings whilst recognising difference. In this sense, one could argue that the 'whole Being' needs parts.

***

Sheldrake's position is similar to Capra's and also Rose's, but it appears to have upward and downward components of explanation. It is a kind of **Nested Holism**. This is a distinct form of holism from that of Capra's as it can accept that each level can have its own explanation, whereas ultimate holism cannot. Basing his argument on the notion of the holon; he claims:

> This holistic approach attempts to transcend the long-standing vitalist-mechanist controversy. It agrees with the mechanists in affirming the unity of nature, seeing life as different in degree from the rest of the physical world, but not different in kind. And it agrees with the vitalists in stressing that organisms are organic wholes, and cannot be reduced to the physics and chemistry of physical systems... From this point of view, even crystals, molecules and atoms are organisms (Fig 5.1)... as modern physics itself has shown, they are structures of activities, patterns of energetic activity within fields... And in the light of modern cosmology, physics is the study of the all-embracing cosmic organism, and of the galactic, stellar and planetary organisms that have evolved

> within it... At each level the holons are wholes containing parts, which are themselves wholes containing lower parts, and so on. (Sheldrake 1990, pp. 80/81)

Even though Sheldrake is a holist, one can see from this that he does not make a fundamental difference in kind between the physical and higher levels, the difference is one of degree. But what does it mean to say the difference is one of degree not one of kind? There are two basic possibilities. The first would be to say that the lower level physical is the same kind of thing as the higher levels. For example, the physical by this way of thinking may be conceived as a form of life, of a form of consciousness. But were one to think this, there would be no means of stopping the direction of explanation going on forever upward, as was the case with Capra. This would lead to an indeterminancy in explanation. Moreover, how could one argue that the laws of life, like reproduction are only different in degree from the laws of physics? How could one, for example, change reproduction into the Coulomb's law by a change of degree?

The second possibility is the difference in degree is that of the physical. In this sense, he would be a physicalist that accepts that there are higher levels to the physical. In other words, from an ontological perspective he would be arguing for physicalism, but from an epistemological perspective he seems to accept the need for higher levels of explanation.

The trouble with Sheldrake's position is that it does make ontological claims; it is not just about explanation. For example, he argues that the difference between levels is one of degree not kind, this is not compatible with the next sentence that says that organisms **are** wholes that cannot be reduced to the physics and chemistry of physical systems. This latter statement is an ontological proposition. It implies that organisms need explanations that are not found in physics, this is not a difference of degree, no shift in the magnitude of the laws of physics is going to give a law of biology, like reproduction for example. As that is the case, and if it is true, then the differences between levels of **reality** are differences in kind. My proposal is that if these higher levels are different kinds of explanation, then it is reasonable to accept them also as different kinds of reality or Being.

Furthermore, the holon is again an abstract principle of the kind outlined in chapter 2. In my view it makes little sense to talk about the interaction between abstract levels of existence, what matters is real Being. If the holon is re-defined in terms of Being, that is a being **is** a holon then the matter looks different: the interactions occur within actual Being and are brought about by actual being, not by abstracted processes. I shall return to the question of levels in chapter 4.

In this way, I would argue that wholes are not mere explanations, but are real wholes that need real parts.

***

(3.4) Each Being is a Whole

Neither reductionism nor holism in their ultimate forms can recognise that each level has its own intrinsic kind of explanation. Pluralism can, but left to itself it can find no way for the different kinds of explanation to interact. But I will use here the idea of 'Each Being is a Whole' to express my own form of pluralism.

***

Gould (2003) is against reductionism and is for what he calls 'consilience of equal regard' (Gould 2003, p. 189); this is a form of **pluralism**. This follows from the fact that Gould interprets the emergents as becoming their own principles of explanation (see quote below). He uses the two ideas of Emergence (p. 221) and Contingency (p. 224) to make his argument. Concerning emergence he argues:

> Reductionism works by breaking down complex structures and processes into component parts, and then ultimately explaining the complexity as a consequence of properties and laws regulating the parts... Now, and obviously, just knowing the properties of each part as a separate entity (and all the laws regulating its form and action as well) won't give you a full explanation of the higher level in terms of those lower level parts because, in constructing the higher-level item, these parts combine and interact.. Thus one must also

> include these interactions as essential aspects of higher-level explanation. How, then, can reductionism work if interactions among lower-level parts must figure prominently in any higher-level explanation? In such cases... reductionism still suffices if the interactions can be fully understood and predicted from the parts separately... The interactions of A and B may impart distinctive properties to C (as we do not taste salt in either pure sodium or pure chlorine). But so long as we can predict these distinctive properties from knowing A and B alone (as we can infer the production of table salt from two components of such different appearance), then reductionism still applies. In technical parlance, the interaction predictable from the constituent parts alone are called "additive" or "linear". And so long as interactions remain additive, we can achieve full reduction because nothing must be known or observed exclusively and explicitly at the higher level, in and for itself. That is, we can formulate an explanation, and make correct predictions, simply from the knowledge of the components and their interactions. (Gould 2003, p. 221/2)

The first part of his argument for 'pluralism' is the idea that the **interactions** between the lower level parts become essential aspects of higher-level explanations. But is this a genuine form of ontological pluralism? Put like this, Gould's pluralism could be interpreted as a form of reductionism because the so-called interactions are between the physical parts, not between another kind of level of reality and the physical. In this sense, Gould's view may be pluralist, in so far as higher levels of explanation are necessary, but it is is not 'interactionist' *between* the levels of explanation or of reality. I shall return to this question in the next section.

The second part of his argument is interesting, but I do not think that it can be entirely right. The reason is that reductionism does not suffice, as he claims, because the distinctive properties of C cannot be predicted, or understood, from A and B alone from an *a priori* perspective without an implicit *a posterior* element derived from previous experimentation. The predictability and understanding are derivatives of the analytic process, they are artefacts of reduction. A better approach would be by using the concept of Being outlined

earlier. Consider the example he uses, that of salt. Is it possible to predict the properties of salt from those of sodium and chlorine **alone**? No it is not, as he himself says. So is it possible to predict on the basis of what he calls "predictable necessity from the properties inherent in A and B considered separately" (p. 221). Again the answer is no. Prediction is possible, I would argue, but only **after** 'salt as a whole' has been known. If my earlier argument is recalled, the starting point for scientific research is a whole Being of some sort. In this case, I will call "salt" a whole Being. Its properties can be known as holistic properties. The analytic process, in this case by experiment, separates the sodium and the chlorine. The properties of both can then be observed. What can be recognised from this process is that at least some of the properties of salt are not present in either sodium or chlorine. But because we know the properties of salt as a whole Being and that sodium and chlorine can be separated out, and that if we put them back together we have salt again, **then and only then can we say that the properties of salt are predictable**. This predictablity does not come from knowing sodium and chlorine separately, but by knowing that they are derivatives of the Being 'salt as a whole'. One could just as well say that sodium and chlorine are predictable derivatives of salt. So reductionism does not work in this case, but holism based on Being does. Being is the whole from which the parts are derived, if the whole is predictable from the parts, it is only because the whole was known in the first place. This points to the idea that a pluralism of explanation is necessary in so far as a diversity (two in this case) can emerge from the one.

Gould then turns to the question of "nonadditive" or "nonlinear" phenomena. A nonadditive phenomena, for Gould, is one that arises from a complex set of conditions, one in which there is no predictable outcome by knowing the parts alone. To understand such a system, and to be able to make predictions, one needs knowledge of the way **all** the components interact. If this is the case, then "reductionism fails in principle" (Gould 2003, p. 223). His reasoning is not difficult to see, as reductionism requires knowledge of the parts alone, and what he calls emergence, needs knowledge of all the parts. The 'alone' and the 'all' approaches are not compatible in his view. He concludes:

> if these emergent properties simply do not exist at the lower level, and can't be inferred, as a consequence of their nonadditive character, from knowledge of lower level components or their interactions at their own level, then these properties have "emerged" at the higher level, and have no standing within any reduced science on the consilient chain. And, finally, if these emergent properties (as they so often do) become central principles of explanation at the higher level, then reductionism has failed, and the higher level must be studied in its own totality if we hope to achieve a satisfactory scientific explanation.
>
> (Gould 2003, p. 223)

My main disagreement with this aspect of his argument, is that the 'all' as he puts it is not necessarily a whole. His view could be interpreted as seeing the 'whole' as a sum, albeit a large sum, that is simply difficult to grasp rather than being irreducible in principle. Having to study all of the parts does not refute reductionism in general; it only refutes that sort of reductionism that thinks that the whole can be understood from one or two of its parts. Reductionism could quite easily accept the idea of a complex set of parts that determines and explains the whole of which they are parts.

A way around this problem, I would argue, is to posit the idea of a whole that is not a sum of its parts, however complex. This whole, again, I would explain in terms of Being. In this case interpreted as akin to *primary substance* (Being of the more informed kind) (Aristotle 1992, p. 7). The individual Being would have properties that none of its parts have and these properties, as I argued above, would be known through knowing the whole Being in the first place, not by predicting them from the properties of the parts alone. This Being could be quite simple, as in the case of salt, or it could be complex, as it would be for a higher mammal. Both suggest a pluralism of explanation.

Gould's view is also different from mine in that he does not draw any ontological conclusions from his epistemological / explanatory arguments. In particular, he sees "Emergence as a scientific claim about the **physical** nature of a complex system" (Gould 2003, p. 22)(My emphasis). The question is: in what sense can emergent phenomena be considered to be 'physical'? Gould's way of looking

at this implies a hidden form of physicalism. As such it contradicts his own views. His argument for emergence shows that he is convinced that reductionism for nonadditive phenomena has failed. Now were physicalist reductionism true, then everything would be explicable, ultimately, in terms of the laws and properties of physics. But he has just shown that there are emergent properties at a higher level than the physical. But then he goes on to claim that emergence is a claim about the **physical** world. The only way out of this contradiction for him would be to argue that the word 'physical' is meant in the Futurist version of physicalism. But as I have argued, Futurism is not a useful concept as it is too indefinite.

A better solution would be to argue that the issue of emergence is indeed a scientific claim, but one that is about reality as such, not just reality based on physics. Science does not need to be defined by physics, but it could be defined by 'Being' in the sense that Being has those kinds of reality, and this may be diverse, which can be posited from the different kinds of explanation that are needed. This is a way of doing science that can be applied to every area of existence, whatever they are, as it does not rule out *a priori* the possibility of new kinds of reality. From an epistemological, Being in this way would begin as a general idea that would become more special through the process of understanding. From an ontic perspective, Being may be conceived as already informed, but, to begin with, we may not know what this is. The aim is to find out what informed Being is.

Another idea that Gould poses as being against reductionism is that of **contingency**. He sets the idea of contingency against that of law-like principles. According to Gould, reductionism is based on the idea that a phenomenon or another law can be explained in terms of some fundamental principles. With Wilson, for example, these are the laws of physics. But Gould argues that explanation in biology and in the humanities is largely about contingencies, i.e., one-off events. The emergence of human beings, for Gould, is a fortunate, for us, contingent event. Thus, if reductionism is based on fundamental laws but contingent explanations are also needed, then reductionism has failed. He says:

> But if *Homeo sapiens* represents more of a contingent and improbable fact of history than the apotheosis of a

> predictable tendency, then our peculiarities, even though they may be universal *within* our species, remain more within the narrative realm of the sciences of historical contingency than within the traditional, and potentially reductionist, domain of repeated and predictable natural phenomena generated by the laws of nature... although science can study contingency just as well as any factual subject, such understanding must be achieved primarily by the different methods of narrative explanation, and not by pure reductive prediction. So, as a general statement with many potential exceptions, the "higher" we mount, the less we can rely on reductionism for the twinned reason of (1) ever greater influence of emergent principles, and (2) ever greater accumulation of historical accidents requiring narrative explanations as contingencies. The "topmost" fields of the humanities, whose potential for incorporation within the reductionist chain expresses Wilson's primary hope and rationale for his book *Consilience*, seems least likely, for both these reasons, to assume a primary place and definition as the most complex factual systems subject to standard analysis by reductionist science.
>
> (Gould 2003, pp. 227/8)

For Gould, then, the humanities are not reducible to the sciences due to the two conditions of emergence and contingency. In relation to the last condition, I have no fundamental disagreement with the idea of having narrative explanations, but are they really so opposed to lawlike explanations? If one considers the law model of explanation outlined in Fig 1.2b the "contingencies" could easily be included on the level of special conditions. In which case, the explanation of something could involve the **conjunction** of the basic "law" and the contingencies. In which case, laws and contingencies are not opposed but complementary. As I will argue in chapters 5 to 8, by unifying laws and contingencies (conditions) in explanation, laws themselves may change to new kinds of laws.

Part of the problem with Gould's argument is that he assumes the basic model of explanation derives from a model based on explanation in physics. This is in effect the law model in which the law, as the focus of explanation, is explanatorily separate from the

special conditions or contingencies. Hence, conditions according to the physics model, seem to have no real role in explanation. This is what Gould disagrees with. Take for example the laws of dynamics. If an object is projected through the air, the explanation of what occurs is in terms of Newton's laws, the special conditions only say where and when etc., they say which "accidental" properties a phenomenon has, they do not explain as such.

But what if the physics model of explanation is not universally valid? I would argue this from the point of view of Being. Take for example any 'living' Being and how it evolved. It could be that the 'living' needs a new model of explanation not derived from physics. For example, it is a part of the theory of evolution that species can become adapted to special environments, for example crocodiles are adapted to swamp-like environments. It is within the central explanatory principle that special conditions, i.e., contingencies, are a part of, and can become, the explanatory principles of the emergence of species. But in this conception, species are not single events, they can be interpreted as lawlike principles that produce individuals over time. One could say that in a sense, Living Being gives contingencies a life beyond the moment by making them into lawlike and "explanatory" principles. In this sense, Gould is wrong to interpret lawlike and narrative explanations as being in competition, rather they can be incorporated in explanation through 'Living Being'. This 'Living Being' is another kind of explanation to that of physics and, for the reasons argued in chapter 2, another kind of reality.

Finally, epistemological pluralism does not imply an interactive element between the different levels of explanation. The 'physical' and 'life', etc., for pluralism, the argument is about only what they are 'in themselves'. For ontological pluralism, 'Each Being is a Whole' is an appropriate expression for the emergents of evolution.

(3.5) Being is Together

The idea that the different levels of explanation help explain each other in some way implies, from an ontological perspective, the idea that 'Being is Together'. I will use Rose (1997) to make this argument.

Rose in turn argues for a **dialectical** form of explanation which tries to unify reductionism and holism:

> Humans are not empty organisms, free spirits constrained only by the limits of their imagination... Nor are we reducible to 'nothing but machines' for the replication of our DNA. We are, rather, the products of the constant dialectic between 'the biological' and 'the social' through which humans have evolved, history has been made and we as individual have developed. (Rose 1997, p. 6)

The background to this is a mode of explanation which tries to explain wholes in terms of parts and parts in terms of wholes. The dialectic is that both parts and wholes, in some way, explain each other. The difficulty is that just left like this it is contradictory. The whole point in any kind of explanation is that the *explanans* is supposed to explain the *explanandum*. There is a direction to the explanatory procedure. If Rose's approach was correct, and I don't think it can be, then one is left with circularity in the argument.

Dialecticism could work, however, if either the whole or the part initiated some kind of change over time. For this to be successful, the change once initiated would then have to be passed on to the other, either the whole or the part. In this case, for example, the part would explain the whole during one time period, whilst the whole would explain the part over another time period. I will return to this in chapter 5.

Also, as I pointed out in chapter 2, 'the biological' and 'the social' are abstract notions that are products, or artefacts, of the analytic process. As that is the case, the dialectic between these two cannot occur as they do not exist in the sense that they are meant. A better argument would be to say that 'the biological' and 'the social' are aspects of Being. In this case Being Human. Following Aristotle, the individual human being is the more informed and contains the more generic concepts of ‘biological’ and ‘social. ’This avoids the idea that Being Human is a product of the biological and the social, rather the biological and the social are products of Being Human. It is the Being Human that is the Whole that has and produces the two Parts 'biological' and 'social', not the reverse. If there is a dialectic, it is brought about by Being Human.

Arguably, from an ontological perspective, Being holds the diversity together. It shows how interaction can occur between the different levels without the homogenising effect of either ultimate reductionism or ultimate holism. This is a form of pluralism in which 'Being is Together'.

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(3.6) Conclusions

A consequence of the above for my argument for Being is that the discovery of an intrinsic level of explanation can act as a stopping point for both reductionism and holism. In their extreme forms, reductionism and holism allow for no intrinsic meaning, or explanation, at each level. Reductionism tries to explain in terms of lower levels, culminating in physicalism. Holism explains things in terms of a never ending 'regress' to higher levels. In their extreme forms, neither recognises the explanations that are innate to each level, consequently a diversity of reality for these positions is not really possible. The problem for pluralism, on the other hand, is that it has no unifying principle for the unity of explanation or of reality.

I propose that it is only when reductionism and holism are unified with pluralism and dialecticism, views that accept the diversity and interaction of explanations innate to each level, that their extremes can be averted. By using the concept of Being as a Whole, i.e., a diverse whole, holism, reductionism, pluralism and dialecticism can be brought together into a unified system of an ontology of emergent evolution. This can be aided by: "Goethe's view... always takes its manner of observation, not from the mind of the observer, but from the nature of the thing observed" (Steiner 1978, p. 7). The different kinds of reality that emerge in evolution may then be explained from their own nature rather than that of the physical alone. Emergent evolution can then be conceived as the creative emergence of a real diversity of layered realities that comprise the rich tapestry of the World’s becoming.

(4) BEING INCLUSIVE

(4.1) Introduction

In this chapter, I will propose and explore the idea that the higher levels of Being are more inclusive than that of the physical. Consequently, these higher levels explain, to some extent, the physical. I will base my argument on the notion of levels of explanation. This is in contrast to chapter 3 where the concern was largely with the diversity of distinct explanatory laws rather than the levels of those laws.

As can be seen from chapter 3, frequent references were made to the idea of the inclusivity of an explanation. One of the arguments for physicalist emergentism is that physical laws are more inclusive, or more general, than the emergent principles of life, sentience and cognition / sociality. This is sometimes referred to as the breadth, or applicability, or comprehensiveness, of an explanation (Deutsch 1997, p. 13; Gould 2003, p. 193; Weinberg 1993, p. 20/1 & p. 42; Wilson 1998, p. 59).

I will argue though that the meaning of the terms 'inclusive' or 'general' is far from obvious. I will show that a confusion of the meaning of inclusivity leads to the belief that the later phases of evolution are ultimately reducible to, i.e., explicable by, the physical phase, and the similar belief that the human, psychological and biological laws are ultimately reducible to the laws of physics.

I will investigate therefore the **logic of inclusivity** that underlies explanations of emergent evolution. I will show that the way the logic of inclusivity is interpreted affects how we explain evolution and its emergent phases; and that a different logic points to quite a different way of explaining emergent evolution.

I shall argue that, were explanation to be **Whole-Being** orientated, then cognitive / social phase of evolution would be the most inclusive phase of Being. In that sense, the earlier phases of evolution are explicable, at least partially, in terms of the later phases and not the reverse as is usually believed by physicalism. There are the following aspects to this:

In 4.2, I will try to show how Being can define the inclusivity of an explanation. This will be done in contrast to physicalism which uses the idea of the 'Extent" of an explanation in order to argue that physics is applicable to all levels of explanation. I will show, however, that Being determines a concept called "Depth" which ultimately explains Extent. This will show reductive physicalism to be wrong in focusing on the Extent of an explanation.

In 4.3, I will argue that as a consequence of explaining through the concept of Depth, that the system of the sciences, which lies in the background of explanations of the emergent phases of evolution, can be defined by Being.

In 4.4, I will try to show that, following on from 4.3, that Being can also define the inclusivity of the emergent phases of evolution.

***

(4.2) Being defines the Inclusivity of Explanations

Being, I will argue, should define the inclusivity and thereby the levels of explanation. By Being in this context I mean the holistic and diversified unity of those real and special Beings in the world that can be observed and understood. Beings are thus the everyday realities that people meet: minerals, plants, animals and other humans that are **unified** in general Being. It is these Beings and our concepts of them which can enable us to define the inclusivity of an explanation based on unified Being.

This approach is in keeping with chapter 2 in two basic ways. Firstly, I argued there that explanation implied ontology. Consequently, the concept of Being in terms of observability and comprehensibility should not be understood nominalistically. In this thesis, Being observable and understandable implies real Being. We can know what exists through observation and understanding if we accept the holistic arguments of chapter 2. If we can observe something and find a necessary explanation for it, then it can be said to exist. Such explanations are not nominalistic.

Secondly, the concept of Being used here is developed largely from a critical investigation of popular science writers searching for a *unified form of explanation* rather than philosophers of science

(Barrow 1991; Deutsch 1997; Weinberg 1993). Having said that, there is one aspect of the problem of Being in philosophy that is worth mentioning here namely that of the relationship between the universal and special aspect of Being. Heidegger (1993, p. 22) points out that "the 'universality' of Being is not that of a *class* or *genus...* and species... The 'universality' of Being *transcends* any universality of genus. In medieval ontology 'Being' is designated as *'transcendens'* ". From the perspective of this chapter, there are two basic ways in which Being could be understood. Firstly, that Being is a transcendent universal that is not inclusive of special kinds of Being, i.e. Being of genus or species. If this is the case, then Being, as Heidegger (1993, p. 23) said, would be "the darkest of all", [explanations that is]. Being as a transcendent universal could have not special attributes *because* it is *transcendent*. If that is the case, then it is hard to see how Being could be known, i.e. cognised, at all. It seems to me that Being interpreted **only** as a transcendent universal, without any special attributes, is not a positive direction to research, at least one could suggest that it is not scientific as all the sciences invariably deal with **special** content. The second basic interpretation is where Being is seen as a **unity** of the universal and the special. I shall outline this now.

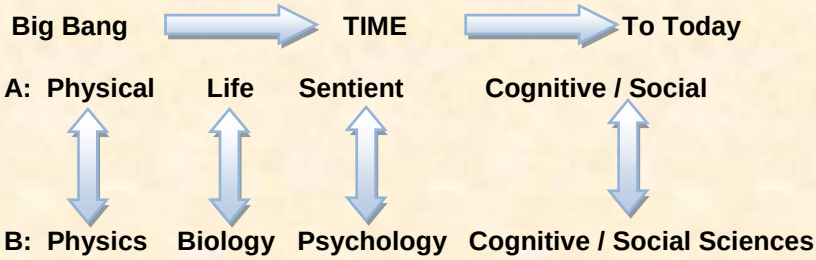
In chapter 3, I argued against the reductionist interpretation of unification and for pluralist realism. In this chapter, I try to show how this pluralism of 'Being' can be unified. The attempt, then, is to show how the *special* and *general* aspects of Being can be unified. Just as some popular science writers do (Bohm & Peat 1987; Goodwin 1994), I also take an indication here from Goethe, for whom the general and the special aspects of Being are not conceived as separate. This would be another way of interpreting Goethe's idea that the "General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369). In fact, it may be suggested, in keeping with the arguments of chapter 2, that the separation of General Being and Special Being is another example of the **Isolatedness Fallacy**: the supposed split between them is, arguably, also an artefact of reduction. In this thesis, I shall argue that the 'special' aspects of Being, as evidenced by the emergent phases of evolution, should not be conceived as separate from the general concept of Being; rather they should be seen as a **holistic** unity with it: "the Special **is** the General that appears under various conditions".

This interpretation of Being has an impact on how the inclusivity of explanations is understood in its application to the emergent phases of evolution. Through this each of the phases can be explained as: **special kinds of Being that are General Being that appears under various conditions.** In this sense, General Being can be said to be **inclusive** of Special Being. One way of investigating this is through a consideration of the relationships between the different scientific disciplines.

Some authors have already suggested that the evolutionary phases can also be understood as the emergence of existents that are to be explained by distinct scientific disciplines (cf Harman 1994; Popper 1977; Rohrlich 1988). For example Rohrlich has argued: "The unity of nature can be best argued from cosmic evolution. In the process, the cognitive emergence of the various branches of science will become evident" (Rohrlich 1988, p. 297). In light of this, I think it will be useful to compare the structure of the phases of evolution with that of the sciences in order to provide a framework of analysis for the concept of inclusivity.

In keeping with this suggestion one perspective would be that each of the emergent phases could be seen as embodying the **unique** aspects of the explanatory principles of the various sciences: the physical phase - principles of physics, chemistry and geology; the life phase - the principles of biology; the sentient phase - the principles of psychology; the cognitive phase - the principles of epistemology. Or put the other way around, each of the phases appear to be subject to the laws, properties and processes that each of these sciences aim to explain. This idea can be pictured as:

FIG 4.1



Row (A) represents the sequence of **unique** emergent **attributes**, and the name is intended to encapsulate these. This describes the unique or distinctive attributes of emergent entities rather than the complete set of attributes that they possess.

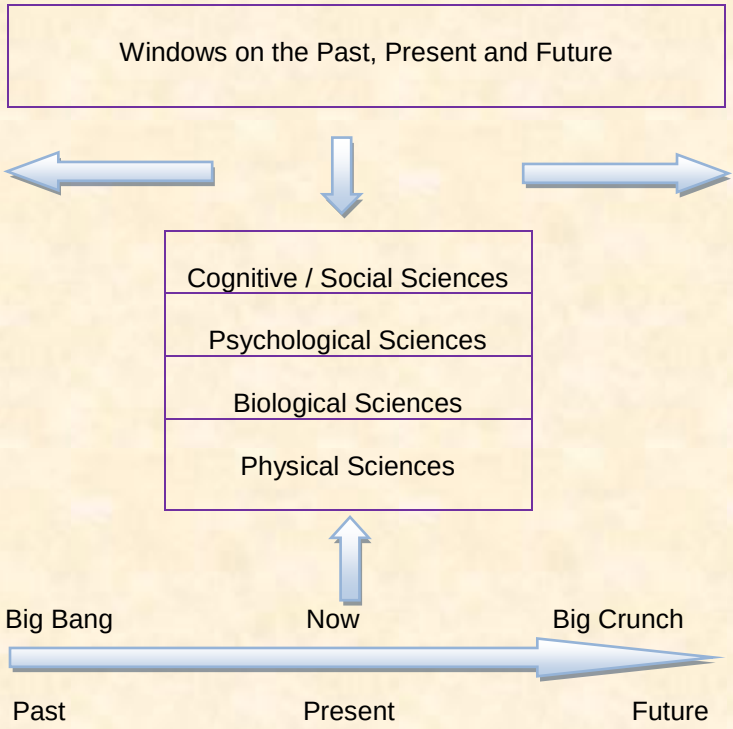
Row (B) represents the sciences whose principles explain the potentially unique aspects of the emergent phases in Row (A).

As argued in chapter 2, the emergent phases can be conceived as distinct kinds of Being in the evolutionary process, isolated fragments of the process of Becoming. Each type of explanatory principle represents 'parts' of this process.

This would seem a reasonable way of looking at the relationship between the phases of evolution and turns part of the research into an investigation of the relationship between **explanatory principles** of the individual sciences. This approach has the distinct advantage of putting the problem on the meta-level of the fundamental principles of explanation, rather than the reducibility of all the theories of all the sciences. It also enables a connection to be made with the more general discussions about reductionism and holism. It is in this context that the idea of inclusivity is largely debated. **The main focus here is on how the interpretations of inclusivity determine the direction of explanation**.

