Chapter 1

There are more things in heaven and earth than are dreamt of in computationally bounded philosophies.

John Kelly, *Artificial Intelligence - A Modern Myth*

Introduction

1.1. Overview

In this chapter the connection between scientific and philosophical approaches to the study of the world and phenomena such as matter, life and mind is introduced by way of a brief examination of the thought of Erwin Schrödinger. It is shown that science is ultimately grounded in metaphysics, a domain which is beyond the physical and thereby beyond the reach of science. A brief history of the development of metaphysical thinking in the Western philosophical tradition is presented and the term metaphysics is defined. A framework for investigating the relation between metaphysics and metaphor due to Pepper (1942) is presented. It is shown that metaphysical systems are either based on simple 'root' metaphors or eclectic combinations of root metaphors. Computationalism, the metaphysical view that the being (or essence) of the world at its most fundamental level is computational, is introduced as an example of an eclectic metaphor and its connections to the ideas of artificiality and emergence are briefly stated. A phenomenological approach to studying computationalism by investigating emergent-artificiality is introduced and its basis in existing phenomenological approaches is examined. Finally, a statement of the thesis, the objectives of this study, the strategy to be adopted and a summary of each of the remaining chapters is presented.

1.2. Schrödinger's Musings

What is *Matter*? *Life*? *Mind*? How are they *related* (if at all)?

Numerous attempts have been made at answering these questions within both the Eastern and Western philosophical traditions, the generally speculative nature of early schemes
discouraging universal adoption of any single framework. However, with the rise of the Western experimental method with its foundations in philosophical rationalism, empiricism and mechanistic-reductionism, it became possible to approach the questions from a new perspective, viz. science. One relatively recent scientific approach is that due to Erwin Schrödinger who addressed the question of matter, life and mind - and their relations to each other - from the perspective of a quantum physicist interested in the connections of his field to other disciplines such as biology and psychology. In What is Life? (1944), Schrödinger investigated the Darwinian theory of evolution, explaining the phenomenon of mutation in quantum mechanical terms, an idea which was to be instrumental in laying the foundations for the development of modern molecular biology. Throughout this work, Schrödinger argued for a position similar to that of von Neumann, viz. that it is only the organization or construction of living matter that distinguishes it from non-living matter (chapter 4); both are consistent with, although living matter is not reducible to, physico-chemical laws. Thus, following Descartes, who dualistically separated nature into matter and mind, regarding life as a mechanistic phenomenon, Schrödinger argued for a conception of life in materialistic or physical terms. On his view,

the new principle that is involved [in life] is a genuinely physical one: it is, in my opinion, nothing else than the principle of quantum theory all over again. (p.81)

Further statements indicate his support for a mechanistic biology, viz.

with life, we are here obviously faced with events whose regular and lawful unfolding is guided by a `mechanism' entirely different from the probability mechanism of [classical] physics. (p.79)

[Nonetheless] the clue to the understanding of life is that it is based on a pure mechanism, a `clock-work'. [In fact] the finest masterpiece ever achieved along the line of the Lord's quantum mechanics. (pp.82-85)

It might appear from such statements that Schrödinger endorsed a purely scientific approach to the problems of matter, life, and mind (and their relation), as adopted, for example, by the positivists\(^1\). However, Mind and Matter (1958), in which the many-minds-but-only-one-world problem was investigated, presents a very different side to Schrödinger's thinking. For example, the materialistic view of mind is rejected:

Are we not inclining to much greater nonsense, if in discarding [the] gross superstitions [of the Western pluralistic or many-worlds views] we retain their naive idea of plurality of souls, but `remedy' it by declaring the souls to be perishable, to be annihilated with the respective bodies? (p.88)

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\(^1\) Briefly, positivism is a form of empiricism in which it is maintained that only that is real which can be observed (or measured). In this sense, positivism is closely linked to instrumentalism (in which it is maintained that scientific theories are not true descriptions of an unobservable reality, but merely useful instruments which enable us to order and anticipate the observable world), pragmatism and idealism.
In its place, a non-Cartesian\(^2\) conception of the mind-matter relation similar to the psychophysical parallelism (chapter 4) of Spinoza is endorsed, viz.

I in the widest meaning of the word, that is to say, every conscious mind that has ever said or felt `I' - am the person, if any, who controls the `motion of the atoms' according to the Laws of Nature. (p.87)

Further inquiry reveals the inspirational source of Schrödinger's concept of mind to be the Vedantic philosophy contained in the Hindu Upanishads. On this *mystical* view, the individual self (or mind) and the One (Universal Self or Mind) are identical and real; the plurality of worldly phenomena is merely an illusion (*maya*). Hence, Schrödinger is dualistic in his metaphysics, being committed to mysticism with respect to mind and mechanism with respect to matter and life. Given the strain of mysticism in his thinking, it might be asked whether Schrödinger's approach to the above questions is scientific or not. But what is a *scientific* approach?

A naive definition of science might be "the explanation and prediction of phenomena using the experimental method". On this view, science implicitly rests on the twin pillars of reductionism and mechanism: To *explain* is to reduce to a set of ultimate primitives; to *predict* is to know the mechanisms governing the behaviour of these primitives. The `scientific method' is often depicted as the ordered sequence (Casti,89)

observations/facts $\rightarrow$ hypothesis $\rightarrow$ experiment $\rightarrow$ laws $\rightarrow$ theory.

A more sophisticated version of the above scheme incorporating `feedback' between theory and experiment is shown in Fig 1.1.

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\(^2\) As will be seen in chapter 4, Cartesian dualism is substance-pluralistic and hence, stands in contrast with Schrödinger's substance monism.
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However, as Chalmers (1982) has argued, observations are theory-dependent, thereby introducing a potentially vicious infinite regress into the above scheme. Moreover, the theoretical 'background' upon which observations are made implicitly incorporates factors conventionally viewed as being of a non-scientific nature. A detailed historical investigation of this 'background' problem was made by Thomas Kuhn in *The Structure of Scientific Revolutions* (1962). Kuhn argued that science is an essentially social activity which both gives rise to and takes place within what he called a paradigm. Chalmers captures the essence of the Kuhnian notion of paradigms and the way in which they evolve over time in the following statement:

A paradigm embodies a particular conceptual framework through which the world is viewed and in which it is described, and a particular set of experimental and theoretical techniques for matching the paradigm with nature. But there is no a priori reason to expect that any one paradigm is perfect or even the best available. Consequently, science should contain within it a means for breaking out of one paradigm into a better one. This is the function of revolutions... [and] when a crisis develops [that is, when the current paradigm fails to adequately resolve lasting problems], the revolutionary step of replacing the entire paradigm by another becomes essential for the effective progress of science. (p.99)

Hence, according to Kuhn, there are two types of scientific activity, viz. 'normal' or *intra-* paradigmatic science and 'revolutionary' or *inter-* paradigmatic science. A scientific 'revolution' or 'paradigm-shift' occurs when evidence of the inability of the existing

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3 Cariani (1999) maintains that observations can be theory-dependent in two ways: Either "the choice of observables is theory-determined" or "the individual observations themselves are theory-determined." (p.1) The former (which Cariani accepts) is consistent with epistemological constructivism (operationalism) and asserts the ontological necessity of both observer and observed in the act of observation and the emergence of observables; the latter (which Cariani rejects) entails a commitment to some form of idealism. According to Cariani (1989), "[an] observer's states are .. implemented by the process of measurement .. They represent a classification of the measuring device's interactions with the physical system. This classification is the categorization into one of two or more discrete symbolic types [emphasis added]." (p.78) On this scheme, observations are objectivistic in the sense of third-person or externalistic. However, Chalmers' (1982) implicitly contests this position in maintaining, for example, that "the perceptual experiences that observers have in the act of seeing is not uniquely determined by the images on their retinas .. What an observer sees, that is, the visual experience that an observer has when viewing an object, depends in part on his past experience, his knowledge and his expectations." Furthermore, "the subjective impressions experienced by the observers were influenced by their expectations [emphasis added]." (p.25) Crucially, such impressions are perceptions and not interpretations. Chalmers clarifies this position in asserting that "what observers see, the subjective experiences that they undergo, when viewing an object or scene is not determined solely by the images on their retinas but depends also on the experience, knowledge, expectations and general inner state of the observer [emphasis added]." (p.26) Thus, there is a third way in which observations can be theory-dependent, viz. relative to subjective (first-person, internalistic) state. Against idealistic interpretations of his position, Chalmers' maintains that he is "certainly not claiming that the physical causes of the images on our retinas have nothing to do with whatever we see. We cannot see just what we like. However, while the images on our retinas form part of the cause of what we see, another very important part of the cause is constituted by the inner state of our minds or brains, which will clearly depend on our cultural upbringing, our knowledge, our expectations, etc. and will not be determined solely by the physical properties of our eyes and the scene observed [emphasis added]." (p.27)
paradigm to cope with lasting problems of concern reaches a critical yet undefined break-point. What is important about Kuhn's work in the context of this discussion is that it points to something beyond science, something (non-scientific) which is both grounding and encompassing with respect to science. Although social scientists have seized upon Kuhn's work in order to argue for due consideration being given to the social, economic and political forces both motivating and being motivated by science, it is the conceptual dimension of paradigms which is significant in the context of this study. Conceptual frameworks (that is, Weltanschauungs or worldviews) are inclusive of both scientific and non-scientific - scientists might argue pre-scientific - domains and, consequently, are more encompassing than scientific frameworks. Furthermore, they provide a 'background' to scientific activity and hence, are necessarily prior to science. This view of a conceptual framework as both a ground and an encompassing whole is remarkably similar to the notion of a metaphysical system. Harris (1965) maintains that

the need accordingly remains for the metaphysician's effort to see things together, as Plato recommended - not to correct, outdo, or modify the pronouncements of science, but to reflect upon them, to develop their implications and mutual connections, examine their presuppositions, and to form as complete and systematic a conception of the world as the available evidence permits [emphasis added]. (p.29)

What is metaphysics? This question will be examined in greater detail in section 1.3 and a series of definitions are presented in section 1.3.2; however, it should suffice at this point in the presentation merely to state that metaphysics is that which is beyond physics in both the above senses of (1) a prior ground and (2) an encompassing whole.

Given all that has been stated above, the classification of Schrödinger's approach to the question of matter, life and mind (and the relations between them) remains problematic. Clearly, if science is taken to imply universal mechanistic reductionism his position must, ultimately, be viewed as non-scientific; however, if a Kuhnian perspective is adopted, his position can legitimately be viewed as scientific since, on this view, all scientific activity takes place within the metaphysical context of a paradigm, and it is at least conceivable that mysticism (or some other idealistic ontology) might provide a necessary and sufficient metaphysics for matter, life, and mind (section 1.4). In any attempt at transcending the diversity of phenomena in order to develop a unified conception of the world, reductionism necessarily gives way to (some variant of) holism (chapter 4) and science becomes metaphysics via the interpretation of the phenomenal world in terms of a set of primitive (ontological) concepts associated with the former. However, and conversely, science itself is ultimately grounded in metaphysics because

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4 As shown in section 1.6.3 and chapters 6 and 7, this 'background' is the hermeneutic (or interpretative) circle in which the interpreter (in this case, scientist) is existentially situated. This situation is given to the interpreter who finds himself (herself) 'thrown' into a world of interactions with phenomena that he (she) did not create. For this reason, the 'background' that is the world is existentially - which means historically - prior to the interpreter and his (her) interpretative frameworks - in this case, science.
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its methodology makes assumptions about the ultimate nature of reality (ontology) and how this can be known (epistemology).

1.3. A Brief Introduction to Metaphysics

The literature on the origins and historical development of metaphysics within the Western philosophical tradition is voluminous and a survey of this area of thought is beyond both the aim and scope of this study. A conventional introduction to post-Classical metaphysics is provided by Sprigge (1984) and a radical reinterpretation of metaphysical thought from the perspective of existentialist phenomenology is given in (Heidegger,59). However, perhaps the most appropriate starting point in the context of a study concerned with examining the metaphysical claim that the world is computational is R.G.Collingwood's *The Idea of Nature* (1945) and it is from this source that an insight into the historical development of metaphysics will be derived.

1.3.1. A Brief History of Metaphysics

Investigation of the idea of nature within the Western tradition has its origins in pre-Socratic thought, most notably in the writings of Heraclitus, Parminides and Anaximander. For the Ionian Greeks (seventh-sixth centuries B.C.), the question "what is nature ?" was equivalent to the question "what are things made of ?" which was in turn reducible to "what is the original, unchanging substance which underlies all the changes of the natural world with which we are acquainted ?" Henceforth, the notion of an underlying substance became an essential component of metaphysical thinking, although alternative schemes which replaced the primacy of substance with that of process were postulated (Rescher,96). The organismic worldview of the Greeks, which was developed most explicitly by Aristotle, was anthropomorphic or 'human-shaped', based on an analogy with the conception of the human being as both mental (thinking) and vital (living) as well as physical (material); in short, man the microcosm was projected onto nature the macrocosm. The sixteenth century Renaissance view of nature, by contrast, was based on an analogy with the Christian idea of a creative and omnipotent God and the human experience of designing and constructing machines. This mechanistic metaphysics, which was both product and producer of the newly emerging scientific approach to the study of nature, expressed itself in various ways: For example, the deiocentric or 'God-centred' view of the world associated with Newton, the mechanocentric or clockwork universe of Laplace, and the anthropocentric or 'human-centred' view developed by idealists such as Kant within the empiricist-rationalist

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5 Processualism is examined briefly in chapter 2 in connection with computationalism and again in chapter 6 in the context of (1) an ontical (causal) interpretation of *poiēsis* as becoming and (2) an ontological (existential) interpretation of the Heraclitean link between Being and becoming.
tradition. Following the Greeks, Renaissance cosmologists held that nothing is knowable unless it is unchanging, and underlying the appearance of change is an unchanging reality; hence, the postulate of (i) an underlying 'substance' or 'matter' whose changing arrangements and dispositions (primary qualities) were the realities whose appearances to our senses took the shape of secondary qualities and, (ii) a set of 'laws' according to which these arrangements and dispositions changed. Additionally, it should be noted that for the majority of Greek thinkers (including Plato, despite assertions to the contrary), life and mind were immanent in the body whereas for Renaissance thinkers from Descartes onwards, mind (and possibly life) was transcendent, giving rise to dualistic philosophies of mentalism (matter-mind) and vitalism (matter-life) with all their attendant problems. These two developments, viz. dualism and mechanism, were extremely important since they laid the foundations for the development of functionalism (section 1.5.2), a philosophical position which was to emerge in the latter part of the twentieth century, and which forms the basis of computationalism (chapter 2), the metaphysical position examined in this study. However, according to Collingwood (1945), writing in the first half of the twentieth century and therefore before the information, communication, and computation-theoretical sciences had begun to emerge, the modern worldview either was - or, if not, would be - based on an analogy with human history and defined in terms of process, change, development, progress, and evolution, all of which rested on the following assumptions:

- change is no longer cyclical but progressive, whereby the latter is understood novelty and not necessarily improvement
- nature is no longer mechanical
- teleology is re-introduced
- substance [and structure] is resolvable into function
- functionality is defined in terms of minimum space and minimum time (pp.13-24)

Collingwood's metaphysics was inspired by the development of evolutionary thinking beginning with Hegel and Darwin, through Bergson and Alexander, and culminating in

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6 Mercer (1917) maintains that a cosmology "aims at understanding the governing laws of the universe". (p.44) By contrast, a cosmogony is "an account of how the world came into being" and, on his view, "the use of the term is practically confined to the creation myths of primitive peoples ... though it is occasionally extended, in accordance with its etymology, to include such scientific systems as that of Laplace or the nebular theory of matter." (p.43)

7 The mechanistic distinction between primary and secondary qualities is examined in further detail in chapter 2.

8 The emergentist metaphysics of Alexander (1920), which is grounded in a Space-Time event monism and which provides the basis for unifying the artificial sciences (AI, A-Life, artificial physics) under
the organicism of Whitehead, viz. "the world as an organism". How could he have known that his worldview was to be upstaged\(^9\) by an eclectic synthesis of Classical and Renaissance metaphysical concepts, viz. computationalism (section 1.6) ?

