THE PROBLEM OF COMPLEXITY.
RE-THINKING THE ROLE OF CRITIQUE

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Declaration

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Summary

This dissertation departs from the argument that an encounter with complexity exposes the *breakdown* of traditional doctrines that have been taken for granted for too long (markedly modernist reductionism). Contrary to reductionist strategies that rely on the methods of analysis and isolation, the study of complex phenomena focuses on the dynamic relations and organisation of systems and their environments. Although the proliferation of ideas concerning the notion of complexity is abundant, there is no agreed upon definition that informs an overarching 'Theory of Complexity.' This problem is addressed by following the historical development in the field of systyms thinking. A distinction is made between 'restricted' and 'general' theories of complexity.

The study problematises the conceptual and empirical difficulties of studying complex phenomena. The impossibility of being able to have complete knowledge of complex systems is discussed in detail. It is argued that although the study of complexity serves as an alternative approach to reductionist approaches, our knowledge of complexity in principle remains a reduction thereof. This insight leads to the claim that the study of complex phenomena is at best a post-reductionist effort, which is necessarily a critical position. It is argued that the 'complexity approach' coincides with other poststructural approaches in the field of philosophy in general and with deconstruction in particular.

However, situating the complexity approach within poststructuralism is not unproblematic, seeing that poststructural forms of critique are marred by problems of legitimation. Allegiance to postmetaphysical ideals implies that objective grounds for justifying or warranting the choice of norms from where to launch critical inquiry are sacrificed. A deconstructive reading of the Kantian concept of 'critique' reveals a double movement that is at work in the concept. This double bind displaces the definition of critique to change to mean 'critique as stricture.' From this perspective the logic of *différance* is at work in critical analysis and the limitations of our meaning making strategies are exposed. It is suggested that 'critique as stricture' is a poststructural form of critical inquiry that regains legitimacy by operating in the tension of the force field created by antagonistic positions. A provisional grounding in the name of the limit emerges. The kind of thinking that can be cognisant of this general movement of 'critique as stricture' is found in the notion of 'complex thinking.' By drawing on Derrida' and Morin's reappropriation of Bataille's distinction between the restricted and general economy, it is demonstrated how complex thinking is operating within the movement of the general economy.

The study concludes with the argument that informed by 'critique as stricture,' the complexity approach progresses to what Cilliers calls 'critical complexity.' This brand of complexity distinguishes itself by a normative turn, which is distinguished by three imperatives: 1) the Provisional Imperative, 2) the Critical Reflexive Imperative and 3) the World-disclosing Imperative. All of these operate under the influence of the general economy, which allows critical inquiry to be grounded and legitimised in the tension of thinking antagonistic positions together without reducing them to one another.

Opsomming

In hierdie proefskrif word aangevoer dat die verskynsel van kompleksiteit die *disintegrasie* van tradisionele leerstellings se aansprake, wat te lank as vanselfsprekend aanvaar was, ontbloot (merkbaar reduksionistiese modernisme). In teenstelling met reduksionistiese strategieë wat staat maak op metodes van analise en isolasie, fokus die studie van komplekse verskynsels op die dinamiese verhoudings en organisasie van sisteme en hul omgewings. Alhoewel die studie van kompleksiteit ’n byna alledaagse verskynsel geword het, bestaan daar geen bindende definisie wat ’n enkele ‘Teorie van Kompleksiteit’ daarstel nie. Daar word spesifiek op hierdie probleem gefokus in terme van hoe die wetenskaplike studie van kompleksiteit histories ontwikkel het. Dit word aangevoer dat dit sinvoller is om eerder tussen ‘beperkte’ en ‘algemene’ teorieë van kompleksiteit te onderskei as om ’n oorkoepelende teorie te ontwikkel.

Heelwat probleme duik op in die poging om komplekse verskynsels konseptueel en empiries te bestudeer. Alhoewel die studie van komplekse verskynsels ’n alternatiewe posisie tot reduksionistiese benaderings daarstel, kan kennis van kompleksiteit in beginsel slegs ’n reduksie daarvan wees. As gevolg hiervan word die studie van komplekse verskynsels ten beste as ’n post-reduksionistiese poging beskryf wat noodwendig ’n kritiese posisie impliseer. Die kompleksiteitsbenadering stem in die algemeen met post-strukturele filosofiese benaderings, en spesifiek met dekonstruksie ooreen.