In the following text I shall try to answer the question: which of the sciences does one accept as being the most inclusive, and therefore the most explanatory, for our understanding of emergent evolution? Do we take a select few, regarding the other sciences as in some way included by, or reducible to, them or do we regard each of the sciences as having some unique kinds of inclusivity that are irreducible and therefore have something important to contribute to our understanding of evolution? This can, from a philosophical point of view, be considered from epistemological and ontological perspectives and raises questions concerning the 'windows' or 'filters' through which we view evolution. This can be pictured in the following way:

Fig 4.2



Clearly, which sciences we consider to be the most inclusive informs our view concerning the past, present and future. If we think that the physical and biological sciences are the most inclusive, then our explanations of the psychological and cognitive sciences will necessarily be framed in physical and biological terms or conceptions. Consequently, our interpretations of the past present and future will be coloured by these windows. This may have a distinct influence on how emergent evolution is explained.

The question then is: how should inclusivity be defined?

***

As shown, reductive physicalism argues that physics is the ultimate aim of explanation, is the most inclusive form of explanation because of its generality or comprehensiveness. The difficulty is that inclusivity can be defined in at least three different ways. The first is called the **Extent** of the applicability of laws. The second is the **Content** of laws. The third is the **Depth** of an explanation.

I will argue though that Content is determined by Being because it is owned by Being. Fundamentally, therefore, it is Being that explains, not abstracted ideas like Extent or Content. Being, I will show also has **Depth** or **Rich** meaning (Curd & Cover 1998, p. 886; Koestler 1976; Harré 1993, p. 57; Kim & Sosa 1995, p. 158). I will define these to be:

> 1) The **Extent** of an explanation is concerned with the **breadth of applicability**, it is the set of all objects to which it is applicable.
>
> 2) The **Content** of an explanation is that which differentiates one law from another; it is the specificity of the particular law. Content is also considered to be definitive of Being or Beings, and also that which gives meaning (Hare 1993, p. 57; Curd & Cover 1998, p. 886)
>
> 3) The **Depth** of an explanation is the number of levels of explanation which it includes, i.e. the number of holons (Wholes) on any given level of explanation (Koestler 1976, p. 58).

I will show that just because an explanation may have some aspects of another within it, it does not at all mean that its complete Content can be logically derived, or deduced, from the other. Similarly, just because a later phase of existence has physical processes in common with an earlier phase; it does not mean that it is nothing but the earlier phase, or even a rearrangement of it. I will show that to argue the contrary is to fail to recognise the difference between the Extent of an explanation and its Content.

At this point, I want to give an indicative definition of a relatively pre-analytic system of levels based on the idea of Being (see chapter 2). This will give a preliminary concept based on the idea of Depth which

will provide a foundation for what comes next. Consider Fig 4.3 which represents a table of relatively pre-analytic concepts that will be dealt with in the next stage of my argument:

Fig 4.3

Human Being: Social / Cognitive; Sentient; Life; Physical.	
Animal Being:	**Sentient; Life; Physical**
Plant Being :	**Life; Physical**
Mineral Being :	**Physical**

If this image is compared to Figs 4.1 and 4.2, the difference is between a system of real Being and a system of abstract principles. What I am proposing, is a shift from explanation, and a system of sciences, based on abstract principles, to explanation based on Being. I will return to how this affects the system of sciences and system of emergent evolution shortly.

Again, in keeping with Goethe's idea that "the General and the Special fall together...", these different kinds of Being are not seen as separate from universal Being but are Being "that appears under various conditions".

A problem with the above diagram is that it may be conceived as being anthropocentric and therefore becomes another kind of reductionism. It may be recalled from chapter 1; however, that reductionism is the attempt to explain one kind of theory, or law, in terms of another one of a different kind. But the above does not suggest this. The physical is not to be explained by the **uniquely** human level, not even the physical aspect of the human; rather, as I

have shown in chapter 3, each kind of reality has its own explanation. Furthermore, as I will try to show, there is an aspect to human Being that is not merely to do with the human but is also universal and therefore not anthropocentric. For now, however, Fig 4.3 merely proposes that the human has more levels (Depth) of explanation than the physical. I shall argue this in more detail in the following.

The Depth of a Being is the number of levels that can be said to be included within a Being. From the above figure, it can be seen that the Depth of the Human Being is the unity of the social / cognitive, sentient, life and physical. For the Animal Being the Depth is the sentient, life and physical, The Depth of the normally developing Being 'plant' subsumes the 'physical' under its principles. For the Mineral Being the Depth is the physical. There is another aspect of the inclusivity of Being, and that is the way it includes the **dual** nature of **ontological dependencies**. It may be recalled that in chapter 3, that I argued that the question of ontological dependency is at least two sided and not one. Contra physicalism, I argued that not only are emergents ontologically dependent on the physical, that the physical aspect within a Being is also ontologically dependent on its emergent level. The example I gave was that of a plant whose physical reality depended to some degree on the 'life' principle. In other words, when a plant is growing normally, it takes physical and chemical substances into it and conforms them to its life principle. It is not only that the plant has an extra level of reality to it than let us say some physical or chemical object, but it also makes them operate in a certain way in accordance with its unique defining principle.

From Fig 4.3, Human Beings seem to have the greatest Depth, they contain the greatest number of levels of explanation and this includes ontological dependencies. These are both aspects of the Depth of Human Being. In terms of explanation, the unique emergent level of the Human Being can be seen as the cognitive / social. Following on from my arguments of chapter 3, I shall consider this to be irreducible to the other levels as well as being in a mutual relationship of ontological dependency. Arguably, the cognitive / social is ontologically dependent on each of the other levels: on the physical, on life, and on being conscious. It clearly depends on these for its existence. But on the other hand, without

the social / cognitive decision processes, then the other levels could not be within the Human Being. Were one, for example, to make the wrong cognitive decision concerning food then one could die. The physical aspect of such a person could not, at least after a while, be with that person it would decay into the world physical.

I want now to introduce a concept that I shall call the **Highest Content** of a Being. No doubt all of this could be contended, but as stated this is intended as a starting point for my next consideration. It is this HC, as I will show, that can define a level of explanation, it is kind of natural stopping and starting point for explanation. If you take, for example, 'Human Being', its HC can be considered to be the 'cognitive / social': the processes of knowing and acting; for 'Animal Being' it may be the 'sentient',; having awareness and feeling; for the Being 'Plant' it has as its HC something that we may simply call 'life': reproduction, metamorphosis, evolution etc.; for the Being 'mineral', the HC would be physics and chemistry. The HC of a Being are not only its highest level of explanation, but also its highest level of reality. This is a consequence of my earlier argument that extra explanations imply extra realities if one is a holistic realist.

The Extent of a Being is all those other kinds of Being to which its HC is applicable. Consider the proposition that the HC of Human Beings is the cognitive / social, the Extent of this is, for the sake of this discussion, all Human Beings. The HC of Mineral Being is the physical, but in this case the Extent is the all of the levels of Being. So in this comparison, the Extent of the physical is the greatest, whilst that of the cognitive / social is the least.

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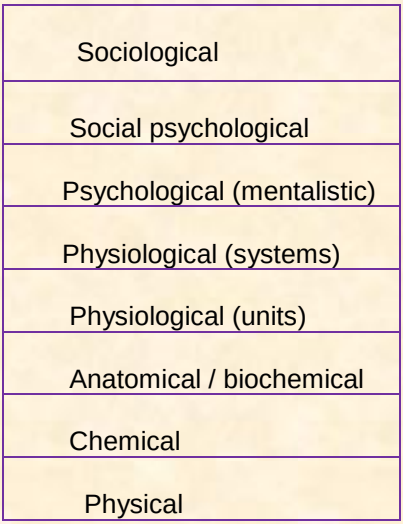
The first problem of inclusivity concerns whether or not the laws of physics are truly 'applicable' to the higher levels and therefore explain them. I will do this through a consideration of a system of levels. There is a variety of these (Deutsch 1997; Harman *et al* 1994; O'Connor 1983; Popper 1977), but I will explore only one at this point in order to exemplify these three ideas of inclusivity. One example is (Rose 1997, p. 9):

Fig 4.4



Rose describes this as:

> the different 'levels' of the pyramid are really arranged hierarchically, so that the lower they are the more 'fundamental' they are. Because physiology is positioned above biochemistry, it, not biochemistry, is the one that should be eliminated, and so on ultimately down to physics, What are the grounds for providing this ordering, for defining 'fundamental' in this way?.. Two arguments are sometimes given. The first is that the lower levels represent the **more generally applicable principles**. For instance, the findings ('laws') of atomic physics are believed to apply throughout the entire universe, whilst those of physiology, so far as it known, only to the special case of living systems here on Earth... The second is that the **higher levels represent more complex states of matter**. Matter takes on a more complex form of matter in a fish than in the water through which the fish swims. From these two premises it is said to follow that, while all physical facts, principles and laws apply to living systems that the physiologists study, the reverse is

> not true. Physiological principles are not applicable to stones and planets... There is a counter argument... the nature of evolutionary and developmental processes in biology, means that there is not such necessary primacy. Wholes, emerging, may in themselves constrain or demand the appearance of parts. Arthur Koestler... described each 'level' as having a Janus - like relationship to the others. To that immediately below it, it was unitary (or, as he named it, a holon), while to that above it, it was an assemblage of components. The ontological unity of the universe consists not of a pyramid of levels, but of a nested hierarchy of holons. (Rose 1997, pp. 92-94) (My emphasis)

The first point that Rose makes concerns what is called the Extent of a law. It is all those things to which the laws of physics, in this case, apply. It is on account of this supposed universal applicability that the laws of physics are believed to be more inclusive than the other levels of laws and are therefore thought, by some, to explain them.

The second point gives the appearance of physical continuity between the different so-called levels (I say so-called as they may be neither ontological nor epistemological levels, some may be of the same level or merely of a different kind). In this way it is assumed that, because of the latter premise, the lowest level, i.e., physics is applicable to the higher levels. What I will show though, is that this is not as obvious as it seems.

In what sense, then, if any, are the laws of physics more universally applicable than those on the other levels? Take, for example, Newton's law of gravitation, its Extent is all those Beings to which it is applicable: planets, rocks, humans, etc.; its Content is the specific relationship between objects with mass, namely:

$$F = \frac{GM1M2}{4\Pi R^2}$$

From explanatory and ontological perspectives the Content of the law determines the things to which it is applicable, that is the Content determines the Extent. For example, the Content is the force determined by a mass relationship, the Extent is all those Beings which have mass. However, this particular Content does not

determine the total Content of those Beings. The Content of the law of gravity only refers to that aspect of a Being which we call mass.

The question is in what way can it be said that the law of gravitation applies to any other level? Surely this only shows that this law only applies to the same level, not a higher or different one. For example, a rock will be subject to the laws of gravitational attraction because it has mass. Therefore this law is applicable to the rock. But the set of attributes that a rock has is not exhausted by this law. More precisely, the defining concept of, say, a piece of limestone is not determined by a physical law involving mass alone. In other words, just because the Extent of a law says it is applicable to a Being does not mean that this law applies to all levels.

Another example could be that of a plant. A plant has mass and therefore Newton's law of gravitation applies to it. Similarly so do the electromagnetic laws and the other laws of physics. But does this mean that these laws are applicable to the level of 'life': reproduction, inheritance, development, etc. No it doesn't. It only means that the laws of physics are applicable to the Being 'plant' because is possesses physical characteristics. But the plant is not exhausted by these laws; it also owns 'life'. In this sense, the Depth of the plant is the 'physical' and 'life' conjointly. These can be argued to be derivatives of the Being 'plant' and in this way Being is fundamental.

Similar arguments could be made for the other emergent levels; sentience and the cognitive / social. If one looks at what is specified by a law of physics, as for example Newton's law of gravitation, the main Content specifications are mass and force. Or with Coulomb's law of electrostatics it is charge and force. The Content of these laws does not mention life, sentience or the cognitive / social. The Contents of Newton’s and Coulomb’s laws do not require such concepts. In what sense then do the laws of physics apply to the later emergent phases? They don't, they apply to the Beings which have physical characteristics as well as the emergent ones. As I argued in chapter 2, these can be all seen as derivatives of the epistemic analysis of Being. From an ontological perspective, it is arguable that each of these emergent levels are derivatives of Being, in particular Human Being. In this sense, it cannot be argued that the laws of physics will ultimately explain everything because they are not applicable to the higher levels at all; they are only applicable

to the **same** level, i.e., the same level of a Being which also possesses other levels of reality.

From this it follows that the whole Being defines the Content. This is the Depth of a Being; in this case it is the number of integrated levels of Content of a Being which defines what it is. In the case of the plant, this will be the unified set of those principles which make it what it is and nothing else. Included within this are content are the life principles and the relevant laws of physics.

> In summary, connecting with Goethe's idea, the "General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369); it follows that **Being (Unified in the Special and the General) determines the Depth of an explanation, which contains Content that stipulates Extent. In that sense, Being is fundamental and therefore explanatory**.

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Another argument for physicalism is that because the laws of physics are the most inclusive, the other laws can therefore be **derived** from them. This not only occurs in debates about the different levels, but also within the one level of physics: "elementary particle physics is more fundamental than other branches of physics... in the end the explanation will take the form of a mathematical demonstration that deduces the existence of phenomena... " (Weinberg 1993, p. 46). This question of deduction is a logical problem that is based on the relationship between Extent and Content.

Taking a more philosophical approach, Nagel (1974, pp. 37-42) acknowledges two senses of the term "general" but does not discriminate the Extent from the Content dimensions of a theory. He states that:

> the premises of satisfactory explanations do appear to be more general than the explicanda. This greater generality of the explanatory premises is of considerable importance because this feature contributes to the achievement of inclusive systems of explanation. (Nagel 1974, p. 42)

The question in this case is what is meant by an inclusive system of explanation and what has this to do with generality? It is true, for example that the laws of physics apply to more beings than do the laws of life, they even apply to beings that have life. But the problem is that, from the point of view of conceptual containment, it does not follow that the laws of physics actually contain the laws of life. The main difficulty is that the Extent does not by itself imply that one law contains another. This is because it is the Content of a law that determines what is contained within. It follows that the more inclusive notion is that of the Content of a theory, law or science, not the Extent. The two senses of the term "general" must not be confused when it comes to inclusivity, I would argue that the Extent is the generality of applicability, the Content is the generality of containment. Logical derivation, I would argue is determined by the Content of a theory, not its Extension. And this depends on the kinds of categories a theory contains. In the case of Coulomb's law this content is force and charge, for Newton's law it is force and mass.

As mentioned, the problem with Nagel's argument is that it fails to discriminate the Extent from the Content dimensions to a theory. As a consequence, his inclusive system of explanation is applicable only to the Extent component. As he puts it:

> the range of objects to which one or the other of the first set of predicates [the first law or theory] actually applies is more inclusive than is the corresponding range for the second set [the second law or theory] (Nagel 1974, p. 41).

If it is accepted for now that one natural kind is distinctly different from another, then a being which falls under one of these kinds cannot be derived, and therefore explained, from some other kind even though it may fall under it extensionally. Due to the arguments of chapter 2, where I tried to unify epistemology and ontology, this also follows for ideas of reality. Predication, in this sense, is also ontological. For example, physicality is predicated upon the whole universe just as being mortal is predicated upon Socrates; part of a being falls under the conceptions of greater extent. Similarly mortality can be predicated upon a lion. But given the general concept of mortality, neither the concept of Socrates nor that of a lion can be derived; the concepts of Socrates and lion are not completely

covered by mortality. The concept of mortality is merely that content which they have in common; it does not contain their **special content**. Similarly, just because human beings are subject to the fundamental law of gravity, just as is a rock, it does not mean their complete Content is covered by this law.

Logically speaking, this can be equally argued for the later phase's evolution in respect of the earlier physical ones. From the point of view of the logical categories needed to explain it, the current phase of existence appears to have greater Depth of explanation than the earliest one. It is arguable that the Depth of present phase of evolution includes the social / cognitive, sentient, life and physical. From this point of view, it cannot be said that current phase is explicable in its full Content by the earliest one; it can only be argued that the laws of the physical are applicable to the level of the physical aspect of the present phase. Explanation then is better defined from the perspective of the **inclusivity of Depth**, not from inclusivity of application or Extent.

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(4.3) Being defines the System of Sciences

Being, I also argue can help define the system of sciences, and thereby the emergent phases, when seen from the perspective of the Depth of explanation.

Medawar (1974) put forward an idea of the inclusivity of explanation based on a geometric model of the sciences. He suggests the following table for comparison:

(1) Topology — **Increasing Inclusivity**
(2) Projective Geometry
(3) Affine Geometry
(4) Euclidean - Metrical Geometry. — **Increasing Richness**

He argues that each of the geometries is a special case of the one above. This is based on Felix Klein's view that any geometry is the ensemble of properties which remain invariant under the transformation of a given group. So in any given geometry, some properties will be variable whilst others are invariable when a transformation is applied. In reference to the hierarchical table

shown, Topology is that geometry which has the most generally applicable axioms, that is, its axioms are applicable to all the geometries below. However, the reverse is not true, Euclidean geometry has the greatest number of axioms but they are not all applicable to the geometries above it.

Going from above to below, Medawar argues that: each of the geometries is a special case of the above; that the concepts become richer; there is a progression from the more general to the more special; and that every statement above is true below. In this process he sees the emergence of new properties which were not present in the one above.

By comparison he offers the following hierarchy for the sciences:

(1) Physics
(2) Chemistry
(3) Biology
(4) Ecology / Sociology

Increasing Inclusivity

Increasing Richness

He claims that going down the line: the sciences become richer in empirical Content; new concepts emerge; there is a progressive limitation of interactions from the sciences above; every statement in physics is true in the others. In this scheme physics would have the most generally applicable laws and processes. For example, the physical proposition: $E = MC^2$ is true, he argues in all the sciences below. However, he admits that certain physical and chemical propositions would not necessarily be interesting to a subject like sociology as they would not have any bearing on its distinctive problems.

Sociology would be the richest in empirical Content, as well as new concepts appearing under its umbrella. For instance, he states that "Just as a concept like that of a 'circle' simply cannot be envisaged in the world of topology, so a contextually distinctive notion like the 'foreign exchange deficit' cannot be envisaged in the world of physics" (Medawar 1974, p. 62). He sees the reduction of sociology to biology consisting in searching for the restrictive clauses and special qualifications to explain the interactions of human beings which constitute a social phenomenon. Similar arguments would

follow for the other sciences in relation to the ones below them in the hierarchy.

He claims that "There is reduction here but no diminishment. Biology is not just physics and chemistry, but a very limited, very special and profoundly interesting part of them. So it is with ecology and sociology" (Medawar 1974, p.62). Clearly, he is a reductionist but with apologetic leanings, his argument, in the special form that he means it, reduces all the sciences to physics.

In its current form Medawar's argument does not work. From the number of laws, i.e. Depth, point of view, it is not true, neither necessarily nor contingently, that the sciences lower in the hierarchy are richer in empirical Content. It may well be that their laws are more complex, conceptions of humans are arguably more complex than concepts of optical dispersion, but Medawar's argument is based primarily on the number of operating laws. There is no reason, under the current conception of the sciences, for any science to contain laws or concepts other than those which are unique to it. It surely cannot be the main aim of sociology to relate ideas of individuality and community, for instance, to Newton's laws of motion. Nor can it be the primary task of biology to concern itself with the relationship of organic development to the special theory of relativity or quantum physics. This is not to rule them out as research possibilities, rather than to do this presupposes the existence of at least two distinct knowledge areas possessing specialised theories and concepts.

If this is true, then each of the individual sciences should primarily occupy themselves with Contents that are unique to them. There is no sense in which there are sets of common, or invariant, laws of physics running through them, however restricted in class one considers them to be. If this is the case, then one cannot argue that chemistry, biology and sociology are special and limited forms of physics. Consequently, there is no reduction but an affirmation of uniqueness of the Content of each science. All other forms of research would be interdisciplinary, investigating the relationships between different kinds of concepts.

Medawar's argument leans too strongly on the geometric analogy. Clearly the argument works better there, even though the special

properties of the lower geometries are not logically derivable from the properties of the higher geometries. But the relationships between the sciences are far more complex than those between the geometries. For one thing, in the case of the geometries we are not considering different disciplinary boundaries. Geometry is dealing primarily with the categories of form and number. The sciences are dealing with many different kinds of categories. The chief ones we have been looking at in emergent evolution are physicality, life, sentience, cognitive / social. It is one thing showing the invariances between the different branches of geometry, it is quite another when the Contents are of a different nature.

His main mistake, then, is that he confuses the abstract scientific disciplines with real Being, where real Being is the unity of the special and the general: "the Special is the General that appears under various circumstances" and not the abstract artefact of reduction. If one takes a Being perspective on this, however, the idea of increasing richness may work. I will consider this now.

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This Being approach provides a possible step from an abstract categorisation of the sciences to a proposal for a science based on Beings: a **Whole Being Orientated Science**. This would be a science where "the Special is the General...", so it would be a science not only a science of singular beings but also of being as such. By this conception, we gain knowledge of general being through special being. I propose, then to consider Beings as the manifestation of Being "under various conditions" as a starting point for science.

Human Beings, for example, also have explanations to them other than from the sciences of cognitive and social; some of the laws and processes of physics, chemistry, biology and psychology are also applicable. This is not necessarily true for the physical sciences; uniquely human processes are not, as far as we can tell, operating within physical processes in general. For instance, conceptions of justice do not appear to be operative within sub-atomic particles. One could argue then that, in respect of the operation of **kinds** of laws and processes, Human Beings are richer in Content than physical processes. Humans have greater Depth.

A future human science, which encompasses all that there is about human beings, would be, in this sense, the richest in empirical Content; it would contain the greater number of different kinds of laws and theories. Physics, on the other hand, would be the poorest in empirical Content due to the fact that it is concerned with laws and processes of only one kind. Of course such a future human science does not exist, but there is no principle reason why it could not.

If such a science were to exist, one could claim of it: **a science based on Human Being is the science of greatest Depth.** Or using Koestler's terminology: Human Being based science is the science of Deepest (Richest) Content. This is because it would have within its sphere features of the psychological, biological and physical sciences as well as the cognitive / social. Between these there would be the dual sided ontological dependencies outlined earlier.

Now there is a converse, but distinct argument to this. The science of physics is arguably of greater Extent than the other sciences. This is meant in the sense that its laws and processes can be applied to more Beings. That is to Beings that also have biological, psychological and social processes. Following from this, it could be claimed that: **physics is the science of the greatest Extent but least Depth.**

These concepts of **Content**, **Extent** and **Depth** help to distinguish the broad features of the sciences. The Extent of a science refers to the applicability of its features across ontological domains, the Depth and Content of a science is concerned with the kinds of laws and processes it contains. Thus a science derived from Human Being would contain laws and processes of: physics, biology, psychology as well its own HC the cognitive / social.

But such a future science would only be relevant to a **restricted class** of processes in the other sciences as not all aspects of Human Being are relevant to all Beings. On the other hand, the laws and processes of physics would have their Extent across all these domains but without containing the laws and processes that are unique to them. Physical science would merely have its own laws and processes as its Content.

Similar considerations could be made for the other sciences. For example, Beings possessing sentience also seem to be subject to life and physical processes, living beings appear to be subject to physical processes. On the other hand, physical laws do not seem to contain, under the present conceptions, the laws of life and the laws of psychology.

From out of this, and in respect of the proposed inclusive system of the sciences derived from Being (compare with Fig 4.3), it could be suggested:

Fig 4.5

Cognitive / Social science is the greatest Depth.
Psychological science is second greatest Depth.
Biological science is the third greatest Depth.
Physical science is the smallest Depth.

The cognitive / social sciences are named after the HC derived from Human Being. In that sense, their Depth includes not only the cognitive / social, but also the sentient, life and physical. By this way of thinking, the Depth of the Psychological sciences is the sentient, life and physical level; the Depth of the Biological sciences is the levels of life and physical; and the Depth of the physical sciences is just the physical level.

Moreover, following on from my earlier argument, the cognitive /social level is ontologically dependent, in, I would claim, an

irreducible way, on that of the sentient, life and physical levels. Arguably, it needs to include them as the bases for its own autonomous operation. This is another aspect of the Depth perspective.

From the Depth and Extent points of view, however, the physical and cognitive / social sciences appear to be opposites. The cognitive / social sciences would be of the greatest Depth, but least Extent (as they would be the least applicable across the levels of Being); whilst the physical sciences would be of the least Depth, but greatest Extent. Then the question of reducibility becomes two directional instead of one. The cognitive / social sciences would only be reducible to physics in respect of the laws and processes of physics found within Human Beings, not in respect to their own HC. Conversely, physics would be reducible to human science in the sense that the latter would be the science of the greatest Depth that is containing all those laws and processes, including the physical, needed to understand Human Beings as wholes, rather than their unique characteristics alone.

Following on from this I would propose a science that incorporates both the greatest Extent and Content. A science that actually includes the common features of all the sciences as well as showing how, in potential, all their unique aspects can be found. One might give a more general conception than that which presently exists by simply defining **Holistic Science as the most inclusive of the sciences**. Its task would be to investigate the common features of all the sciences and it would explore those characteristics which were concerned with how the unique features of the specific sciences can be known. Holistic Science would have as its special task the understanding of the unique theories, methods and phenomena, of the other sciences. Its Content would also be concerned with how they are known, or cognised. In this way, Holistic science would have to include how anything can be known. But at the same time, it would have to include all the sciences. Holistic science would not only be meta-epistemology, in the sense that it aims to understand all forms of knowing, but, because of the arguments of chapter 2, where I attempted to unify ontology and epistemology, it would also be ontology. Moreover, in order to avoid the Isolatedness Fallacy, Holistic Science would not separate meta-epistemology off from ontology as an ‘artefact of reduction’: it

would not only be **about** Being but also be **in** Being. In this sense, meta-epistemology is in Being and not some abstract formal subject that has no connection with Being.

But another aspect to this is that Holistic Science is arguably an aspect of Human Being. Human Being is everything concerned with being human; this would evidently include human cognition. It is through cognition that humans know what they know. But then this joins up with the 'cognition' aspect of the Highest Content of Human Being. If for the purposes of discussion, cognition can be defined as 'that through which anything can be known', we have an idea of knowledge that is the most inclusive. This should not be seen as unduly anthropomorphic. If we follow through the idea of Goethe's that "the Special is the General...", then 'cognition' may be conceived as the special way the general appears in human minds. This is consequent on my arguments from chapter 2, where, on the basis of Bohm, I tried to show that it is in inner perception, of the mind, where the **World's** Potentialities are revealed. Put briefly, Holistic Science is a form of Being within Human Being that shows World Being as Potentialities. From its Content perspective, therefore, Holistic Science is not merely anthropomorphic but is inclusive of the rest of the World.

Holistic science, if it then also includes the cognitive, is the most inclusive from the Content and Extent perspectives. Holistic Science could not only have human beings as its reference, it also refers to the rest of the world. It is that aspect of knowing which points not only to itself but also to the world. In this sense, Holistic Science has as its reality reference Holistic Being, not just specialised dimensions of Being, i.e. the physical, biological, sentient and cognitive / social by themselves, but as the unified reality of Being. After Goethe, Holistic Science could be seen from the point of view of "the Special is the General that appears under various conditions" in that it is not only about the special Being but is also about general Being. In Aristotle's terms, Holistic Science is also about Being *qua* Being. That is, the reality from which the specialised dimensions of Being were originally derived in reality and in the analytic process in scientific method and explanation. Being in this sense is the holistic reality that has diverse levels of reality within it and needs diverse levels of explanation for it.