1.3.2. What is Metaphysics ?

As stated previously in section 1.3, the literature on metaphysics is extremely vast and for this reason, it is difficult to determine exactly what constitutes the essence of this concept. Fortunately, various philosophical dictionaries such as (Walsh,67), (Flew,79), and (Angeles,81) are beneficial in this respect, the latter of which, in particular, provides a comprehensive list of definitions of which those regarded as bearing most directly on the subject matter at hand are reproduced below:

- Metaphysics is the attempt to present a comprehensive account (picture, view) of reality (being, the universe) as a whole.
- Metaphysics is the study of ultimate reality - reality as it is constituted in itself apart from the illusory appearances presented in our perceptions.
- Metaphysics is the study of the underlying, self-sufficient ground (principle, reason, source, cause) of the existence of all things, the nondependent and fully self-determining being upon which all things depend for existence.
- Metaphysics is the critical examination of the underlying assumptions (presuppositions, basic beliefs) employed by our systems of knowledge in their claims about what is real.
- Metaphysics is the study of Being as Being and not of "being" in the form of a particular being (thing, object, entity, activity).

It is important to appreciate at the outset, as Flew maintains, that "any attempt at characterization of reality as a whole must perforce use concepts originally developed to distinguish particular elements within reality and hence can only misuse them." (p.213) This point is developed by Beardsley (1967) who asserts that metaphysical statements "extend the part metaphorically to the whole [emphasis added]." (pp.286) Hence, there is a connection between metaphysics and metaphor.

1.4. Metaphysics and Metaphor

Aristotle defines metaphor as "giving the thing a name that belongs to something else ..

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\(^9\) Anticipating the presentation in chapter 6, it is maintained that Collingwood's historical conception of metaphysics is consistent with Heidegger's hermeneutic ontology of Being and that to the extent that the latter constitutes a legitimate basis upon which to mount a critique computationalism (chapter 7), Collingwood's position is, in fact, valid as a statement regarding the future of metaphysics.
on the grounds of analogy [that is, similarity]" (Poetica, 1457b). The link between analogies and metaphors on the one hand, and analogies and models on the other facilitates the association of models and metaphors, that is, conceptual schemes and frameworks and the metaphorical bases underlying such schemes (Leatherdale, 74).

1.4.1. The 'Root Metaphor' Theory

This link is developed in the 'root-metaphor theory' due to Pepper (1942) which, "if true, shows the connection of [metaphysical] theories with common sense, illuminates the nature of these theories, renders them distinguishable from one another, and acts as an instrument of criticism for determining their relative adequacy." (p.84) Pepper holds that metaphysical schemes or 'world hypotheses' may be generated in essentially two ways, viz.

1. via analogy (similarity) or

2. via permutations of logical postulates, that is, derivation from a set of premises (propositional statements which correspond to facts about the world).

However, he maintains that "no conventionalistic world hypothesis has ever been generated by the postulational method. It is only a possible alternative." (p.89) His justification for this assertion is that "the postulational method itself is not quite free from structural presuppositions [or assumptions]" (p.89), the source of which is to be found in the corroboration of fact with fact which can be shown to be equivalent, in reduced form, to an existing world hypothesis, viz. formism. Pepper identifies six basic world theories derived from the following 'root' metaphors (Table 1.1):

<table>
<thead>
<tr>
<th>World Hypothesis</th>
<th>Root Metaphor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formism</td>
<td>Similarity</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Machines</td>
</tr>
<tr>
<td>Contextualism</td>
<td>History</td>
</tr>
<tr>
<td>Organicism</td>
<td>Organisms (or Integration)</td>
</tr>
<tr>
<td>Mysticism</td>
<td>Experience of Love</td>
</tr>
<tr>
<td>Animism</td>
<td>Common-sense Man</td>
</tr>
</tbody>
</table>

Table 1.1 World Hypotheses and corresponding root metaphors.

The first four hypotheses are regarded as 'relatively adequate' whereas the latter two are viewed as inadequate on grounds of breadth (scope) and depth (precision) of phenomenal coverage respectively (pp.115-137). The various root metaphors may also be distinguished according to whether they are analytic (that is, reductionistic) or synthetic (holistic) respectively (Fig 1.2).
1.4.2. The `Root Metaphor' Method

Pepper upholds the following as maxims, viz.

I  A world hypothesis is determined by its root metaphor.

II Each world hypothesis is autonomous.

III Eclecticism (that is, the combination of hypotheses) is confusing.

IV Concepts which have lost contact with their root metaphors are empty abstractions (and lead to hypostatization, that is, the assumption of intrinsic and ultimate ontological status).

He does not rule out the possibility "that the root metaphor of one theory may merge with that of another, and eventually all may harmoniously come together [although] this idea is itself a principle derived from one world theory [viz. organicism, an example being the synthesis of opposites within Hegelian dialectic], and cannot be affirmed until, or if, that theory .. should turn out to be completely adequate." (p.105) Nonetheless, it is not a priori inconceivable that an eclectic theory combining the strengths of different root-metaphors might be more adequate, that is, expressive, than the root metaphor theories from which it is composed. However, he maintains that this view is untenable on the grounds that eclectic theories fail to meet the criteria of relative adequacy, viz. "achievement in attaining complete precision in dealing with all facts whatever presented." (p.115) This latter point is critically important since, as will be shown in chapter 2, computationalism is correctly identified as a member of the class of eclectic metaphysical systems.

Pepper presents a method for identifying the metaphorical bases underlying metaphysical frameworks, viz. the 'root-metaphor method', which is also the means by which a
worldview or ontology is established:

1. In attempting to understand the world, search for a clue to its comprehension.
2. Select a domain of common-sense fact and attempt to understand other domains in terms of the selected domain.
3. The selected domain becomes the basic analogy or root metaphor.
4. Attempt to describe the characteristics of this domain by discriminating its structure.
5. A list of the structural characteristics of this domain provide the basic concepts of explanation and description. These are known as categories.
6. Investigate all other domains of fact whether analyzed or unanalyzed in terms of the categories.
7. Attempt to interpret all facts in terms of the categories.
8. As a result of the impact of these other facts upon the categories, make any necessary qualifications and adjustments to the categories. (p.91)

However, in step (2), it is unclear what is meant by a `common sense fact'. For Pepper, it is `uncriticised evidence', "something precritical and probably not critically sound" (p.39). At this point, a link between `common sense' and the socialisation of metaphysical claims alluded to in section 1.2 can be established: Just as a metaphor may become literal (`dead') through extended use within a community of users, so also the metaphysics associated with a class of metaphysics-defining metaphors can become hypostatized, that is, canonized in an ontology, via socialisation (maxim IV above). That this has happened on numerous previous occasions is well attested to within the literature cited in section 1.3. However, with respect to computationalism (chapter 2), the view that the world is computational at the fundamental level of its being, something additional has happened: An eclectic (or synthetic) metaphor has emerged, its root metaphors conveniently effaced, and the emergent metaphor subsequently hypostatized; hence, the claims for computationalism as a radical alternative to existing metaphysical schemes.

1.4.3. Problems with Metaphors

Lakoff and Johnson (1980) maintain that the human conceptual system is largely metaphorical in character and that metaphorical linguistic expressions are systematically linkable to metaphorical concepts. However, they draw attention to a serious problem associated with the use of metaphors in conceptual thought, viz.

the very systematicity that allows us to comprehend one aspect of a concept in terms of another .. will necessarily hide other aspects of the concept. In allowing us to focus on one aspect of a concept .. a metaphorical concept can keep us from focusing on other aspects of the concept that are inconsistent with that metaphor. (p.10)
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Again, and in the context of metaphysical systems, which are, as Pepper maintains, ultimately grounded in metaphor, "it is important to see that .. metaphorical structuring .. is partial, not total. If it were total, one concept would actually be the other, not merely understood in terms of it." (p.13) Metaphor is closely associated with another idea, viz. abstraction: Metaphor involves the identification of one thing with another on the basis of an analogy or perceived similarity holding between them. When the metaphor is taken as primitive (ontological) and other things defined in terms of it, then it has become the root metaphor for a particular metaphysics; abstraction, on the other hand, is simply the means by which similarity and difference is established. For example, if we have a collection of things and proceed to define all things in terms of a particular thing, then the thing chosen in order to define the other things determines the root metaphor for the associated metaphysics while the process by which the thing attains this status is abstraction. (The root metaphor is also known as an abstraction; hence, the term abstraction refers both to a process and its product). Problems arise when the fact that abstraction has occurred is ignored, that is, when the metaphorical basis of a metaphysical system is disregarded. The possibility of this happening is alluded to by Rogers (1995) who maintains that not only do particular concepts, metaphors, etc. bewitch; a certain kind of bewitchment is endemic to the use of concepts in general. They induce in us a certain kind of mental set. (p.85)

It is argued that this is precisely what has happened in the study of matter, life and mind: The computational metaphor (chapter 2) guiding recent thinking in physics, biology and cognitive science has, like its predecessor the machine metaphor, receded into the background; its generative source, the human being in its capacity as abstractionist\(^{10}\) (that which performs the act of abstraction), having been conveniently removed from the picture\(^{11}\). However, it is maintained (i) that a thing cannot be a metaphor (or abstraction) unless it is interpreted as a metaphor (or abstraction) by someone both implying and being implied by (ii) the existential fact that metaphors (abstractions) are produced by someone. This leads to the interpretation-production duality introduced in section 1.6 and described in more detail in chapter 7.

1.5. Computationalism

In this section the concept of computationalism (chapter 2) and its links to notions such as artificiality (chapter 4) and emergence (chapter 3) are introduced. This is done in order to prepare the way for an examination of the approach adopted in the critique of

\(^{10}\) Elstob (1982) defines an abstractionist as "a physical system of the kind that can give rise to and sustain ideational happenings." (p.25)

\(^{11}\) This corresponds to what Baudrillard (1983) has referred to as the 'liquidation of referentiality' and will be discussed in detail in chapters 6 and 7.
computationalism presented in this study (chapters 6 and 7) and briefly introduced in section 1.6.

1.5.1. What is Computationalism?

As stated previously, computationalism is the metaphysical view that the world at its most fundamental (or ontological) level is computational in being (essence). Computation is usually defined in terms of information processing by a class of abstract mathematical machines known as Turing machines, whereby 'information processing' is usually meant formal symbol manipulation (chapter 2). Although computationalism had its origin in the philosophy of mind, it has transcended this discipline to become - arguably - the guiding ontology in science and philosophy. According to Putnam (1988), with the rise of computer science, an entirely new paradigm of what a scientific realist account of intentionality [that is, the directedness of mental states towards objects] might look like presented itself. The need for a full-length investigation of the question of the scientific reducibility of intentionality in the age of the computer thus arose. (p.108)

Similar assertions have been made in the context of life (Rifkin, 84), viz.

Darwin constructed nature in the image of the industrial machine. The new temporal theory of evolution is reconstructing nature in the image of the electronic computer (p.200)

and the extension to physical reality itself is widely documented in the literature. For example, Davies (1992) maintains that

history has thrown up many physical images for the underlying rational order of the world: the universe as a manifestation of perfect geometrical forms, as a living organism, as a vast clockwork machine and, most recently, as a gigantic computer. (p.22)

The essence of the computationalist worldview is succinctly captured in an observation of Davies which echoes the positivist-instrumentalist maxim12, "what cannot be measured cannot be talked about in any precise or definite way", viz. "what can't be computed is meaningless." (p.146) According to Rifkin,

[the computer] is becoming the chief metaphor for the reconceptualization of the origin and development of the species. It is no mere coincidence that many of the operating principles that animate the computer happen to be the same operating principles that biologists now claim are the basis of all living systems. The cosmologists are once again borrowing the organizing technology of the society and 'projecting' it onto nature. To the question How does nature operate? the new answer is that it operates in a manner similar to the electronic computer [emphasis added]. (p.201)

In the context of this study, there are (at least) two points to note in connection with the above statement: First, like all metaphysical systems that assume a position of dominance

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12 I am grateful to Peter Cariani (1999) for this concise formulation of the positivist-instrumentalist position.
at some epoch in history, computationalism determines (1) what questions can (descriptive) - and should (normative) - be asked and (2) how they can - and should - be answered. On this basis, it is argued that critical evaluation of claims for the sufficiency of computationalism (and other metaphysical system) is necessary in order to guard against the possibility of dogmatic obscurantism within the sciences and humanities. Hence, the motivation behind the study reported herein; second, and more immediately relevant is the fact that computationalism is a metaphysics and, as a metaphysics, either has a defining root metaphor or is defined in terms of a synthesis (‘eclectic mix’) of root metaphors (section 1.4.2). In this case, the metaphor is clearly identifiable as the computer. However, since (according to Pepper) this is not a root metaphor (section 1.4.1), it must be a synthetic (or eclectic) metaphor, the precise nature of which is examined in chapter 2.

In the remainder of this section, links between computationalism, artificiality (chapter 4) and emergence (chapter 3) are briefly examined in order to establish further support for the view that computationalism constitutes an a priori tenable metaphysical position.