Hierdie ooreenstemming is egter nie onproblematies nie, aangesien post-strukutrele kritiese posisies deur probleme van legitimasie gekenmerk word. Lojaliteit aan post-metafisiese ideale het tot gevolg dat daar geen objektiewe, grondige vertrekpunt bestaan vanwaar normatiewe begrondings geregverdig kan word nie. ’n Dekonstruktiewe lees van Kant se idee van die begrip ‘kritiek’ openbaar dat daar ’n ‘double movement’ aan die werk is wat die konsep ‘kritiek’ kan verruim ten einde dit te verander om ‘critique as stricture’ te beteken. Die werking van *différance* is altyd betrokke tydens kritiese analise waardeur die beperkinge van ons singewende strategieë blootgestel word. Hierdie her-definiëring van kritiek as ‘critique as stricture’ stel ons in staat om nuwe lewe in die kritiese projek te blaas deurdat legitimiteit gevind word in die spanning van die kragveld wat geskep word tussen antagonistiese posisies. ’n Voorlopige grondslag word in die naam van die beperkings van ons denkstrategië gevestig. ‘Kompleksiteitsdenke’ (‘complex thinking’) stel ’n denkstrategie daar wat tred hou met die dinamiese beweging wat in ‘critique as stricture’ teenwoordig is. ‘Kompleksiteitsdenke’ word aan die hand van Derrida en Morin se interpretasie van Bataille se onderskeid tussen die

beperkte en algemene ekonomie gedoen ten einde te demonstreer dat ‘kompleksiteitsdenke’ binne die beweging van die algemene ekonomie val.

Die studie word afgesluit met die argument dat, ingelig deur ‘critique as stricture’, die kompleksiteitsbenadering tot die begrip ‘kritiese kompleksiteit’ ontwikkel soos voorgestel deur Cilliers. Kritiese kompleksiteit word deur ’n normatiewe impuls gekenmerk wat in sigself weer deur drie noodsaaklike eienskappe uitgeken kan word: 1) die Voorlopige Imperatief, 2) die Kritiese Refleksiewe Imperatief en 3) die Wêreld-ontsluitende Imperatief. Al drie hierdie imperatiewe staan onder die invloed van die algemene ekonomie wat ons toelaat om kritiese analise te begrond in die spanning wat onstaan wanneer antagonistiese konsepte saam gedink word sonder dat hulle tot mekaar gereduseer word.

Dedication

The process of writing this dissertation happened during the messy process of navigating between the limits that mark all lives. For me in particular, these limits were articulated by a beginning and an ending. On the one hand, there was the wonderful beginning brought about by the birth of our son Richard, in January 2010. Sadly however, this project also witnessed an ending, with the very untimely and sudden passing away of my promotor, mentor and friend, Prof. Paul Cilliers, in July 2011.

Dedicated to Paul, I hope that the ideas that were developed in this dissertation, may serve as an expression of my indebtedness to the person who influenced my understanding of complexity most profoundly. As Derrida reminds us in his book *The Work of Mourning* (2003),[i] there is a link between *death* and *debt*. Derrida contends that there are moments when, as mourning demands, one feels obliged to declare one's debts. We feel it our duty to say what we owe to our friends. And of course, this duty resembles an *incalculable debt*.

In light of the above, this dissertation is a small token of gratitude for the gifts and traces that Paul left behind in my life. The gift of his friendship, mentorship and persistent thoughtfulness now form the cornerstone of our inheritance. Being comforted by Derrida's words, the writing of this dissertation served as a kind of ongoing conversation between Paul and myself. And I hope that this will not be the last word of the conversation. In fact, we owe it to Paul to not stop thinking and writing about complexity. By writing and thinking with and through him, Paul, in his absence, offers us a way to interrogate the meaning of our own lives anew and in his own way he has given philosophy a chance to think artfully about the questions that challenge us on this journey we call life.

May we always be reminded of the many ways in which Paul touched our lives and how he infected us with the seeds of his ideas and extraordinary humanity. And who knows, in that strange tension between *absence* and *presence*, we might just catch ourselves thinking that traces of Paul are more present through his absence than we might have ever have imagined.