(4.4) Being defines the Inclusivity of Emergent Evolution

In light of this different perspective on Holistic Being and Holistic Science and hence the evidence for emergent evolution, a similar structure to the phases of evolution is **logically** possible. It has to be born in mind however that in the process of evolution we are dealing with an accumulation of the different kinds of laws and processes. The argument so far suggests the following possible configuration:

Fig 4.6

The cognitive / social phase is the greatest Depth.
The sentient phase is the second greatest Depth.
The life phase is the third greatest Depth.
The physical phase is the least Depth.

What these terms seem to signify is the emergence of the inclusive features of the unique emergent characteristics as seen from empirical evidence. To describe the phases as wholes, one would need to recognise that the so-named cognitive / social phase would contain all the same kinds of laws present in the antecedent phases. The current phase of evolution could be named after the cognitive / social as this is arguably the Highest Depth of the present. This is meant in the sense of containing the highest number of levels of explanation and well as the mutual ontological dependencies. as outlined earlier.

It seems clear that as the physical phase of evolution is of the least Depth that the future phases would be unpredictable because the concepts of the later are not contained in the earlier, nor can they simply be deemed to be the logical consequences of the earlier. If the above proposal is accepted, then the later phases really would

be unpredictable, bearing within them new Contents and which are not derivatives of their antecedents. Throughout evolution, there would be a gradual unfolding of ever increasing uniqueness, leading to diversification, enrichment and increasing inclusiveness.

If this is the case, then physicalist emergentism looks doomed and has to be replaced by a new kind of emergentism based on Holistic Science that has the aim of explaining the evolutionary emergence of Holistic Being. Physicalism tries to explain all the emergent phases in terms of the science that has least Depth, i.e., physics. Holistic Science would attempt to explain the emergent phases through that which is greatest in Depth. In this sense, Holistic explanations have Depth. If we follow now the idea that "the intension [content] of a predicate is its meaning"(Curd & Cover 1998, p. 886), and that Depth is the number of levels of Content, this implies that: **Holistic explanations are deep in meaning. Consequently, the cognitive / social (moral) phase of evolution is the deepest in meaning; its Depth includes that of the earlier phases and therefore explains them**.

Such an interpretation can be seen as a complete inversion of the physicalist explanation of inclusivity. For physicalism, the most fundamental form of explanation is that of the physical. As a realist interpretation, this means that the only kind of reality is the physical and others are derived from it. The view presented here, however, conceptualises the cognitive/ moral as the deepest form of explanation and reality.

(4.5) Conclusions

I have argued in this chapter that Being determines the inclusivity of an explanation. This is shown in that the concept of Depth is the most important aspect of this, rather than the Extent or Breadth. This means, in the end, that the most inclusive mode of explanation of emergent evolution is the 'cognitive / social phase'. It is arguable in this way that the cognitive / social includes the sentient, life and physical and thereby explains them. This is a compete inversion of the physicalist interpretation of the inclusivity of an explanation and therefore of emergent evolution.

(5) EXPLANATIONS AS GENERATIVE POTENTIALS OVER TIME

(5.1) Introduction

In section 1.25, I introduced the idea that emergence can be explained through the idea of Potentialities. In this chapter and in chapters 6, 7 and 8, I will explore this as a possible solution to how creative emergence can be explained.

The argument in this chapter is not only meant in an epistemological sense, in that I interpret explanations as Potentialities, but also in an ontological one. This follows from chapter 2, where I argued for a holistic approach to the relationship between epistemology, ontology and method. On the basis of the Metaphysical Empiricism proposed there, I conceive that what follows for one follows for the other. In short, what is true epistemologically is also true for ontology: Potentialities are also ontological.

The idea of potentialities can also be suggested from the perspective of ontological pluralism as well as epistemological pluralism. In chapter 3, I argued that ontological pluralism seems to be the better kind of explanation than reductionism. Pluralism, however, implies that each emergent phase of evolution is its own "law of explanation". This suggests that, as laws can also be conceived as causes, or agents, each emergent is its own cause. If something is its own cause, though, an explanation needs to found which models how this could happen. What I propose is that Generative Potentialities as Explanations can help explain how a pluralism of laws can work.

The opposite position to mine is that explanations are to be found by looking to the past (rather than 'Over Time'), this I shall call **evolutionary reductionism or actualism** (Harré 1993). This is the view that argues that wholes are produced by, or emerge from, the parts that preceded them in time. Due to the fact that purely physical parts came before everything else in time, this position is the one held by reductive physicalism. This can be formulated in the following way:

> **Due to the fact that the physical causally precedes everything else, all other emergents can be explained as emerging from the physical.**

There are other kinds of evolutionary reductionism, including the idea that because biological processes precede the psychological and cognitive, the former must therefore explain them. Likewise, as the physical precedes the biological it therefore explains the biological and anything that comes after it. Such attempts at this kind of reduction can be found in evolutionary psychology and evolutionary epistemology. But the structure of such reductionist arguments is the same: the earlier in some way explains the later. In effect, evolutionary reductionism is a kind of **'Thinking / Explaining Backwards in Time'**.

In the following, in contrast, I will using a form of **Thinking / Explaining Over Time** that argues that explanations can be seen as "**Generative Potentials Over Time"**. On an ontological level, in opposition to reductive physicalism, I shall contend that:

> **The emergent phases of evolution, the physical, life, sentient and cognitive/social, phases, are actualities that have emerged from their own Potentialities.**

In order to show this, I need make three basic arguments:

The first is that explanations can be interpreted as potentials (section 5.2),

The second is that such potentialist explanations can be seen as 'Over Time' (section 5.3),

Thirdly, I argue that potentialities can be conceived as generative. I will provide some indications for this in this chapter, but argue it more substantially in chapters 6, 7 and 8. I will use these arguments to support my idea that evolutionary emergence can be explained in terms of potentialities rather than by the physical.

(5.2) Explanations as Potentials

In this section I will make an argument for explanations as potentials. I will identify and evaluate potentialist explanations in other authors as a part of this, and show some significant differences in respect of the understanding of emergent evolution. I will consider Potentialities from both epistemological and ontological perspectives.

The view expressed here stands in contrast to physicalist emergentism. It will be recalled in chapter 1, that the generalised process of emergence can be depicted in the following way:

Fig 5.1

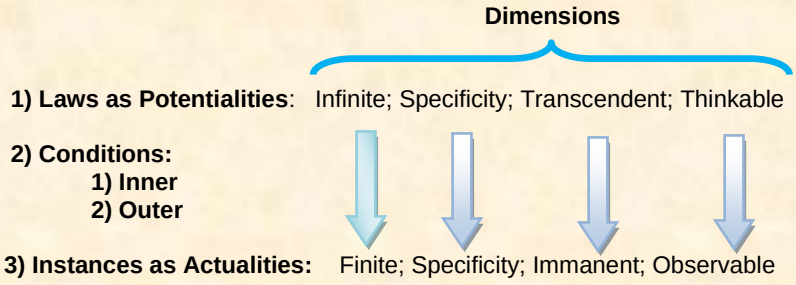
For physicalism, the base is the physical, i.e., the laws, objects and properties of physics as **actual** realities. As I will show soon, this is the actualist assumption of physicalism and is the foundation upon which it is believed that all explanations of later emergent realities are grounded.

The idea of Generative or Creative Potentials, that I propose, is similar to a variety of notions which have been explored by a number of authors. Boden (1990, 1994, 1996, 1998) has referred to 'conceptual space'; Bohm (1980, 1994) the 'implicate order'; Dawkins (1992) 'genetic space'; Dennett (1995) 'design space'; Goethe (1982) ‘archetypes’; Goodwin (1994) the 'morphogenetic field’; Harré (1993) 'powers'; Ingold (1990, 2000) 'generative potentials'; Plato (1987) ‘Forms’; (Popper (1990) 'propensities'. Whilst these seem quite different ideas on the surface, there are some very fundamental similarities which I attempt to identify with the idea of potentiality. In this chapter, I will first introduce the concept of potentiality from a more general perspective, then, in chapters 6, 7 & 8, I will track the basic criteria of what counts as a potentialist explanation in the different types of evolution ranging from cosmological to the biological, cognitive and social. What I shall propose here is that a way to explain emergent evolution of any type is through the use of a holistic concept of Generative Potentials.

It will be recalled that in chapter 1, I described how explanation is

frequently phrased in terms of laws. The laws are in fact seen as the termini of explanation and explain the instances. As I will show, however, laws can be interpreted from a Potentialist as well as an Actualist perspective (Harré 1993, pp. 43-45). In the following, I shall show these to be in a kind of law-like relationship and as having particular dimensions:

Fig 5.2



I would first like to consider this from an **epistemological / explanation perspective**. As can be seen from the diagram, there are some fundamental differences between potentialities and actualities. It is these differences, coupled with the dimension of specificity, through which it may be argued that the **potentialities explain the actualities**. In fact, these are the same dimensions through which it can be argued that laws explain instances. It may be recalled from chapter 4, that inclusivity is an essential aspect of explanation, this notion can also be applied to the laws of explanation in relationship to instances: the laws can be said to explain instances because they include them. In fact, laws can be interpreted as having an identity with their instances, the only difference being their 'universality' (see chapter 1 where I described how one argument for reduction, the explanation of one thing in terms of another, was determined by the concept of identity). More generally, my argument is that it is these dimensions that make laws of explanation into potentialities.

The conditions in Fig 5.2 are important as they are often considered from the perspective of agency, or causation: they can be referred to as *conditions of realisation*. As can be seen, there are two basic

types of these: inner and outer. As I will show in section 5.3, this raises some interesting questions concerning the appropriate model of explanation for the origination of the emergents of evolution. The question is do emergents need explanations with their own inner conditions of realisation or only outer physical ones?

Concerning the instances in Fig 5.2, as said they are believed to be explained by the laws. As I will show, reductive physicalism puts the later emergents of life, cognition and physicality on this level and on this basis claims that the laws of the physical therefore explain them.

One of the problems with this though is that it is based on methodological reductionism. In chapter 2, I showed how methodological reductionism tries to isolate parts of reality and then assumes the parts have some kind of independent existence. A similar way of thinking is involved when reductionism interprets the above model of explanation: it assumes that the laws, conditions and instances can be isolated from each other and are separate in reality. Realisation physicalism, as one interpretation of reductionism, separates the conditions of realisation from the content of instances on the one hand and the laws from the instances on the other.

From the perspective of methodological holism, Fig 5.2 can be interpreted differently. The holistic approach considers the above to be three distinct aspects of one whole. In the context of emergent evolution, this suggests that laws, conditions and outcomes can be interpreted as a unity. As I will argue in section 5.3 and chapters 6, 7 and 8, this allows for the possibility that each of the emergent phases could be explained as being their own potentialities with their own inner conditions of realisation.

A question that may be asked at this point is: in what sense are these 'laws of explanation' potentialities? If one looks at this at first from an epistemological perspective, without any ontological commitments, for now, there are four fundamental dimensions to laws that may justify this. These are 1) infinity / universality; 2) specificity, 3) transcendence and 4) thinkability (see chapter 2). I draw the first two of these largely from Aristotle (1992, pp. 329/30), Harré (1993, pp. 39-61), Kim & Sosa (1995, pp. 405-407), and

combine them with the third (Davies 1995) and fourth (Bohm & Peat 1987).

The ontological, or metaphysical, perspective on these dimensions cannot be ignored. As in chapter 2, I take my lead from Goethe on this and develop my ideas on the basis of the holistic unity of epistemology and ontology. It will be recalled from chapter 4, that, drawing on Goethe: the "General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369) lead to a unified understanding of the nature of Inclusivity. This can be added to at this point to develop a unified understanding of the dimensions outlined in Fig 5.2. Goethe has also declared:

> What is the General? The Single case. What is the Special? Millions of cases... In natural science one cannot speak of certain problems as belonging together unless one calls on metaphysics to help... [The **Archetype** is]: **Ideal-Real-Symbolic**. Ideal, as the last **Knowable**; real, as known; symbolic, because it grasps all cases**; identical**, with **all cases**. Goethe (1982, Band 5, pp 369-370) (My translation and emphasis).

Interpreted in the light if this research, this implies that the dimensions are not just epistemological: **Ideal, knowable**; but also ontological (metaphysical), **real**, which are **identical with all cases** ("General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369). For Goethe, the infinity / universality of the **all cases**, is not just an epistemological concept but also has reality. As Steiner said of Goethe's position: 'Metaphysics is for Goethe the knowledge of the General as it lies in Appearance, not the researching of a 'Transcendent Beyond' (Steiner 1982, p.369) (My translation). For the research presented here, then, we are dealing with a unity of epistemology and ontology applied to the pairs of dimensions in Fig 5.2: **Infinite-Finite; Special-Special; Transcendent-Immanent; Thinkable-Observable.** I will now discuss each of these, primarily in the context of popular science writings.

The **universality** of a law has an implied infinity in it, laws are supposedly true of 'all' instances of a specific kind. There seems to

me to be two basic ways in which this 'all' can be interpreted. Firstly, as a sum of finite instances in time, either 'till now' or 'into the future'. Secondly, the 'all' could be conceived not as a sum, but as all potential instances over time. In which case, there are always unrealised potentials. It is this latter sense that the 'all' is meant in this thesis. This is the infinity of the **could** not only of the **is**, or of the **was**, a universality of the possible not the just the actual (Harré 1993, p. 39). For example, Newton's law of gravitation is supposedly true of all masses, not just one instance, or many instances, of a mass; Darwin's theory of evolution is intended to be true of all living things; and if ever laws of cognition and society are found, then they would be true of all instances that could be called cognition and society. It is in virtue of this universality that laws are said to **explain** instances as *they include all of them*. What can also be said is that this universality, or infinity, may also be interpreted as a potentiality as the law not only includes those instances that have happened, but also all those that **could** happen in the future and all those that **could have** happened in the past. For this way of thinking, finite actualities are mere instances or 'parts' of a specialised pathway through "that which is, was and could be possible".

The 'all' of the potential, Aristotle's *infinite* potential (Moore 2005, p. 39), goes beyond not only the finite but also the actual transfinite (the always addable) (Cantor 2005); it also could be interpreted as including them. For Cantor, the concept of transfinite numbers is very much connected with his methodology and can be interpreted as a form of methodological reductionism. One can see this from the definitions that he uses when referring to "Aleph-zero" (the smallest transfinite number): "is a transfinite number... is not equal to any finite number μ follows from the simple fact that, if to the aggregate {v} is added a new element e_0, the union aggregate ({v}, e_0) is equivalent to the original aggregate {v}" (Cantor 2005, p. 982). Clearly this is dependent on his concept of aggregate: "By "aggregate" (Menge) we are to understand any collection into a whole (zusammenfassung to einem Ganzen) M of definite and separate objects *m*... "(Cantor 2005, p. 971). One may see in this that his approach is to begin with finite objects and attempt to add them up to a whole. This, however, is the same problem as with methodological reductionism (chapter 2) which tries to explain a whole by adding up the parts. I will consider which of these interpretations is preferable in the following.

The question of infinity has been discussed in popular science, usually in the area of mathematics. In relationship to this, transfinite numbers have been described in a variety of ways: as “the various flavours of infinites” (Clegg 2003); “an infinity of infinites... each nested in the other” (Seife 2007, p. 152); as a “hierarchy” (Barrow 2005, pp. 88/89). Rather than discuss infinity, Dennett (1995, p. 109) has preferred to write about the “Very-much-more-than-astronomically” aspect of possibilities. What matters for the purposes of this thesis is that the infinity aspect of potentialities is required in order to explain, ontologically and epistemologically, the ongoing, and the conceivably endless, generation of instances of like kind. What is needed for this is a law, species, or type, defining principle (see Fig 5.2) and something like an infinity. The reason for this is the same as that which I argued for earlier concerning the interpretation of the word “all”. If the “all” were interpreted from an actualist perspective, then it could only mean the “all **so far**”. In which case, the generative principle of organisms, for example, would not be able to reproduce others of like kind in the future. What is needed is that the “all” be understood from a potentialist perspective which can allow for this. In which case, something like infinity is required. One may be tempted to call this a multiplicity, but one would have the same problem here too: an actualist multiplicity would mean a “so far” and would not include the future generation of instances. This follows from an interpretation of an aspect of constructive empiricism (chapter 2): “an empiricists theory of knowledge... based on experience... experience discloses to us no more than what has *actually* happened **so far**” (van Fraassen 1985, pp. 247-253)(My emphasis). This is why metaphysical empiricism is preferable, as I argued in chapter 2, to constructive empiricism because, while it is also based on experience, it can also transcend it by allowing for potentialities, in explanation and in reality, that are “Over Time”. Metaphysical empiricism accepts the **reality** of potentialities on the grounds that such potentialities have the capacity to produce other instances of like kind in **the future**; it does not just add, epistemologically and methodologically, to the explanatory law when new instances come along, but counts them as produced instances of the potentialities. Again, a potentialist interpretation seems more suitable than an actualist one. In this sense, infinity, or universality, meets one of Harré’s conditions for being a 'power' (potential).

As can be seen from this the second condition (fig 5.2), that of **specificity**, is also indicated in that each of the laws is specific to a kind of thing. Even with this, there is no reduction as the class of a thing does not affect its universality / infinity (Harré 1993, p. 56). Even if the 'law' of life is applicable to fewer kinds of objects, it is still infinite as it applies to all living things.

The third condition, **transcendence**, is partly derived from the nature of prediction (chapter 1). From an epistemological perspective, one could say that, on the basis of specific laws, we are able to say 'beforehand' what might happen in the future or 'afterwards' what did happen in the past. In this way, the law in the mind of the scientist is a kind of potentiality that is antecedent in terms of what could happen in the future, or 'retrodicts' what happened in the past. In this sense, the perspective of 'transcendence' includes past and future and is therefore one aspect of potentiality as conceived in this thesis. But in an ontological sense, I interpret transcendence to mean that potentialities are 'Over' actualities. Usually, transcendence is contrasted with immanence, or being outside of something *versus* being within something respectively. Transcendence can also be expressed as a "way to indicate both a separation and a connection between two subject matters, or entities" (Kim & Sosa 1995, p. 235). I shall use the idea of transcendence to describe a separation **and** a connection of potentialities and actualities 'Over Time'. So in the context of this research the separation between potentialities and actualities is not absolute, rather it is relative to the time process: **actualities are interpreted as realisations of potentials** (Aristotle 1992, p. 330; Whitehead 1978, p. 39 / 40). This is also another way in which potentialities could be said to precede actualities in time. More precisely, potentials are 'Over Time' until they are realised as actualities.

The fourth condition, **thinkability**, is derived from the discussion of 'observability' in chapter 2. Basing my ideas on Bohm, I argued there that whilst potentialities are not observable, they are 'thinkable'. But I also argued that the 'observability' criterion for reality, accepted by empiricists, should not exclude potentialities from our ontology as they can be 'tested' out to the extent that they can become observed. Thus potentialities can be 'conjectured' to be and 'tested out' through

actualities, which are observable. This is also one of the ways in which the metaphysical empiricism that I argued for in chapter 2, is different from reductive empiricism. The latter sees predictive laws as ‘summaries so far’ and being entirely in the mind of the scientist. The former interprets predictive laws, as potentialities, as ‘Over Time’ and as objectively real.

This can be done if the content of the potential and the actual are the same, but that the potential is universal and the actual is particular (this is why the specificity dimension is the same for both potentialities and actualities). In this way my position is different from metaphysical realism, as the laws and entities that it postulates are unobservable; and from empiricism which would have to reject potentialities on the grounds that they are unobservable.

The perspective of universality is also important to differentiate potentialism from preformationism. As potentialities are 'infinite' and unobservable, but 'thinkable', they are not subject to the same objections as preformationism. With the latter, the 'potentials' were finite and supposedly observable. For example in the case of the homunculus, a little person was supposed to exist as a finite and observable entity prior to its unfolding in embryonic development (Wolpert 1993, p. 32). As it turned out, no homunculus could be observed. My position is more like Popper's (1977, p. 31) where potentialities, like Popper's propensities, are infinite possibilities and not finite. Potentialities are 'infinite' in the sense that they can give rise to endless possibilities of like kind and that they are not observable until they become actualities; the potentiality is inferred by 'thinking over time' not by looking backwards in time to the first stage of development and not by just by adding up the actualities ‘so far’.

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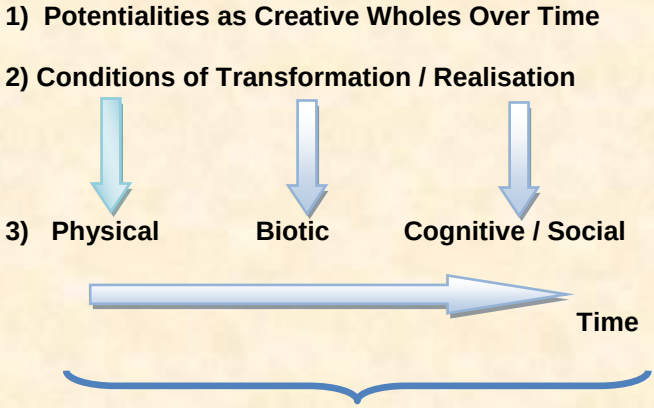
If we focus now to the **ontological perspective**, in relationship to Fig 5.2 below, there are differing positions concerning the explanatory structure concerning potentialities and actualities. Physicalism accepts that only the actualities exist and can explain. This is the view that argues that "We can characterize the universe as a continuum of successive, instantaneous states" (Smith 1999, pp. 583/4). In other words, for physicalism the universe is defined in

terms of these **actual** instantaneous states, not in terms of potentialities. I will argue against this position. I shall contend that the above dimensions describe, in outline, the basic processes of how emergence happens: **From the Potential to the Actual**.

I will show that the explanatory model appropriate for the emergent phases of evolution can be depicted in the following way:

Fig 5.3



As I will show in section 5.3, evolutionary reductionism adheres to an explanatory model based on the bottom line; this is the approach that culminates in reductive physicalism which is based on the causal laws. But there are two ways in which one could be a reductive physicalist. The first kind tries to show how the content of one law can be explained by the content of another. This was the question that was largely addressed in chapter 3 where I argued that the content of laws presumed by reductive physicalism cannot explain that of the later emergents.

The second kind of reductive physicalism does not do this, rather it concentrates on the concept of causation and argues that physical causes 'realise' the later emergents. This is a view that I referred to in chapter 1 as 'realisation physicalism' (Melnyk 2003). This view

does not deny that new content emerges in evolution; in fact it tries to make reduction and emergence compatible by making the distinction between **cause** and **content**. What is meant by this distinction is that many compatibilists recognise that emergents have distinctive properties, or characteristics, etc., i.e., special **content**, but that they are **caused** by the physical. Life, sentience, cognition and the social all are believed to have their own contents but are caused by the physical.

My main aim here is to challenge this distinction between cause and content in explanatory principles. I will show that this is an inadequate view for two basic reasons. Firstly, I will argue that the distinction between cause (or agency) and content cannot be made when one considers the transition from the physical to the other emergents of evolution. Secondly I will show that the physical, as is usually conceived, is only one distinct creat**ed** part-in-time amongst others. I will argue that a **Generative Potential Explanation is better for the emergent phases as it unifies content and cause**. This form of explanation is the direction of explanation going from level 1, through level 2, to level 3 in Fig 5.3. I will show that the processes on the bottom line can be better explained as the created parts of the Generative Potential. This is in effect an argument for a specific form of Potentialist Emergentism, in opposition to Physicalist Emergentism.

In this way, level 1 in the above diagram represents the 'base' in the general model of explanation, whilst level 3 represents the emergents. From this it can be seen that the explanatory principle is not from the past to the present and future, but essentially Over Time. What this requires is a new way of thinking that allows explanations to unfold over time. In this sense, Generative Potentials can be seen as Creative Wholes Over Time.

(5.3) Potentialist Explanations are Over Time

In this section, I will argue that Potentialist Explanations are 'Over Time'. As an aspect of this, I will show that the emergents, as actualities, can be conceived as irreducible 'Parts in Time'. This is seen as a preparation for the coming chapters where I argue them to be 'created parts' of their own potentialities. Here I will challenge realisation physicalism which splits cause and content, and I will argue that: **the explanation of emergent evolution requires a unity of cause and content**. I will try to provide a re-conceptualisation of physical causation, as an actuality, as just one 'Part in Time' amongst others with no explanatory privilege.

For realisation physicalism, life, for instance, may be accepted as an emergent content, i.e., as having unique properties, but it is caused by the physical, it is not a cause in itself or of itself: "Let me start by formulating a more precise thesis of the completeness of physics: all physical causes are fully determined by prior physical occurrences... there is no room left for anything nonphysical" (Papineau 2001, p. 8). This is used to explain emergence in physical, biological and cognitive / social evolution. Clearly, for Papineau, the later emergents cannot be said to have caused themselves because of the **'prior condition'** of causal explanations because before life, the cognitive and social only the physical existed. In other words, because of the 'prior condition' ultimate reductive physicalism follows.

Clearly, Papineau's claims are not just epistemological, but also ontological. His propositions are about reality, for him the ultimate prior nature of physical occurrences is about what **is**, or, more precisely, what **was**. In keeping with chapter 2, whilst my arguments are, to begin with, epistemological, they are also ontological: conclusions about the 'prior condition' refer also to reality.

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In popular science, from a physicist's perspective, the central concept of evolutionary reductionism has been described by Deutsch:

> I must mention another way in which reductionism misrepresents scientific knowledge. Not only does it

> assume that explanation consists of analysing a system into smaller simpler systems, it also assumes that all explanation is of later events in terms of earlier events; in other words, that the only way of explaining something is to state its *causes*. And this implies that the earlier the event in terms of which we explain something, the better the explanation, so that ultimately the best explanations of all are in terms of the initial state of the universe. (Deutsch 1997, p. 24)

Something similar has been described by Davies:

> We usually think of causes as preceding effects. It is therefore natural to try to explain the universe by appealing to the situation at earlier cosmic epochs... But at some stage in the chain of explanation they will reach an impasse, a point beyond which science cannot penetrate. This point is the creation of the universe as a whole, the ultimate origin of the physical world. (Davies 1992, p. 39)

What can also be seen in this is the linkage between explanation, causation and time. What these quotes express is in effect a kind of 'Thinking Backwards in Time'. The time structure of such explanations can be found in many examples of evolutionary emergence:

> All objects are in the last analysis different forms and manifestations of the entities originally present [the fundamental particles]. (Rohrlich 1988, p. 298/9)

> organisms are constructed by selfish genes that have weathered natural selection. (Dawkins 1992, p. 54)

> We already know how psychological phenomena arise: they arise from the evolutionary and ontogenetic articulation of matter; more specifically, from the articulation of biological organization. We therefore **expect** to understand the former in terms of the latter. The former is produced by the relevant articulation of the latter.
>
> (Churchland & Churchland 1995, p. 71)

> No doubt there are many disanalogies between biological, cultural and social evolution, but the three exist on a continuum. It therefore makes sense to apply the concepts of variation, replication and selection at all three levels.
>
> (Runciman 1998a, p. 28)

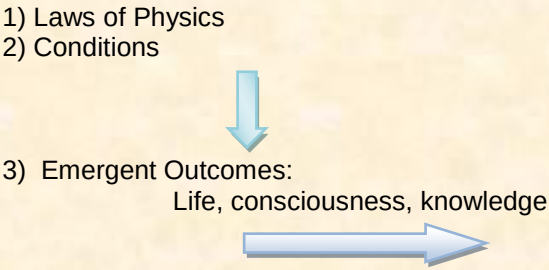
The question is, however, can this explanation (ontologically and epistemologically) in terms of the past really work, especially when considered from the perspective of ultimate causation? Can a first **physical** cause that is **in** time and space really work when we are trying to explain, *inter alia,* how time, space and the physical 'came *into* being'? How could the physical explain its own emergence if it did not already exist?