1.5.2. Computationalism and Artificiality

Artificiality can be understood in two distinct senses, viz. (1) artificiality as appearance and contrasted with reality, and (2) artificiality as artifactuality (or made-ness) and contrasted with naturality (or givenness). Crucially, these distinctions are held to be orthogonal: For example, the original oil on canvas painting known as "The Mona Lisa" is real; yet, it is also a man-made object, an artifact and hence, not a natural. Since Mona Lisa (the person) is both real and a natural, it follows that reality encompasses both naturals and artifactuals. By contrast, someone (an actress) impersonating Mona Lisa (the person), can appear to be Mona Lisa; yet, this person as a person (that is, by virtue of being a person) is a natural and hence, not an artifact. Since a replica (fake) of "The Mona Lisa" is both artifactual and apparent, it follows that appearance encompasses both naturals and artifactuals. These distinctions are summarized in Table 1.2:

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13 This statement is not merely polemical and rhetorical. According to Casti (1989), "the modern scientist is in much the same situation as the artisan of the Renaissance, at least when it comes to needing a patron to finance pursuit of the muse. The only difference is that nowadays everyone has the same patron - the federal government. As a result, most funds are allocated by federal agencies, making liberal use of the so-called peer review process. This involves committees of experts from the various fields getting together and recommending to the funding agencies those projects and those scholars whose work they feel merits support. According to the ideology, this process ensures that money is channeled to those ideas, institutions, and individuals showing the clearest evidence of being able to do something productive with it [emphasis added]." (p.14)

14 The givenness vs. made-ness distinction is examined in chapter 6 and 7.

15 Various objections to this assertion are briefly considered in chapter 4.
Chapter 1

Introduction

The Oxford Companion to Philosophy (1995) defines noumena as “things that are thought” in contrast to phenomena as “things that appear”. Hence, the rationalistic connection in Kantian metaphysics between thought and reality: For Kant, “the intelligible world of noumena is known by pure reason, which gives us knowledge of things as they are [an sich].”

Conversely, by establishing the fact that epistemological issues of truth (noesis) are grounded in ontological issues of becoming (poiēsis), it is possible to argue that naturals and artificials are members of a common class of beings (chapter 6). By displacing questions concerning poiēsis (becoming, coming-forth, bringing-forth) in favour of questions concerning noesis (knowing), it is possible to argue that naturals and artificials are members of a common class of beings. However, this necessitates the adoption of a philosophical position supporting the interpretation of naturals and artificials (as artifactuals) as instantiations of a universal essence defined in abstract terms. A philosophy supporting abstraction of this kind is functionalism which was originally developed by Hilary

<table>
<thead>
<tr>
<th>Artifactuality</th>
<th>Reality</th>
</tr>
</thead>
<tbody>
<tr>
<td>’Mona Lisa’ (an impersonator)</td>
<td>Mona Lisa (herself)</td>
</tr>
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</table>

Table 1.2 Orthogonal Appearance-Reality and Artifactuality-Naturality Distinctions.

It is crucial to appreciate at the outset that the appearance-reality distinction is concerned with epistemological issues of truth, more specifically, with the possibility of establishing correspondences (isomorphisms) between natural and artificial (as artifactual) phenomena as instantiations of some underlying noumenal form; the artifactuality-naturality distinction, by contrast, is concerned with ontological issues of becoming, more precisely, with the distinct ways in which different phenomena, specifically, naturals and artificials (as artifactuals), come-to-be. The former distinction can be classified as noetic and the latter, as will be shown in chapter 6, as poiētic. Postulating the orthogonality of these distinctions is of critical significance because it supports the possibility of "strong" artificialities (as artifactuals), that is, artifactual analogues of natural phenomena, whereby analogue is understood realization or emulation as opposed to mere simulation (chapter 4). By displacing questions concerning poiēsis (becoming, coming-forth, bringing-forth) in favour of questions concerning noesis (knowing), it is possible to argue that naturals and artificials are members of a common class of beings.

Although functionality can be - and on deistic-theistic argument for design theses (chapter 6) has been - interpreted in teleologically a priori or goal-directed terms, viz. function as final cause, end or purpose, Darwinian evolution provides the possibility for a non-teleological (or teleonomically a posteriori) interpretation of functionality: A physical modification or variation (behavioural, structural etc), occurring in an organism either for the first time or as a characteristic inherited from the phylogenetic line (species), is considered functional if adaptive, that is, if conferring survival advantage to the organism in the context of its environment. Moreover, all modifications are held to be either (1) adaptive or (2) non-adaptive (‘side effects’ or by-products) but also non-deleterious as a consequence of the ‘weeding out’ mechanism of natural selection.
Putnam (and others) in the context of the philosophy of mind. *The Oxford Companion to Philosophy* (1995) defines functionalism in the following terms, which have been generalized to account for the application of this philosophical position to phenomena other than the mental:

The theory that the condition for being in a mental [or vital or material] state should be given by the functional role of the state, that is, in terms of its standard causal relationships, rather than by supposed intrinsic features of the state. The role is normally envisaged as being specified in terms of which states (typically) produce it and which other states and behavioural outputs will (typically) be produced by it when the state interacts with further mental [or vital or material] states .. and inputs.

Functionalism is a development of the mentalistic aspect of Cartesian dualism, viz. mind is to matter as function is to (material) realization. Functionalism is readily linked to computationalism, viz. function is to (material) realization as software is to hardware. However, the connection is a contingent one; many different kinds of functionalism are possible and computer-functionalism or computationalism is merely one type, albeit the most familiar in the context of discussions of what Simon (1981) calls the "sciences of the artificial", that is, artificial intelligence (AI), artificial life (A-Life), artificial physics (A-Physics) and artificial or virtual reality (A/VR) (chapter 4). However, it might be argued that a transition from functionalism to computationalism is almost inevitable given the fact that the originator of the former (Putnam) analyzed function in terms of a class of abstract, ideal, formal-mathematical objects known as Turing machines (chapter 2). Hence, the link between computationalism and artificiality via functionalism.

1.5.3. Computationalism and Emergence

If computationalism is to provide a sufficient metaphysical basis for artificiality, it must be shown how phenomena associated with individual artificial sciences can be integrated into a unified framework. This is necessary for (at least) two reasons: First, computationalism is a metaphysical position and hence, must, by definition (section 1.3.2), support phenomenal unification; second, functionalism, which provides the

Hence, it no longer appears to be necessary to hold that biological purpose is real; final causation can be viewed as a merely anthropomorphic interpretation projected onto the behaviours of organisms which are, in reality, unconsciously generated in response to a contingent environment.

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19 If mind and function are conceived in dynamic, processualist (rather than in static, substantialist) terms then the computationalist duality is more accurately given as process (or program in execution) is to processor. The link between computationalism and processualism is briefly examined in chapter 2.

20 However, as will be seen in chapter 4, it is important to appreciate that the "sciences of the artificial" are not limited to these disciplines. This follows, in part, from the fact that, for Simon (1969, 1981), artificiality does not refer to a particular type of artificiality but to the concept of artificiality as such, that is, to what constitutes the essence of an artifact as an artifact. In chapter 4, it is argued that artificiality must, therefore, be understood in (at least) two senses, viz. (1) as the universal essence of artifactuals and (2) as particular artifactual domains (such as AI, A-Life, A/VR etc).
philosophical basis for the possibility of "strong" artificiality (as artifactuality), requires an isomorphism or one-one correspondence (functional, behavioural, causal, structural etc) between artificiality and naturality to be established in order to grant the former the status afforded the latter, viz. reality (section 1.5.3). This necessitates considering (i) whether naturality is organized; (ii) if organized, the nature of this organization; and (iii) how such an organization (if its exists) comes into existence. The existence of structure, pattern, organization, order etc in nature is a necessary condition for the possibility of science; furthermore, most serious philosophy assumes the metaphysical axiom of universal order in order to get started. In the context of this study, it is assumed that nature or naturality is organized; hence, "strong" artificiality (as artifactuality) must also be organized and in such a way as to be isomorphic with naturality. With respect to the nature of this organization, there are a number of alternatives (chapter 5); however, perhaps the most common is the hierarchy (chapters 3 and 5), viz. a system of things arranged in a graded order according to certain criteria: For example, the naturalistic hierarchy matter-life-mind, where matter is historically antecedent to and a basis for life (and mind), and life is historically antecedent to and a basis for mind. Crucially, if naturality is hierarchically-structured structure then artificiality (as artifactuality) must, of necessity, be hierarchically-structured. This follows directly from the functionalist requirement for isomorphism between the two kinds of phenomena.

Functionality can be conceived as originating in essentially one of two ways, viz. as a result of design or as a product of evolution (chapter 6). Similarly, there are essentially two ways in which to generate a hierarchy, viz. design or emergence. A detailed investigation of the notion of emergence is presented in chapter 3. In the context of the current discussion, it is sufficient to identify emergence with the appearance of a new property (the emergent) arising in a systemic complex as a consequence of a specific pattern of activity of its components (the substrate). In order for a property to be considered emergent, it must not be possible for the property to be deduced from the properties of the substrate. For example, on the emergent-materialist theory of mind due to Searle (1992), consciousness is a biological property which emerges as a consequence of neurophysiological processes.

The two possibilities for hierarchy generation, viz. design or emergence, correspond to the two possibilities for naturality, viz. intentionalistic creation or naturalistic evolution. If creationism is false then evolution must have occurred since natural phenomena clearly

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21 Certain strains of post-modern thinking such as Derridean deconstructionism and ontological relativism are, therefore, excluded on this view.

22 The qualifier 'naturalistic' is necessary because supernaturalistic interpretations of evolution are possible (Mercer,17).
exist and their existence must be accounted for by some naturalistic means. Hence, the naturalistic hierarchy must be emergent and, as a consequence of the requirement for "strong" artificiality (as artifactuality) to be isomorphic with naturality, the hierarchy of artificialities must also be emergent. Furthermore, the link between computationalism and artificiality on the one hand, and between artificiality and emergence on the other must be considered: Computationalism is an ontology; hence, the hierarchy of artificialities must emerge from a computational substrate. This leads directly to the notion of computationally emergent artificiality or CEA (chapter 5).

Computationalism is grounded in the notion of computation, more specifically, symbolic information processing by Turing machines (section 1.5.1). A Turing machine is completely specified when its `hardware' (symbol processing machinery) and software (symbolic program) have been described (chapter 2). By adopting a functionalist position, this software-hardware duality can be brought into correspondence with Cartesian mind-body dualism, a generalization of which features in the emergentist conception of nature described by Samuel Alexander in *Space, Time and Deity* (1920). For Alexander, the ultimate stuff of reality is Space-Time, Cartesian dualism finding expression in Alexander's guiding maxim, "Time is the mind of Space". On this scheme, matter is emergent from Space-Time, life is emergent from matter and mind is emergent from life (chapter 5). Alexander's ontology provides a suitable basis for exploring the links between computationalism, emergence and artificiality, more specifically, for developing a unified framework of computationally emergent artificiality or CEA (chapter 5): Space-time events are prior to matter, life, and mind; hence, Space-Time is an abstract or ideal (that is, non-physicalist) metaphysics. Computationalism is also an abstract or idealistic metaphysics (chapters 2, 5 and 7); hence, the possibility of reinterpreting Alexander's ontology in computationalist terms by establishing an isomorphism between computations and Space-Time events. However, since the required isomorphism is structural (or behavioural) as well as functional (or logical), Turing machines cannot fulfil this role; hence, the adoption in this study of cellular automata or CAs (chapters 2 and 5) as the means by which to implement computationalism, leading to the concept of a unified framework of emergent artificiality.

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23 Alternatively, natural phenomena could be granted axiomatic status; they are simply given. Such a position is, however, regarded as stultifying within the reductionist Western scientific-philosophical tradition which seeks to explain things in terms of other simpler things.

24 Creationism is incommensurable with computationalism if the ontology of the Creator is held to be non-computational.

25 In short, if functional (or logical) isomorphism is necessary yet insufficient for noumenal (substrate) and phenomenal (emergent) isomorphism.
grounded in CA-computationalism, viz. computationally emergent artificiality or CEA\textsuperscript{26} (chapter 5).

1.6. Critique

In this section, the motivation underlying the critique of computationalism presented in this study is examined and the approach adopted is briefly described.

1.6.1. Why Critique Computationalism?

Roszak (1986) maintains that

\begin{quote}
\textit{a significant, well-financed segment of the technical and scientific community - the specialists in artificial intelligence and cognitive science - has leant the computer model of the mind the sanction of a deep metaphysical proposition (p.217)}
\end{quote}

an observation which may be generalized to computational models of matter and life and, conceivably, to reality itself. How could this happen? According to Rose et al. (1984), "by a process of the 'willing suspension of disbelief', unspoken agreement on an appropriate level of criticality occurs among the disinterested parties, and a corpus of scientific knowledge is created, validated and legitimated by its creators." (p.35) As stated previously, this involves \textit{determining} (specifying, bounding, circumscribing) the \textit{what} and \textit{how} of a science (that is, valid subject matter and methods for its study), an activity that is \textit{necessarily} extra- or meta-scientific since, as Heidegger (1977d) states, "the sciences are not in a position at any time to represent themselves to themselves, to set themselves before themselves, by means of their theory and through the modes of procedure belonging to theory." (p.177) For example, "physics as physics can make no assertions about physics. All the assertions of physics speak after the manner of physics. Physics is not itself a possible object of a physical experiment." (p.176) Science is \textit{essentially} non-reflexive (that is, incapable of self-reference and self-grounding\textsuperscript{27}) because of its definition in objectivist terms (Nagel,86). As stated in section 1.2, that which is both prior to and beyond science, beyond or \textit{meta-} the physics and providing the latter with its ontological ground, is \textit{metaphysics}; hence, the act of defining a science

\textsuperscript{26} It is worthwhile, at this stage in the discussion, clarifying what is meant by the term \textit{computationally emergent artificiality} or CEA (chapter 5). This does not refer to the capacity of a computational system to generate artifacts which are identifiable by the system as artifacts distinguishable (presumably) from computationally emergent naturals. Although this is an interesting possibility to consider - and is certainly consistent with what might be required of a "strong" artificial intelligence - this is not what is meant by CEA. Rather, the latter is a generic term for the class of artificial analogues of natural phenomena (such as matter, life and mind); furthermore, such artificial phenomena as emerge from a computational substrate.

\textsuperscript{27} On this view, second-order cybernetics, in which reflexivity, self-reference and the \textit{intrinsic} role of the observer (subject) are essential, cannot be classified as science.
Chapter 1 Introduction

The existential (or ontological) phenomenology of the German philosopher Martin Heidegger (1889-1976) provides the basis for the poietic critique of computationally emergent artificiality presented in this study. Certain key aspects of his early thinking are briefly outlined in what follows. A more detailed examination of those aspects of his thought directly relevant to this study is presented in chapters 6 and 7.

Thus, autonomous metaphysical systems, that is, metaphysical schemes that have, paraphrasing Baudrillard (1983), `liquidated their referential' (the referential in this case being the associated metaphors), are grounds that become tacit (or implicit), in short, backgrounds.