[i] Derrida, J. 2003. *The Work of Mourning*. (eds. Brault, P-A. & Naas, M.). Chicago: University of Chicago Press.

Him who measures the world and cuts it up in simple parts, him no
Him who thinks him is good because he follows rules, him no
Him who makes us believe him has one theory of everything, him no
Him who tricks us with fancy words and clever formulas, him no
Him who shows us complex thinking and teaches us to laugh through our tears,
Him Paul.

- modified from an ancient troll pictogram as found in the Discworld novels of Terry Pratchett.

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– And lastly, but most importantly the two men in my life: my husband Wolfgang and our son Richard. You have taught me that what is most important in life cannot be captured in the pages of a book or in theoretical principles—it is the lived experience of knowing that you are loved and cared for beyond measure that allows us to dream better futures for ourselves and others. My life has been changed because of your love and the wonder you bring to my existence.

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INTRODUCTION

> *Human reason has the peculiar fate in one species of its cognitions that it is burdened with questions which it cannot dismiss, since they are given to it as* ***problems*** *by the nature of reason itself, but which it also cannot answer, since they transcend every capacity of human reason.*
>
> – Opening words of the Preface of the second edition of Kant's *Critique of Pure Reason* (1998:99, Avii)

1. The turn to critique

More than some two hundred years after the publication of Kant's *Critique of Pure Reason* (1781), the study of philosophy is still concerned with a number of insoluble problems. The Kantian critical project that aimed to establish the conditions of possibility of reason and its questioning of the dogmatic theories of Kant's time remains an important and worthwhile undertaking for contemporary forms of critical inquiry. Kant was motivated by discontent for the kind of answers his peers were giving to questions regarding the nature of reality, the methods with which to study reality and the reach of their knowledge claims. If it is discontent that provokes criticism, the situation is no different today than it was in the time of Kant.

Although our contemporary world developed in ways in which Kant could not have dreamt, all our technological advancement, political freedom and scientific discoveries have not brought us closer to finding solutions for eliminating poverty or for preventing war and social injustice or crime against humanity. In fact, it seems that our current world is marred by being in a constant state of discontent and crisis (Ramos 2011) and that we are facing even bigger problems to solve than ever before when we consider the threat of global climate change, the rise of new and incurable epidemics, the threat of a depletion of natural resources and ultimately economic meltdown and severe recession.[1] In light of the above, it seems that there would be no age quite so disposed to discontent and criticism as ours.

[1] From the examples mentioned in this paragraph, it is clear that this study will explore the blind spots that reveal themselves in a critique of the assumptions of Western modernity. It is noted here that 'Africana' scholars like Lewis Gordon (2000, 2008) argue in favour of the view that Western modernity was not the first modernity ever to bring 'enlightenment' to humanity. Although this study acknowledges

A philosophical position that takes the challenges of living in a contingent world seriously and reflects upon it critically cannot afford to embrace a position that "comforts intellectuals in a world in decay", but should respond to "a calling to put reflective analysis to work as an instrument in handling moral, medical, and political issues" (Toulmin 2001:214). A central claim of this dissertation is articulated in the argument that a return to Kant's original concern with the notion of critique contains interesting and unexplored possibilies for constructing new meanings of the notion critique. By expanding and changing our ways of knowing the world, thinking about it and acting in it, philosophers are compelled to reflect critically upon their intellectual obligations in order to heal the wounds that false rationalities and arrogant ideologies impose on reason.

Considering the state of the world as described above, it is evident that the problems of our current age provide us with enough reason for discontent. And discontent always suggests that we become critical of current ideologies, policies, solutions and predictions. In light of the above, contemporary philosophical inquiry is challenged to engage with intellectual activities that offer new ways of knowing, thinking and acting so as to find answers to the difficult problems that mark our world today. Moreover, our modes of criticising the *status quo* should be of such a nature, that we are challenged to come up with new ways of responding to the difficult and often unsolvable crises that characterise current academic theories and practices that subsequently inform social and political institutions. As Kompridis (2006a:3) argues, an awareness that things are "terribly wrong" emerges from "the need to rethink our commitments to certain ideals and practices, perhaps to break free of them, by imagining previously untried or uncovering previously suppressed possibilities."