Deutsch's own position gives an important indication for the investigation of explanation in this section, namely the distinction between the **content** of an emergent and its **cause**. Despite the rejection of reductionism, his position is still one of realisation physicalism. For him, the later emergents of life, consciousness and epistemology are **consequences** of physical laws as I described earlier:

> What is life?' This problem was solved by Darwin. The essence of the solution was the idea that the intricate and apparently purposeful design that is apparent in living organisms is not built into reality *ab initio*, but is an emergent consequence of the operation of the laws of physics. The laws of physics had not specifically mandated the shapes of elephants and peacocks, any more than the creator had. They make no reference to outcomes; especially the emergent ones, they merely determine the rules under which atoms and the like interact... Newton's laws... [likewise] make no mention of ellipses, though they reproduce (and correct) Kepler's predictions under the appropriate conditions.... That is the sense in which I expect the solution of the 'What is consciousness?' problem to depend on quantum theory... It seems unlikely, then, that we shall be able to explain what consciousness is, as a physical process, before we have explained knowledge in physical terms. (Deutsch 1997, pp. 337/8)

In terms of the law model of explanation, this can be pictured as:

Fig 5.4



One can see again that the emergents that appear later in evolution are relegated to mere outcomes of the conjunction of physical laws and special conditions. In the above, Deutsch is in effect arguing that the contents of life, in the forms of elephants, peacocks, as well as the contents of consciousness and knowledge, are not to be found in the laws of physics but are caused by them. This follows from the comparison of Newton's laws and ellipses. The ellipses are outcomes, effects, of the laws of physics in combination with the conditions.

Before I argue against the dividing of cause and content in explanations of emergent evolution, I do accept that this is possible in some cases. But the question is how to interpret this. In energy conversion, for example, one kind of cause can be brought forth by another one, like electric causes can produce magnetic effects and dynamic effects; the content of one kind of thing can be brought about by a cause of another kind. But I still maintain that this leaves an explanatory gap: the new emergent contents need their own explanations and are also causes. In this sense, there still needs to be some degree of unity of content and cause to give a more complete explanation.

Moreover, even in physics there is no separation between the cause and the content of a law of explanation. For example, in Coulomb's law of electrostatics $F = Q_1 Q_2 / 4\pi \varepsilon r^2$ there is no separation of the content of this law, which is the unity of the relationships between the variables, and the cause. The properties of charge Q_1 & Q_2, are the

causes of the force F and are part of the content of the law. The split between cause and content is made by realisation physicalism in order to explain the shift between the physical and 'life'. It does this also with regard to the other emergent phases of evolution.

My main argument, however, is that the 'prior condition' and the division of cause and content cannot work as conditions of explanation in emergent evolution. Firstly, by this model, first events or initial states cannot be explained. An example of this might be the Big Bang singularity. This is because the causal model of explanation requires that all events are explained by a cause that existed prior to them in time. From an epistemological perspective the causal model of explanation breaks down as a satisfactory form of explanation. Now, from an ontological perspective, if the initial state is genuinely the initial state there cannot have **been** anything before it. If so, no explanatory cause can be found as nothing **existed** before the first event. This argument holds for any ontological explanation that assumes there **was** a first event / state and that a prior existing cause is the only means to explain it. So this type of explanation breaks down for first events. It follows from this that realisation physicalism cannot even explain the first emergence of the physical, so as a thesis of ultimate ontological explanation it fails. I shall return to this question in chapter 6 where I consider a model of explanation which explains the emergence of time itself and where simple ontological causal explanations involving 'before' no longer hold.

If one still asserts evolutionary reductionism, then the remaining option is to argue on the basis of the 'nothing' that existed before the first event. What this means for explanation is that the first event / initial state, and everything that came after, are supposedly explicable in terms of 'nothing'. This is because of the 'prior condition' of causal explanations. Putting this more formally, an explanation with no **content** is supposed to explain something with content. But this is impossible; an explanation with zero content cannot explain another explanation with content. This follows from the basic principles of theory reduction. For theory reduction to work at all, bridging premises have to be found between the content of one theory and the content of another (chapter 1). It is through this that science is supposed to grow in empirical content and increase in explanatory power (Curd & Cover 1998, p. 903). But if the ultimate

terminus of explanation is a theory with zero content; and that all other theories are to be explained, ultimately, in its terms, then there is a reduction in empirical content and reduction in explanatory power. In fact, both would be zero. It is the contrary that is true, only a law with content can explain, in principle, another law with content.

Again it needs to be stated that when content is spoken of it is not meant in just an epistemological way. On the basis of the arguments of chapter 2, content has a real reference. In the example of Coulomb's law mentioned above, the content is the real forces and charges implied by the equation. Content, for a realist, refers to something real.

But the next question is: what is a first event? So far I have been discussing only the big bang singularity as a first event, i.e., in the sense it is supposed to have been the original emergence of the physical universe. It is also possible, however, to accept the emergence of a new explanatory principle, or law, as a first event, a first event of a new kind of explanation. An example of this might be life. It is thought by most scientists that life, or the state of the living, has not always existed, that there was a time in cosmic history when life did not exist. The appearance of life, in this sense, can be seen as the first emergence of a new kind of principle. Even in the minimum scenario that one only accepts it as an epistemological principle that has no corresponding reality, the concept of life can be interpreted as the explanation of a first event. By this idea, it is possible to see that no explanation of life is possible through what is supposed to exist before it **as an actuality** (see Fig 5.3). The reason is that the previous stage of evolution, from an actualist perspective, did not have life as part of its content. Potentialism provides a beginning to such an explanation as it does not require an explanation by a previous actual stage. I would claim, in order to explain an evolutionary emergent, the explanatory principle must have the content within it of that which it is to explain. Potentialities do contain this content but are interpreted as being 'Over Time' and not 'In Time' until actualised. Realisation physicalism rejects this and assumes that the laws of physics can cause life even if the content is different. I would argue though, at least that 'life' can become a new content, a new 'part', in time by being actualised from out of its own potential.

The question of content also has another aspect to it and this brings me back to the first question indicated above. As can be seen from the above quote, Deutsch argues that the laws of physics do not contain the shapes of elephants and peacocks. But if this is the case then the laws of physics cannot explain those shapes in the full sense and I doubt that they can be said to cause them either. If so, how is the content of emergent entities to be explained? One of the things that I reject in Deutsch's position is the suggestion that Darwin solved the question of life though the laws of physics. But Darwin (1985, p. 459) referred to the four 'laws of life' as Growth and Reproduction; Inheritance; Variability; and Natural Selection. None of these laws are present in physics nor were they present in a purely physical stage of evolution. Just like living organisms, the laws of life were not present in the actual universe *ab initio*, as Deutsch admits. So, the least that could be said about the laws of life is that they are new contents to evolution.

So the next question is: are the laws of life causes too? One aspect to this is that even if one accepted the actualist position, that the antecedent laws of physics originally caused the laws of life to emerge, this does not mean that the laws of life are not causes as well. It seems to me that Reproduction, for example, is a very effective cause through which whole organisms of like kind can come into existence, it is a form of causation that does not exist in the individual laws of physics. It is for this reason also that I do not think that it can be argued that the laws of physics were the first cause of life either. What is more likely is that the laws of physics are 'enabling conditions' (Rose 2005) upon which life has an ontological dependency (Chapter 3). It follows from this that the laws of life are better explained as having their own content and cause, so in this instance I reject the split between them that is made by realisation physicalism. It could be said at this point then that 'life' became a new 'part in time' both in content and cause. I see no reason why this cannot also be the case for consciousness and knowledge: they may also be new irreducible 'parts in time' that have their own content and causation. As I will show in further chapters, generative potential explanations can help explain how this comes about.

The consequence of this for emergent evolution is that for the position of physicalism there can be no **ultimate** explanation for any phase that comes later. One way out might be that proposed by

Dawkins in that one may try to explain one level in terms of the next level down. But as I have shown in chapter 3, this is not a possible move as there no way to stop 'one step' reductionism (Dawkins 1991) falling into ultimate reductionism. But as I have just argued, ultimate reductionism, of the kind described above, is not possible if based on the model of causal explanation shown.

A solution to this problem is to give up the usual causal model of explanation. The first possibility is to stay with the cause - effect model but give up the 'before' aspect of the cause. In other words, causes and effects are supposedly simultaneous. If one does this, however, there is no means to differentiate between cause and effect as they both happen at the same time. If so, one cannot designate which is the cause and which is the effect, so no explanation is possible.

A better model of explanation is based on generation rather than just causation. The concept of Generation that I propose does not require the ontological separation that standard cause-effect explanations do. It accepts that only a law with a unity of cause and content can explain emergent evolution; it also argues for a form of explanation that is 'Over' the time / space nexus that it explains. Generative Potentials are not conceived in this thesis as being temporal themselves; rather they are interpreted as that which produces space, time and physicality, etc, generally.

Taking the last point first, as was shown above placing causal explanations in a 'before - after' relationship is problematic, especially with first event - initial states issues. So, looking for **ultimate** explanations within time / space looks impossible. What also looks impossible is a form of explanation that is always **outside** time / space: how could something be said to cause something when it is outside the time and space of the thing it is supposed to produce?

My proposal is to try to provide a holistic idea that unifies the ‘outside’ and ‘in’ time concepts in an idea I shall call ‘Over’. In the context of this thesis this means that Generative Potential explanations refer to that which is **Over** time / space, neither just inside nor outside. Seen ontologically, Generative Potentials holistically unify the inside and outside aspects of time.

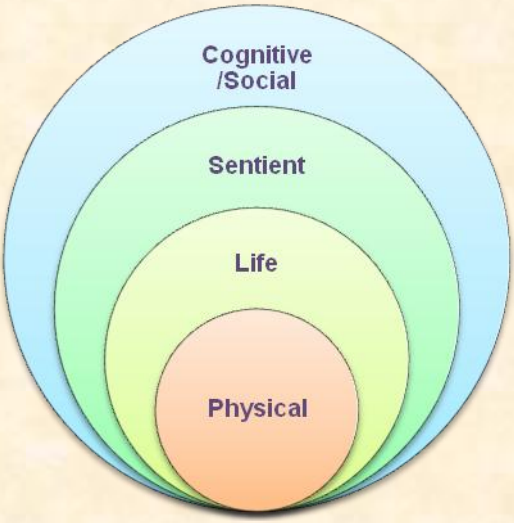
Epistemologically, this helps overcome another split, it seems to me, produced as an artefact of reduction by methodological reductionism.

I would argue that new content and causation emerge Over Time; they become new actualities, 'parts in time', in the process of evolution. In this way, the Generative Explanation is 'Over' time / space in that it explains the objects of time / space from out of a domain that is neither a 'before' nor an 'after'.

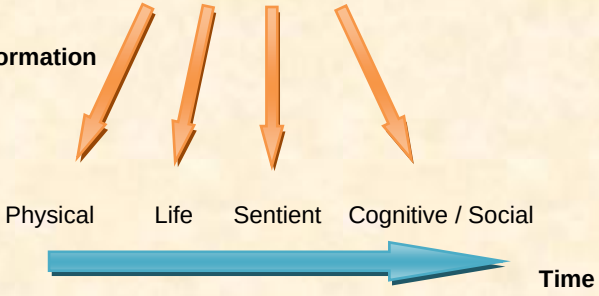
If we now link this on to the argument provided in chapter 4, we can also interpret Potentialities as being inclusive from the Depth perspective. If that is the case, then the Cognitive / Social(Moral) Potential can be said to be inclusive, and therefore explanatory, of the other levels of potential. In this way, Goethe's idea that: "General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369), can be extended from **Being to that of Becoming.** The Inclusive **Depth** of generality explains the actualisation of the emergent phases of evolution from out of a nested set of Potentialities, and of which the cognitive / moral is the most inclusive, and gives a depth of meaning to the other phases which they would not otherwise have. **The Becoming of the emergent phases of evolution is from out of this deep potentiality space**. If this is put into an evolutionary time sequence, we arrive at the following explanatory picture:

Fig 5.5

(1) Generative Potentialities Over Time and Space



(2) Transformation



(3) Actualities as they Emerge in their Evolutionary Time Sequence

(5.4) Conclusion

In this chapter, I have shown that explanations can be conceived as potentialities. I have also identified potentialist explanations in popular science literature, made a critique and some proposals. I have argued that causal explanations cannot do justice to emergent

evolution and that a new kind of explanation is necessary that I have called Generative Potential Explanations. In the following I will consider that:

> Generative Potential Explanations refer to **real** Generative Potentials. Generative Potentials have content and causation (agency) that are 'Over Time / Space', and are identical in content to the realities that they produce. Content and Cause emerge from Potential Reality. Linking this with my arguments of pluralism and holism in chapter 3, each new emergent phase can be explained as emerging from its own potentiality.

The question now arises, if causal laws from the past cannot explain the emergence of a diversity of new laws, neither from a content nor pure cause perspective, then how are they to be explained? Ontological pluralism suggests that each emergent phase of evolution finds its own explanation within itself: if the explanation does not come from outside itself then that leaves only the option that an emergent explains itself. This suggests that each emergent phase is its own content and cause.

This implies a concept of self-generation, sometimes called 'autopoiesis' (Capra 1997, 2002; Maturana & Varela 1980; Rose 2005). The idea of autopoiesis is that something generates, or produces, itself. In the context of this thesis, I shall consider autopoiesis, of the emergent phases of evolution, as a process which is a unity of cause and content. But the concept of autopoiesis, which I will discuss in more detail in chapters 6 to 8, has an interesting feature. If autopoiesis is the idea that something created or generated itself, then in the context of emergent evolution, this would imply that new laws created themselves somehow. This involves a paradox, namely how can something be explained as being brought into existence by itself if it did not already exist?

I shall use the idea of Generative Potentials in order to overcome this paradox. The proposed solution is that autopoiesis suggests the need for generative potentials in existence. The idea is to postulate a form of potentiality existence that produces its own actuality. The contents and causes of new emergents are then potentialities that produce their own actualities. These potentialities can be conceived

as Creative Wholes Over Time, the actualities are the created Parts In Time.

If potentialism is combined with my argument for pluralism from chapter 3, I will show that each new kind of emergent phase emerges from its own potentiality. In other words, each creative potential autopoietically produces its own actuality: the physical emerges from its own potential just as life, cognition and society emerge from their own potentials. This position is in opposition to reductive physicalism that argues that everything emerges from the physical. Rather, I argue that:

> **In emergent evolution each emergent becomes itself a process of self-realisation between the potential and the actual.**
>
> **At the same time, as a consequence of this chapter and chapter 2, the lower levels can be interpreted as being nested in a higher set of Potentialities which give them a greater Depth of explanatory meaning in their evolutionary Becoming.**

I will show that there are variations to this theme:

In 6, I show that the physical emerges autonomously from its own potential,

In 7, I argue that life emerges autonomously from its own potential,

In 8, I show how the cognitive / social emerges autonomously from its own potential.

In general, the most overarching form of explanation is "from the potential to the actual". I shall clarify this in the text.

(6) THE PHYSICAL EMERGES FROM ITS OWN POTENTIAL

(6.1) Introduction

In cosmology, some authors have suggested that the universe as a whole is self-creative, or autopoietic. Such an idea led one author to claim that: "The reason the universe exists is that it caused itself to exist" (Smith 1999, p. 597). It seems to me that the idea of autopoiesis has a particular role to play in supporting a potentialist interpretation of emergence. This would be in opposition to reductive physicalism which tries to unify all the laws into one theory (Zinkernagel 2002). If one takes the big bang singularity and considers it from the perspective of autopoiesis, then the problem to solve is how could energy/matter cause itself to come into existence if it did not already exist in some way? If the singularity was the beginning of energy/matter then there cannot have been anything in **this** universe, from an actuality point of view, that could have caused it to be. Unless one posits that the universe existed in some different way, for example in a potential way. This is what I will argue.

In 6.2, I show how the physical cosmos can be explained as a potentiality as well as an actuality,

In 6.3, I argue that the physical can be conceived as autopoietic - a unity of cause and content,

In 6.4, I show how emergence can be explained as the potential of the physical to diversify.

In each case, my first concern is with providing an argument for the conditions required for explanation in terms of potentialities. Due to chapter 2, where I tried to unify epistemology and ontology, the arguments in this chapter will be linked to an understanding of reality.

***

(6.2) The Physical Cosmos as a Potentiality and as an Actuality

In the context of cosmology, the use of potentiality-like explanations can be found in discussions of the origin of the universe, i.e., the origin of energy and matter. From an idea such as the 'virtual' popular science writers attempt to explain the physical universe and its origin (Davies & Gribbin 1992; Deutsch 1997; Greene 2005; Weinberg 1993). I will provide a different interpretation and re-conceptualise the emergence of energy and matter as a **process of Becoming** 'from the potential of the physical'.

Davies and Gribbin (1992), provide an account of the beginning of the universe when, they claim, the whole of matter, energy, space and time were created. There was no outside environment into which the big bang exploded; the environment was a part of the creation. The big bang is taken, by them: "to represent the origin of the entire physical universe, and not merely the origin of matter." (Davies and Gribbin 1992, p. 115).

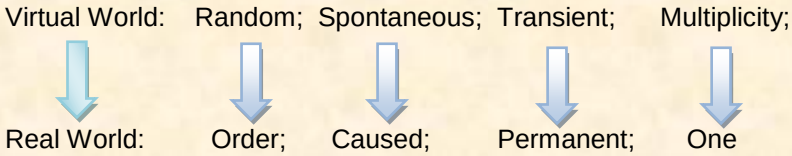
The solution described by Davies and Gribbin is that of the relationship between the virtual universe and the quantum vacuum (see also Deutsch 1997; Guth 1998). These are conceived as being the creators of the 'real' universe. The virtual world acts as the producer of a multiplicity of possible "bubble universes", the quantum vacuum 'selects' a particular one. In other words, we have a creative process supposedly occurring between a virtual world and a real world, or perhaps, a virtual world creating the real world.

There is a problem here of how to explain the relationship between a virtual world and reality and the idea that the entire universe came into existence as a unity. How is this to be explained? To begin with, **it all hinges on how reality is defined**. This, in turn, if my argument from chapter 2 is correct, should be determined by the concept of Being. As I argued there, methodology and epistemology should be attuned to Being which, as I argued, can be seen to have a potential as well as an actual dimension. I argue here that the so-called virtual can be re-conceptualised as a real potential. There seems to me to be no reason why the so-called virtual universe needs to be considered not to be real. But there is a danger of this if the word ‘virtual’ is used.

From an ontological perspective, it seems to me, also, that reality would be better interpreted as having a creative potential dimension and a created actual dimension. These two dimensions would certainly have different characteristics, but they would be certainly both be real. The creative process could then be understood as a transformation from one type of reality to another. Consequently cosmological evolution could be understood in terms of the transformation over time from one aspect of reality to another. It is just that we will then need to understand these two types of reality.

How, then, are these two different types of reality to be characterised and how are we to define the **creative process of Becoming** between the two? At various points in the discussion by Davies and Gribbin, descriptive differences arise between the virtual and the real as well as how the differences emerged. The differences can be expressed in the following way:

Fig 6.1



The creative process at the singularity is described as basically corresponding to a transformation between the top and bottom descriptors. The choice of some of the descriptors is mine, but they seem to me to give a fair representation of what the underlying concepts are. For example, the random → order transition represents the change from a universe that was completely chaotic, having no order to it at all, to a universe where order gradually began to appear. The spontaneous → caused movement is, likewise, a creative shift from uncaused quantum events to the beginning of causation. Similarly, in the transformation from transience → permanence, the beginnings of stable forms of matter appeared from a process of relatively fast coming-to-be and ceasing-to-be. The multiplicity → one change is a description of the continuous welling up of trillions of miniature bubble universes from out of which one was selected that became the one universe which has evolved into the one in which we now live.

It may be recalled that I have considered potentialities as being defined by universality, specificity, transcendence and thinkability. If one now looks at the above, some of the descriptors correlate to these. For example, the transition from random to order may be an example of the emergence of specificity as also could be the transition from the spontaneous to the caused. The universality can also be identified in the shift from multiplicity to the one. An example of this is the emergence of the one universe from the infinite possible universes that 'bubble up'. Transcendence partly follows from this too as the infinite possible universes 'transcend' the finite one universe.

But there are some problems with this. What Davies and Gribbin fail to address is that the various dimensions of the virtual universe and of the real universe cannot be conceived as belonging to two different universes. The absolute distinction between the creator and the created cannot be made. The reason is that the singularity is conceived, even by them, as the beginning of the entire physical universe. If that is true, then the above descriptive differences have to be seen as dimensions of one reality. Rather than interpret the virtual and the real as being like two kinds of universes, they could to be conceived as dimensions of one universe. But to propose this is to challenge our conception of reality, which, according to Davies and Gribbin, appears to be only identifiable with the set of characteristics on the bottom line above.

If one then sees the virtual perspective as a potentiality, the real perspective and the quantum vacuum selective process as a unity, as we must if the totality of the universe came into existence together, then creative reality could be seen as a creative-selective-created "whole". Put differently this creative process is a potential-actual-process with no separate universes needed, rather it can be interpreted as one universe in transformation.

(6.3) The Physical as Autopoietic

The idea of autopoiesis, I would argue, needs a unity of cause and content. This follows from the fact that for something to be autopoietic means that it created itself, thus nothing could have come from the outside, either in cause or in content. If this notion is applied to emergence in cosmological evolution, this means that the explanation of the physical needs a unity of the content and the cause of the physical. This, I would argue, gives a further argument that potentialities are required to explain the emergence of the physical.

Davies has proposed the idea of 'Inherent Creativity', or Self-Creativity, to explain two of the fundamental problems facing cosmologists today: 1) the origin of the universe and 2) the emergence of the complex from the simple, the diversity from a unity:

> the Universe is not only self-creating, it is self-organizing too. From what is known about the very early stages following the big bang, the Universe was essentially featureless... All the rich diversity and complexity of physical forms and systems that adorn the cosmos today have arisen since the beginning in a long and complicated sequence of the **inherent creativity** of nature. (Davies 1995, p. 228) (My emphasis)

The notion of the **inherent** creativity of the universe is intended, by Davies, to offset it against the idea of supernatural causation: i.e., a form of causation that is outside, or beyond, the laws of physics. In order to avoid supernatural causation Davies has to posit the idea that physical laws are the cause of the universe, including themselves: the laws of physics are in some way supposed to be self-creating.

Davies' explanation of the universe's self-generation depends on the epistemological license provided by Heisenberg's Uncertainty Principle. This allows for spontaneous events to occur without "well defined prior causes" (Davies 1995, p. 128). Also the idea that 'prior' to the big bang that there was no space and time hence there could not, as the theory goes, be any causation as there was no antecedence. The principles of quantum theory seem then to allow for the possibility of spontaneous self-creativity without prior causation of the universe.

But does inherentness solve the problem? Certainly, the idea of spontaneity, as an attribute of a quantum physical process provides a feasible basis for explaining the emergence of the universe without invoking external causes, but it does not solve the problem of prior causation. There could just as well have been prior natural causes as supernatural causes. It still leaves us with the question: what does it mean to say that something created itself?

What seems to happen in discussions about the big bang is that the self-creation of the universe is explained in terms of a relation between supposed 'inexistence' and existence. There are two basic ways in which this 'inexistence' can be characterised. The first is to refer to it as 'nothing'. Some cosmologists think of this as what existed before the big bang; the second way is to see 'inexistence' as simply meaning that the emergent did not exist whilst something else might have done. There appear to have been moments in the universe's unfolding when some things which only later existed did not exist. If one posits the transition from inexistence to existence to be explicable in terms of self creativity, then the problem arises that something that did not exist brought itself into existence. But if this creative principle is the same as that which is created then how is this possible? It would involve the contradiction that something existed and did not exist at the same time.

A way around this, I suggest, would be to posit the existence of the creative potential with its own cause. The creative potential could be seen as that which self-realises as its own created product. But that would require that something, for example the laws of the universe, could have a creat**ive** existence and a creat**ed** existence. The law would then have the ability to take on these two different forms of existence over time. Supernatural causation would not be necessary, but a partially transcendent form of causation would be: the laws of physics transcend themselves in so far as they are the self-creative centres of their own actualities / instances. In this argument there would be no absolute distinction between a law and its instances, they would constitute a whole that would have the two different forms of existence.

This approach helps overcome the paradox of how to explain the transformation from inexistence to existence. The main reason

being that the potential needs to be posited as existing, not as inexisting. If this is so, the transformation would be from a potential existence to an actual existence with no concept of inexistence concept required. The explanation of autopoiesis is then one kind relationship between potential and the actual. Or put differently, autopoiesis can be explained as a kind of Becoming, a self-becoming from the potential to the actual. Through autopoiesis, the universe can be conceived as transforming itself from the multiplicity of potential universes (see Fig 6.1) into the one universe that exists today.

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The argument for an autopoietic emergence in cosmology can be further argued in the context of discussions about the relationship between laws, conditions and outcomes (see Fig 5.2) This is especially the case when authors, like Davies, couple self-creativity with the idea of **transcendent** laws (potentialities) in the creative process in evolution:

> the laws of physics are like a blueprint for the Universe - an algorithm might be a better word. There is in some sense a cosmic blueprint because these laws of physics bestow upon matter and energy an uncanny ability to organize themselves and evolve along certain pathways leading from the simple to the complex. (Davies 1995, p. 229)

> When it comes to cosmology... The sharp distinction between the laws of physics and the initial conditions therefore break down... I believe that these proposals about laws of initial conditions strongly support the Platonic idea that the laws are "out there" transcending the physical universe. It is sometimes argued that the laws of physics came into being with the universe. If that was so, then those laws cannot explain the origin of the universe because the laws would not exist until the universe existed. This is most forcefully obvious when it comes to the law of initial conditions, because such a law purports to explain precisely how the universe came to exist in the form that it does... If the laws are not transcendent, one is obliged to accept as a brute fact that the universe is simply *there*, as a package,

> with the various features described by the laws built in. But with transcendent laws one has the beginning of an explanation for why the universe is as it is. The idea of transcendent laws of physics is the modern counterpart of Plato's realm of perfect Forms which acted as blueprints for the construction of the fleeting shadow-world or our perceptions. (Davies 1992, pp. 90-92)

Davies first introduces here the idea of the 'blueprint' or 'algorithm' as something that transcends the physical universe and yet gives matter and energy the ability to organise itself. Implicitly, he also distinguishes between transcendent laws and immanent laws, the latter being the ones that came into existence with the physical universe. One can see from this that he gives priority to the transcendent laws.

Davies seems to create an ontological divide between laws and matter / energy. The idea that it is the laws that bestow upon matter and energy the ability to evolve from the simple to the complex suggests a distinction, or separation, between the laws on the one hand and matter and energy on the other. Matter and energy appear to be contentless, and the transcendent laws as that which gives them content. A kind of ontological separation appears to be implied with the creative principle being located in the law, the **created** outcome is the ability of matter and energy to complexify; a separation between blueprint and matter-energy.

The trouble is that Davies wants the universe also to be self-creative (autopoietic), so this type of ontological separation will not work. If the universe is to be conceived as self-creative, there has to be an identity, or a unity, of the creative and the created. The idea of self-creativity requires that that which is created is the same as that which created it. So there could be no absolute ontological distinction between laws and matter / energy. For the arguments to be consistent, laws and matter / energy need to be seen as identical but having two aspects of existence. If this is the case, then laws do not bestow upon matter / energy the ability to complexify, rather Complexification is an attribute of the law / matter / energy identity. Self-creativity of complexity then becomes a possible conception.