Chalmers (1982) asserts, in order for Kuhnian intra-paradigmatic or `normal' science to be possible since

if all scientists were critical of all parts of the framework [paradigm] in which they worked all of the time then no detailed work would ever get done. (p.98)

This position is supported by Jacobs (1995), who maintains, adopting a Heideggerian perspective, that "how [a] science came about (by not only determining what beings were meant to be studied but by already giving what it means `to be' for those certain beings) is the fundamental question. This question, however, must remain closed off to science for there to be scientific activity, for if a scientist continually questioned the ontological basis of his or her science, activity would necessarily cease." (pp.7-8) Hence, there are two separate issues: (i) what is science and (ii) what is it that makes science possible? As stated previously, since the answer to the latter question cannot be something scientific without a self-referential paradox arising, it must, therefore, be something both prior to and beyond science, that is, something metaphysical. An insight into the nature of the metaphysical is given by Nietzsche's assertion that rhetoric (persuasion) is the ground of dialectic (reason), which, suitably deconstructed (Norris, 82), supports the view that the metaphorical is the ground of the conceptual as implied in Pepper's (1942) root metaphor theory (section 1.4.1).

Given the link between science, metaphysics and metaphor described herein and in earlier sections, it might be asked What is wrong with metaphysics? More specifically, what is wrong with computationalism? And is there really something wrong? Conceptual schemes (that is, metaphysical systems) and the metaphors on which they are based are not causes for concern when metaphors and the links between metaphors and conceptual schemes are readily identifiable, for in such cases, metaphysics is recognizable as metaphysics (section 1.4.3). Problems arise when a conceptual scheme is detached from its metaphorical base(s) to become the tacit (or `background') ground of a paradigm. It is precisely this kind of problem which leads Chalmers to issue the following caveat, viz.

if all scientists were and remained normal scientists then a particular science would become trapped in a single paradigm and would never progress beyond it. (p.98)

28 The existential (or ontological) phenomenology of the German philosopher Martin Heidegger (1889-1976) provides the basis for the poietic critique of computationally emergent artificiality presented in this study. Certain key aspects of his early thinking are briefly outlined in what follows. A more detailed examination of those aspects of his thought directly relevant to this study is presented in chapters 6 and 7.

29 Thus, autonomous metaphysical systems, that is, metaphysical schemes that have, paraphrasing Baudrillard (1983), `liquidated their referential' (the referential in this case being the associated metaphors), are grounds that become tacit (or implicit), in short, backgrounds.
According to Cariani (1989), there is "a pervasive tendency in artificial intelligence and computer science to believe that literally everything is a computation." (p.xi)
various manifestations. At this point, Heidegger's views regarding the possibility of any such project become important: His recognition of the historicity and situatedness of the investigator, viz. we are all beings in the world in time, is illustrated by the following caveat which he issued in the context of his own exploration of the question of Being (Heidegger):

The consideration of Being takes its start from beings. This commencement is obviously determined by the factual experience of beings and the range of possibilities of experience that at any time are peculiar to a factual Dasein [that is, particular human being], and hence to the historical situation of a philosophical investigation. It is not the case that at all times and for everyone all beings and all specific domains of beings are accessible in the same way; and, even if beings are accessible inside the range of experience, the question still remains whether, within naive and common experience, they are already suitably understood in their specific mode of Being. Because the Dasein is historical in its own existence, possibilities of access and modes of interpretation of beings are themselves diverse, varying in different historical circumstances. (p.22)

1.6.2. From Philosophy to Phenomenology

Phenomenology, as the name implies, refers to the study of phenomena. Phenomena comes from the Greek phainomenon which in turn comes from phainesthai, `to appear' and phainein, `to show' (Angeles); hence, phenomenology might be described as the study of appearances. However, `appearance' can be understood in at least two senses: (i) appearance as contrasted with reality (Kant); (ii) appearance as the coming to presence of reality (Heidegger); on the former view, appearance and reality are different while on the latter view they are the same (although this is a simplification). Adopting the first view and writing in Critique of Pure Reason (1934), Kant described the distinction between appearance and reality or phenomena and noumena as follows:

A transcendental use is made of a conception in a fundamental proposition or principle, when it is referred to things in general and considered as things in themselves; an empirical use when it is referred merely to phenomena, that is, to objects of a possible experience. (p.182)

The conception of a noumenon, that is, of a thing which must be cogitated not as an object of sense, but as a thing in itself (solely through the pure understanding), is not self-contradictory, for we are not entitled to maintain that sensibility is the only possible mode of intuition. Nay, further, this conception is necessary to restrain sensuous intuition within the bounds of phenomena, and thus to limit the objective validity of sensuous cognition; for things in themselves, which lie beyond its province, are called noumena for the very purpose of indicating that this cognition does not extend its application to all that the understanding thinks .. [Hence,] the conception of a noumenon .. is connected with the limitation of sensibility, without, however, being capable of presenting us with any positive datum beyond this sphere. (p.188)

[When] we say, the senses represent objects as they appear, the understanding as they are, the latter statement must not be understood in a transcendental, but only in an empirical signification, that is,

31 The justification for adopting a phenomenological approach to the question concerning computationalism is presented in section 1.6.4 and chapter 6.
as they must be represented in the complete connection of phenomena, and not according to what they may be [that is, as things in themselves], apart from their relation to possible experience, consequently not as objects of the pure understanding. For this must ever remain unknown to us. (p.190)

In the last statement, Kant identifies three orders: (i) the order of sense (`as they appear'); (ii) the order of understanding (`as they are'); (iii) the order of the unknown (`as they may be'). (i) and (iii) correspond to appearance (phenomena) and reality (noumena) respectively; (ii) arises from Kant's attempt to reconcile rationalism and empiricism via the synthetic a priori, that is, mental structures supplying categories such as causality, space, time etc which are responsible for `filtering' and ordering sensory experience.

Hence, the human mind is partially responsible for determining what counts as appearance (phenomena); reality (noumena), however, is permanently beyond its reach.

The two interpretations of being, viz. `as they are' and `as they may be', lead to an ambiguity in the way that Kant uses the term 'appearance' which Scruton (1982) identifies as follows:

Kant sometimes writes as though appearances are 'appearances of' something, whose reality is hidden from us. At other times, he writes as though appearances are independent entities, which derive their name from the fact that we observe and discover their nature. (p.43)

The latter interpretation is consistent with the modern scientific view in which appearances correspond to physical objects and there is nothing beyond the physical. The former view, viz. reality encompasses appearance, is developed in Heidegger's philosophy of Being, although Heidegger employs the term appearance in a radically different sense to that of Kant (chapter 6). For Heidegger, the appearance-reality distinction is a product of the division of Being into essence (whatness) and existence (thatness) as shown in Fig 1.3.

The latter interpretation is consistent with the modern scientific view in which appearances correspond to physical objects and there is nothing beyond the physical. The former view, viz. reality encompasses appearance, is developed in Heidegger's philosophy of Being, although Heidegger employs the term appearance in a radically different sense to that of Kant (chapter 6). For Heidegger, the appearance-reality distinction is a product of the division of Being into essence (whatness) and existence (thatness) as shown in Fig 1.3.

According to Heidegger, Being was originally understood (by the pre-Socratic Greeks) as aletheia-physis, the emerging power which brings itself forth into presence from concealment (Heidegger,73). It was with Plato and Aristotle that Being became...
fragmented into the oppositions idea (form) and energeia (substance), possibility and actuality, culminating, in the Kantian duality of reality and appearance (or representation). The link between representation and appearance is a consequence of the mediation of phenomena by a representing agency, viz. the human mind with its "filtering" structures, the synthetic a priori; appearance is representation because it is a re-presentation of underlying reality by the mind. However, for Heidegger (1959), reality is appearance; Being is what comes to presence (appears) from concealment, although it appears or discloses itself multiply in beings (or things), viz. "just as becoming is the appearance of Being, so appearance as appearing is a becoming of Being." (p.115) A figurative depiction of the difference between appearance and reality as understood in Kant and Heidegger is shown in Fig 1.4.

The Kantian phenomenal-noumenal or appearance-reality distinction may be viewed as a staticization of the Heideggerian concept of Being. This can be shown by establishing a link between the two interpretations of appearance on the basis of the following statement taken from An Introduction to Metaphysics (Heidegger,59):

Physis is the emerging power, the standing-there-in-itself, stability. Idea, appearance as what is seen, is a determination of the stable insofar as it encounters vision. But physis as emerging power is by the same token an appearing. Except that the appearing is ambiguous. Appearing means first: [1] that which gathers itself, which brings-itself-to-stand in its togetherness and so stands. But second it means: [2] that which, already standing there, presents a front, a surface, offers an appearance to be looked at. (p.182)

Thus, Being manifests itself [1] dynamically and continuously as emergence and [2] statically and discretely as appearance; consequently, for Heidegger, the substance ontology versus process ontology debate in metaphysics (Rescher,96) is misconceived: Substance and process are two aspects of the same thing which can only be related into a unity by appreciating the historicity or temporality of Being as it emerges into appearance as the Being of beings (things). This issue will be examined in detail in
chapter 6 in connection with a discussion of the unitary relatedness of Being, becoming and appearance in Heideggerian ontology.

The different understandings of appearance in Kant and Heidegger give rise to an interesting problem: If appearance and reality are (ultimately) the same, as Heidegger holds, then to make a distinction between them is meaningless. If, on the other hand, they are distinct, as Kant argues, then to assert their identity is clearly false; yet, if it is meaningful to make a distinction, on what basis can the distinction be made? Kennick (1967) maintains that this must be the possibility that appearance and reality are identical. However, this would contradict the Kantian claim for their being fundamentally distinct; hence, the Kantian formulation leads to a paradox. The Heideggerian solution to this problem involves the notion of temporality: The Kantian paradox arises because reality and appearance are regarded as static binary opposites; if, however, they are regarded as temporally-related aspects, viz. emergence (dynamic) and appearance (static) respectively, the paradox can be resolved. A similar problem arises in the context of artificiality: Does the latter imply appearance or reality? Again, the Heideggerian solution is to invoke historicity and consider the poiēsis or coming-forth (section 1.6.5 and chapter 6) of artificialis as contrasted with naturals. This in turn necessitates considering artificiality from a temporal ontological perspective, viz. artificiality as artifactuality, as opposed to a static epistemological perspective, viz. artificiality as appearance (section 1.5.2). In order to clarify the relation between the two interpretations of artificiality (appearance and artifactuality), it is necessary to develop a phenomenological framework for investigating the ontological (productive, organization) aspects of artificiality on the one hand, and the epistemological (interpretative, observational) aspects of artificiality on the other (section 1.6.5 and chapter 7). In the course of this study, the implications of adopting Kantian and Heideggerian interpretations of appearance will be examined: In chapter 4, the former is shown to lead to an endorsement of functionalism and "strong" computationally emergent artificiality or CEA (chapter 5); however, in chapter 6, the latter is shown to provide the means by which the poiēsis (coming-forth, bringing-forth) of computationally emergent artificiality may be differentiated from the poiēsis of naturality. On this basis a poiētic difference, that is, a difference in becoming entailing a difference in the Being of natural and artificial (as artifactual) phenomena (beings) is established, thereby undermining the possibility of "strong" CEA.

1.6.3. A Brief Introduction to Heideggerian Phenomenology

In the previous section, phenomenology was defined as the study of appearance. However, within philosophical circles, phenomenology refers to something much more specific. In Basic Problems of Phenomenology (1982), Heidegger maintains that

> phenomenology is not just one philosophical science amongst others, nor is it the science preparatory to the rest of them; rather, the expression 'phenomenology' is the name for the method of scientific philosophy in general. (p.3)
Chapter 1  Introduction

The original formulation of phenomenology as a scientific method (and movement) can be traced to the works of Edmund Husserl, specifically his Logical Investigations (1901) and Ideas (1913). Husserl began by accepting the Cartesian maxim that the conscious self (or ego) constitutes the indubitable ground of experience: Cogito ergo sum, "I think, therefore I am". Following Brentano, he asserted that an analysis of consciousness reveals it always as consciousness of something, that is, there is an `aboutness' associated with consciousness by which the mind is directed towards objects under some aspect. This directional teleology of the mind is referred to as intentionality and Husserl maintained that only mind is intentional, a claim which was later challenged by Heidegger in Being and Time (1927). Husserl argued that there must be some kind of content in the mind which accounted for its intentionality. This led him to develop a general theory of intentional states and distinguish between the contents (or objects) of consciousness and the conscious act (noesis). The abstract representational structure by virtue of which the mind is directed towards objects under some aspect is called a noema. Thinking about the noesis makes it the object of a secondary noesis, a reflexive act; this is analogous to thinking about the content of a previous act. Hence, time (or temporality) as the `horizon' of experience is an essential component of Husserlian phenomenology. However, all of this presupposes Husserl's original contribution, `the phenomenological reduction', which was made in connection with the Kantian appearance-reality (or phenomenon-noumenon) problem. As Magee (1987) states,

there can be absolutely no doubt whatsoever that the objects of our consciousness exist as objects of consciousness for us, whatever other existential status they may have or lack, and therefore that we can investigate them as such without making any assumptions at all, positive or negative, about their independent existence. (p.254)

According to Husserl, philosophy should concern itself with appearance (which was indubitable), more specifically, with the systematic analysis of consciousness and its objects; the ultimate nature of such objects - an ontological problem - was to be ignored or 'bracketed' since it was unanswerable. Thus, Husserl had effectively eliminated the noumenal world from inquiry. However, it is important to appreciate that the ontological question is only unanswerable if (some variant of) the Kantian interpretation of appearance is adopted. Clearly, in proposing the phenomenological reduction, Husserl assumed the Kantian appearance-reality distinction as valid. Crucially, by ignoring ontological issues relating to the coming-to-presence or emergence of that which appears (Being as physis) and focusing exclusively on epistemological issues relating to the experiencing of objects already present (Being as idea), Husserlian phenomenology provided the philosophical basis for the functionalist philosophy of artificiality, specifically for the artificiality32 known as artificial intelligence. This claim is supported by the existence of two distinct stages in the development of Husserl's thought corresponding to what Fodor (1980) has called the `representational theory of mind'

32 Here, artificiality refers to an artificial phenomenon (that is, artifactual analogue of a natural phenomenon) as opposed to the class of all such phenomena (chapter 4).
(which has already been briefly described) and the `computational theory of representations' respectively. According to Dreyfus (1982), in the later Husserl, there is a move away "from the view of intentional content as a logical property of intentional states to the view of the content as a \textit{noema} or rule governing the operations which make intentionality possible" (p.11) This finds expression in two notions associated with Husserlian phenomenology: (i) \textit{eidetic reduction}, which involves the reduction of everyday phenomena to essential phenomena or ideas. Husserl maintained that every concrete, material object has its essence. Hence, the sciences rest on the basis provided by phenomenology; and (ii) \textit{transcendental reduction}, involving the reduction of \textit{noesis} (the act of consciousness) to a description similar to that produced when \textit{noemata} are analyzed in eidetic reduction. The transcendental reduction is necessary in order for Husserl to ensure the objectivity of his phenomenology; hence, the reduction of the subjective empirical ego to the objective Transcendental Ego, the universal Platonic `form of forms'. This makes possible the computational theory of mind and artificial intelligence because it allows for functionalism and the notion of multiple realizability: Subjective human consciousness is merely \textit{one} realization (or instantiation) amongst many possible realizations of the universal form that is the Transcendental Ego. As Dreyfus states,

the constant reference of all mental operations back to their source in the constitutive activities of the transcendental ego might seem to suggest that for [Husserl] consciousness plays some crucial role in the organization of experience and in the production of intentionality. If this were indeed the case, Husserl's phenomenology would be the extreme opposite of a computational theory of representational contents which treats the rules it postulates as programs that could run on any `device', whether it be a mind or a nonconscious computer. But, in fact, for Husserl like Kant, \textit{the notion of mental activity is so broadened that it does not require consciousness at all}. Indeed, Kant and Husserl are precursors of cognitivism precisely because their rules operate like programs totally independently of the awareness of a conscious subject [emphasis added]. (pp.11-12)