2. The place of complexity

A central premise of this dissertation is expressed in the argument that the *study of complexity* proposes a *critical response* with which to respond to current world problems and crises. Moreover, the dissertation suggests that the study of complexity offers us a new way of thinking

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the fact that Western modernity can be viewed as being one of many preceding paradigms of thought that influenced the ways in which humanity positioned itself in terms of its relation to nature, the main focus of this study will be concerned with the notion of Western modernity or Western rationality. It is not in the scope of this study to consider the political and historical importance of other modes of modernity that might have preceded or coincided with Western modernity, but such perspectives might be fruitful to consider in future research projects.

that is translatable into critical modes of action that have the potential to disclose 'previsouly suppressed possibilities' to know and study the world.

In this dissertation it will be demonstrated that an encounter with complexity exposes the *breakdown* of inherited doctrines that have been taken for granted for too long (markedly the Newtonian/Cartesian tradition). Within the current body of literature that is available on the subject of complexity, the notion of complexity is presented as offering a form of critique on the course of 'doing science as usual' and that it can open new windows upon reality and possibly even posing a 're-enchantment of reality' (Bhaskar 2002:242).[2]

Not only does the study of complexity provide us with the conceptual tools with which to tackle contemporary crises in the world, but it also serves as a productive force that overthrows the complacency of theoretical positions that assume congruent and comprehensive explanations of the world and humanity's place in it. As will be argued in this study, there is a double movement situated within the notion of complexity: the recognition of complexity is at once a critique of modernism (as encountered in Enlightenment thought strategies or logical positivism), and at the same time it offers a tool (a mode of critical practice) with which different strategies or interventions can be explored so as to negotiate the possibility of social change or transformation. Hence, the construction of a 'functional analogy' (Hofmeyr 2005:20) between the Kantian critical project (and the subsequent deconstructed notion of 'judiciary critique' into 'critique as stricture') and the complexity approach's exposure of the breakdown of traditional scientific analysis illustrates how the complexity approach can be situated within the broader framework of Critical Philosophy. The complexity approach exposes the limit of the 'epistemological field' (Butler 2002) and subsequently can be said to share a mutual concern for critique as expressed in the Kantian critical project. Deriving our understanding of critique from Kant, the following question expresses the problem of critique itself succinctly: 'Do you know

[2] The notion of 're-enchantment' as quoted by Bhaskar, is used in reference to the notion of 'disenchantment.' This term was first used by Max Weber in his essay *Science as Vocation* (originally delivered as a speech at Munich University, 1918, published in English in 1946) in which he offered a critique of the process of 'increasing intellectualization and rationalization' of knowledge. Weber used the term 'disenchantment' (or as he expressed it in German: '*die Entzauberung der Welt*') to refer to the consequences of the Enlightenment and its role of rationalising knowledge about the world. Modernity's elimination of mythical knowledge (a kind of knowledge which resembles the enchantment of the world) amounts to the 'disenchantment' of reality. In essence the disenchantment amounts to the fact

> … that principally there is no mysterious incalculable force that comes into play, but rather that one can, in principle, master all things by calculation. This means that the world is disenchanted. One need no longer have recourse to magical means in order to master or implore the spirits, as did the savage, for whom such mysterious powers existed (Weber 1946:132).

up to what point you can know?' (Butler 2002:220). This question coincides with the problem of complexity that is also concerned with the limits of our knowledge generating strategies.

In addition, this dissertation highlights the fact that although the acknowledgement of complexity encompasses a critical stance toward modernist thought strategies, it also at once recognises the fact that we cannot discard the premises of these strategies and that even the so-called 'complexity approach' (discussed in Chapters 1 and 2) is reductionist in essence. However, the acknowledgement of the limitations of our scientific strategies and knowledge producing practices does not suggest that we succumb to some kind of nihilism or relativism. Often theories that are critical toward modernist thought strategies (markedly postmodernism and poststructuralism) are criticised for their lack of guiding principles and 'anything goes' mentalities (as discussed in Chapter 3). Hence, an important concern of this dissertation is expressed in suggesting a way of thinking (see the notion of 'complex thinking' as discussed in Chapter 4) that could equip us to overcome the logic of binary oppositions so as to negotiate our way through either/or deadlocks.