But there is a problem with this, namely if laws, matter and energy are an identity then how could the beginning of the universe be explained? Surely there needs to be some form of distinction? A solution to this could be recognising that the distinction need not be one of identity, i.e., that the laws and the instances are separate kinds of things. This could be achieved through seeing that laws have a potentiality aspect as well as an actuality aspect. The difference could then be that the law as potential and the law as an actual would correspond to what we normally call law and instance respectively. If the universe is conceived as having the potential and actual dimensions as continuous becoming as it were, then so-called bestowing of complexity would be seen more as a self-realisation. There would be no ontological separation of laws on the one hand and matter-energy on the other, but an ontological identity with internal diversity and potential for diversification. The physical cosmos could then be seen as autopoietic as there would be a unity of law and their instances, of cause and content.

Similar arguments apply to the relationship between laws and the conditions of realisation. The problem for Davies is that he describes laws as universal, absolute, eternal and omnipotent (Davies 1992, pp 82/3). But he is now proposing that there could be some kind of law of initial conditions. If that is the case, then are they laws too? If so then how could they be initial conditions that actually set the universe going? The set of attributes necessary for initial, or special, conditions are completely opposite to those necessary for laws. Conditions have to be particular, acting only in this special instance. Additionally they cannot transcend the universe; after all they are supposed to be the very special conditions that got this particular universe going: they can only be immanent. The only way out of this for Davies would be to suggest that in addition to the laws of the initial conditions that there are actual conditions. But if he does that then we are back to square one: a distinction between laws and conditions, the difference being only between laws of conditions and actual conditions.

I suggest a better solution would be to say that the laws and the conditions of realisation form two distinct aspects of a whole. By this I mean that laws can be interpreted as having the dimensions of transcendent potentiality and immanent actuality. Emergent evolution at the singularity would then consist in the transformation

from the former to the latter. This requires that we see **Laws as potentiality to actuality transformations**. What we normally regard as laws would be the potentiality perspective, what we regard as conditions would be an actuality perspective. One could use the concept of Becoming as the unity of both as well as the transition from one to the other. This would not invoke the problem of the ontological separation that I have considered. There would be an ontological identity of laws and conditions. Given that that is the case then the universe can be a self-caused reality, a form of Becoming that creates the conditions for its own existence through being a process that moves from: the potential to the actual, the transcendent to the immanent.

If one were to speak then of primacy of laws, it would be only in relative terms, where at any given time moment the complexity of the universe's potential may be greater than the complexity of its actuality.

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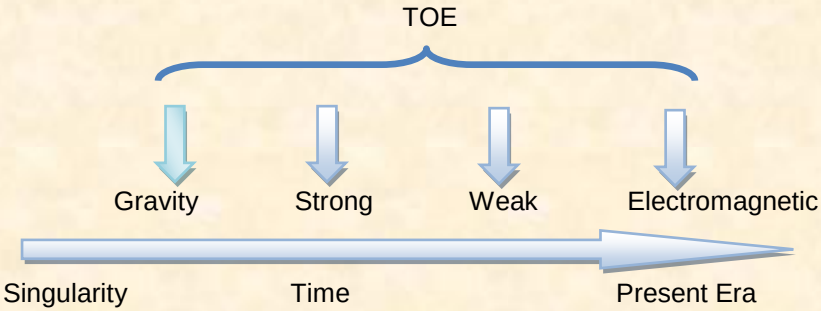
(6.4) Physical Laws Diversify from the Potential

Potentialism is also suggested by the emergence of a diversity of laws in cosmology. Of particular import to the issue of emergent evolution are proposals for a Theory Of Everything (TOE). Many authors see the TOE as the unity of all the laws of physics and may be considered to be a prime example of reductionism. This raises the problem of explaining how the diversity of the universe was created if it was an original unity. This is often put in a cosmological context due to the use of a TOE to explain the diversification of the fundamental forces of physics: how is it possible that the universe diversified if it was a uniformity? I will show that a TOE supports the idea of a potentialist interpretation of a unified diversity of physical laws.

The process of diversification from a unity can be modelled in the following way:

Fig 6.2



What Fig 6.2 shows is the separation and diversification of physical laws since the singularity. The unification concerns an explanation of what happened at or near the big bang. The diversification is usually related to the expansion and cooling of the universe.

It has to be kept in mind that all the laws are thought to be still existent in the present era of evolution and are considered to be explanatorily and ontologically irreducible in this period. What this means for ontological pluralism is that, seen over time, there is an emergence of distinct 'parts' that are their own laws of explanation even in the evolution of the physical. These laws are ontologically dependent (Chapter 3) on the heat state of the universe (Barrow 1995), at least after the Big Bang Singularity, but are not reducible to the heat state. The relationship between these emergent laws and the heat state is what might be called one of 'enablement' rather than causation (Rose 2000, p. 251) and which entails conditions and antecedence. One could say that the cooling heat state of the universe enables the emergence of the diversity of laws that are their own explanation.

But the question is in what sense is this unification meant? Is it a reduction or something else? Maudlin (1996) has made some arguments for the reduction of the emergent laws in cosmology. He argues that only identity is a genuine unification (see also chapter 1):

> We have a lower limit in our search for unification. Consistency, common dynamics, and nomic correlation are all features we might seek when constructing theories of forces, but they fall short of unification... Were the projected

> unification of electromagnetism, gravity and the strong and the weak forces to run as deep as the examples we have just examined, then the very distinction among the forces would disappear... it seems fair to say that a deeper or more complete unification cannot be described.
>
> (Maudlin (1996, pp. 132 - 134)

The first three kinds of unification are rejected by Maudlin on the grounds that they leave the forces ontologically distinct, for him true unification is when these distinctions disappear. Genuine unification, he argues is only through identification and he gives the two examples of special theory of relativity (STR) and general theory of relativity (GTR). In the case of STR, he argues: "there is only one thing: the electromagnetic field tensor [the electric and magnetic fields are] merely frame - dependent artefacts... "unified" by being, in a way, eliminated entirely from the fundamental ontology, and by being replaced by a single - frame - independent entity" (Maudlin 1996, pp. 132 - 133). In the case of GTR, he argues for something similar for gravity and inertia, both are reduced to the metrical structure of space - time: "Neither of the original entities survives unscathed in the later theory (as happens in true reduction), but rather both are replaced by a single new object (Maudlin (1996, p. 133).

Accepting for the moment that this is true reduction, where one kind of law is explained in terms of another, there is still the problem of how to explain the emergence of diversity from some original unity if it was a uniformity. Just suppose we accept his claim that genuine unification is only when the distinctions between forces (laws) disappear. This would imply that all the four fundamental forces would lose their identity. Such a TOE would be a mere uniformity and would not be able to explain the emergence of the different forces over time. Maudlin's approach is simply to 'Think Backwards' in time rather than as well as 'Forwards' and 'Over' time.

In his argument though there is a hint as to how to solve this problem. He mentions the distinction between frame - dependent and frame independent entities. The four forces could be interpreted as being actualisations of a potential in evolutionary time frames, they are dependent on the process of realisation in becoming irreducible realities. The frame independent reality could be

conceived as a potentiality that contains within it the possibilities of the emergent realities that are frame dependent. In this case the TOE is not a uniformity, rather it is a unified diversity. Here, we are not just thinking backwards in time to obtain our TOE, but also forwards and over time. The potentiality in the TOE is a diverse unity that explains how the diversity emerges in actuality over time.

Smolin (1997) has considered a potentialist perspective of the cosmological emergence of variety from unity:

> Each elementary particle has a **set** of different **potential** properties, only one of which can be realised in a stable universe... The **laws** of elementary particle physics do not choose among these configurations, they merely allow them as different **possibilities**. This means that the properties of the elementary particles are in the end influenced by the **history and state of the whole universe**.
>
> (Smolin 1997, pp 55-57)(My emphasis)

Through these different physical principles, a plausible explanation is given of how the diversity of the different forces can be unified as well as the particles that they govern, and likewise how the universe, since the big bang singularity, diversified from an original unity. The question then is what explanatory principle is this process of unification based on? If we temporarily focus on the epistemological perspective, the fundamental problem is that there needs to be some kind of explanatory principle that enables a unity on the one hand, and on the other an emerging diversity over cosmic time that was in some way a part of the original unity.

One major problem is if this unity, as described by a TOE, is actually a uniformity, then the flowing of a description of all of nature from it would not be possible. Epistemologically, a uniform content of a law cannot be the terminus of explanation for that of one with a different content. This follows from the basic principles of derivability outlined in chapter 1 and argued in chapter 5: no term can appear in a derived law unless it is present in the law from that which it is derived. Likewise, ontologically, from a complete uniformity only uniformity can come.

On the other hand, there appears to be some need for a theoretical unity. Barrow (1991, p. 31) has also shown that the TOE cannot be a mere collection of different pieces; it must be a single law "a single invariance that remains unchanged in face of all the complexity and transience". Silberstein, on the other hand, interprets the TOE as applied to cosmology as a good argument for radical emergence, how the "one becomes many" (Silverberg 1998, p. 473). The question is, how is this "one becoming many" to be explained? If there is no diversity already within the original unity, then it is difficult to see how the diversity arose at all. On the other hand, if there was some kind of diversity present in the original unity, either of laws or particles, then one would need to find an interpretation of a diversity to diversity relationship in cosmic emergence. But this is not what cosmology shows, rather what seems to be agreed upon is that the early universe was simple and that the diversity has only emerged over time.

This assumes, however, that what is meant by 'universe' is to be identified with a succession of its actual states. If, however, the universe is conceived as the unity of its potential and actual states, then this problem disappears. If there existed something equivalent to a TOE as a real process in the world, then its potential aspect of existence could be seen as a unified diversity that actualises over time. The actualisation of diversity would then be an outcome of a potential diversity. Cosmic evolution could then be seen as an emergence of the diversity of laws, particles and states of matter from a potential space to an actual space. This process of emergence would be shown in terms of its 'ontological dependencies' (see chapter 3), for example how the various laws, forces and particles are dependent on the expansion and heat state of the universe, but this shows no uniformity, rather merely the existential dependencies.

The idea of the diversity of the potential of the universe is based on the observation of the diversity of its actuality and on the notion that each law is irreducible. Looking at the apparent fact of the diversity of the world and estimating the original simplicity based on physical laws, the actual diversity is conjectured to be an outcome of the diversity of the original potential. Actuality shows what the potential was. But current accounts only attempt to understand the actual states of the beginning. These are arguably simple, so cosmic

history is usually described as a simplicity to complexity process. In other words, cosmic evolution is conceived of only in terms of its actuality over time, that is its potentiality perspective is not a part of the current theory. But I argue that the theory of the universe's unfolding is not explicable without recognising its potentiality dimension. If this is recognised then the process of cosmic evolution can be interpreted as a transformation from a diverse potentiality to a diverse actuality with ontological dependencies.

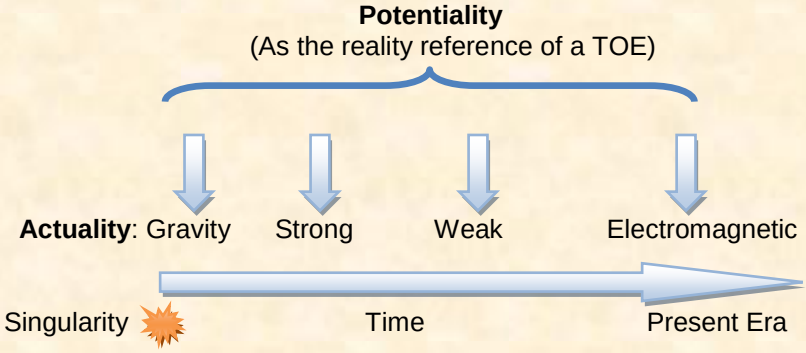
The question then is how is the TOE, as a 'formula for everything', to be ontologically interpreted from the perspective of potentiality and actuality? If we recall, the singularity is conceived as being the origin of all matter / energy, space and time. Now if the formula is to describe the actual origin, and not just some small moment after, it cannot be a mere matter / energy, space / time equation. It has to 'transcend' such descriptors of the universe if it is to explain their origin. But it has to include them as potential actualities. It also has to include the irreducible laws that emerge over time, from the big bang to the present. The TOE then could be conceived as a Potentiality / Actuality equation that in respect of the origin transcends the actual universe. In itself, it refers to a pure Potential reality that unfolds as matter / energy, space / time actualities "Over Time". If we then refer to actualities that have unfolded in evolution as being specific forms of a more overarching reality, then the TOE refers to a potentiality aspect of reality that creates actuality. In this sense, one could say that a TOE describes a process of Becoming from the potential to the actual and explains the emergence of a diverse but unified set of laws.

It is vital, however, that for the self-creativity of the physical universe to be possible, what counts as reality has to be based on a conception of a form of holism that transcends, but also includes, the actual. I have expressed this holism by means of a theory of a potentiality transcendent of actuality. It is only if reality extends across both these dimensions that the actual can be accounted emergent from something inactual and **real**.

(6.5) Conclusion

For the concept of a Theory of Everything to work, it needs to have within its compass the relationship between the potential and the actual. If a genuinely unified theory is to be possible, i.e., one that shows the emergence of laws, forces and particles "Over Time", there could be reference to these within the theory. Such a unified law could not be a reduction. It would be a kind of subsumption that must contain the concepts of the emergents: otherwise no explanation of them would be possible. This means that a TOE would be a unified diversity with many kinds of explanation. After all, it would be essential to show how and why some laws, forces and particles are not reducible but essentially different under evolving cosmic conditions. I shall model this as follows:

Fig 6.3



In this sense, the TOE would be better conceived as a Potential-Actual equation. It must have within it the **Potentialities for the Actualities of Existence** of all the emergents of the later physical cosmos. It would be diverse, both in its laws and its conditions. It would be a kind of unified law of creativity of the physical cosmos.

These Potentialities are Explanations Over Time. In the case of autopoietic emergence in cosmology, the **process of Becoming is one in which, from an original unified diversity of potential, a diversity of ontologically distinct laws emerge over time**. One could explain this as a process 'from the whole to the parts' and 'from the potential to the actual'.

(7) LIFE EMERGES FROM ITS OWN POTENTIAL

(7.1) Introduction

The main thesis that I will argue here is that emergence in biological development and evolution can also support a potentialist interpretation of explanation. I argue:

In 7.2, that life can be explained as potentiality as well as an actuality; and that its **origination** needs an explanation of the form "**from** the Potential to the Actual".

In 7.3, that life can be conceived as autopoietic, and therefore supports the idea of explanations as generative potentials,

In 7.4, that the diversification of life supports the notion that explanation of emergence in biological evolution is "**between** the potentialities and actualities".

These explanations may have ontological implications, for if new kinds of explanatory principles can be demonstrated, and if my argument from chapter 2 is correct, then 'life' may be interpreted not just as a new epistemological explanation, but also as an ontological one. Life may emerge from its own potential **in reality** rather than being a realisation of, or identical with, the physical.

***

(7.2) General Life as a Potentiality and an Actuality

General Life may also be considered to be a potential as well as an actual reality. This can be derived from several popular science writings. For example, there is an important similarity between certain aspects of Dawkins's (192, p. 57) concepts of the genetic formula and genetic space and Bohm's idea of the Implicate Order (Bohm 1980; Bohm & Peat 1987), and Goodwin's (1994, pp. 80/81, 91, 161/2) morphospace. Dennett (1995, p. 103) is more explicit in his advocacy of a potentiality perspective: "The contrast between the actual and the possible is fundamental to all explanation in biology".

All the authors appear to ascribe a potentiality dimension to these formulas, fields and spaces. Interpreted in Bohmian terms (chapter 2), both the genetic program and the morphogenetic field formula

could be conceived as types of the implicate order. In this case, actualised forms drawn on a computer screen, representing an organism's development, can be interpreted as generated instances of the 'implicate order' (the genetic program and the morphogenetic field equivalents).

For **real** organisms, on the other hand, the generative potential may be argued to produce the organism just as the implicate order produces the explicate order. Both the potential formula and the implicate order can be seen as being fundamental in the sense of being the producing principle as well as being something that is enfolded within reality, i.e., it is not an observable to the extent that their infinite possibilities for production are not observable all at once. Both the generative potential and the implicate order appear to be creative principles that are hidden from sense perception as totalities. Only their singular instances, as actualities, can be perceived.

This is admitted by Dawkins and Goodwin:

> The [evolutionary] ancestor is a tiny creature, a single dot. Although the ancestor's body is a dot, like a bacterium in the primeval slime, **hidden inside it is the *potential* for branching.** (Dawkins 1991, p. 57) (My emphasis and italics)
>
> the goal of scientific explanation is... to explain what is observed as a specific actualisation of the possible by particular conditions. (Goodwin 1994, p. 80/1)

***

Potentialism can be seen here if it is recognised that the generative potential has infinite extension, i.e., that it contains effectively infinite possibilities for the production of individual organisms, whereas an individual organism is just one; and a number of them is can be seen as just a finite set of actualised instances. As Dawkins (1991, p. 66) has said "Genetic Space is an **endless** but orderly vista"(my emphasis). This is the same condition for potentialities mentioned: for something to be a potential it needs to have something like infinite possibilities. Thus both the genetic program and the

morphogenetic Field can be conceived as potentialities from this perspective.

The specificity of these potentialities can also be identified: "The space we are talking about is genetic space. Each animal has its own position in genetic space" (Dawkins 1992, p. 66); "for these ancestral types, unexplained by Darwinism, can now be understood as the generic or typical forms produced by the generative process, the dynamic of morphogenetic fields that underlies the origin of species." (Goodwin 1994, pp. 127/8). It can be seen in both cases that there is specificity. For Dawkins, the 'animal' is the genetic program for the production of all instances of an animal of a particular species; it has its own unique place in genetic space that establishes its identity. Likewise, for Goodwin, the morphogenetic field is also species specific in that it produces specific types of life form.

Closely connected to this is the idea of transcendence. One can see this in that the genetic program is tacitly assumed by Dawkins to transcend the computer 'organism' that it creates. Similarly if the analogy is to work, the genetic program must be assumed by Dawkins to exist prior to the real organism that it generates. The same can be said of the morphogenetic field as it is believed to be the producer of the organism and in that sense must be antecedent to it. Whether or not the morphogenetic fled is a physical field I will leave till later.

The criterion of 'Thinkability' (Chapter 5) seems important here. This is directly linked to my argument for metaphysical empiricism in chapter 2. On the basis of Bohm, I argued that reality can be accessed by inner perception (reason) and outer perception. Knowledge, I argued, consists in unifying the two: the former gives the ‘thinkable’ potentialities, the latter gives the actualities (see 2.4). Consistent with my earlier argument, I would claim that if something is said to be 'hidden inside' and 'potential' means that the creative process of an organism is not observable to outer perception but is ‘thinkable’. From the perspective of metaphysical empiricism, the creative process can be interpreted as a transformation from the ‘thinkable’ potentials to the outwardly perceptible actualities. In this sense, whether it is computer programs or generative potentials of real organisms, we appear to be dealing with a more fundamental

reality than that which is shown to sense perception. We are considering a form of reality that is supposed to create that which is observable to the senses. This may be seen as a form of reality that can only be 'thinkable', but of course based on a temporal sequence of sense observations.

This requires a different epistemic stance needed to understand the creat**ive** potential as distinct from the creat**ed** object. Neither genetic formulas, genetic space nor the implicate order can be observed with the senses. But their creations can. On the other hand the creative potential can be thought. Thus thought and perception, the two modes of knowing advocated by Bohm, are the two types of knowing necessary for the potentialities and actualities respectively.

If, on the other hand, we were to base science only on what can be observed, as would constructive empiricism, then our understanding would refer only to what has already happened in evolution - it would be fixed in the past, in actualism. But as I have argued, potentialities are essential to our explanation of reality. Evolution can be conceived, at least in part, as the transformation of the potential into the actual.

***

Dawkins may be viewed, then, as a potentialist even though he is also a reductionist (chapter 3). This latter position shows itself again in his discussions of emergence in evolution. He sees whole organisms as being created by parts:

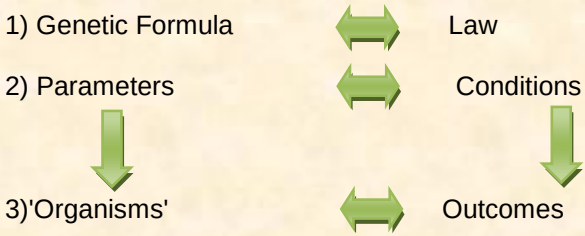
> The argument of this book is that we, and all other animals, are machines created by our genes... They are in you and me; they created us, body and mind; and their preservation is the ultimate rationale of our existence.
>
> (Dawkins 1992, pp. 2-20)

> The genes, as we shall see, are more like a recipe than a blueprint; a recipe, moreover, that is obeyed *not* by the developing embryo as a whole, but by each cell or each local cluster of dividing cells. I'm not denying that the embryo, and later the adult, *has* a large scale form. But this large scale

> form *emerges* because of lots of little cellular effects all over the developing body... (Dawkins 1992, p. 53)

Dawkins's proposal for the explanation of the generation and the development of biological organisms, is what I shall refer to as the 'genetic formula'. He discusses this in relation to a computer program that he calls DEVELOPMENT. This argument is based on an analogy with computer programs that seem to be able to draw, over time, organism-like images starting with simple line elements that relate to each other through generative processes (Dawkins 1992, p. 51). This can be pictured as follows and is equivalent to the law model of explanation:

Fig 7.1



The genetic program contains the relationships between the basic line elements used for drawing the 'organism', the depth of recursion, i.e., the number of times the program is repeated in order to draw the 'organism' as a whole. The genetic program, in other words is the creative source of the organism. The parameter values give specificity to the sizes of lines and the angles between them and are the means through which the program is actualised. The developing 'organism' is a mere outcome of the conjunction of the genetic program and the parameter values, it has no creative role itself.

The concept of 'genetic formula' is important for Dawkins as it bears within it the potentiality of reproducing a multiplicity of forms of identical type. Also, Dawkins sees the genetic program as a species defining principle, each species having its specific lines, branching angles and depths of recursion. The program is capable then of creating the same type species of 'organism' an endless number of times. The relationship between the genetic program and the

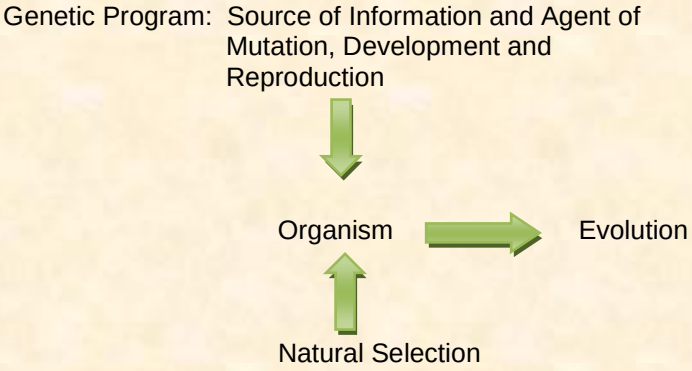
development of organism can be described as defining a direction to the creative process that goes from the genetic program to the created organism.

The next step in Dawkins's argument is to integrate the DEVELOPMENT program with a program called REPRODUCTION, and then join it with a program named EVOLUTION. I will try to connect these with the concept of the genetic program advocated by Dawkins. His concern is primarily with the relationship of creativity to biological ideas of 1) development, 2) reproduction, 3) evolution and 4) natural selection.

The program EVOLUTION, and therefore Dawkins's concept of evolution depends, ultimately, on the concept of creativity applied to the DEVELOPMENT and REPRODUCTION programs. In his case, the creativity is asserted to lie in the genetic formula. This formula is converted into drawing **action**. The created individual organism then emerges from this action and is subsequently subject to **selection**.

Dawkins's concept of evolution can be expressed in the following way showing the directions of information content and agency of realisation:

Fig 7.2



The genetic program, as he himself argues, is more like a recipe than blueprint. In other words, it is a set of rules for producing

something. It is clearly, also quite different from a 'substance' gene. This latter distinction is important as many scientists see the gene as a substance. Whatever the case, the distinction is important as what may be true for a genetic program may not be true for a substance gene.

Dawkins's position is reductionist in the sense that it sees the emergence of the whole form of organisms from local cellular effects, or parts. Part of the problem is that he centres his mode of explanation on the singular instances rather than the whole. I argue, however, that a singular observed instance is not a whole and therefore cannot be fundamental for explanation. It is rather the genetic program that is the Whole as it contains all possible instances of a certain kind. Dawkins's emphasis on observable instances shows itself in his computer analogy. He argues that the equivalent large scale forms shown on the computer screen are outcomes of the step-by-step building up from primitive elements, namely the line. The line is posited to be the most fundamental component of the whole 'organism'. Likewise, in real organisms it is the gene that is considered to be the most fundamental.

This is problematic as the computer model he uses shows a relationship between a creative process and created objects not just between observable singular created objects as Dawkins implies. The difficulty for Dawkins lies in the ascription of the "**because** of little local cellular effects". The implicit assumption here is that the large scale form is **due** to the small scale form that appears before it. From the point of view of what is observed on the screen the individual line can be seen to appear prior to that resembling large scale forms. The latter seem to be built from the lines and small scale 'organs' that are antecedent to them. This is another example of "Thinking Backwards in Time" (chapter 5).

However, the first phenomena to appear, i.e., the individual lines, are also creations of the whole program which is merely generating its potentials in a time sequence. The creative process is not from the individual elements, but from the whole program realising its potential in a sequence of time. This program is like a law in the law model of explanation, in that it embodies the whole relationship between the elements as well the possibility of endless repetition. In

my view, the program is a kind of potentiality that generates a meaningful and coherent "Whole Over Time".

***

Goodwin's (1994) concept of the morphogenetic field is an important contrast to Dawkins as it is also a potentiality concept but under a holistic framework. Hence there are some important differences, as well as similarities, between the two approaches. The structure of Goodwin's proposition is fundamentally the same as Dawkins's. The differences lie in what precisely counts as Wholes and Parts and hence the interpretation of the creative potential and creative agent. The morphogenetic field is considered by Goodwin to be the generative or creative potential of organisms; it is also thought to be the creative agent. Genes and natural selection are mere boundary conditions that put limiting factors on the morphogenetic field. This is clearly quite different from Dawkins's who thinks that the gene, or genetic program, is a creative source or potential, not just a boundary condition. But Goodwin argues:

> a distinction is made between [1] genes as **parameters** and the [2] generative field as the **dynamical equations** used to describe the process of producing the [3] form of the developing organism. Distinctions of this kind are useful in analysing complex systems, but they need to be recognised as abstractions. The Organism itself is a unity... First there is the process whereby the generative field, influenced by inherited particulars, produces the adult form of the organism. This is the developmental process, and for the moment this is the line shown from the generative field to the adult. Next, there is the environment... organisms require particular environmental conditions in order to survive. However, the environment can also have a specific influence on development by acting on the generative field. (Goodwin 1994, pp. 37 - 39) (My emphasis and numbers)

Goodwin's concept of the field is then integrated into an overall model of evolution. This is very similar to the law model of explanation in Fig 1.2b. This can be depicted in the following way (see Goodwin (1994), figure 2.4 p. 37):

Fig 7.3

1) Dynamical Equations: Morphogenetic Field

2) Parameters: 1) Genes as inherited particulars;
2) The Environment.

3) Outcomes: 1) The Forms of the developing organism;
2) leading to the evolution of forms.

It can be seen from his description that the centre of generation and explanation for Goodwin is the dynamical equation forming the morphogenetic field. Evolution under this description is the actualisation of the morphogenetic field equation. Genes and the environment, in the form of natural selection, are mere parameters, or conditions, for the unfolding of the contents of the dynamical field equations. It is the generative field that is the source of the process of production. As such genes and environment have little explanatory function for the generation of the forms. Organisms are also identified by Goodwin (1994, p. 36) as "dynamical fields of particular kinds". However, he also says that these distinctions, between inherited particulars, fields and organisms, are abstract: "inherited particulars are part of the organism, which is a field that is organised in space and time" (p. 37); moreover "the organism is itself a unity" (p. 38).