Husserl maintained that in order to be considered psychologically real such rules have to be available to consciousness, a position which would seem to contradict the previous statement. However, this depends on whether consciousness is necessary or contingent with respect to cognition. Adherents of computationalism and materialism are divided on the issue. For some, consciousness is a fiction; cognition does not require consciousness because consciousness does not exist. For others subscribing to a form of computationalistic-emergentism (chapter 3), consciousness is an emergent property of a particular computational organization (Chalmers,96); on this latter view, Husserl's position might be correct. However, it is the conceivability of cognition as computation without consciousness which has given rise to the possibility of philosophical \textit{zombies}, that is, nonconscious beings which are behaviourally, functionally, and perhaps even physically indistinguishable from conscious human beings (Güzeldere,95). It is the possibility of zombies which provides support for Dreyfus' assertion to the effect that although Husserl's phenomenological reduction was supposed to eliminate (or `bracket') the noumenal world, the idea of a noumenon was, in fact, tacitly reintroduced in the later phase of the development of his phenomenology in that experience itself was reduced to
something non-experiential, viz. rules, programs or computations - the objective Transcendental Ego. The reduction of a phenomenon or experience to the noumenal or non-experiential is a principal feature of Samuel Alexander's `phenomenological reduction' which Brettschenider (1964) describes as follows:

Alexander's method of arriving at pure Space-Time is a process that starts with images of material things and events [in conscious experience], and then strips them one by one of the qualities which they present to mind. As we rid things of all of their qualities, in effect, we are turning back the pages of emergent history. Alexander expects this process to bring us ultimately to a residuum of quality-less simples. This, the simplest stage of existence, is the level of pure Space-Time. (p.3)

It is conceivable that the result of the Husserlian phenomenological reduction could, in turn, be phenomenologically reduced according to Alexander's scheme, viz. phenomena are first reduced to a set of rules which are then reduced to a configuration of Space-Time. This is significant since it establishes a link between cognitivism and computationally emergent artificiality or CEA as realized in cellular automata (section 1.5.3 and chapter 5). However, what is more significant is that both Husserl and Alexander are committed to a view that sees the anthropocentricity (human-centredness) of everyday experience as a derivative (or secondary) phenomenon and thereby capable of phenomenological reduction. It is precisely this view which Heidegger sets out to challenge in Being and Time (1927). As Dreyfus (1982) states, "Heidegger attempts to show that Husserlian intentionality is not self-sufficient. He claims to give a `concrete demonstration' that the interconnected totality of equipment and social practices which he calls significance is a condition of the possibility of abstracting meanings, such as Husserl's noemata." (p.21)

Dreyfus (1991) describes Heidegger's phenomenology as hermeneutic realism. The word 'hermeneutics' derives from Hermes, the messenger of the Greek gods; thus, hērmēneuein, `to interpret' and hērmēneutike (techne), the `art of interpretation'. As originally defined by Schleiermacher, the Protestant theologian and Plato scholar, hermeneutics referred to that discipline concerned with the systematic interpretation of speech and (sacred) texts; however, the meaning of the term was extended by Dilthey to refer to the interpretation of all human behaviour and products. Heidegger redefined hermeneutics as the study of Being commencing with that being for which Being is an issue, viz. Dasein (human being). In Basic Problems of Phenomenology (1982), Heidegger outlines the difference between his phenomenology and that of Husserl with respect to their differing interpretations of the phenomenological reduction:

For Husserl, the phenomenological reduction .. is the method of leading phenomenological vision from the natural attitude of the human being whose life is involved in the world of things and persons back to the transcendental life of consciousness and its noetic-noematic experiences, in which objects are constituted as correlates of consciousness. [On my view:] phenomenological reduction means leading philosophical vision back from the apprehension of a being [Dasein or human being], whatever may be the character of that apprehension, to the understanding of the Being of this being. (p.21)
There are two stages which may be identified in the development of Heidegger's phenomenology just as there are two stages in the development of Husserlian phenomenology. In Husserl, the later stage is marked by the transcendental reduction; in Heidegger, the later stage is marked by `The Turn' (Die Kehre) away from a hermeneutic (or `existential analytic') of Dasein and toward a historical study of Being itself. While it is the thought of the later Heidegger which is of particular significance in the context of this study, in order to appreciate this later work it is necessary to have a basic understanding of his earlier writings since the two are intimately connected. In this respect Hubert Dreyfus' Being-in-the-world (1991), a commentary on Division I of Heidegger's Being and Time, provides a useful point of entry and it is from here that an account of the early or pre-Kehre Heidegger will be drawn.

In Being and Time (1927), Heidegger claims to be doing ontology, that is, inquiring into the nature of the understanding of Being not that we know, but that we are. Why should he want to do this? According to Heidegger, an ontological approach to phenomenology is necessary because the philosophical tradition since Plato has concerned itself exclusively with epistemological issues, that is, with explaining how ideas in the mind can be true of the world, and in so doing, has overlooked the most fundamental fact regarding the world, viz. that it is. Heidegger's project is an attempt at redressing the balance; more precisely, he argues for the priority of ontology over epistemology. There are two main aspects of the epistemological approach to the world which Heidegger rejects: First, the Platonic view that human activity can be explained in terms of theory; and secondly, the Cartesian view of the mind (as a knowing subject) directed towards the world (as a known object). The culmination of this Platonic-Cartesian tradition is identified by Heidegger as Husserlian transcendental phenomenology which, he maintains, is of derivative (or secondary) status relative to existential (or ontological) phenomenology.

According to Dreyfus (1991), "Heidegger wants to avoid what he sees as the recurrent structure of traditional ontology, namely, grounding all kinds of being in a causally self-sufficient source. He proposes, nonetheless, to show that all beings gain their intelligibility in terms of the structure of one sort of being [viz. Dasein or human being]." (p.12) This is an extremely important point in the context of the present study: It implies that if the Heideggerian approach to Being is correct then "strong" computationalism is impossible although "weak" or anthropocentric-computationalism (that is, computationalism-relative-to-human-being) is possible. This is because Being is not to be conceived causally (chapter 6) while computation is quintessentially viewed in causal terms, specifically in terms of necessary causation or deterministic mechanism (chapters 2, 6 and 7).

Dreyfus (1991), following Heidegger, defines Being as "that on the basis of which beings are already understood. Being is not a substance, a process, an event, or anything that we normally come across; rather, it is a fundamental aspect of entities, viz. their intelligibility." (p.xi) According to Heidegger, there are two main categories of Being:
(i) human being or Dasein and (ii) non-human being, the latter of which may be further categorized into the ready-to-hand (Zuhandenheit) and the present-at-hand (Vorhandenheit). Dasein (being-there or rather, being that 'site' or 'clearing' which enables Being to come forth from concealment) is ontically distinct from non-human being in that it has the understanding of Being as its unique characteristic. This understanding is either (i) preontological (that is, pretheoretical) or (ii) ontological (that is, hermeneutic); in the former, understanding takes the form of tacit and ineffable know-how which assumes a 'background' of shared practices, skills etc, while in the latter it takes the form of reflective know-that (or know-what) characteristic of the kind of understanding usually associated with a conscious cognizing subject. Dasein is a being-in-the-world where the 'in' of being-in should be understood in terms of concernful involvement (for example, 'being in love') and not spatial location (for example, 'being in a box'). The ready-to-hand (or available) is how Dasein encounters non-human being when coping with the world in an average-everyday unreflective manner. The ready-to-hand is something which is used in-order-to get something done and is, therefore, defined in terms of its equipmental functionality with respect to the concerns (unreflective purposes) of Dasein. However, as Dreyfus (1991) states, "an 'item' of equipment is what it is only insofar as it refers to other equipment and so fits in a certain way into an 'equipmental whole'." (p.62) The equipmental whole may be distinguished from other 'wholes' such as the referential and involvement wholes as follows: The equipmental whole describes the interrelated equipment; the referential whole its interrelations; and the involvement whole human purposiveness which is defined in terms of significance, "the background upon which entities can make sense and activities can have a point." (p.97) Heidegger elucidates the meaning of the ready-to-hand by way of an example, that of a person engaged in the act of hammering: If all is going well and the nail is being driven into the wood, then hammer, nail and wood are all transparent to the one doing the hammering, forming part of the functional network of equipment. The present-at-hand (or occurrent), encountered by Dasein in the mode of Cartesian subject (or thematic ego) reflecting upon objects, is experienced as such for a number of reasons. As Dreyfus states,

deliberate attention and thus thematic [or representational] intentional consciousness can .. be present, for example, in curiosity, reading instruments, repairing equipment and in designing and testing new equipment. Heidegger, however, concentrates on the specific experience of breakdown, that is, on the experience we have when ongoing coping runs into trouble. (p.70)

There are three modes of breakdown which Dreyfus views as "increasingly serious disturbances in which a conscious subject with self-referential mental states directed

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33 Technically speaking, this is an example of care (chapter 6) as opposed to concern since the relation is between Daseins rather than between a Dasein and non-Daseins.

34 In fact, the distinction between Dasein and the world in which, as a hammering being, it is situated disappears, to be replaced by the unity of being-in-the-world.
towards determinate objects with properties gradually emerges [emphasis added]" (p.71) and which he defines as follows: (pp.71-83)

- **Malfunction**, in which there is a transient shift from one form of absorbed coping to another form of absorbed coping with a corresponding transient shift between things encountered as ready-to-hand and unready-to-hand.

- **Temporary Breakdown**, in which there is a shift from absorbed coping to deliberate coping to deliberation (reflective planning). The ready-to-hand becomes the unready-to-hand.

- **Total Breakdown**, in which there is a transition from involved deliberation and its concerns to theoretical reflection and its objects. The ready-to-hand becomes manifest as the present-at-hand.

The present-at-hand describes beings (things) viewed independently of functional context, significance or the equipmental whole, and hence, independently of their relationship to Dasein. When the ready-to-hand becomes the present-at-hand, it is revealed as an object with determinate, context-free properties. Dreyfus maintains that Heidegger "wants to stress three points. (1) It is necessary to get beyond our practical concerns in order to be able to encounter mere objects. (2) The 'bare facts' related by scientific laws are isolated by a special activity of selective seeing rather than being simply found. (3) Scientifically relevant 'facts' are not merely removed from their context by selective seeing; they are theory-laden, that is, recontextualized in a new projection [emphasis added]." (p.81) This is consistent with arguments asserting the theory-dependency of observation statements (section 1.2).

The transition from a concerned being-in-the-world to a subject reflecting upon objects emerging during breakdown lends support to Heidegger's contention that the primordial mode of Dasein is the unreflective or pre-ontological mode:

Heidegger does not deny that we sometimes experience ourselves as conscious subjects relating to objects by way of intentional states such as desires, beliefs, perceptions, intentions, etc., but he thinks of this as a derivative and intermittent condition that presupposes a more fundamental way of being-in-the-world that cannot be understood in subject/object terms. (p.5)

However, what is also thereby asserted is the primacy of the functionally-contextual nature of the equipmental whole:

For Heidegger, unlike Descartes, Husserl, and Sartre, the object of mere staring, instead of being that which really is, is an impoverished residue of the equipment we directly manipulate. The bare objects of pure disinterested perception are not basic things we can subsequently use, but the debris of our everyday practical world left over when we inhibit action. (p.47)

Heidegger maintains that the ready-to-hand is a more primordial way for things to be than the present-at-hand. Consequently, for Heidegger, Husserlian phenomenology is concerned with a secondary or derivative mode of human being. However, Heidegger should not be understood as merely asserting the primacy of the practical (praxis) over
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Heidegger distinguishes two kinds of care relation, (1) concern or comportment, which is characterized in terms of Dasein being-amidst non-Daseins, and (2) solicitude, which is characterized in terms of Dasein being-with other Daseins. Hence, the hermeneutic ontology of Dasein.

In chapter 6, this post-Kehre phase of Heidegger's thought is characterized in terms of the question concerning the Being (Sein) of Being as such (Seyn).
"For Heidegger, scientific theory is an autonomous stance. It is not mere curiosity, nor is it merely based on an interest in control [emphasis added]." (p.80) This position conflicts with the account of science given in The Question Concerning Technology and Other Essays (1977), a post-Kehre work in which science is linked with technology which is, in turn, linked to the Greek notion of technē under its modern interpretation as Enframing (Gestellen), that is, ordering for use. Heidegger maintains that it is with Plato and Aristotle that technē begins to assume this meaning, which leads to the metaphysical grounding of science in the duality of essentia (whatness) and existentia (thatness). According to Heidegger, the pre-Socratics had a very different understanding of technē, a consequence of their very different understanding of Being as aletheia-physis or the emerging power which brings itself forth from concealment (section 1.6.2 and chapter 6). The thinking of the later (or post-Kehre) Heidegger is marked by a shift (or `turn') in focus from the question concerning the meaning of Being to the question concerning the truth of Being (Heidegger,93b). This engenders a corresponding shift (or `turn') in methodology, viz. a poetic approach to the understanding of Being (Heidegger,71) on the one hand, and an attempt at clarifying the nature of logic and science in order to draw attention to the `danger' inherent within technology (Heidegger,77) on the other. Of particular relevance in the context of the current study is Heidegger's understanding of mathematics (Heidegger,77b), viz.

mathematics is the reckoning that, everywhere by means of equations, has set up as the goal of its expectation the harmonizing of all relations of order, and that therefore `reckons' in advance with one fundamental equation for all possible ordering [emphasis added]. (p.170)

By this, Heidegger means to imply that mathematics and modern science (which is mathematical) are self-fulfilling in the sense that both specify a priori what and how things are to be encountered, viz. as the Enframed and ordered, a consequence of the fact that science and mathematics have their metaphysical origins in technē (chapter 6). This point is of critical importance in the context of this study since computationally emergent artificiality or CEA (chapter 5) is grounded in CA-computationalism and CAs are mathematical formalisms (chapter 2).