3. Reading together complexity and critique

Drawing on the challenge that the preceding argument presents, this dissertation suggests that there is a middle way that might help us navigate the stalemate of a binary logic. We are not left with a grand 'either/or' choice (i.e. either we subscribe to modernist principles and are labelled positivist dogmatists, *or* we embrace postmodernism and are pigeonholed to be relativist anarchists). Based on and derived from a deconstructive reading of Kant's notion of critique and enriched with Derrida's (non-)concept of *différance*, the generative movement of the Derridean double bind is inscribed into both the concepts 'critique' and 'complexity.' A synergy is formed which amounts to the notion of 'critical complexity.' What do I hope to accomplish by focusing the attention on the reading together of the notions 'complexity' and 'critique'? I hope to establish an argument that allows for the possibility that the notion of *critical complexity* (discussed in Chapters 3 and 5) presents a way out of the either/or predicament of the binary logic. To be sure, critical complexity suggests a 'brand' of complexity thinking that is informed by a kind of thinking that overcomes the either/or dilemma (see Chapter 4). It proposes an 'and/and' way of thinking that allows us to be critical of modernist or reductionist strategies, without discarding them and at the same time it affords us the means with which to expand these strategies to include other ways of thinking and doing.

Moreover, the notion of critical complexity represents a 'theoretical balancing act' (Hofmeyr 2005:21) that allows us to negotiate the challenges of finding legitimate groundings from where to formulate principles in whose name a postmetaphysical form of critique can be justified. Critical complexity offers us three such non-foundational grounding principles (they substantially overcome the 'problem of legitimacy' as discussed in Chapter 3), namely the Provisional Imperative, the Critical Reflexive Imperative and the World-disclosing Imperative (see Chapter 5), that pose a restorative critical practice, which allows for new and alternative ways of responding to the condition of complexity.

4. Aims of the study

This dissertation has five general underlying aims that guide the structure and nature of the arguments presented here. These five general aims can be summarised as follow:

1) To delimit and provide some conceptual clarification for the relatively new field of study that is often called 'complexity theory.' Chapters 1 and 2 are concerned with such a theoretical and conceptual demarcation and provide a critical overview of the current trends noticeable within the body of knowledge that informs the theoretical engagement with complex phenomena.

2) To situate the problem of complexity within the broader philosophical framework in general and to clarify how the implications of adopting a complexity approach coincide with the challenges that mark poststructural philosophical positions in particular. The most salient challenges are identified as being that of reductionism and legitimation.

3) To formulate some conceptual device by which the crisis of legitimation that marks poststructural forms of critique (of which the complexity approach belongs to), can be overcome. This device is found in the notion of 'critique as stricture' by means of a deconstructive reading of the Kantian notion of judiciary critique (see Chapter 3).

4) To engage with the notion of 'complex thinking' more substantively as has been done up until now. Chapter 4 offers an in-depth discussion of how the notion of 'complex thinking' can be conceptually consolidated and substantiated by developing Morin's notion of the difference between 'general' and 'restricted' complexity in more detail.

5) To build and expand on the notion of 'critical complexity' as initiated by Cilliers (Preiser & Cilliers 2010, Woermann & Cilliers 2012) and to explain why this 'brand' of complexity differs from other interpretations of complexity that are mainly interested in descriptive interpretations of complexity. At the same time these markers could provide some non-foundational grounding principles whereby the challenges of reductionism and legitimation (as mentioned above in point 2) that characterise the crisis of current critical theorising can be overcome.

In order to fulfill these aims, the study will demonstrate that an acknowledgement of complexity demands a revision of theories and scientific practices that reduce and conceal the epistemological consequences that emerge during our engagement with complex phenomena. This requirement will be supplemented with the argument that a theoretical perspective that embraces the implications of acknowledging complexity necessarily demands to be a critical position.