I am largely in agreement with Goodwin, as it is consistent with my previous arguments for potentialities, but for philosophical purposes, I would like to add the following interpretation. Goodwin sees the organism as the unity, i.e. the whole, and as the fundamental unit of life. However, he also says that the generative field produces the adult form of the organism. That is, the adult organism is a produced 'Part'.

It seems to me, though, from an ontological point of view, that the individual adult organism can be seen from both Whole and Part perspectives: it is a whole in relation to the parts it possesses at that

particular space-time moment, but it is a 'part ' in so far as it is a product of the generative field ‘Over Time’. The adult instantiated organism is, more fundamentally, a 'part' that is created by the generative potential that is the whole.

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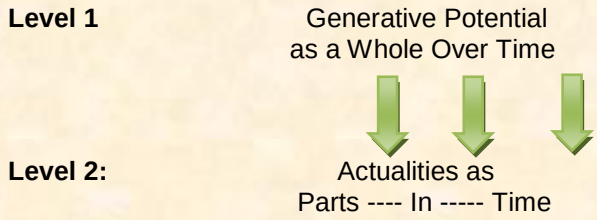
Drawing on Goodwin (1994), I would like to depict the general direction of emergence in the following way:

Fig 7.3



Dawkins would explain the process only on level 2; this is consequent on his position of hierarchical reductionism applied to sequences in time shown in chapter 3. But I would argue that the generative process is **from** level 1 **to** level 2. Each individual line, and the temporally emerging whole form, is nested in a coherent creative process 'Over Time'. In this case, ‘Over Time’ refers to the time over which ‘life’ exists, or it could refer to the life time of an individual ‘organism’. In other words, the genetic program is a generative whole, the lines are generated parts. The computer drawn lines and 'organism' emerge from the potential, not from the preceding lines, as a reductive physicalist might believe who can only think "Backwards in Time".

If this is true of computer programs, could there be also something similar regarding real life organisms? If there is something equivalent in the organism, in the sense of being a generative potential, then one can hardly argue that the large scale forms of a whole organism emerge from the antecedent, small scale forms, but rather from the generative principle which realises its potential in a time sequence. For example, an acorn and an adult oak are two stages in the lifetime of an oak tree. The latter has an ontological

dependency on the former (chapter 3). However, this does not imply that the acorn generates or explains the adult oak. I would argue that the acorn and adult oak are both created parts of the generative potential and are both explained by it. The sum total of the observable phenomena is the set of created instances of the generative potential over time.

A similar argument can also be put forward for the explanation of the computer 'organism'. As shown earlier, Dawkins also applies his hierarchical reductionism to time sequences. In this particular example, Dawkins's implicit assumption is that the earlier and more simple phenomenon explains the later and more complex one; but this is false too. It is the generative potential that explains each individual phenomenon that appears on the screen. In the case of the computer it is the program that explains the appearance and nature of both the line and the large scale forms: the program explains the relationship of the small scale to the large scale forms, the small scale does not explain the large scale forms.

In real biological organisms, I would argue, it is the generative potential that explains both the large scale as well as the small scale forms. The gradual building up of an organism from simple elements during development only shows an ontological dependency (see chapter 3). Each stage of the organism depends on the previous one. This does not mean, however, that the later stages are generated from the previous ones, nor does it mean that they are to be explained by them. What it means is that there is a generative potential that produces each stage in a time sequence, between which stages there exists an ontological dependency. Similarly, it can only be the generative potential that can explain each stage as it is the only thing that contains the principles through which they are built and contained.

I would also like to add that this generative principle can only be known, epistemically, when the whole developmental process is known, i.e., Over Time (see 2.4). The nature of the organism can only be known through knowing the set of 'stages' over the whole life span of the organism, not through one prior-existent stage. This is then embodied in a conception or theory that extends 'Over Time' and space and is not to be identified with one singular instance but nevertheless explains them and embodies them all. The process of

knowing the whole requires a 'thinking over time' and not just a 'thinking backwards in time'.

(7.3) Autopoietic Life

In consideration of the above, how can the concept of autopoiesis support the potentialist interpretation of emergence? In what sense can emergence of 'life' be argued to be autopoietic, or self - emergent? Dawkins thinks that the explanation of life comes from Darwin's theory of evolution which he believes to be a special case of physics (see chapter 3). Goodwin, on the other hand, thinks that life has its own explanation, but the morphogenetic field is really an example of physics and chemistry that is unique to life and includes: "spatial organising activities that involve clearly defined physical and chemical processes, though combined in a way that is distinctive to the living state" (Goodwin 1994, p. 88) In these senses, Dawkins is a reductive physicalist, Goodwin a non-reductive physicalist, or pluralist physicalist. Is either position viable, however?

If we consider the computer program that Dawkins uses, I think that an argument for autopoietic life can be made that differs from reductive or pluralist physicalism. This has two elements: 1) Information Content (Content for short) and 2) Agency (causation) (see 6.3). I will show that for the biological to be said to be autopoietic, self creative, the potential has to have a unity of content and agency.

The first element, that of content, concerns the relation of 'life' to the 'physical'. Clearly, in the computer example, the laws and entities of physics are utilised in the production of the 'organisms' and their components. The question is: where does the specific content of these 'organisms' come from? One of the things that could be said about this is that the content does not come from the laws of physics. The reason is that many different kinds and species of 'organisms' can be drawn by the computer; the same physical entities and laws are used in each case so there is no differentiating principle on this level of explanation. What does make a difference is the specific content of information embedded in the computer program. The program determines in what specific way the electrons are to move in order to draw the 'organisms' over time. There is clearly an ontological dependency (chapter 3) of the ‘drawn’ ‘organisms’ on the physics of the computer, but the content is an additional 'law' that

imposes a different kind of reality on the physics of the situation. From this perspective, the computer 'law of life' not only adds new content to that of the physical but also causes it to take on a specific nature. In this sense, the computer example may be seen as an argument for 'life' to have its own content and cause (agency).

A similar kind of argument can be made for real organisms. On the fundamental level of physics, there is very little to differentiate one species of plant from another. It seems to me that, from an explanation perspective, that it is something like the generative 'life' potential that contains the content of the unique aspect of explanation life and which imposes a superordinate form of reality on the laws of physics. In which case, one could at least say in this respect that life has its own autopoietic content and cause.

There is another aspect to the question of content and that is to do with its location: is it located in the genetic program or in the parameter values? In Dawkins's genetic program, in order for there to be a new emergent 'organism', a new value can be added to a parameter, for example a new value to the branching angle. This leads to a similar but new form for the offspring that are produced by the next generation's DEVELOPMENT program. This then puts the location of the creative process for the new in the specific parameter values, not in the genetic program. This is not especially problematic for computer generated 'organisms', but Dawkins's real intention is to show that the genetic program, and by extension real genes (the parts), are creative in evolution. The difficulty for Dawkins is that specific parameter values are not parts of the genetic program so as such he puts the content of the 'law' (program) outside of the genetic program (genes). If so the genetic program cannot be argued to be creative rather it would be the parameter values as they contain the content. But I would argue that for real organisms the generative potential cannot generate the whole 'organism' if the content does not lie within it.

The second element to autopoiesis is agency. I would also argue that the distinction between the **content** and **agent**, which Dawkins fails to note, is an important one. It is important in the sense that, for an explanation to describe autopoiesis, both content and agency have to be a unity. On an ontological level, if life may be considered to be autopoietic, it must have its own content and agency. If this is

not seen, then one could be drawn into believing that the sole creative agent in evolution is natural selection (Gould 1990, pp 101/102).

If real organisms can be explained as autopoietic, then both content and agency have to be a unity with the created organism. As I have argued, in agreement with Goodwin, the generative potential provides the ongoing content over the life time of a created organism with which it is a unity; and it is also a unity with its own agency. There can be no ontological split between these three aspects of a living being. What sense does it make to say there is an ontological separation between the creative potential, creative agent and the organism? They are after all supposed to refer to the unity of living organisms as well as the unity of species. It would be far better to argue that each of these three aspects were in fact dimensions of a unity - there could not be an ontological split between an organism and its creative potential, otherwise it would have no information content, nor between the organism and the creative agent, otherwise it could not be produced. Similarly, any ontological split between creative potential and creative agent would see some species defining content unable to be realised and hence there could be no organism anyway and no way of knowing if the creative potential and creative agent existed.

***

There is another aspect of this question of the autopoietic nature of organisms. Do organisms emerge from the activities of genes or from the generative potentials of whole organisms? In the above I argued that living organisms emerge from the potentiality of *whole* organisms. This means that both the content and agency of life are to be found in the whole organism, not in one of its actual parts. In opposition to this, reductionism would argue that whole organisms emerge from the genetic parts. Part of the argument for this position is based on the notion that the information content of whole organisms is contained in the genes. I shall argue here, however, that this is not the case and that genes can be explained as created parts in time and space, or as emergents of the generative potential of 'life'.

As has been described, Dawkins emphasises the genetic program in the creative process in development and evolution, consequently, he locates the information content there too. However, he does not highlight the difference between the cause and the information content in the relationship between the genotype and the phenotype. Firstly, I would ask, what is the content relationship between genotype and phenotype; and secondly what is the causal relationship between them? As I have argued for a unity of content and cause, I will focus on the former of these.

Dawkins has argued, for instance, that the information content is to be found in the gene rather than being on the level of the phenotype. But what is misleading about this is that his concept of gene is not any particular physical manifestation that biologists usually associated with a gene. His concept of the gene is rather one of information content distributed through space and time than any particular substance:

> there won't be a complete developing embryo unless there is a whole program of chemical and cellular events, under the influence of lots and lots of other genes, and lots and lots of other, non-genetic, causal influences. The particular effects that genes have are not intrinsic properties of those genes. They are properties of embryonic processes, *existing* processes whose details may be *changed* by genes, acting in particular places and at particular times during embryonic development. (Dawkins 1991, p. 169/70)

> But the set of atoms that is any one copy of the gene is not of permanent interest. It has a life expectancy measured only in months. As we have seen, the long-lived gene as an evolutionary unit is not any particular physical structure but the **textual archival *information*** that is copied down the generations. This textual replicator has a distributed existence. It is widely **distributed in space** among many individuals, and is widely *distributed in time* over many generations. (Dawkins 1991, p. 170) (My emphasis)

The problem is where precisely is the textual archival information supposed to be located? Is it in the whole organism or in the gene? The first quote seems to be saying that the affects that genes have

are not properties of the genes, they are properties of the embryological process and therefore I assume also of the phenotype as a whole. This is fair enough, but the important point is that the observable information content of the gene is different from that of the embryological process and the phenotype. If we are referring to the gene as textual archival information spread across space and time, then what is it? Dawkins has already tacitly admitted that the information content of the gene is different from that of the phenotype. If that is the case then the information content of the gene does not contain that of the phenotype. So how could the genetic formula be the creative potential for something for which it does not contain the information? This makes no sense: to explain something an explanation needs to contain the content of that which is to be explained (chapter 5).

Where then could the information content be that is spread across space and time? I would argue that this information content has its location in the generative potential. The content in the generative potential can be 'thinkable' on the basis of observations of actual organisms. The information content of the whole organisms is a unity of its Parts-in-Time & Space. Each organism would be the unity of what is usually called the genotype and the phenotype. Although I would argue that there is in fact no ontological separation between the two: genotype and phenotype are merely two aspects of the whole organism. They may have different roles to play in the life of that organism, but they are not separate entities.

If this is the case, then the Creative Potential that contains the textual archival information of the whole organism, cannot be Dawkins's genetic formula. It has to be something that contains the creative potential of the content of both the actual substantial gene and the actual observable phenotype. **What I will call the generative potential then contains the information content for the production of both the organism as a whole, and the gene.**

The generative potential is not a particular or specialised actuality, it has a universal content that transcends particular organisms, but is immanent in the creation of them. In other words, the Whole and its Parts are a unity of information content; but Parts are really instantiations **of** Wholes, they are special cases of them.

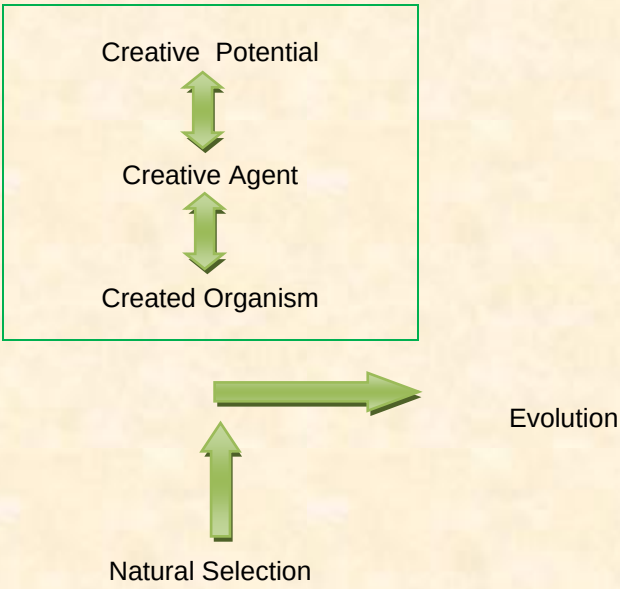
The information content of a whole organism is 1) not primarily but only secondarily to be found in the substance gene; 2) nor is it found in the gene program but primarily in 3) a generative potentiality. The information for genes and gene production is also included in the generative potential.

The Generative Potential I interpret as a Creative-Whole-Over-Time that contains the information content of all aspects of individual organisms as parts, or instances. Substance genes are explained as Created Parts-in-Time & Space. The Generative Potential contains the information for the substance genes, it is the transcendent element of a reality to which actuality is immanent. This helps explain why the manipulation of real substance genes affect the organism: because they a parts of a unity with the Generative Potential.

***

In light of this discussion, I will propose then that the concept of emergence is the relationship between the creative potential, the creative agent, the created, or instantiated organism and the selecting environment. This can be depicted as follows so long as it is kept in mind that the creative potential, creative agent and organism are dimensions of a Whole and that the creative potential and agency are not to be identified at this point with the genetic program:

Fig 7.5



The actual evolutionary emergence of a real organism is then, I would argue, to be explained as a combined creative relationship 1) the creative potential, 2) the creative agent the 3) created organism **as a Whole** and 4) the selecting environment.

(7.4) Life Potentials Diversifying

I argue in this section that for explanation to model life, Generative Potentials need to diversify. This concerns the emergence of species, as generative potentials, as distinct from the emergence of the general life potential addressed in the previous sections of this chapter.

As principles of explanation, Generative Potentials diversify, I argue, through a dual process of: 1) **internalisation** and **externalisation**; and through 2) **universalisation** and **specialisation**. I shall argue that emergent evolution can be explained through the **Meeting** of the Generative Potential and the Environment.

***

Generative Potentials, I claim, internalise history. They also externalise the parts that make up observable history. It is in this dual nature that Generative Potentials diversify. In this aspect, I am in much agreement with Goodwin's view (1994, pp. 80/81), with the important exception that I do not see history as a mere boundary condition. Rather, history is not something that remains an outer condition to the evolution of living organisms, it can also become internalised in the Generative Potential and thereby provide content for further creativity.

Goodwin is generally critical of historical explanations used to explain evolution. This is the Natural Selection aspect of his argument. For him history only comes into explanation in the form of initial conditions. He thinks that the historical approach is inadequate, like trying to explain planetary motion through the mere fact of the initial occurrence, or of a set of occurrences. He argues:

> the goal of scientific explanation is to reduce historical accidents to the minimum possible and seek explanations in terms of the principles according to which systems are organised. The procedure is to describe the states that are possible in a system according to intrinsic properties and then to explain what is observed as a specific realisation of the possible by the action of the particular conditions (History). Historical explanations are not regarded as sufficient. Why, then, are they used so extensively in

> biology? If organisms can do almost anything, then they don't obey any laws of their own; that is, there are no principles of organization in biology that might allow us to describe what is and is not possible in biology. The whole of biology is really just the accidents of history, what forms happened to be selected in particular environments. Biology therefore becomes a set of historical narratives... Unlike the other sciences, in which principles of organization allow one to understand the structure of the physical and chemical world in terms of regularities and general principles, the phenomena of biology are *unintelligible* in such terms and survival is the only law. This is why natural selection has become so important in biology it is the only 'force' that is used to explain what has happened in evolution.
>
> (Goodwin 1994, pp. 80/81)

He goes on to propose a theory that explains how forms are produced. It will be a kind of explanation of the type provided by Newton. The centre of this explanatory principle is, as we have seen, the morphogenetic field. The morphogenetic field is "a spatial organizing activity that involves clearly defined physical and chemical processes, though combined in way that is distinctive to the living state" (Goodwin 1994, p. 88).

The morphogenetic field, Goodwin argues, is the way both species and genera can be explained, it is not their history that explains them. It is the way their basic structure is generated that matters; not the accidents of history, just like the content of a mathematical equation matters not the parameter values.

***

For Goodwin, then, the history of the environment is merely another boundary condition. In a present life situation an organism and its environments would appear to have some degree of 'separateness' from each other even though it could be said that an organism lives within an environment. This is meant in the sense that the generative principle of an organism is not identical to that of its environment. Were the latter the case then in order to create an organism all one would have to do is set up the appropriate environment to produce it. This would be like thinking that in order to

create a crop of wheat all that is needed is the appropriate soils and other environmental conditions. Goodwin believes, in contrast, that the content of generation has its origin in the morphogenetic field, the environment only selects.

This is connected with the issue of speciation. One of the main concepts of evolutionary theory is that different species diverged from a common ancestor. In Goodwin's terms one would have to interpret this in relation to the creative morphogenetic field - over evolutionary time different kinds of generative fields have emerged that produce the individual organisms that belong to distinct and reproductively isolated species. The traditional argument is that various extrinsic environmental factors, like geographic isolation, have brought speciation about. Goodwin opposes this in favour of the intrinsic generative field. If this were to work then the ancestral generative field would have to diversify over time out of its own intrinsic processes. The natural environment would have no role in this other than selecting, for or against, the diverse species.

I would like to consider how this would be possible from the perspective of the law model of explanation. In line with the philosophical intent of this thesis, one would have to imagine an original generative field, as a special example of the law model, which already contained within it the means for its own diversification and reproductive isolation. Whether or not an individual organism, as a product of the generative field, survived would then depend on the existence of a suitable environment. In this account, no reason could be given for the fact that reproductive, i.e., generative, isolation has occurred. How could the generative field as well as the individual organisms have become reproductively isolated? From the law model perspective, this could not be possible as it would imply that the reproductive isolation of a specialised generative potential was present before it occurred!

An alternative way of interpreting this would be to see the evolutionary process as partly one of the 'internalisation' of the information content of the environment within. By this I don't mean that the generative principles of the environment somehow passed from the outside into the 'inside' of the organism. What I mean is that the original generative principle became a more specialised content that was **attuned** to the contents of the environment.

Through the **meeting** of the inner generative principle and the outer environment an **attunement** process of general to special is outlined in generative potentials of evolution. In other words, specialisation of the generative Potentials occurs through the internalisation of the content of the external environment.

This view needs to be considered in relation to the idea of mutation, on the level of the generative potential, being the originator of evolutionary change. What I am putting forward is compatible with this, mutation may originate the information content of an organism, i.e. its phenotype, this then, if successful, matches the information content of the environment, which then becomes established within the organism through internalisation.

This would be more in keeping with the view that reproductive isolation was due, at least in part, to geographic isolation. The speciation question would then be conceived as a result of a meeting of inner and outer, between the intrinsic and extrinsic - evolution would be partly seen as the extrinsic becoming intrinsic, and perhaps the intrinsic becoming extrinsic. Evolution would be the transformation between inner and outer, outer and inner. This could work if the original generative field, which produced the common ancestor of all living things, contained the **potential for specialisation**, without those things being actualities, which then came into existence through a meeting with the actual environment. This would be the transformation of the Potential for General Life into Species Specific Potentials. Through this meeting the generative field of organisms became specialised by internalising sufficient characteristics of the environment. Through this process, the original generative field undergoes a transformation from a general life creating principle to a multiplicity of specialised life creating principles.

If evolution is viewed in this way the absolute dichotomising of intrinsic nature and extrinsic environment has to be given up. Evolution is seen as a transformation, a becoming, between the inner and the outer, the intrinsic and the extrinsic. In one particular time moment, the inner gives the basic general creative principle, the outer gives speciality. The outer can, however, become internalised and thereby become part of the creative potential that provides the content for generative activity in a later time moment.

In my view, the Generative Potential produces changes in the organism, is responsible for mutation on the whole body level, this is either selected for or against. Over evolutionary time, this **Meeting** becomes established in the Generative Potential and leads, eventually, to speciation. In a sense, the **information content** of the history of a species of organisms is **internalised** in its Generative Potential over evolutionary time. This Generative Potential can then become **externalised** in the production of individual organisms of specific kinds. This is not to argue that the **agency** of the organism **originated** in its past environments, rather that there is degree of match between the information **content** of the generative field of the organism and its history. If this is the case, then **history is not a mere boundary condition, having little to no explanatory role, it is in this sense that it can become a part of the nature, the Generative Potential, of an organism and partly explanatory of it**.

***

Internalisation, however, is not enough to explain how life's potentialities diversify. The reason being is that the information content of the environment that is 'internalised' is finite, or particular. But reproduction, as a facet of life's potentialities, requires a 'multiplicity' or 'infinity' (see section 7.2). Another pair of processes that is needed within the explanation is **universalisation** and **particularisation**. This is a dual process through which organisms become capable of producing endless possible instances of similar kind. For example, in reproduction there is the twofold creative process that leads to similarities and differences within species. It is the similarity producing principle that is being referred to in this context, i.e. it is the species seen as a Generative Potential. It is the characterization of 'endlessness' that is important for the explanation of 'endless variety'. This endlessness, or infinity, is an essential characteristic of the Generative Potential and differentiates it from its finite products. Generative Potentials are wholes because they have this feature of infinity. Parts can only be finite. I have addressed this question of infinity in chapter 5. Hence holism is a better from of explanation than reductionism in this perspective too.

Dawkins introduces his concepts of Biomorph Land and Genetic Space in order to come to a deeper understanding of the creative processes in evolution. Both these are ascribed the attribute of having endless or infinite variety:

> Biomorph Land is very very large, and the total number of creatures sitting there is **all but infinite**... You have to adopt some more efficient-creative-searching procedure.
>
> (Dawkins 1991, p. 65) (My emphasis)

> The computer biomorph models make these points well, and they constitute a constructive bridge between **human creative processes**... and the **evolutionary creativity of natural selection**, the blind watchmaker. To see this we must develop the idea of biomorph land as a mathematical 'space', an **endless but orderly vista of morphological variety**, but one in which every creature is sitting in its correct place, waiting to be discovered.
>
> (Dawkins 1991, p. 66) (My emphasis)

The set of biomorphs is regarded by Dawkins as a domain called Biomorph Land or genetic space. It appears to be intended as the sum total of the generative principles of all the individual species. That is, a kind of mathematical world that contains all the creative principles of each species. This genetic space is quite distinct from the space in which computer 'organisms' exist. In fact it is the space from out of which the computer organisms are generated.

In a similar fashion to Dawkins, Goodwin grounds his concept of the morphogenetic field in the theory of morphospace, which he derives from Gould (1977). He defines this as "the space of possible morphologies for species organized according to certain principles" (Goodwin 1994, p. 100).

So morphospace is seen as an all embracing space that includes the different types of generative principles as distinct from the actual existence of an individual organism. Morphospace is a potentiality space not an actuality space. Like Dawkins's formulas and genetic space, the fields which are parts of morphospace are specific potentialities: each field contains endless or infinite possibilities of actualisation.

The question then is: how is this infinite or universal existence connected to the actual parts that make up the history of life? Some kind of concept is needed to explain the relationship between the universal 'whole' and the finite 'parts'.

In order to make a bridge between genetic space (which I re-interpret as a potential) and actual parts of evolution, Dawkins proposes the notion of the evolutionary trajectory. Evolution in a sense becomes described as a process, or movement, between genetic space and the existing species or individuals. This, however, raises questions concerning the attributes of the explanatory principles used as well as the reality to which they are supposed to refer.

> What is the point of thinking in terms of genetic space?... The answer is that it provides us with a way to understand evolution as a gradual, cumulative process. In any one generation, according to the computer model, it is possible to move only one single step through genetic space... **Every evolutionary history consists of a particular pathway, or trajectory, through genetic space**.
>
> (Dawkins 1991, p. 67) (My emphasis)

A particular problem, that Dawkins does not address, arises in respect of the attribution of endless, or infinite, variety to genetic space: actual evolution shows only a sequence of finite entities, or parts. If the producing process, either as a specific genetic formula or as genetic space, has the attribute of endlessness, how is the fact of the evolution of a finite set of organisms to be understood? How come endless variety does not exist for observation? That is, an endless variety that can be observed through the senses? Dawkins is not explicit about this issue, but it is implicit in his whole argument about the relationship between the genetic space and actual evolution.

As we have seen, genetic space, and each individual formula for an organism's formation, has effectively infinite possibilities. This is true also of the possible pathways between the species generating principles, or between the different types of genetic formulas. If, however, we are to find a bridge to actual evolution, some kind of process between the universal and particular is required.

Evolution then will need to be partly explained as a **process between the infinite and the finite**. This will have to include, of course, mutation or variation. The reason is that a 'formula', as a species generating principle, is needed to explain **all** organisms of a kind – i.e., the 'formula' has to have infinite extension otherwise its future individual products would not be explicable. That is, since formulas as mere finite summaries of the past cannot explain future creations, they would be anti-evolutionary.

Actual evolution would then be partially explained as an actualisation of a particular, or particularised, pathway of the endless or infinite potential of the creative process. If something like genetic formulas and genetic space actually exist (realist position) or even if we see the need for endlessness as an attribute of our explanations (instrumentalist position) then an understanding of the process of particularisation is essential.

Now I would argue that the process between the infinite and finite, or process of particularisation, in real evolution can be interpreted as a process between something analogous to the relationship between the potentiality aspect of an equation, its parameter values and the specific outcome (cf Goodwin 1994; Ingold 1990). This is not to claim that this real evolutionary process is identical to the mathematical process, but that there is a similarity in that both involve a kind of movement between the infinite and finite, the general and the specific, the universal and the particular.

Goodwin's (1994, p. 102) proposal for the process of realisation seems to be that it is the genes that specify the morphogenetic trajectory of the gametes, and ultimately the life cycle of an organism and its evolution. In his mathematical formalism, the gene acts as a kind of initial condition for the field equation to be actualised, that is, to be brought into finite existence.