Crucially, Heidegger maintains that although the Enframing (Gestellen) that is characteristic of modern theoretical science is a way of revealing Being, it does not constitute the (only) way of revealing Being; hence, his commitment to pluralistic realism (chapter 6). On his view,

crude as it is, Heidegger means that, in this sense theory never makes its way around nature - nature that is already presencing - and in this sense theory never makes its way around nature. Physics may well represent the most general and pervasive lawfulness of nature in terms of the identity of matter and energy; and what is represented by physics is indeed nature itself, but undeniably, it is only nature as the object-area whose objectness is first defined and

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38 As will become apparent in chapter 6, poetry and poiēsis stand in close relation in Heideggerian phenomenology.
determined through the refining that is characteristic of physics and is expressly set forth in that refining. Nature, in its objectness for modern physical science, is only one way in which what presences - which from of old has been named *physis* - reveals itself and sets itself in position for the refining characteristic of science. Nature thus remains for the science of physics that which cannot be gotten around. [This follows because] scientific representation, for its part, can never decide whether nature, through its objectness, does not rather withdraw itself than bring to appearance the hidden fullness of its coming to presence. Science cannot even ask this question, for, as theory, it has already undertaken to deal with the area circumscribed by objectness. (pp.173-174)

In this statement, Heidegger means to imply that scientific objectivity prevents the unconcealment, appearance or emergence of other ways of Being. Clearly, the Heideggerian concept of emergence (chapter 6) must differ radically from standard scientific-philosophical concepts of emergence (chapter 3): Broadly speaking, on the latter, emergence denotes the appearance of new properties in a whole that are not present in any of its parts, necessitating an *a priori* commitment to (1) a subject-predicate ontology and (2) an objectivist (that is, externalist, third-person) conception of properties (or predicates); on the former (Heideggerian) view, by contrast, emergence is held to denote the appearing of Being from a state of unconcealment in a mode of revealing which is prior to the subject-object duality. This is an extremely important point which has implications for the possibility of "strong" artificiality (as artifactuality), that is, realization as opposed to simulation (chapter 4). It might have been inferred from section 1.6.2 that Heidegger's (re-)interpretation of appearance as emergence allows for isomorphisms to be established between artificiality and naturality once the former is reconceptualized in emergentist terms since on the Heideggerian view the Kantian appearance-reality *duality* is actually a *unity*. However, this would be to ignore the distinct nature (Being) of the emergence occurring in naturality and artificiality (as artifactuality) respectively. In the context of the present discussion, it fails to recognize that natural-emergence is *prior* to the subject-object duality while artificial-emergence is *grounded* in the subject-object duality. In order to clarify this point, it is necessary to examine - via Heidegger - the Greek notion of *poiēsis* (coming-forth, bringing-forth) which allows *physis* (naturality) and *techne* (artificiality as artifactuality) to be differentiated. The notion of *poiēsis* is introduced in section 1.6.5 and discussed more fully in chapter 6.

The above statement indicating the limitation of the revealing of Being which results from the adoption of scientific objectivism is significant for another reason: According to Searle (1992), consciousness is a biologically emergent property *caused* by neurophysiological processes (section 1.5.3). However, this position does not solve the category problem (chapter 7), that is, the problem of explaining how ontological subjectivity (experience, internality, first-personhood) arises from an ontologically-objective (non-experiential, externalistic, third-person) substrate. On the Heideggerian interpretation of emergence outlined in chapters 6 and 7, it is maintained that ontological subjectivity does not emerge from an ontologically-objective substrate; rather, *both* ontological categories emerge from that which is prior, viz. being-in-the-world (or *Dasein*). Consciousness is a mode of Being which emerges into unconcealment in a
particular kind of being (Dasein): It is not constructed; it is revealed\textsuperscript{39}. This position is a departure from more conventional interpretations and applications of Heideggerian thought with respect to the phenomenon of consciousness: For example, Dreyfus (1992) and Globus (1995) maintain that connectionist (or bottom-up) approaches to the brain-mind relation are consistent with Heideggerian thought and may provide the means by which consciousness is instantiated in artificiality. However, such approaches are problematic for a number of reasons as will be shown in Part II of this thesis.

1.6.4. Why a Phenomenological Critique?

In the context of discussing the distinction between the conventional (Christian) and radical Heideggerian interpretations of logos (chapter 6), Heidegger (1959) asks

\begin{quote}
which interpretation is the true one, the one which simply takes over a perspective into which it has fallen, because this perspective, this line of sight, presents itself as familiar or self-evident; or the interpretation which questions the customary perspective from top to bottom, because conceivably - and indeed actually - this line of sight does not lead to what is in need of being seen. (p.176)
\end{quote}

Similarly, in the context of evaluating the sufficiency of computationalism as the metaphysical basis for a unifying framework of emergent artificiality, it might be asked: Which interpretation is the true one, computationalism or the philosophy which calls computationalism into question? As stated previously in section 1.5.3, Alexander's metaphysics, suitably reinterpreted in computationalist terms - specifically, under CA-computationalism (chapters 2 and 5) - provides an appropriate emergentist framework on the basis of which tentative "strong" artificialities (such as AI, A-Life and A-physics) can be unified. However, as was shown in section 1.6.2, Heideggerian phenomenology also provides a suitable conceptual framework within which to examine the relation between computationalism, emergence and artificiality, albeit from the opposing position, that is, in support of a critique of computationalism and the possibility of

\textsuperscript{39} This interpretation of emergence derives support from etymology. According to Room (1986): "merge (combine, unite, blend, or cause to do this) As first current in the seventeenth century, 'merge' meant 'immerse', 'plunge', more figuratively than literally." According to Ayto (1990): "Merge comes from Latin mergere, which meant 'dive, plunge' (it was also the source of the English emerge (16th), which etymologically means 'rise out of a liquid', immerse (17th), and submerge (17th). Merge was originally used for 'immerse' in English too, and the modern meaning 'combine into one' did not emerge fully until as recently as the 20th century. It arose from the notion of one thing 'sinking' into another and losing its identity; in the 1920s this was applied to two business companies amalgamating, and the general sense 'combine' followed from it." According to Hoad (1986): 'emerge come to light, arise (16th); rise out of a liquid (17th). emergence (17th); emergent (15th). merge extinguish or be extinguished by absorption (18th)." According to Klein (1966): 'emerge, intr. v., to rise from a fluid, to appear. - L. emergere, 'to come forth, come up, rise, extricate oneself', fr. e- and mergere, 'to dip, immerse, plunge.' According to Partridge (1966): "Emergere, to come to the surface (of an enveloping liquid), gives us emerge." Finally, according to Glare (1982): "Emerγo-γere 1. to come up out of the water, emerge. 2. to come forth (from confinement, concealment ..), emerge. 3. to get clear (of a difficult situation), extricate oneself. 4. to become apparent, come to light; (of something unexpected) to turn up, present itself, to appear as a result, to emanate. 5. to emerge from, get clear of; to permit .. to escape."
"strong" artificiality.

It is in the thinking of the later (post-Kehre) Heidegger, when focus has shifted away from the existential analytic of the *Dasein* and toward the question concerning the *truth* of *Sein* (Being), that an implicit critique of computationally *emergent* artificiality or CEA (chapter 5) is to be found. Most existing phenomenological critiques of computationalism and artificiality focus on top-down or *designed* artificiality: For example, the critique of the symbolic or representationalist approach to artificial intelligence (AI) presented by Dreyfus (1972, 1979, 1992), which is contested by Casti (1989) on the grounds that it *assumes* the correctness of hermeneutic (or existential) phenomenology. According to Casti, Dreyfus merely presents "what amounts to anecdotal evidence involving such pursuits as the acquisition of skills and expertise in activities like chess playing, driving, poetry writing, and so forth." He goes on to state that "there are many things I don't like about this line of reasoning, but the most important is the *ex cathedra*-like pronouncement: Phenomenology says! On what grounds, other than faith, can one swallow the conclusions of the phenomenological philosophers?" (p.333) However, Dreyfus' critique is not so easily dismissed: The failure of top-down or symbolic AI to deliver on the polemical claims of its proponents is a well documented fact which is endorsed by those who were previously active practitioners in the field (Winograd,86). The intrinsic yet unforeseen shortcomings of "Good Old Fashioned AI" (GOFAl) are readily recognized once it is appreciated that GOFAl recapitulates Husserlian transcendental phenomenology (section 1.6.3). Analogous to the way in which Heidegger's approach to phenomenology provides a means by which to disclose the shortcomings of transcendental phenomenology (Dreyfus,82), specifically, the problem of articulating the structure of the human life-world (*Lebenswelt*), Dreyfus' Heideggerian critique provides a means by which to identify the shortcomings of GOFAl. This has led (at least in part) to a `paradigm shift’ within AI towards approaches emphasizing the role of the body in situated cognition (Prem,96). Given the objective of this study, viz. a critique of computationalism as the metaphysical basis of a unifying framework of emergent artificiality, it is natural to adopt a phenomenological approach, specifically a Heideggerian approach, on the basis of precedent (chapter 6). Two core related assumptions underlying GOFAl are: (i) intelligence requires a mental representation of the world; and (ii) the phenomena of the world are reducible to context-free atomic 'facts'. If this view is incorrect, as Heidegger and Dreyfus have argued, then any artificial science which is (i) representationalist and (ii) constituted from context-free atomic facts may be liable to a critique similar to that of GOFAl. It is an aim of this

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40 Casti (1989) encapsulates Dreyfus' anti-AI argument in the following syllogism: "I. The AI community claims that thinking is the manipulation of formal symbols according to rules. II. Phenomenology claims that knowing, understanding, perceiving, and the like involve more than just following rules. III. Phenomenology is correct. Therefore, no amount of AI, however clever, will ever duplicate human thinking." (p.317)

41 A specific example, the Frame Problem, that is, the problem of determining contextually-relevant knowledge, is briefly examined in chapter 7.
study to investigate the extent to which such a critique applies to other artificialities such as A-Life and A-Physics conceived as bottom-up (or emergent) phenomena in the context of a unifying framework of computationally emergent artificiality or CEA (chapter 5).

According to Heidegger (1927),

> the question of Being aims .. at ascertaining the a priori conditions not only for the possibility of the sciences which examine beings as beings of such and such a type, and, in doing so, already operate with an understanding of Being, but also for the possibility of those ontologies themselves which are prior to the ontical sciences and which provide their foundations. (p.31)

On the basis of this statement, Dreyfus (1991) maintains that "the need for such a study becomes clear whenever a normal science is in crisis, and it is also required by sciences that are unclear about their method and subject matter." (p.16) It is argued that this is precisely the case for what Simon (1969) has referred to as the "sciences of the artificial" (chapter 4) since it is unclear whether artificiality (as artifactuality) constitutes a "strong" or a "weak" analogue of naturality, that is, realization or simulation of the latter. This lack of clarity, it is maintained, is a direct consequence of the Kantian distinction between appearance and reality (section 1.6.2). As stated previously in sections 1.6.2 and 1.6.3, reinterpreting the concept of appearance as emergence (following Heidegger) enables this problem to be resolved; in short, the *poietic difference*, that is, the difference in becoming (coming-forth, bringing-forth) between naturals and artificials (as artifactuals) entails an *ontical difference*, that is, a difference in Being between such phenomena, because Being and becoming stand in essential, unitary relation to each other (chapter 6). Thus, Heideggerian phenomenology provides an appropriate framework within which to critically evaluate the possibility of "strong" computationally emergent artificiality or CEA (chapters 5 and 7).

According to Waterhouse (1981), Heidegger maintains that metaphysics belongs to the nature of man, viz. "it is the ground phenomenon of *Dasein*. It is *Dasein* itself." (p.123) It was shown previously in section 1.4 that there is a connection between metaphysics and metaphor, specifically, that the former is grounded in the latter. This view is supported by Heidegger (1927) who holds that "*Dasein* has an in-built tendency to interpret itself in terms of what it confronts - the world." (p.36) However, this should not be understood to mean that *Dasein* is primordially metaphysical: In the mode of being-in-the-world, *Dasein* is clearly non-metaphysical in coping with the world unreflectively, that is, unthematically. It is in the mode of the Cartesian ego or subject that *Dasein* becomes metaphysical since it is in this mode that metaphysical systems can be formulated and recognized as metaphysical systems. However, since the Cartesian subject is a mode of *Dasein*, metaphysical thinking is also, therefore, a characteristic of
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**Dasein.** One of Dasein's characteristics (or existentials\textsuperscript{42}) is its `thrownness' or situatedness in a world, whereby `world' is understood a totality of skills, practices, equipment and other Daseins (chapter 6). If and when Dasein becomes the reflective Cartesian subject, it projects from its world into thought and becomes metaphysical; hence, the connection between metaphor and metaphysics in Heideggerian phenomenology. Dasein is metaphysical because Dasein is in-the-world\textsuperscript{43}. It would seem, therefore, that Heidegger's phenomenology provides the basis for an analysis of computationalism: Modernity can be characterized in terms of its association with information, communication, control and, most importantly in the context of this study, computation. Hence, the world of modern Dasein is a computational world. Consequently, when Dasein becomes reflective, its metaphysics is grounded in the character of that world, the defining metaphor of which is the computer; hence, a computational metaphysics - computationalism. Although this fact may appear trivial, it is worth mentioning since it clarifies the nature of the dialectic between technology, science and metaphysics on the one hand and human society on the other. Moreover, it enables a link to be established between Dasein and the notion of abstraction (section 1.4.3): Metaphysics can be traced back to metaphor, metaphor to abstraction, and abstraction to the act of an abstracting agency, viz. Dasein in the mode of the subject relating to objects whose acts may be either epistemic (interpretative) or ontic (productive). This leads directly to a consideration of the concept of poiĕsis (coming-forth, bringing-forth).

1.6.5. Towards a Phenomenology of Poiĕsis

In *Philosophy of Existence* (1971), Karl Jaspers states that "philosophizing can neither be identical with nor opposed to scientific thought" (p.11). He further maintains that any `serious' philosophy must incorporate knowledge gained through the scientific mode of inquiry. Accepting the validity of this assertion has necessitated incorporating a number of scientific facts associated with investigations of computation (chapter 2), emergence (chapter 3) and artificiality (chapter 4) into the unifying framework of computationally emergent artificiality or CEA presented in this study (chapter 5). It is crucial to appreciate, however, that on Jaspers' view, philosophy transcends science. As he states,

> scientific cognition of things is not cognition of being. Scientific cognition is particular, concerned with determinate objects, not with being itself. The philosophical relevance of science, therefore, is that, precisely by means of knowledge, it produces the most decisive knowledge of our lack of knowledge, namely our lack of knowledge of what being itself is.

\textsuperscript{42} The distinction between concrete-universals or existentials and concrete-particulars or existentielles is described in chapter 6.