In this study it will be argued that a General Theory of Complexity (see Chapters 2 and 5) provides us with the conceptual means with which to develop an expanded definition of the concept critique whereby the critical project of Philosophy can be revitalized. This project will draw on a definition of critique that is informed by a deconstructive reading of Kant's definition of 'judiciary critique' (or 'critique as judgement') as used in his *Critique of Pure Reason* (1998) (see section 5.1 in Chapter 3) in general and more specifically, in terms of what Kant intended with his project of critique. The study will demonstrate how this expanded (or deconstructed) understanding of the Kantian notion of 'judiciary critique' can be explained in terms of Derrida's concept of *stricture* and how 'critique *as* stricture' is informed by the logic of *différance*.

To be sure, the study will argue that the re-thinking of the role of critique as *stricture/différance* is a task that compels one to move beyond the point of analysing concepts in binary opposition. This will be done by examining the distinction between 'restricted' and 'general' economy as coined by Bataille and re-appropriated by Derrida and Morin (see Chapter 4). Derived from a complex systems understanding of how meaning and our interpretation of reality arises, the notion of *complex thinking* proposes a type of thinking that necessitates a double movement similar to what Derrida calls the double bind. It suggests that the concept and its counterpart (the *yes* and the *no*) are thought simultaneously. Morin (2007) calls this the "logical core of complexity" which is *dialogical* in nature. However, the art lies not in thinking of opposing

concepts in binary motion, but in terms of how the one is dependent and determined by the other. This dialogical way of thinking which marks the 'logic of complex thinking'[3] will then form the backbone for formulating an understanding of complexity that is informed by the general economy (discussed in Chapter 4). It incorporates an understanding of 'critique as différance' in order to consecutively progress to what Cilliers calls 'critical complexity' (Preiser & Cilliers 2010, Woermann & Cilliers 2012). By inscribing the generative movement of the Derridean double bind into both the concepts 'critique' and 'complexity' a synergy is formed which amounts to the notion of 'critical complexity.' It will be argued that an understanding of critique that is informed by the 'logic of complex thinking' (see footnote 3) cannot dismiss normative issues when engaging with reflexive analyses and that critical complexity marks the normative turn in the study of complexity. The notion of critical complexity is then consolidated by discerning it from other brands of complexity by being recognisable in terms of three non-foundational grounding principles, namely the Provisional Imperative, the Critical Reflexive Imperative and the World-disclosing Imperative, that pose a restorative critical practice, which allows for new and alternative ways of negotiating complex realities.

In developing a deeper understanding of what 'critical complexity' could mean, this dissertation will draw heavily on the work of Cilliers who invented this concept but never had the chance to develop it in more detail. In addition, the study endeavours to give more substance to the idea of critical complexity by drawing on the work of authors such as Morin, Derrida, Heidegger and Kompridis (see Chapter 5).

5. Methods employed in the study

Guided by the aims of this study as explained in the preceding section, Chapters 1 and 2 set out by engaging with the notion of complexity by means of a thematic *descriptive analysis* of the conceptual underpinnings and theoretical development that inform the study of complexity. Simultaneously these two chapters offer an exposition of the problems of complexity and the subsequent implications these problems have for our knowledge generating strategies.

[3] Throughout this dissertation the terms '*logic* of complexity' or '*logic* of complex thinking' will be used. It should be noted that the word 'logic' in this respect could be translated to mean 'the *way* or *mode* of thinking or reasoning that informs this thought strategy.' Hence, the use of the term 'logic' in this respect should not be confused with the more formal meaning of the term which refers to the 'discipline of logic' (as found in the study of analytic philosophy and mathematics) that determines how arguments can be constructed to be valid or invalid according to deductive and inductive forms of reasoning (of which the work by Copi (1968) is exemplary). Hence, the use of the word 'logic' in this study can be replaced (or used interchangeably) with the notion of *economy* (as discussed in Chapter 4) which supplements the term 'logic' and is used as an alternative concept to describe the thought process whereby meaning is created.