From an ontological perspective, I would like to re-interpret this as follows. The gene, as a **real**, **existent**, entity, is not just a parameter or boundary condition; it is an integral part of the nature of the organism. As a consequence, the actual gene must be interpreted as an outcome of the generative field itself; it cannot be given an ontological independence necessary for an actualising boundary

condition. If gene and field are aspects of an ontological unity, i.e., a **whole** organism, then the life and evolutionary trajectories are self-actualised by the organism. The **agency** lies in the organism itself. What this suggests is that the process of actualisation, or particularisation, is determined from within the organism itself, not by an external boundary condition. Mathematically this makes no difference from Goodwin, but from an ontological perspective it means that genes are aspects of a whole organism that realises itself in space and time. This ontological interpretation is entirely consistent with Goodwin's view that 'the organism is a unity' (Goodwin 1994, p. 38)

Goodwin's view can be complemented by that of Steven Rose whose approach is distinctly historical:

> Lifelines are thus inherently homeodynamic, The present instant of our, or any other organism's life, is simply inexplicable biologically if considered as a frozen moment in time, as the mere sum, at that moment, of the differential expression of a thousand genes. Each of our presents is shaped by and can only be understood by our pasts, our personal, unique, developmental history as an organism... nothing makes sense except in the light of history.
>
> (Rose 1997, p. 157)

What Rose is referring to with his idea of lifelines is the developmental process an organism goes through in its life. But this, I would claim, should not only include the bodily organism, but also the external space and time process. The reason I argue this is because of my conviction about the explanatory need for the meeting between the Generative Potential and History. Rose's view inclines towards explanation through the finite parts that have occurred through time. In this I concur with Goodwin. I would argue that without the *explanandum* being primarily located in the Generative Potential, then evolution looks like a series of fortunate events. On the other hand, Rose's idea of lifelines, when extended in the way indicated, helps provide some understanding of how specialised organisms can **become** creative wholes. It is the unique nature of the lifelines of species that is universalised into the Generative Potential which then becomes the source for the 'particularisation' of the next generation.

In summary, Goodwin's view can be complemented by the concept of the lifeline of organisms; Rose's position, on the other hand, may be supplemented by the concept of the generative potential. I argue that the conjunction of a modified version of both positions provides a better account of the creative process of evolution: **A species of organisms can be conceived as a creative potential as well a sequence of individual instances of themselves that act in this creative Becoming in evolution**. In this way, explanation is 'between the parts and the whole'.

(7.5) Conclusion

In the above I have argued that genes can be explained as emerging from the potentiality of the whole organism. As such this is a rejection of reductive physicalism which attempts to explain the whole as emerging from prior existing physical laws. But I have also shown that there is an element of explanation of the 'between the potential and the actual' kind.

I have also argued that evolutionary history gives evidence that explanation is both 'from the potential to the actual' and 'between the potential and the actual'. In this sense, there are two basic forms of **Becoming** required to explain the emergence of life. First, the emergence of the general life process can be explained as being 'from the potential to the actual'. In an understanding of the first emergence of life, and as life can be claimed to be autopoietic, life can be said to be self-emergent from its own potentiality. **Life is its own Becoming from its own Potential**. Secondly, once having emerged, life has elements of emergence that are 'between the potential and the actual'. **Life's specialised Becoming is a meeting between the Potential and the Actual**. I argued this in the discussions about internalisation / externalisation and universalisation / particularisation. But in both cases, I would argue that it is the potential that is most fundamental to the explanation as it is always the agent in these processes. In this sense, emergence in biological evolution can be explained as being most fundamentally 'from the potential to the actual'.

(8) THE COGNITIVE / SOCIAL EMERGES FROM ITS OWN POTENTIAL

(8.1) Introduction

I will show here that emergence in cognitive / social evolution supports the potentialist explanation of emergent evolution. I will also show that actualism cannot allow for this as it assumes that the past generates the present. On the other hand potentialism can allow for new social ideas as it postulates that the world has a perspective to it that may be called the 'Cognitive / Social Potential'. This also includes an element for autopoiesis in cognitive / social explanation, that a component of a purely individual potential is admitted into the explanatory 'law'. More generally, I show how explanation in cognitive / social evolution can accept within its form a Becoming from the individual to society and from society to the individual. In this sense, explanation in the social sphere is dialectical (Rose 2005). I draw from the work of Mithen, Ingold and others whilst showing some important differences.

In 8.2, I argue that the cognitive / social needs potentialities and actualities within its 'law of explanation',

In 8.3, I show that such explanations should allow for an element in the 'law' that reflects that individual persons can be seen as their own autopoietic potentialities,

In 8.4, I argue that the appropriate model for emergence in cognitive / social evolution requires that the generative potential explanation can diversify.

In these senses, the cognitive / social is explained as emerging from its own potentiality.

(8.2) The Cognitive / Social as a Potential and an Actual

To make the argument for potentialism, I will track the four basic dimensions of potentialities presented in section 5.2: universality, specificity, transcendence and thinkability and link them to the concept of autopoiesis. I shall try to explain the emergence of new social forms in these terms. I will show that these four concepts are necessary to explain emergence in cognitive / social evolution. The writers that I consider use different terminology from mine, but I will

try to demonstrate that the underlying evidence and concepts they adduce may be used to support a potentialist explanation of emergence.

In order to first identify potentialism, I will take as the starting point for this part of my thesis the popular science work of Mithen (1996). I will try to show that his explanations, and those of others, are potentialist in nature. He tries to explain the emergence of creativity in human evolution and explores the origins of art, science and religion in the upper Palaeolithic period (ca 60,000 to 30,000 ya) during which "the cultural explosion occurred... derived from a major change in the nature of the mind" (Mithen 1996, p. 15). He then links on to other authors, like Boden (1990, 1994), Karmilov-Smith (1992, 1994), Hirschfeld & Gelman (1994), Sperber (1994) and Cosmedes & Tooby (1994).

I shall look at Mithen's concept of **Cognitive Fluidity** as playing a similar explanatory role as a 'Theory Of Everything' or the general 'Morphogenetic Field'. This may be argued in the sense that the concept of cognitive fluidity acts as a unifying principle (chapter 3), but has within it the potential for diversification. It is not merely a uniform 'generalised intelligence' but contains four basic intelligences and has the potential for combining them in a 'limitless' number of ways. This unity, with at least some degree of internal diversity, is used to explain the far greater 'cultural diversity' which is actualised, or emerges, from this potential.

Mithen's approach is archaeological, using artefacts like stone tools and weapons, ornaments, and also works of art like cave paintings and religious relics such as carvings of 'goddesses'. Through these he makes an argument for a shift in the creative capacity of the human mind.

According to Mithen, during the Upper Palaeolithic period , there was an evolutionary shift in the human mind to what he calls 'cognitive fluidity' (Mithen 1996, p. 70) in which the specialised intelligences: natural intelligence, technical intelligence, social intelligence and linguistic intelligence, were integrated and between which the human mind can flow. The suggestion then is that it is because of this cognitive fluidity that the creative explosion is supposed to have occurred as it enabled the human being to have a "limitless capacity

for imagination" (Mithen 1996, p. 71) in respect of how the various specialist intelligences are connected with each other. It is through this cognitive fluidity, according to Mithen that art, science and religion came into being.

Mithen connects his concept of cognitive fluidity to Boden's (1990, 1994) 'conceptual space' and Sperber's (1994) 'module of metarepresentation' or ‘concept of concepts'. In the case of Boden, this lies in the suggestion that creativity consists in the transformation of conceptual spaces being similar to cognitive fluidity. Mithen has argued:

> Rather than using the terminology of 'conceptual spaces', I referred to these [different kinds of intelligences] as 'cognitive domains'... The 'creative explosion' of the Upper Palaeolithic was a result, I have argued, of a newly evolved ability for precisely the 'mapping, exploration and transformation of conceptual spaces that Boden has identified as lying at the core of creative thought. I have termed this as capacity for 'cognitive fluidity' and suggested that this is a universal feature of modern minds, differentiating us from Early Humans, and is the root cause of creative thinking. (Mithen 1998, pp. 169/170)

In turn, Boden has defined creativity in the following way:

> To understand this [creativity] we need the notion of conceptual space... The dimensions of conceptual space are the organising principles that unify and give the structure to a given domain of thinking... it is the **generative system that underlies that domain and defines a certain range of possibilities:** chess moves, or chemical structures, or jazz melodies. (Boden 1998, p. 26) (My emphasis)

From the perspective of this research the question then is: does the above in any way support potentialism as a mode of explanation? On the first level, it can be seen that the concepts of cognitive fluidity, conceptual spaces, or 'concept of concepts', have been described as 'a generative system that.. defines a certain range of possibilities', in other words as generative potentials. They also have the characteristics of specificity (domain specificity); infinities

(endless possibilities), transcendence and thinkability. The first of these seems fairly straightforward, so I shall concentrate on transcendence (as the unity of antecedence and futurity).

The two aspects of transcendence and thinkability can also be found in Carruthers (2002). He has suggests that early humans, *homo sapiens sapiens*: "would have needed a supposition-generator... to create representations of imagined **possibilities**. And second, humans would have needed a **possible** worlds box, which is a memory system designed to store suppositions and their elaborations during the course of a pretend-episode" Carruthers (2002, p. 241) (My emphasis).

From the perspective of this thesis, what Carruthers seems to refer to is the existence of something that would enable humans to transcend the sense-perceptibly given. It may be recalled from chapter 5, that one of the characteristics of potentialities is that of 'thinkability'. In the example given here, this 'thinkability' of the 'possible worlds box' would seem to enable humans to transcend their outer perceptions (Bohm & Peat 1987). I will consider this in the following.

One can see that when the early humans contemplated imagined possibilities, the focus of attention was not so much on what was actual but what is possible. In the moment of contemplation of the possible the actual is transcended, the human being is considering what could be, not just what actually is (see section 5.2). This took place within the human mind, but when one of the imagined possibilities was enacted, I think it would be reasonable to say that the actual then became a realisation of the potential. In other words, the new actuality emerged from the potential. In this example, the potential is conceived as a way of interpreting Boden's 'conceptual space' which is **thinkable** before becoming an **observable** actuality. Whether or not these are only 'cognitive potentials', existing only for the human mind, I will leave open for now.

From another point of view, Mithen (1996, p. 179) has argued that early humans began to develop a degree of integration of the different intelligences (mental modules) through 'cognitive fluidity'. I would interpret cognitive fluidity as a kind of potentiality to transcend the specific given intelligences, in other words to go beyond the

actual intelligences already present. The idea of cognitive fluidity is inferred, epistemically, from the appearance of certain artefacts in the archaeological record: figures of humans were first made as well as bead necklaces, showing an integration of social and technical intelligence; animals and plants were depicted as people, people depicted as animals, suggesting an integration of social and natural history intelligence; parts of animal were used as specialised technology, as in the case of bone arrows, evincing an integration of natural history and technical intelligence; and finally, the first signs of art, science and religion started to appear. What this seems to suggest is that early humans, in a similar way that we do today, think about and realise objects that transcend those given by nature, through outer perception, on the basis of an exploration and transformation of a 'thinkable', 'conceptual', space. This, arguably, is an example of what Boden (2004) calls a 'Mapping, Exploration and Transformation of Conceptual Space'. Put in terms of this thesis, this may be interpreted as a creative activity within the space of Generative Potentials. As I have argued in chapters 2 & 5, potentialities are given through 'reason' whilst actualities are given through outer perception. As I have suggested, conceptual space can be interpreted as a kind of **inwardly thinkable** potentiality space that transcends and pre-exists the **outwardly perceptible** 'actuality space'. In this sense, I would claim that these potentialities are not derived from actualities in an ontological sense; after all, if my argument is correct, the actualities are outcomes of potentialities.

It isn't clear whether Mithen would agree with this. In the above he referred to the 'cultural explosion' being a result of cognitive fluidity. In this instance, his logic suggests that cognitive fluidity had the pre-existent, antecedent, potential for the production of this cultural explosion. If he thinks this I would agree. But he also refers to cognitive fluidity as an 'evolved ability' which might seem to suggest that it was a product of what preceded it in time, thus avoiding the question of a transcendent potential. This, however, would bring us back to a problem that we have met before in the discussions about cosmological and biological evolution: how to explain one kind of 'explanatory law' (in this case cognitive fluidity) in terms of a previous state of existence that did not contain its explanatory content. This seems to me not possible and a more satisfactory explanation would be to say that the universe had cognitive fluidity as a potential which, in the evolutionary epoch being discussed, became a part of human

minds. From an epistemic perspective, however, we can infer this, however, only once it became actual, once there was observable evidence for it.

Boden would no doubt disagree with my argument as she believes that conceptual spaces are already present within existing outer culture:

> Conceptual spaces are structured styles of thought. They are normally picked up from one's own culture or peer group, but are occasionally borrowed from other cultures. In either case, they are already there: they aren't originated by one individual mind. (Boden 2004, p. 4)

But the problem with this is that from an evolutionary perspective it cannot work. If one consider the evolutionary epochs when first general intelligence emerged and later cognitive fluidity arose, then there were moments of origination where these could not have been 'picked up' from the cultures of the time. The reason being that these changes in mental ability **originated** then: at this moment there was no culture that contained them from which they could be 'picked up'. It which case, it would be better simply to say, from the perspective of generative potential explanations, that the universe contained potentials from which these mental abilities emerged. But they were also ontologically dependent upon, without reduction, the pre-existing biological and cultural realities (see chapter 3).

This explanation can look rather strange, but a possible reason for this is that we are used to identifying 'the world' or 'reality' with the actual. As outlined in chapter 2, we become aware of the world as an actuality through sense perception and take this as the primary criterion for reality. Hence anything that is not perceived, but only thought, as potentials are, is assumed not to be a part of reality. But if potentials are taken to be real, and in fact **generative** of actuality, then the emergence of mental abilities from out of the world's potentials does not seem so odd. In fact, I would claim it makes better sense than trying to explain them as coming from nothing or from something wholly different in content.

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(8.3) Autopoietic Individuals as Potentials

Ingold is more explicit about advocating 'potentialism'. On the basis of some of his ideas, I will argue here that if an allowance is to be made in our explanatory principles for both social and individual creativity, then the concept of cognitive / social potential is needed. This is meant in the sense that, if new content is to emerge in cognitive / social evolution, from individuals and society, then a theory of potentialism is required. I will argue for potentialism and the idea that emergence in cognitive / social evolution can be explained in terms of individual cognitive / social potentials as well as those of the existing general social field. This view interprets emergence in the cognitive / social domain as being from its own potential rather than from pre-existing biological laws.

Ingold appears to be a potentialist because of his conception of social evolution being expressed in terms of the transformation of the generative or creative potentials of fields. His ideas are partly built upon the popular science writings of Bohm (1980) and Goodwin (1984). For Ingold, the sum of all the generative potentials of society he calls sociality. The person and society emerge from the **transformations** of sociality. The question is: what is a concept of transformation? Ingold argues:

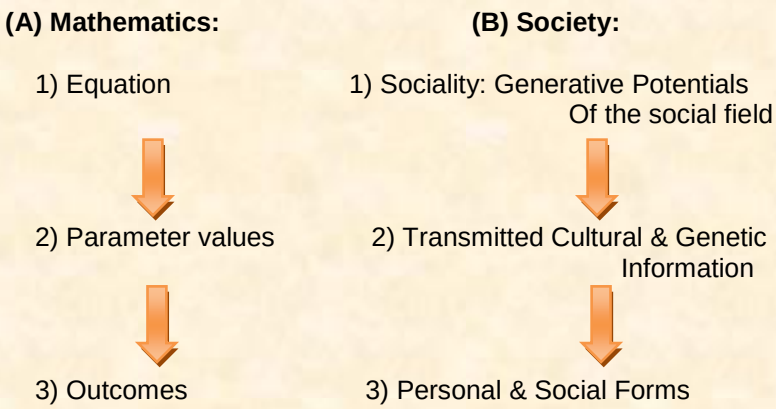
> Social evolution should be regarded as an exploration, over time, of the generative potentials of sociality. In our view, however, **social evolution** consists precisely in transformation of the **total** relational field within which the development of every human subject proceeds. Hence it is simply not possible to separate the study of development from the study of evolution. For just as the genesis of the organic form lies in the **self-organising *potentials* of the generative field** that intervenes between genotype and phenotype, so also the genesis of the **social form** lies in the **transformative *potentials*** of the field, constitutive of persons as intentional agents that intervene between genes or culture and manifest social behaviour. This is an argument for the assigning to persons an **active** role in the origination of social order, rather than relegating them to the status of passive vehicles for the replication of a design written into the materials of heredity or tradition.
>
> (Ingold 1990 p. 221) (My emphasis.)

Ingold, just as Goodwin does for biological evolution, bases his idea of social evolution on a mathematical, or topological, form: □

> To give you an analogy, all the conic sections, from ellipse to hyperbola, can be generated from a basic quadratic equation by changing the parameter values. But the latter do not on their own dictate the form of the curve, since one must know the equation... I recommend that we view social life not in statistical terms, as the outcome of a large number of interactions among discrete individuals, but in topological terms as the unfolding of a total generative field. I have used the term 'sociality' to refer to the dynamic properties of this field... these properties stand to genetically and culturally transmitted information as an equation stands to its parameter values. Genetic or cultural variation may be expected to induce evolutionary modulations of the social field, but this is not to say that social forms are in any sense genetically or culturally determined.
>
> (Ingold 1990, pp. 217- 223)

This analogy can be expressed as:

Fig 8.1



The emphasis, for Ingold, is the transformation, or emergence, of the person from the generative or creative potentials of sociality. As was

the case for Boden, for Ingold persons emerge from out of the properties of an existing, **actual**, relational field, not from out of their individual personhood, or individual consciousness. Unlike Boden, however, he connects this to the equivalent notions of his view of biological evolution. In effect, he sees the processes of biological evolution and social evolution as the same: both are due to the self-organising potentials of the generative field. For the same reason that organisms are active, so are persons in their respective forms. The relationship between a person or a social form and sociality or the social field, is comparable to the creative relationship between an equation and its outcomes: the boundary conditions, as genetic and cultural information merely modulate, they do not generate.

What the mathematical analogy shows is that Ingold wants a form of explanation of social evolution that is potentialist in nature. What this means in effect is that, as with mathematics, an outcome, or instance, is a combination of the essential attributes of an equation and accidental properties. For example, if one were to draw a triangle on a blackboard it would have some features that would be essential in that they are the defining characteristics of a triangle, but it would also have features, such size, position and colour, which would be considered ‘accidental’ and therefore not explanatory. Were Ingold's analogy correct then a person would only be an instance of a general principle and whose 'creativity' would be reduced to the realisation of accidental properties. It is difficult to see, from Ingold's position, how an individual person could have an active role in the origination of the social order from the **content** perspective if he or she is only the **agent** of realisation (chapter 5). I would claim, though, that to allow for an individual person to be active in the production of social order, one needs a generative potential that has a unity of content and agency within the explanatory principle ('law').

Much of the above follows from that fact that, despite Ingold's desire for a potentialist explanation of social evolution, he is in some respects an actualist. One can see this when he refers to human infants being 'already situated' and 'becoming a person is a matter of gathering those relations into the structures of consciousness' (Ingold 1990, p. 221). For him, this is how a person's mind **'emerges'**. As such, it is difficult for him to explain genuinely new emergents rather than merely new instances of a general social

potential. This can be seen in Ingold's conviction that the direction of emergence is from society to the individual. If all that is meant by this is that an individual person's mind is **partly** formed through an already existing field of social relations, his argument is fairly reasonable. But it does not at all cover the logical possibility of the source of generation of new social relations; it only covers the logical possibility of **variations** of already actual social relations. If the direction of emergence of the individual person is from society to the individual, no new relations would be possible, not even new social re-arrangements. The reason is that what cognitively confronts the person, as the seat of consciousness, is existing, i.e., **actual** social information. In other words, Ingold is an actualist concerning the emergence of individual persons. That is, his holism is also actualism. The social potential, for Ingold, it is a **Whole-in-Actuality**. If, however, one accepts that new social forms are to be possible then, logically speaking, this could only arise from the original generative capacity of the individual person. The kind of social potential that Ingold has in mind already exists in the world so it cannot explain genuine origination, only variation. Logically, from the perspective of explanatory principles, one has to postulate the existence of the individual person's potential to generate new social ideas (content) that can be unfolded (Bohm & Peat 1987) as new social forms over time. Arguably, the individual may be incorporated into the 'law of social explanation' not only as having 'cognitive fluidity' but also as being generative on the basis of exploring the 'conceptual space' (Boden 1996) that transcends the actual. The individual can then use concepts generated in conceptual space for the realisation of new social forms.

One of the problems with Ingold's position, it seems to me, is that he does not differentiate between those kind of potentialities that can be inferred from outer perception and those which can be acquired from reason, or inner perception (see chapter2)(Bohm & Peat 1987). We may, for example, infer a concept of trust, a potentiality for trust, on the basis of outer observation. In which case, trust is a kind of given (through outer observation) or actuality, from which a potentiality is inferred. This, however, does not allow for **unique** social ideas **derived from reason (or Intuition, ch 2)**. Such ideas cannot be "given" in this sense, because, if they are to be unique, then they must first be **generated**. That is, **brought into Being in the human mind**. This is not to say that the actual, and outwardly observable,

conditions do not play a role in the formation of unique ideas. I would argue, however, they cannot be **derived** from actualities; otherwise they would have already been present and therefore not unique. In this sense, unique social ideas can be interpreted as having a pure potential origin in respect of their content. Recall in chapters 2 & 5 I argued that potentialities are 'thinkable' whilst actualities are outwardly observable. In the context of human social evolution, unlike other forms of evolution, unique social ideas are *first* thought as potentialities and *then* observed as actualities, once realised. For this aspect of emergence in human evolution, emergence is from the unique human potential to the actual.

Consequently, I would argue, if new social forms, and not just new variations of already existent ones, are to be logically possible, then a facet of personhood could be a purely individual generative potential. An aspect of social evolution could be from the individual to society. In other words, society can also emerge from an individual. Thus both directions may be allowed for in explanations of social evolution. This suggests that a kind of dialectical position of emergence in social evolution is more tenable in a similar sense to that argued by (Rose 1997, 2005). In the context of this thesis, the dialectical position involves a creative relationship between the individual and social 'Over Time'.

This can also be derived from a particular problem with Ingold's thesis that concerns the usage of generic terms and individual personhood. He sees features of sociality like trust and power, etc., as generative potentials of a social field. Each act of trust, for example, is considered to be an instance of trust as a generative potential. I would argue that these notions are comparable to species concepts in biology; therefore any manifestation of them has a similar relationship that an individual organism has to its generative potential. For example, a lion is an instance of the species 'lion'. If the parallel between biological and social evolution were true, then persons would be mere instantiations and members of a species of social potentials. There would be no room for the individual person as an originator of social potentials, only as an agent of transformation, an entity that may have agency but can only actualise those potentials that already exist.

A similar problem arises when it is postulated that social evolution is the transformation of a total relational field. How is this totality to be conceptualised? If it is meant that the totality is a sum of species-type conceptions like power and trust, then again it is not possible for the individual person to be individually creative in a more complete sense, and only active agency is logically possible.

Again there is the difficulty of ascribing an active role to persons if it is the potentials of the social field that are seen as being self-organising. Such a conception is suggestive of an overarching superperson that dictates the content of the individual person. Under this interpretation, the individual person could have no active role in the origination of new contents of social order. The reason is that in order to be active in a generative sense, the person has to have some kind of social idea content that at the very least re-arranges the **existing** social information content in a different or new way. Clearly, the former content cannot already exist otherwise one cannot speak of re-arrangement. It is the very fact that the origination of new social forms **transcends** the existing social forms that the idea of generative origination is necessary.

If the possibility of the creativity of the individual person is to be allowed for in explanations of social evolution, then I would argue that the self-organising potentials could be also explained in terms of their locus in the individual person. The explanatory 'law' of social evolution then consists in the unfolding of the potentials of individuals into society, and the enfolding of the potentials of society within the individual person consciousness. The next question then is: how can this social unfolding and enfolding be understood? I shall try to relate these to actualisation and potentialisation respectively and I will consider this next.

(8.4) Cognitive/Social Potentials Diversifying

Through the relationship between the individual as a potential and the social as a potential, it is possible to come to an explanatory form that allows for the diversification of the cognitive / social. The difference from diversification in biological evolution is that, as I have shown, cognitive / social evolution requires that there is genuine **origination** and not just **variation** allowed for in the 'law of explanation'. The question is how to account for this.

One of the failings of Ingold's position is that it lacks a theory of **potentialisation**. As his view is in effect actualist, he cannot explain how an actual existent reality becomes a potential one. One aspect of this process of potentialisation, I will argue, is the dual activities of **internalisation** and **externalisation**. The other aspect of this is also a dual process of **universalisation** and **particularisation**. These two ideas help support the dialectical mode of explanation when applied to the twin concepts of potentiality and actuality. As I argued in chapter 7, this means that an *absolute* dichotomy between the intrinsic and the extrinsic cannot be maintained. The distinction can be conceived as a *relative* one that can be overcome ‘Over Time’. Through the processes of internalisation / externalisation and universalisation / particularisation, what is intrinsic can become extrinsic and what is extrinsic can become intrinsic.

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In the above, it was shown that Ingold interprets genetic and social information as being like boundary conditions for the creative process in social evolution. These conditions modulate the generative potentials but do not create the type that something happens to be. But this raises the problem of what I shall call internalisability and externalisability in social evolution. This puts into doubt how strict the comparison can be made between the mathematical equation and the social equation. One particular problem is that, in Fig 8.1, under 'A', the parameter values of a mathematical equation cannot be conceived as intrinsic to the nature of the equation. The ascription of precise numerical values, places of occurrence, etc., are not part of the essential character of that type of equation. Whether or not a parabolic equation takes on a certain size, or appears in a particular place, is not essential for being that equation. The parameter values are present merely as

circumstantial, or accidental, features to a specialised manifestation of the equation as a mathematical form, or outcome.

This cannot be so easily argued for 'B'. Cultural and genetic information can **become** aspects of what it means to **be** a social form, or an individual person. They are not mere boundary conditions. That is not to say that either are merely a sum of genetic and social information content, but that the cultural and genetic information cannot be seen as accidental values that merely make some variations in the social potential. The cultural information, in particular, has to be seen as **internalisable** to the social form or person and form a part of their identity. It is through this process of internalisation that further instances become later **externalisable** into society.

Take for example the acquisition of a skill. An individual person will internalise the ideas and practices belonging to a certain existing trade. An aspect of the person **becomes**, evolves, though the internalisation of that aspect of society, it becomes a part of what it means to **be** that person, it is not a mere parameter value but has a changing form of reality from the outer social forms to an inner generative capacity as a skill. This process can be described as a kind of potentialising of the actual. The actual can exist in society, and the individual person transforms this into a potentiality for further actualisations. It is from out of this potentiality that the person creatively actualises or instantiates their skill.

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Two other concepts that are necessary to support the potentialist and dialectical mode of explanation are those of universalisability and particularisability. Universalisability shows how the finite actualities can be transformed into universal possibilities, particularisability on the other hand explains how a Potential can be transformed into an actual instance.

There is a point when Ingold (1990, p. 222) seems to put forward an argument like mine but he does seem to take on board the full import of this. He argues for a crucial distinction between interactions and relationships. He is pro the latter, which involves a series of interactions over time and builds over time. What constitute persons

in this account is not ready-made individuals of separate **natures** that do not change through relationships over time; rather persons, as embodiments or relationships, come to be and exist only as long as they are actively held within the movement of social life. For Ingold, we **start** with social life: persons are generated through the building up of social relationships into the structures of consciousness.

My position is different, and is based on the concept of what I will call universalisability and particularisability. Whilst I agree that, due to the arguments above, persons can evolve through the 'enfolding' of relationships into consciousness; I do not think this constitutes a sufficient condition. Nor do I think this is consistent with the generative field approach that he advocates.

The whole idea of the generative field approach is dependent on the notion that what makes something what it is, is an **intrinsic** creative potential not an initially **extrinsic** environmental factor. This is a point that Goodwin has made quite convincingly. Ingold's view, however, would see the process of person-generation to flow from the existing social relationships to the building up of a person.