\textsuperscript{43} As stated previously, in section 1.6.3, the `in' of being-in-the-world is an `in' of involvement and not a spatial or topological `in'.
[Furthermore,] scientific cognition can provide no goals whatever for life. It establishes no valid values. Therefore it cannot lead. By its clarity and decisiveness it points to another source of our lives. (p.10)

There are (at least) two points to note in connection with the above statements: First, as Dreyfus (1993) - citing Heidegger and Wittgenstein in support - has argued, the determinate objects of science are context-free facts (atomic primitives), that is, ontical\textsuperscript{44} abstractions or `cuttings-out-from' a prior existential whole. Although such `cuts' have existential status (assuming hermeneutic realism), they are not autonomous as `cuts' (that is, with respect to their emergence from the prior whole) and hence, necessitate the existence of a `cutter' or abstractionist (section 1.4.3). This entails support for Jaspers' assertion, viz. that science requires a grounding in values (since "it cannot lead"), thereby necessitating a consideration of metaphysical issues since `cutting' involves anthropocentric selection which is teleologically \textit{a priori} (or intentionalistic). Metaphysics, as defined in section 1.3.2, is that which is both prior to and beyond physics. According to Jaspers' latter statement, goals, purposes, values are both beyond science and a necessary condition for the possibility of science. Proof of the latter assertion is afforded by the recognition that \textit{selection} of phenomena to include in a scientific study, \textit{choice} of experiments to perform in order to test a theory etc, constitute intentional acts, irrespective of whether such acts were reflective or non-reflective\textsuperscript{45}. The point of divergence between Jaspers and Heidegger is in the latter's assertion that science is relative to a set of \textit{norms} (non-mentalistic values) because it is grounded in the \textit{technological} way of Being (\textit{technē})\textsuperscript{46}. However, Jaspers and Heidegger are in agreement that intentionality cannot be explained scientifically; hence, the above two statements are \textit{essentially} related: An understanding of Being requires an understanding of purposes and visa-versa. When the understanding of Being takes the form of science, it necessitates `cutting' or abstraction which in turn necessitates the existence of an intentional agency responsible for the act of `cutting', viz. an abstractionist.

`Cutting' (or abstraction) can be identified with a shift from what Heidegger (1959) describes as the \textit{logocentric} attitude of human beings, whereby \textit{logos} is meant "collecting collectedness, the primal gathering principle" (p.128), towards a \textit{categorial} approach to Being. Heidegger clarifies the distinction between \textit{logos} and \textit{kategoria} as follows, viz.

\textsuperscript{44} In the context of Heideggerian phenomenology, \textit{ontical} refers to beings and \textit{ontological} to the Being of beings (chapter 6).

\textsuperscript{45} That is, whether made by \textit{Dasein} as being-in-the-world or Cartesian subject (ego). While it might appear that scientific intentionality is \textit{necessarily} reflective, this is not, in fact, the case: In `normal science', the individuals (intentional agents) responsible for scientific activity are scientist \textit{Daseins} in the `world' that is their (tacit) scientific paradigm (sections 1.2 and 1.6.1).

\textsuperscript{46} \textit{Technē}-Enframing (\textit{Gestellen}) is a `summoning-forth' of man (\textit{Dasein}) by Being - and hence, also a `destining-forth' of Being itself - that is directional (intentional, teleological), viz. the \textit{ordering} of everything as standing-reserve (\textit{Bestand}) for use by human beings (chapter 6).
"logos is the steady gathering, the intrinsic togetherness of the essent [thing], that is, being." (p.130) In short, logos is the connecting back of beings to Being; kategoria, by contrast, is the abstracting away of beings from Being. On Heidegger's view, the act of naming constrains the possibilities for the Being of a thing. This follows because "the word, the name, restores the emerging essent [thing] from the immediate, overpowering surge to its being and maintains it in this openness, delimitation, and permanence." (p.172) Naming involves the differentiation of beings (things and Daseins); however, as logos, this is always done in the context of an attempt at understanding the Being of beings rather than the beings themselves (as somehow `separate' from Being). According to Heidegger, "logos as gathering becomes the ground of being-human" and "to be a man means to take gathering upon oneself, to undertake a gathering apprehension of the being of the essent, the sapient incorporation of appearing in the work, and so to administer unconcealment, to preserve it against cloaking and concealment." (p.174) Thus, "being-human was initially grounded in the disclosure of the being of the essent." (p.175) Hence, according to Heidegger, logos originally referred to Being's appropriation of man for the task of 'gathering' (collecting, linking) beings back to Being. However, under kategoria, naming leads to the severance ('cutting' or abstraction) of beings from Being and in such a way as to support the view that beings are ontologically primitive, that is, independent of relation to Being. As Heidegger states, with the change of physis [the emerging power] to eidos [the form or idea] and of logos [the gathering together] to kategoria [the categories] the original disclosure of the Being of the essent [the thing] ceased (p.188)

The movement from a naming (‘gathering’) which preserves the connection with Being to a naming (‘cutting’) which effaces this connection by postulating the existence of fundamental categories is, Heidegger argues, what makes metaphysics possible. It could be argued that any metaphysical system which postulates the existence of a set of ontological primitives from which everything else is constructed belongs to the general class of metaphysical systems referred to as atomisms (chapter 2). Crucially, it is precisely this kind of metaphysics that Dreyfus calls into question and which leads him to reject the ontological primacy of the determinate, context-free fact. As Jaspers (1971) states,

whatever becomes an object for me is always a determinate being among others, and only a mode of

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47 Crudely speaking, logos entails holism whereas kategoria entails reductionism.

48 In chapter 6, it is shown that although Being as such (Seyn) can be without beings, the latter cannot be without the former. This follows from the fact that beings as beings necessarily partake of Being.

49 According to Heidegger, atomism as such - rather than the specific form given to it by Democritus and others - characterizes the essence of all metaphysical systems. For this reason, Heidegger's describes his project as an attempt at moving beyond metaphysics (that is, post-metaphysics) towards what he calls thinking.
being. When I think of being as matter, energy, spirit, life, and so on - every conceivable category has been tried - in the end I always discover that I have absolutized a mode of determinate being, which appears within the totality of being, into being itself. No known being is being itself. (p.17)

However, it might be argued that Heidegger's (and Jaspers') position is ultimately self-undermining since it makes use of categories in articulating the structure of Being. In this connection, it is important to appreciate (1) that Heidegger's `categories' (more precisely, existentials) are concrete as opposed to abstract and (2) these `categories' (existentials) are temporal (or historical) as opposed to eternal. For this reason, Heidegger does not - cannot - claim finality for his phenomenological investigations of Being. Although this might appear repugnant to conventional realism, it is fully consistent with hermeneutic realism and affords value to the hermeneutic project: Articulating the structure of Being hermeneutically gives an articulation of Being; what it does not give, however, is the (only) articulation of Being.

At the end of section 1.6.4, it was maintained that the notion of `cutting' leads directly to consideration of the concept of poiēsis. This point requires clarification. As will be shown in chapter 6, the concept of poiēsis can be interpreted in two senses, viz. ontical (secondary) and ontological (primary): Ontical poiēsis refers to the way in which beings become, that is, come-into-being, from other beings. It is causally-productive and has two basic forms: (1) physis, that is, self-causation, self-becoming or autopoïēsis, and (2) technē, that is, other-causation, other-becoming or allopoïēsis (Heidegger,77a). Ontological poiēsis, by contrast, refers to the coming-forth of beings from Being (and the going-back of beings to Being). It is incipiently-emergent and marked by a movement from originary physis (poiēsis as such) to derivative physis (autopoïēsis). The continuity between originary and derivative physis - and discontinuity between originary physis and technē (since the latter is mediated by derivative physis) - is of critical significance because (1) physis also denotes naturality in contrast to technē, which denotes artificiality (as artifactuality), and (2) originary physis is ontologically in-finite whereas derivative physis and technē are finite. As will be shown in chapters 6 and 7, the continuity of finite (closed) naturals with infinite (open) naturality as such allows the possibility of ontological category emergence, that is, the emergence of new kinds of beings; by contrast, the continuity of finite (closed) artificials (as artifactuals) with finite (closed) naturals blocks the possibility of ontological category emergence. This follows from the

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50 That is, interpreting the phenomenon of Being from within Being.

51 As will be shown in chapter 6, this does not entail support for metaphysical relativism: On Heidegger's view, there is only one correct way that the world can be interpreted (or viewed) relative to a particular set of interpretative practices; hence, his commitment to realism. However, there are many interpretative practices; hence, his commitment to pluralism. On this basis, Dreyfus (1991) characterizes Heidegger's position as pluralistic realism.

52 Heteropoïēsis (Maturana,80) is not a basic form but a composite of auto- and allopoïēsis.
fact that infinitude (in some sense of the term) is a necessary condition for categorial-openness. The various relations between Being, naturals and artificials (as artifactuals) and between ontological and optical poiēsis (coming-forth, bringing-forth, becoming) are shown in Fig 1.5. ($B$ denotes Being, $b_n$ denotes naturals and $b_A$ denotes artificials.)

Heidegger's ontological difference is the difference between beings and the Being of beings (chapter 6). In this study, a new concept - the poiētic difference, that is, the distinction in becoming (that is, coming-forth, bringing-forth) between naturality and artificiality (as artifactuality) - is introduced. It is maintained that naturals and artificials (as artifactuals) are ontically different (that is, distinct as beings) for three reasons: First, Being and becoming stand in essential, unitary relation (chapter 6); second, naturals and artificials (as artifactuals) are poiētically different (that is, distinct in their becomings); third, originary poiēsis as such (Being-physis) is continuous with derivative autopoiēsis (beings-physis) and discontinuous with allopoiēsis (beings-technē). In short, the ontical difference is grounded in the poiētic difference is grounded in the ontological difference. Although precedents certainly exist for the poiētic difference (Heidegger, 1977a).

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53 Cariani (1989) contests the role of infinity in open emergence, arguing that finite evolutionary-robotic devices grounded in the analog continuum are capable of open-ended construction of symbolic primitives and hence, infinite or open emergence as a consequence of open-ended possibilities for measurement. However, as shown in chapter 6, this position is problematic for (at least) two reasons: First, it is unclear whether the analog continuum is real. For example, on computationalism, reality is ultimately discrete (granular) and hence, the possibilities for measurement are ultimately finite; second, Cariani's argument against infinity appears to be incoherent since in postulating measurement as an open-ended process, infinity is (tacitly) reintroduced into the system.
(Maturana, 80), until now it has not been explicitly formulated as a difference; furthermore, previous conceptions of this distinction have either (i) ignored its grounding in the ontological difference (Maturana, 80) or (ii) only implied such a grounding (Heidegger, 39).

The link between 'cutting' and poïësis as technē (that is, allopoïësis) follows from the connection between abstraction and artificing (that is, building, constructing, organizing), viz. both involve movements between parts and wholes (chapter 6). However, 'cutting' is necessarily prior to artificing since it is responsible for generating the ontological primitives used in the production of artifacts. Although artifact-production (that is, artificing) can occur through design (top-down construction) or emergence (bottom-up construction), in both cases a set of ontological primitives ('atoms') must first be established by being 'cut-out-from' the prior existential whole that Heidegger refers to as the 'background'. As stated previously in section 1.6.3, Heidegger (1977a, 1977b) maintains that science is grounded in technology and technology in technē under its modern interpretation as Enframing (Gestellen). On this view, Being is revealed as a causal network of objects having determinate, context-free properties, such objects being ordered according to human concerns; hence, there is an implicit connection between technē-Enframing (Gestellen) and Cartesian (that is, subject-object) intentionality (chapter 7). This link is highly significant: Since human beings are the source of technē, that is, artificing (chapter 6), their artifacts will, of necessity and at some level of their Being, be compositional, that is, synthesized from components, irrespective of the nature of the composition process, viz. design (top-down) or emergence (bottom-up). In chapter 6, technē is interpreted in terms of the triadic relation between artificers (productants), substrates (substrata) and artifacts (products) and in chapter 7, a distinction is made between "soft" (or pure) and "hard" (or impure) artifacts: In the former, matter - the component (or substratum) level - is (naturally) given and form - the system (or product) level - is (artifactually) made; in the latter, both matter and form are made. Such a classification is made possible by the re-interpretation of the poiëtic difference in terms of a phenomenological framework of historical ontic (organizational, productive) and epistemic (observational, interpretative) relations between natural and artificial (as artifactual) phenomena and what is referred to as the anthropic component, that is, the human being in its capacity as artificer-interpreter (chapter 7). Computation is identified as an instance - in fact, the defining exemplar - of "hard" artificiality and since "hard" (or pure) artifacts can be shown to be ontologically-closed, it follows that computation must be ontologically-closed, a fact which has negative implications for the possibility of "strong" computationally emergent artificiality or CEA (chapter 5).

In the context of a critique of AI, Kelly (1993) has argued that the tendency to exaggerate the capabilities of computers arises as a consequence of

- a tendency to anthropomorphise our artifacts.
Kelly maintains that although "the computational metaphor has given us valuable insights into the possible nature of human mentation and the more refined exploitation of computers .. there is always a danger that it will be pressed too far." (p.8) While Kelly's observations apply to types of artificiality other than AI, it is the anthroporphization of artifacts which is of particular significance since it points to a wider tendency, viz. morphization, that is, projection of characteristics, properties or features associated with one phenomenal domain (category) onto another (and visa-versa), based on a shift in the categorial "cut", that is, change in the definition of categories, made by the anthropic component (human artificer-interpreter). An appreciation of the link between morphization and "cutting" or abstraction is important because the latter supports functionalism and multiple-realizability (chapter 4) and, thereby, the possibility of "strong" computationally emergent artificiality or CEA (chapter 5). Morphization occurs in both the natural sciences and the "sciences of the artificial": For example, analytic-reductions such as matter-computation (Davies,92), life-computation (Dawkins,95), and mind-computation (Fodor,80), and synthetic-emergences such as computation-matter (Fredkin,90), computation-life (Langton,89b), and computation-mind (Minsky,85) emergents (Fig 1.6).
Isomorphisms (behavioural, structural, functional etc) can be established between the two domains (artificiality and naturality) by adopting a functionalist metaphysics (chapter 4). Since the establishment of isomorphisms necessarily involves *morphization*, this results in the conflation of the categories of naturality and artificiality (as artifactuality) and their subsumption under a new generic category, viz. *phenomenality*. However, it is crucial to appreciate that morphization is made possible by interpreting the distinction between artificials and naturals in *epistemological* terms, that is, in terms of the appearance-reality distinction. In section 1.5.2 it was argued that an orthogonal *ontological* distinction exists and in this section the latter has been shown to be grounded in the *poietic difference* between naturals and artificials as *artifactuals* (chapter 6). In the context of this study, which is concerned with evaluating the sufficiency of computationalism as the metaphysical basis of a unifying framework of emergent artificiality, this latter distinction is of *critical* significance: As stated in section 1.6.2, for Heidegger, there is no appearance-reality discontinuity in naturals since originary *physis* (that is, *poiesis as such*) is continuous with derivative *physis* (that is, *autopoiësis*). However, *physis* (*autopoiësis*) is categorically distinct from *techne* (*allopoiesis*) which means that a *poietic* isomorphism cannot be established between naturals and artificials (as artifactuals). Since Being and becoming (*poiesis*) stand in essential, unitary relation, this means that an ontical (or ontological) isomorphism cannot be established between naturals and artifactuals - irrespective of whether epistemological isomorphisms (behavioural, functional, structural) can be constructed. In short, insofar as the object of concern is ontology (that is, the Being of natural and artificial (as artifactual) beings), epistemological issues (as traditionally conceived) are simply irrelevant: Naturals and artificials are ontologically distinct.

It is maintained herein that the possibility of "strong" computationally emergent artificiality or CEA (chapter 5) is grounded in two assumptions, viz. (1) the *relevance* (or *necessity*) of the (Kantian epistemic) appearance-reality distinction and (2) the *irrelevance* (or *contingency*) of the (Heideggerian ontic) artifactual-natural distinction. In order to appreciate this fact, it is necessary to examine the ontic (productive, organizational) and epistemic (interpretative, observational) relationality that holds between natural and artificial (as artifactual) phenomena and the anthropic component (artificer-interpreter); hence, the need for a phenomenology of *poiesis* (chapter 7).

In section 1.6.3, it was briefly argued that consciousness might be emergent, but in a radically Heideggerian sense. The significance of this for *poiesis*, computationalism, emergence and artificiality requires clarification and the means by which this will be attempted is through a brief discussion of Descartes' maxim, *cogito ergo sum*. According to Walsh (1967), if the validity of the Cartesian dictum - which is usually interpreted as "I think therefore I am" - is accepted then the certainty of metaphysical statements must derive from their status as the products of the ego's reasoning. However, Heidegger (1967) has warned against this naive interpretation of the *cogito:*
In 'I posit' the 'I' as the positer is co- and pre-posed as that which is already present, as the being. The Being of beings is determined out of the 'I am' as the certainty of the positing. The formula which the proposition sometimes has, 'Cogito ergo sum', suggests the misunderstanding that it is here a question of inference .. [However] Descartes himself emphasizes that no inference is present. The sum is not a consequence of the thinking, but vice versa; it is the ground of thinking, the fundamentum. (pp.278-279)

Thus, it appears that Descartes was himself aware that the inversion of the dictum, viz. sum ergo cogito or "I am therefore I think", must also hold: If there is such a thing as a thinking thing, then it must partake of Being since it exists and to exist is to partake of Being; moreover, Being is prior to thought (Heidegger,59). Arnold (1992) has argued that the Cartesian dictum should be reinterpreted as "I experience therefore I am": On this view, it is ontological subjectivity, that is, conscious experience or awareness, and not rationality which provides the indubitable ground of all things, a position adopted by the early Husserl. However, the Heideggerian argument can be applied to this (re-)interpretation of the maxim yielding "I am therefore I experience".

As stated previously in section 1.6.3, Heidegger's post-Kehre thinking is concerned with establishing (that is, unconcealing) the truth of Being. However, the existential analytic of Dasein undertaken in Heidegger's pre-Kehre period must be viewed as preparatory relative to the post-Kehre project since in order to understand Being it is necessary to understand that being for which Being is an issue, viz. Dasein. But what is it about Dasein that makes it possible for Being to be an issue? According to Heidegger, the primordial mode of human existence is being-in-the-world which is non-thematic (that is, unconscious) and characterized by coping, that is, a "pre-ontological understanding" of Being. It might be argued, however, that the ability to reveal (or unconceal) pre-ontological understanding necessitates the existence of a different kind of understanding, specifically, conscious (or thematic) reflection since the former is only knowable to human beings in their capacity as conscious subjects. In support of this contention, Waterhouse (1981) cites Husserl's objection to Heideggerian ontology, viz. knowledge of Being is also knowledge, so epistemology must be primary. In an attempt at answering this criticism, Dreyfus (1991) maintains that Heidegger would probably claim that his hermeneutics is a special form of involved deliberate attention .. If this is so, then Heidegger must mean to distinguish his involved thematic analysis of existence, which reveals that in which we always already dwell, from the detached, objectifying thematization characteristic of any discipline from physics to factual history. (p.83)

This argument is not entirely satisfactory since it is a fact that Heidegger is only able to do hermeneutics because he already is a thematizing or reflecting being. Moreover, when the emergence of Cartesian consciousness from non-conscious Dasein is investigated scientifically, that is, assuming a materialist metaphysics, it immediately leads to what is referred to as the "hard problem" (chapters 4 and 7), viz. how subjective experience can be generated by objective matter. Accepting the reality of this problem renders emergent-materialist interpretations of Heidegger's thought such as those presented by
Dreyfus (1991, 1992) and Globus (1995) problematic. The issue can be resolved if Heidegger's (1959) support of Parmenides' maxim, viz. thinking and Being are the same, captured in the statement "there is a reciprocal bond between apprehension and Being" (p.145), is taken to imply the ontological primacy of Being-Thinking or Being-Experiencing. Such a view appears to be consistent with panpsychism (de Quincey,94,96) and panexperientialism (Griffin,88a,88b,93,98): On the former, which is a variant of animism, phenomena are held to be conscious all the way down the phenomenal hierarchy; on the latter, which is a more sophisticated view, experience is predicated necessarily at the lowest-level in the phenomenal hierarchy and contingently at higher levels, consciousness being a high-level experience.

Although panpsychism lends support to the "strong" artificiality possibility of experiential AI, viz. everything is experiential so AI is also experiential, on panexperientialism, which is grounded in Whitehead's (1978) philosophy of organism, this is not necessarily the case. Panexperientialists maintain that only primordial matter is necessarily experiential. While it is certainly possible that phenomena other than primordial matter can be experiential, even conscious - this is trivially true since human beings are instances of conscious phenomena - it is not necessarily the case that all phenomena are experiential. Panexperientialism is based on a hierarchical view of the world in which experience at one phenomenal level in the hierarchy contributes to the production of experience at a higher level. Whitehead distinguished in his philosophy between two types of organisms, viz. simple aggregates and genuine individuals: In the former, the organism is a non-experiential whole composed of parts which are themselves experiential, a consequence of the particular kind of organization associated with aggregates which leads to the `cancelling out' of the individual experiences of the parts in the whole. Genuine individuals, by contrast, are experiential, enjoying a different order of experience than their parts, because of the specific organization of these parts in the whole that is the individual. Thus, on panexperientialism, organization (or form) is the fundamental concept, a position which allows for the possibility of conflating panexperientialism with functionalism, and, thereby, computationalism, the latter of

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54 As stated previously in section 1.6.3, there is (at least) one other way of interpreting Heideggerian emergentism, viz. as a movement from that which is prior to ontological objectivity (matter) and ontological subjectivity (mind) to ontological subjectivity (mind). As shown in chapters 6 and 7, on this scheme, there are no "hard" or category problems as such; rather there is the problem of explaining incipient emergence (chapter 6), that is, the movement from the ontological (existential) to the ontical (causal).

55 In fact, this is not the case since panexperientialism is based on a processualist metaphysics (chapter 2), whereas Being-Thinking is neither substantial nor processual; rather, it is the existential ground of the categories of substance and process (chapter 6).

56 Experiential AI is merely possible on panexperientialism. However, in chapter 7 it will be shown that this latter position is problematic since it fails to take into consideration the implications of the poieitic difference (chapter 6) between naturals and artificials (as artifactuals) for the question concerning emergence (Ali,98b).
which is intrinsically linked to formism (chapter 2). This is readily shown by considering again the "hard problem" reinterpreted as the problem of crossing ontological categories. If, as Nagel (1979) states, it is impossible "to derive a pour soi [mental subject] from an en soi [material object]" (p.188), the solution to the "hard problem" must lie in the subsumption of the categories of mind and matter either in a meta-category or in something which is prior to the categories. If panexperientialism can be conflated with computationalism then the "hard problem" can be solved by postulating a computational metaphysics: On this view, computation is claimed to be a meta-category subsuming the categories of matter and mind because it is assumed that the maxim "hardware is to software as matter is to mind" is valid (chapter 2) and hardware and software are logically (functionally) equivalent (chapter 5). However, Tallis (1994) maintains that three of the terms in the above maxim (matter, hardware, and software) belong to the same ontological category - the objective - whereas mind belongs to a different ontological category - the subjective. For precisely this reason, computation is incapable of providing an ontology based on a meta-category subsuming matter and mind and cannot solve the "hard problem" (chapter 7). Moreover, although computation is ontologically-objective (externalistic, non-experiential, third-person), it is not objectively real in the way that things in the natural world are objectively real. Computation is an instance of what Searle (1995) refers to as institutional or socially-constructed facts that are ontologically inter-subjective rather than ontologically-objective. In chapter 7, such arti-facts are classified as "hard" (or pure) - in contrast to "soft" (or impure) - and characterized in terms of a priori epistemic (designed) and a posteriori ontic (made) relationality relative to the anthropic component (artificer-interpreter). It is crucial to appreciate that "hard" artifacts are ontologically-ideational (or formalistic) - that is, their Being is defined purely in formal terms because specification of forms entails closure (circumscribedness, boundedness) to emergence.

As stated previously, technē-Enframing (Gestellen), that is, allopoiēsis or bringing-forth by human beings, necessarily involves `cutting' (abstraction) as a preliminary phase in artificing. `Cutting' is necessary in order to identify what are to count as parts, irrespective of whether the `cutting' activity is performed in the context of analysis (interpretation) or as the basis for further activity in synthesis (production), and irrespective of whether the latter involves top-down design or bottom-up emergence.

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57 On panexperientialism, this meta-category is prior and is the experiential event or actual occasion. On Heideggerian pluralistic-emergentism (chapter 6), by contrast, what is prior to ontological objectivity and subjectivity is being-in-the-world.

58 Assuming some variant of realism is correct.

59 First-person experience, by contrast, is intra-subjective (chapter 7).
All `cutting' necessarily produces objective entities since `cutting' is done with the artificer or productant in the mode of the Cartesian subject relating to objects; furthermore, artificing (synthesis, production) is necessarily carried out in the same mode and characterized in terms of a movement between objects (chapters 6 and 7). This leads to the formulation of the following two axioms which, in conjunction with the assumption of the validity of the "hard problem" can be used to formally decide on the possibility of "strong" computationally emergent artificiality or CEA (chapter 5), viz.

\[ \text{Technē} (T) \text{ necessitates `cutting' } (C) \quad T \rightarrow C \]  
(1)  

\[ `\text{Cutting' generates objects } (O) \quad C \rightarrow O \]  
(2)  

Axiomatizing the "hard problem" (chapter 7):  

\[ \text{Objects cannot generate subjects } (S) \quad O \rightarrow \sim S \]  
(3)  

Applying **modus ponens** to (1), (2) and (3):  

\[ \text{Technē cannot generate subjects } \quad T \rightarrow \sim S \]  
(4)  

If the above axioms are correct, which will be established in the course of this study, then it follows that "strong" CEA is impossible since it leads to a problem, viz. the "hard problem" (chapter 7), which cannot be solved on the assumption of computationalism - an ontologically-**objective** (externalistic, non-experiential, third-person) metaphysics (chapters 2, 6 and 7). In short, computationalism is insufficient as a metaphysical basis for a unifying framework of "strong" emergent artificiality which, given the existential fact that naturality has `solved' the "hard problem", implies that nature does not (only) compute.

### 1.7. Thesis

This thesis may be formally stated as follows:

**Computationalism is insufficient as a metaphysical basis for a unifying framework of "strong" emergent artificiality.**

### 1.8. Objectives

While this thesis is concerned with evaluating computationalism in the context of artificiality, its implications necessarily transcend the "strong" artificiality debate. Just as the negative results of the classical (top-down, symbolic) computationalist AI project had negative implications for the computational theory of mind, it is argued that the negative results arising from the computationally emergent artificiality or CEA project should have negative implications for computational-naturalism. As Barrow (1991)
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states,

perhaps the image of the universe as a computer is just the latest predictable extension of our habits of thought. Tomorrow, there may be a new paradigm.” (p.204)

A consequence of the possibility for morphization (section 1.6.5) afforded by the abstracting tendency within functionalism, is the possibility of critiquing a naturality conceived in functionalist - in this case, computationalist - terms via a critique of artificiality. Previous critiques of artificiality have tended to focus on the shortcomings (ontological, epistemological etc) associated with specific artificialities (such as AI and A-Life). What is conspicuously absent from the literature, however, is indication of any concerted effort to unify the artificialities into a single framework and thereby provide the means by which to evaluate candidate ontologies claimed to be able to support the emergence of artifactual analogues of phenomena held to have emerged in the natural world. For this reason, a unifying framework of computationally emergent artificiality or CEA (chapter 5) has been developed as part of the critical evaluation of computationalism reported in this study.

1.9. Strategy

The approach to establishing the validity of the above thesis (section 1.7) is briefly outlined as follows:

1. Examine the concepts of computationalism (chapter 2), emergence (chapter 3) and artificiality (chapter 4) in order to establish a philosophical basis for their unification.

2. Develop a unified framework of computationally emergent artificiality or CEA realized in a cellular automaton substrate based on a computational interpretation of Alexanderian metaphysics (chapter 5).

3. Investigate the distinction between ontical (causal, productive) and ontological (existential, incipient) concepts of poiēsis (becoming, coming-forth, bringing-forth) with a view to defining a poiētic difference between naturals and artificials grounded in Heidegger's ontological difference between beings and Being as such (chapter 6).

4. Explicate the poiētic difference via a phenomenological framework for evaluating designed and emergent artificiality based on ontic (productive, organizational) and epistemic (interpretative, observational) relations between phenomena (naturals and artificials) and the anthropic component (artificer-interpreter). Use this framework to distinguish between "hard" (or pure) and "soft" (or impure) artifacts and classify computationalism as an instance of "hard" artificiality. Establish the validity of the thesis (section 1.7) by showing how
computationalism fails to solve the category problem, viz. the problem of explaining how ontological subjectivity can emerge from an ontologically-objective substrate (chapter 7).

1.10. Note to the Reader

Although the thesis can be stated briefly, establishing its validity necessitates detailed examination of a wide variety of intricately related issues, both scientific and philosophical in nature. For this reason, and to anticipate possible criticisms of the study on the grounds that it sets out to attack a "straw man", it has been necessary to provide extended analyses of certain critical concepts such as computationalism (chapter 2), emergence (chapter 3), artificiality (chapter 4) and unification (chapter 5). Additionally, and assuming a basic unfamiliarity with continental philosophy (specifically, existentialist ontology) on the part of the reader, a detailed critical overview of basic concepts within Heideggerian phenomenology relevant to this study has been presented in chapter 6.

The dissertation is structured in three parts: Part I Construction (chapters 2-5), Part II Deconstruction (chapter 6-7), Part III Reconstruction (chapter 8).