However, this cannot work. The reason is that experiences of a certain type of relationship that a person has are locked into specific actualities in time, they are particular. If that was all there was to a relationship then it could never have another manifestation. In the case of skill acquisition given above, the learning process involves a series of finite instances, each of which are unique in space and time. The whole point of a skill, however, is that it universalises, and transcends, the sum of its finite instances it is based on and is projectable into the future. In this sense, the skill is a transcendent generative capacity. The more coherent picture would be to argue that part of what constitutes a person is the intrinsic generative capacity to acquire, through self-active enfoldment, the existing extrinsic social relationships. What constitutes a person then is this capacity which enables it to transform the set of particular instances into a universal capacity. Through this capacity for universalisation the person evolves itself and society over time. This transformation is a process between the finite examples existing in society and the effective infinite potentialities of the person.

Furthermore, the **internalisability** of the cultural and genetic information, through the generative potential of the person, marks an important difference between the social field and the equivalent physical field, and also, to some extent, the biological field. In particular, physical fields do not appear to have an equivalent process of internalisation of universalisation. The biological field may show a certain sort of internalisability of the environment in the process of speciation, but this is on the level of the species and requires variation as the explanation not origination.

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Another perspective of my proposal is that, in the case of the individual person, the **agent** of transformation is arguably internal to the person. This can be deduced from the arguments for 1) origination of new content and 2) internalisability / externalisability and universalisability / particularisability. What these all support is a dialectical form of explanation whereby the agency of transformation is within the person and not just outside. Put in more general terms, there can be a form of explanation that allows for the possibility that agency can be found within the individual person.

I have argued for the theoretical possibility of the unique generative capacity of an individual person in relation to the evolution of society. This would enable an understanding of the origination of **new** social relationships that Ingold is keen on. In which case, we should be arguing, at least theoretically, for an aspect to the social field that is purely individual. Examples of this may be new scientific ideas, new artistic creations and new social ideas; i.e., new in the sense of being unique, never having appeared before. These new elements to the social field could then be unfolded from an individual person and enfolded by others, acting like parameter values to begin with, not determining in any complete sense, but becoming the generative capacity of the person. Thus social evolution partly consists in the actualisation of the new relations of individual potentials of persons and the potentialising of their actualities by society.

Consider now the process from the universal and the particular and from the particular to the universal and its implications for inner agency within consciousness. If the outer social environment consists in particularised forms, as it does, then the agency by

means of which social information becomes a universal capacity of the person cannot be deduced from the environment. The reason for this is the same as the argument concerning the problem of induction: there is no logical pathway between the particular and the universal (Popper 1972). This points to the possibility that this capacity to universalise must lie within the consciousness of the individual person. This must include the nature of the content of universalisability and the agency to do so.

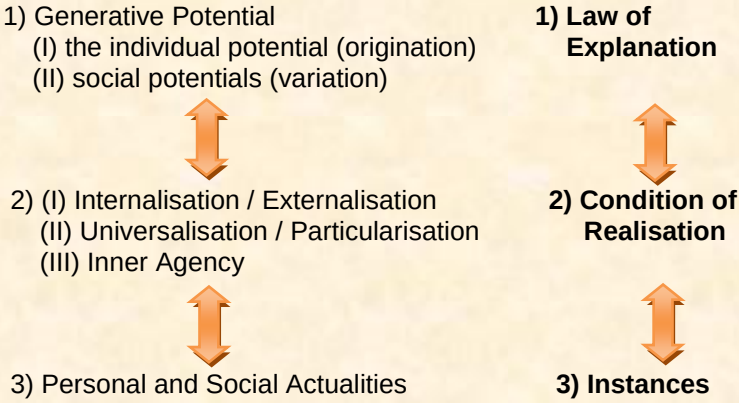
This could also be argued for the process of internalisation / externalisation. In the case of memory, what was once an outer content can become an inner content. This is a transformation from an outer specialised form to an inner specialised form; this is quite different to the particular to universal transformation between particular social information and a universal social capacity.

(8.5) Conclusion

If we are to have explanations of persons as autopoietic individuals, we have to integrate into the explanatory potential the generative capacity to realise new social forms as well old ones both through their own inner agency. The latter may be also be seen as a new way to conceptualise freedom: the freedom to generate and vary ideas and realise them in society and in the person.

Given that this is the case, the 'law' of social evolution would have to include two components 1) the potential and 2) the agency. Cultural information would, under this conception, be seen to be possibly external to the person to begin with, but internalisable through the agency of the person, and then becoming part of the personal potential from out of which an individual person could create and thereby, evolve. So in 'B' above the form explanation through generative potentials would look like:

Fig 8.2



One may see in this potentialist explanation an allowance for genuine autopoiesis in social evolution as well as a partial becoming of the person through social potentials. These generative potentials are Wholes Over Time and express the explanatory 'law' of Social Becoming as a dialectic process. **The Social Becoming can then be explained as emerging from its own social potential which in turn acts as a means through which further social potentials can come about. Within this social potential is the possibility of individual social potentials as well as variations of those of a generic kind**.

(9) CONCLUSION

(9.1) Introduction

In this concluding chapter, I will try to bring things together and put them into a broader context. In the following, I will first summarise the essential ideas of my contribution. I will also offer some brief considerations for further possible research in the context of socio-cultural theory.

(9.2) Summary of the Thesis

I propose that this thesis has made four main contributions to the discussion about emergent evolution. Firstly, in chapter 2, I tried to show how the three dimensions of the debate, the methodological, ontological and epistemological, can affect each other which then influence how creative emergence in evolution is explained. I argued that methodological holism, or emergentism, is the most appropriate method as it allows that reality can be explained from a holistic as well as reductionist and pluralist perspectives. Reductionist method, however, precludes such possibilities *a priori*. I argued that method should at least allow for all eventualities. This is what the emergentist method does.

I also argued in chapter 2 that explanation cannot be divorced from ontology. I showed that there is an element of realism in the most prevalent form of so-called anti-realism, i.e., constructive empiricism. In contrast to contemporary scientific realism, constructive empiricism rejects the existence of the unobservable; it only accepts the reality of the observable. So the observable is real for constructive empiricism and consequently any theory which refers to the observable has that element of realism within it. Everything else in the theory that refers to the unobservable requires an anti-realist stance. As argued in chapter 2, however, the problem for constructive empiricism is that it cannot explain, epistemologically or ontologically, how the emergents observable today can emerge from an unobservable past. As also shown, scientific realism has a different problem in that it interprets emergence as being from the unobservable. If that is the case, then the unobservable cannot be known and does not provide an explanation, epistemologically or ontologically. The position that I argued for, that of metaphysical empiricism accepts some aspects of both of these views and rejects

others. It also extends, on the basis of Bohm, what it means to know and explain. Metaphysical empiricism, in agreement with constructive empiricism, argues for the idea that the unobservable cannot be known to be real whilst the observable can. It goes beyond this however, in that it argues for the reality of the unobservable, in agreement with scientific realism, but 'thinkable', through inner perception (reason), potentialities. This acceptance of the unobservable, but thinkable, does not have the same problems for metaphysical empiricism as it does for scientific realism as there is a *content identity* between the thinkable and the observable, so it does not introduce an unknowable element into the explanation, ontologically or epistemologically. In this way, metaphysical empiricism is a realist position that makes some steps to overcoming the split between constructive empiricism and scientific realism. **Emergence can then be explained within this framework where new emergents are explained in terms of a real Becoming between the potential (thinkable) and the actual (observable).**

My intention is to reclaim a more universal realism which, on the one hand, rejects the idea that higher levels are mere explanations, contra constructive empiricism; and rejects, on the other, the notion that explanation should always be in terms of the physical (physicalism). I argue, in contrast, that we should accept other kinds and levels of reality than the physical. To do this, I showed that we need a different epistemological-ontological stance towards holism, in particular that kind that might be called a "holism Over Time" (potentialism). This stance enables one to recognise that reality can be more than that which is observed, it is also that which is 'thinkable'. Explanation, ontological and epistemological, then consists in uniting the two.

Secondly, in chapters 3 and 4, my primary task was to argue for epistemological pluralism and epistemological holism. When combined, these form a view I call epistemological emergentism which provides a better explanation of emergent evolution than does reductionism. Epistemological emergentism, however, becomes *ontological* emergentism when it is joined with the kind of metaphysical empiricism argued for in chapter 2. Some further arguments were also provided for ontological emergentism (pluralism and holism) in chapters 3 & 4. In contrast, ontological reductionism cannot encompass the idea that there are other kinds and levels of

reality than the physical and hence cannot recognise any other kind of creative emergence other than that which is physical in nature. Emergentism (methodological, epistemological, ontological), on the other hand, is a realist thesis that argues that explanation should be 'attuned to Being'. In chapters 2 & 4, I argued that Being in this thesis can be interpreted in a Goethean sense where "the Special is the General that appears under various conditions" (Goethe 1982, p. 369). In this way, the study of Beings (special) can be unified with the study of Being (general) to which methodology, epistemology and ontology are attuned. On the basis of this, in chapters 4 and 5, I argued that the cognitive/social gives a greater 'depth' of explanation and Being to the other phases of evolution.

In chapters 5 to 8, I extended the idea of such a "holistic pluralism" to that of potentialism, where I argued that a better way to explain emergent evolution than realisation physicalism is that of Generative, or Creative, Potentialism. This is an idea that could be conceived as a kind of holism and pluralism "Over Time". This view allows for the idea that there can be different levels of creative emergence over time: on the cosmological whole level, on the species level and on the individual / social level. Through this, the groundwork is laid for a theory of **Creative Becoming** in evolution that enables creativity to be more than a mere combination of physical things from the past, but is most fundamentally "from the potential".

(9.3) Popular Science and Social Theory

The concept of creative emergence, as has been shown, is central to evolutionary theory. Also, the idea of there being a connection between social theory and evolutionary theory, on the one hand, and social theory and reductionism / holism on the other is not a new one, but in the last few years it has been given some new interpretations. Not only can Darwinian theory be used in support for right wing, or conservative politics (see Murray 2000), but it is also advocated in support of left wing (Singer 1999) and even third way politics (Kay 1998) (see Giddens 1998, 1999, 2000). These are often linked to issues of how reductionism and holism influence our understanding of individualism and collectivism. This has been a topic within the journal "*Philosophy of the Social Sciences*" for some years (Bouwel & Weber 2002; Bunge 1999; Lachapelle 2000; Mäki 1999; Sawyer 2002a & 2002b; Zahle 2003). I am not saying that popular science writers have influenced these authors, but that

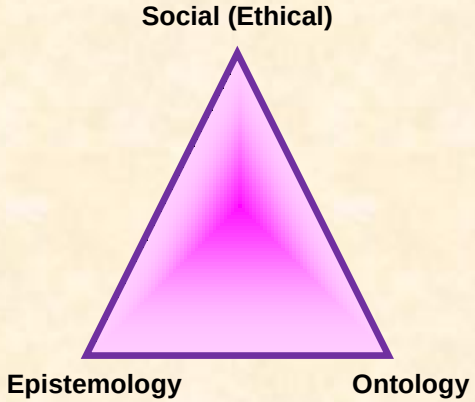
issues of holism and reductionism are a common theme and influence how social conceptions are formed.

There are, it seems to me, some major questions when a connection between evolutionary and social theory is sought. The first one consists in how each of them is defined. Such definitional issues are not without consequence. For example, if evolutionary theory is defined as being essentially adaptation through natural selection, then this may have consequences for a social theory dependent on it. Likewise, if the left or right are defined as being essentially X or Y, then what they are able to give up, in light of evolutionary theory, becomes debatable.

As a consequence of the research presented in this thesis, I will suggest that human evolution needs to be defined in terms of the **common** principles of the evolution of the living world as well as **unique** principles to a distinctively human evolution. What researchers like Runciman (1998) tend to do, however, is focus on the principles that all living beings have in common, namely: variation, inheritance and selection. As this is the case, such a view cannot explain the diversity of the creative processes in the living state or in the social. However, as I have argued in chapters 5 to 8, the common feature of evolution is a relationship between creativity, transformation and adaptation. The unique aspect of human beings is their cognitive fluidity (Mithen 1996) and, what I propose, social fluidity and **individual creativity**.

A way of depicting the relationship between the different areas of research investigated here is as in Fig 9.1. I will be recalled from chapters 1 and 2 that I conceptualised a kind of 'triangular' connection between the 'dimensions': epistemology, methodology and ontology. I propose that an extended way of looking at this is by interpreting methodology as a part of epistemology. This seems justified because methodology is the **process** through which one comes to an explanation, which is the domain of epistemology. I add to these the social (ethical) dimension:

Fig 9.1



In the following, I will explore some areas of possible areas of research concerning this ‘triangle’.

(9.3.1) Evolution between Facts and Values

One possible area of further research would be the connection of the ideas of emergent evolution to the "fact - value" distinction that is sometimes discussed when the relationship between the scientific and the social is debated. It is often said that science deals with facts and is therefore no guide to what we should do in the social sphere. This is sometime referred to as the "is - ought" problem.

A standard way to refute the whole enterprise of establishing a connection been evolution and social theory is to conjure up the supposedly cardinal distinction between facts and values. It is argued, for example, that as evolutionary ideas are about certain **facts** of human existence, that they therefore have nothing to say about social **values**. Another way of describing this is to argue that there is no connection between how something **is** and how it **ought** to be (Singer 1999, pp 12-18).

A fundamental problem that could be researched, however, is whether or not the relation between evolutionary ideas and social theory is a fact-to-value issue at all. If it is not, then the "fact - value", or "is - ought", distinction cannot be used as a valid refutation. If the relation between evolutionary theory and social theory is of another kind, then it becomes theoretically possible to establish a more

detailed account of what it means to argue for a particular kind of politics on the basis of evolution.

Now, one area of research would be to investigate whether or not evolutionary ideas are not merely factual, but also, and primarily, based on our principles of explanations. If this is true, then the general relation between evolutionary ideas and social theory is between explanatory theory and value, not between fact and value. But then this links onto the idea that there is also now substantial evidence that theory is also embedded in values, for example, on the basis of Kuhn's (1970) research, super-empirical values like simplicity and elegance play important roles in scientific theory. Arguably, it is plausible that some explanatory principles of evolution are also embedded in certain values. If this is so, then evolutionary ideas are not merely referring to facts, but are also influenced by the values of the individuals who think about evolution.

A similar argument could also be put forward concerning values. Are values, in turn, influenced by explanatory theory? This cannot be ruled out as a research possibility; therefore what is needed is an evaluation of the relationship between the explanatory theories of evolution and a theory of values. If, for example, a prior commitment to egoistic individualism influences evolutionary theory, it is not very surprising that any social theory based on evolution is going to support egoistic individualism. Likewise if a prior commitment to socialistic values influences the explanatory principles of evolution, then, again, any view of politics based on it is bound to support socialism. For example, Rose et al (1984) argue that Dawkins and Wilson's interpretation has been influenced by their prior commitments to individualism. It could be likewise argued that Rose's account of evolution is influenced by his socialism. The reverse may also be true: a commitment to explanatory reductionism may lead to a social concept of individualism, whilst explanatory holism may lead to socialism.

If this is the case, then what is needed for this type of research is to establish a conception between evolution as a theory and values as theory. If then the implicit values in evolutionary theory can be found, and that these values were actually a part of evolution, then there would be no principle problem to establish a connection to

political values. There would be no fundamental difference between fact and value; rather one would be comparing values to values.

Moreover, in relationship to my contribution in this thesis, the idea of each individual human being having its own creative potential may play significant role in determining the fact - value connection. If my argument is correct, and this would need further research if applied to this context, then each individual has the creative potential to produce new ideas that are not yet actualised. One of these new ideas might be a value. If this is an aspect of the human social evolution, then what **is**, for example a new social idea, is something that **could** or **ought** to, be. In this sense, it may turn out that the fact-value distinction is no argument against the relationship between facts and values, or science and social theory. Research may show that evolution truly is "between the facts and the values".

(9.3.2) Holism and Reductionism in Science and the Social

When further researching the relationship of the ideas derived from this thesis, there may be a number of possibilities. There may be three basic approaches to explaining individuals and society: reductionist, holist and pluralist. My contribution may suggest a fourth view: creative potentialism.

The explanatory principles of reductionism and holism have a conditioning influence on what is considered fundamental in social theory. There seems to be a natural connection between holism and collectivism on the one hand and reductionism with individualism on the other. The reductionist approach may tend to explain the social whole in terms of the individual human being of which it is constituted. In this conception, society is not a thing with any independence from these individuals; it has no existence in and of itself. The holistic approach may be the complete opposite. Individual human beings are to be explained in terms of the society in which they live. Individuals are examples of their society, they come to be and endure within a given society. Various authors have referred to the debate over Social Darwinism in terms of the relationship between individualism and collectivism:

> There are a number of opportunities here for distinct political positions. To a large extent the argument that humans are instinctively competitive and individualistic comes from

> conservative and liberal thinkers, while the argument that we are essentially mutualistic (with modern society having wrecked this mutualism) comes from socialist and anarchist thought. This chapter will argue, however, that neither political perspective can take comfort in the notion of an essential human nature. The picture is more complex than that, the dichotomy between 'competitive individualism' and 'mutualism' being over-drawn. (Dickens 2000, p. 82)

This is an argument that is fairly well accepted today and that the supposed dichotomy between self-interested individualism and mutualistic communalism is not clear cut. It seems that these two positions interact:

> As we have seen from the discussion of natural and spontaneous order in part two, human beings will produce moral rules for themselves, partly because they are designed by nature to do so and partly as a result of their pursuit of self-interest. (Fukuyama 1999, p. 250)

In a sense, this is merely a case of morality and communalism for the sake of self-interest, as he himself says (p. 174). A question would be whether or not this 'reciprocal altruism' (Dawkins 1992) would have any different social and political consequences from egoism. Would it be different, also, from a theoretically conceivable idea, of what may be called **altruistic egoism**: the idea that one is selfish in order to be communal, or cooperative? Additionally, one could ask of the political consequences of a view based on cognitive and social fluidity (see Mithen, 1996): the idea that it is possible to chose from a set of potential moral motives on the basis of its adaptability to the situation.

Most current Darwinian theories of human nature claim that reciprocal altruism (or more precisely Generous Tit-for-Tat) (Ridley 1996, pp. 76-80) is the evolved moral code for humanity. It seem fairly clear that an advocate of reciprocal altruism, if they project this into political theory, would have to argue that as reciprocal altruism is the 'natural' state of humanity, then the best, i.e., most appropriate political state, would be capitalism: we cooperate in order to compete. Competitive, self-interested, Capitalism is the **goal**, and society is best organised to meet that goal. So-called altruism may

become, under this conception, a mere **means** to attain our self-interested goals.

The opposite may be the case for altruistic egoism: it would necessarily support a socialist politics: as we are egoistic only to the extent that it aids cooperation in society and is best organised to meet that goal. Egoism is the mere **means** to achieve an altruistic **goal**.

These ideas are also used in political theorising where the ideas of holism and reductionism are applied to society. Blair has argued for what may also be called a reciprocal view of human nature:

> Socialism, as defined by certain key values and beliefs is not merely alive; it has a historic opportunity now to give leadership. The basis of such socialism lies in its view that individuals are socially interdependent beings - that individuals cannot be divorced from the society to which they belong... it believes, objectively, that it is only through recognising that interdependence and by society as a whole acting on it - the collective power of all used for the individual good of each - that the individual's interest can be advanced.
>
> (Blair 1994, p. 4)

This approach may attempt to explain society in terms of individuals and individuals in terms of society: they are mutually determinative. The basic problem with this approach is, as I have argued in chapter 3, that the argument is circular. Circularity, however, is inadmissible for explanation, there has to be a **direction** to it: the *explanans* must explain the *explanandum* and not the reverse. If, as in this case, individual is the *explanans* of society, then society cannot, at the same time, be the *explanans* of individuals.

The evolutionary approach that I am advocating may provide a beginning to some answers to this problem. The key concept to the problem of the dialectical approach is 'at the same time'. The evolutionary approach puts the idea of the dialectic into a time context. It could be that whilst individuals come to be and are explained by the social context of their becoming, but at the moment that they become individuals with their own creative potential, they may become the formative force for the becoming and the

explanation of society. In this sense, holism and pluralism may be unified in **creative potentialism**.

(9.3.3) Evolution as an Adaptation of Potentialities

Following on from this, one of the most basic ideas that can be found in evolutionary studies is that of adaptation. In the context of biological studies, it is thought that each organism is well adapted to particular kinds of environments. Were one to research this notion in the context of social theory, then one aspect of this could be to what extent social ideas are well adapted to their 'social environments'. If this was investigated on the basis of the thesis presented here, one may explore what the appropriate social environment is for the actualisation of the specific social potentials.

Kay has made an elementary attempt to explore an evolutionary approach to third way politics, showing the **concept of adaptation**, of both active and passive kinds, may help overcome [fixed] political ideologies of the left and right:

> If political action is not to be assessed by progress towards an ideal, what is it measured by? The best term I can find is "fit", or perhaps appropriateness. Metaphors from evolutionary biology are overdone, but as soon as we understand that social and economic development is an evolutionary process, and not the imposition of a grand design, it is impossible to avoid using them. Success in evolutionary terms is measured by how well an organism fits with its environment; evolutionary improvement is about establishing a better adaptation to that environment... While this adaptation is the product of evolution, it is not merely a matter of chance. In contrast to biological evolution, it is not simply the environment that selects the organism: the organism may also select the environment; and it may also consciously adapt both itself to the environment and the environment to itself. The search for fit is not simply a Panglossian assertion that what is must be for the best: fit must be actively sought. (Kay 1998, p. 32/3)

The connection to questions of fixed ideologies is important as it could be argued that left and right are incompatible **in principle**.

Therefore any attempt to unify them in a third way theory is *a priori* impossible. But the evolutionary concept of adaptation may turn out to be useful as an argument against fixed ideologies. This is because adaptation is dependent on **context** and therefore there are no absolute or universal solutions to what is the best fit. From an adaptation perspective, the research question then becomes: **how to define the context**, or environment, for which aspects of a political position is most suited, if any.

The evolutionary approach to such definitions that could be taken may consist in distinguishing **values** from **contexts**. This could be done in order to establish a connection between the evolutionary concept of adaptation and what could be called sub-domains of social contexts. So for example, when *lassez-faire* capitalism is spoken of, the value is liberty and the context, or domain, is economics. Egalitarianism, in contrast, has the same context but uses the value of equality instead. From the evolutionary perspective, the research question could be: which of these values is most suited to the economic context?

The task of some further research could be to make a connection between the three evolutionary concepts of generation, transformation and adaptation/selection and social theory. The argument that could be investigated may show that there is an evolutionary argument for the overcoming of the political boundaries of the left and right on the basis of a re-conceptualised the theory of evolution. This will not be Darwinism in the usual sense of the term but may involve Darwinism as a special aspect of evolutionary theory.

I want to re-emphasise at this point that I am not advocating any kind of biological or social determinism. Basically I think that our biology may turn out to have no complete deterministic input into the social theory we take. In the social area of human life we may well be free to decide and act. However, even if it turns out that there are no causally deterministic forces flowing from the biological to the social, it does not mean that a **conceptual** connection could not be made through further research. The conceptual connection may well be one of free choice; it may not be one that is causally determined. Having said that, I also want to suggest that there may be some essentially different aspects to the social aspect to human nature

that are not found in our biological nature. The most important if these differences could turn out to be, after further research, our potential to originate purely **individual** cognitive and social ideas.

Following on from Broks (2006) and Pels's (2003), there may be also a particular connection of the above ideas to the social context of popular science, namely its connection to culture, politics and economics (see also Held *et al* 1999). As can be seen there is a direct correlation to the debate about what should be the central element of society. This usually revolves around a discussion about the primacy of the individual over society; or society over the individual.

Rose *et al* (1990) have argued that the individualistic interpretations of some biologists, Wilson and Dawkins for instance, support a capitalist view of society. But they and Singer (1999) have argued that an equally good interpretation would support a socialist position based on the 'communalism' of biology.

The argument I have been adducing in this thesis would tend to support the idea that the location of the determinism, and responsibility, which is attendant upon either of these social positions, within the free intentional consciousness of each individual's creative potential, not in the gene, the meme or in society. The creative potential of each individual may well turn out to be self-determined. If this turns out to be the case, if this fundamental freedom is true, the 'creative individual' may be able to realise the potentialities of society it decides on in consciousness and with foresight or it may decide to realise its own potentials. This would stand in complete contrast to neo-Darwinian notion, i.e., where evolution is unconscious and 'blind', and its inherent pessimism and fatalism. Therefore, the conscious choice of the appropriate 'ism' would depend on whether or not it is adaptable to the 'environment' into which it could be placed. It seems to me that there are three theoretical possibilities for the relationship between individualism and collectivism which may be expressed as three 'social formulae':

Fig 9.1

1) A Domain / sphere in which Individualism is more important.
2) A sphere in which Collectivism is more important.
3) A sphere in which Individualism and Collectivism are of the same importance.

The question is: which of these values does an evolutionary view really support? It may turn out that it supports all of them because the appropriate sphere may be determined by the evolutionary principle of adaptation. This may be a kind of an argument for an evolutionary 'third way' (Giddens 1998). Rather than being fixed in old traditions of left and right, my interpretation of evolution may show that we could realise those aspects of any political stream which are adaptable for the right context or environment. Instead of being the actualisers of species-like party policies we may well make individual choices for individual situations.

In a similar manner to Boden (2004), it may be possible to map, explore and transform the concepts of social space. In designating the three social 'formulae', a particular dimension of the 'Space of Social Potentials' is mapped out. Recall that Dawkins argued for the 'Space of Possible Morphologies', a 'Space of Social Potentials' could be the equivalent of that. Such a space has at its two polar termini individualism and collectivism with other variations ranging between them. The human being, as a creative individual and social potential, capable of conscious foresight, agency and adaptability, may well be able to apply these three social principles depending on their appropriate adaptation to the right context. Which are the right principles, if any, that are the best adaptations to the cultural, political of economic domains? That is a question for further research and a critical understanding of the philosophies in popular science may help with this.

(9.4) Ends and Beginnings

In a book recently published, Koch and Smith (2006) try to express what they consider to be the six defining features of Western Civilization. As far as they are concerned, without these features the West would have no identity. The trouble is, as they see it, we are losing our commitment to these which is leading to our decline. One of these features is science. They write of a "loss of faith in science" (p. 85) as a part of the decline of Western Civilization.

The question I would put though is: which kind of science is being referred to here: reductionist or holist? Would they have the same consequences for Western Civilization? Wheeler (2006) has written about new trends in science and their implications for the evolution of culture saying "This book, then, is a sketch... of the history of a paradigm shift which has been taking place in the sciences for the past sixty to seventy years... Laughlin has described this shift as the move from the Age of Reductionism to the Age of Emergence" (Wheeler 2006, p. 20) and "The ideological universe we have inhabited for the past two to three hundred yeas passing, and we enter, to use Robert Laughlin's title phrase, 'a different universe' (Wheeler 2006, p. 157). Are we moving into an "Age of Emergence", or a "different universe"? As can be seen from the thesis presented here, the very interpretation of what emergence means is still very much debated and many reductionists think that reduction and emergence are in fact compatible. I have tried to argue that this is not the case, that pluralist, holist and potentialist ways of thinking are just as important, if not more so, for our understanding of the world. **Perhaps they can also contribute to a new understanding of Western Civilization: rather than understanding it in terms of what it actually is; it might be better to conceive it in terms of what it potentially could Become.** Goethe's idea that the "General and the Special fall together, the Special is the General that appears under various conditions" (Goethe J W 1982, Band 5, p. 369), may play a role in this. By this conception, all beings are autonomous special beings that are within general being. As such what we actually are and potentially can become depends on all. The Special and the General in that sense evolve together.

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