Chapter 3 introduces a shift in the methodology by establishing a meta-position from where the insights regarding the study of complexity are extrapolated to inform a complexity approach. The characterisation of complexity developed in Chapter1, and the subsequent implications for the status of our knowledge of complex matters (Chapter 2), resonates in many ways some of the central insights of poststructural philosophy in general, and with deconstruction in particular. As argued by Preiser & Cilliers (2010:271–274) a certain sensitivity to complexity permeates the deconstructive logic. In an attempt to foster some sustained activity between the complexity approach and deconstruction, Chapter 3 proceeds with a deconstructive reading of Kant's understanding of 'judiciary' critique. The deconstruction is performed by exposing and displacing the 'structural unconsciousness' (Derrida 1988:18) of the hierarchies found in the Kantian notion of critique. Reflecting on the mechanisms of deconstruction, Culler (1998:136) explains that a text or a concept can be deconstructed by considering "the literary significance of proper names and signatures, the structure of double binds" and also by means of "explorations of signifying links between words associated with the phonological resemblance or etymological chains." From this explanation of how a deconstruction can be undertaken, Culler (135) remarks that "deconstruction is, among other things, an attempt to identify *grafts* in the text it analyzes" (my own emphasis added).

Departing from this interpretation of how one can go about 'doing a deconstruction,' by exposing some grafts, the notion of Kant's interpretation of critique as being a judiciary process, is deconstructed by considering the grafts of the 'etymological chain' of the German translation of the word 'judgement' (*Entscheidung*). The justification for using the German understanding of the word 'judgement' can be found in the fact that Kant principally wrote in German. His understanding of the term 'critique' was strongly influenced by the structural hierarchies that exist in the German language and the affiliation between the literal meaning of engaging in the process of criticising and the notion of judgement. As Culler (135) remarks, "Derrida speaks of Kant's theory as the product of grafts." Hence, a double bind is exposed in the literal meaning of the word *Entscheidung* which is then grafted onto the notion of critique. From this process of grafting, a new and displacement meaning of the notion of critique emerges that can best be explained to mean 'critique as stricture.'

From this point onward, the economy of deconstruction, best described as the workings of *différance* is present in the conceptual development of the remaining themes, namely, the concept of 'complex thinking' (Chapter 4) and ' critical complexity' (Chapter 5). Analogous to how the grafting of the economy of *différance* changes and expands the meaning of critique; the

focus of the remaining chapters is also on establishing new and displaced meanings for the characterisation of 'complex thinking' and 'critical complexity.' As a result, traces of deconstructive processes permeate the remaining chapters.

Often the deconstructive 'method' is criticised for its 'impenetrable discussions' and for not engaging with arguments in a serious manner (Habermas 1987). However, this misreading of the deconstructive approach is based on the interpretation that the driving force of deconstruction is that of destruction and ridicule by means of fatal attacks. A more rigorous understanding of deconstruction's strategies demonstrates that its real aim is to destabilise and unsettle reified hierarchies that are locked into the structure of 'polarised doubles' or 'binary oppositions' (Gross 1986:32). Subsequently the outcome of this process of destabilisation provides a more affirmative reading. Contrary to Habermas' critique of deconstruction, this means that to deconstruct a position is not to dismiss it, but to take it rather seriously (Preiser & Cilliers 2010:272).

A pertinent reason why this study draws on utilising deconstructive strategies as a method of analysis and as a tool with which to forge new meanings for concepts like 'critique', 'complex thinking' and 'critical complexity' is found in the argument that although deconstruction cannot be characterised as a form of critique (Gasché 1994), it can be defined as being a poststructural critical strategy or analysis (Gross 1986). Reflecting on the critical nature of deconstruction, Lescano & Christensen (2012:106) argue as follow:

> Deconstruction is, therefore, not merely an external act of critique, which is performed by romantic individuals. Rather, it is far more, not only an internal, but also a constitutive moment within law. Deconstruction alone allows us to grasp the distinction between the decision as an assertion of the law and the communication of law as a decision in all its fundamental import.

By replacing the word 'law' in the preceding quote with 'our systems of meaning' a strong link is forged between the working of deconstruction and the ideals that inform the complexity approach. This mutual concern that is shared by both deconstruction and the complexity approach is articulated succinctly in the following quote by Gross (1986:31): "Its (deconstruction's) aim is the more provisional one of exploring the limits of tolerance of these metaphysical systems, pressing them to a point of cracking." Hence, in this study deconstructive strategies are employed to crack open, rupture and interrupt the traditional interpretations of the

notions of especially ‘critique’ and ‘thinking’ and to inscribe meaning to the concept of ‘critical complexity.’

In addition to serving as a form of critical analysis that is utilised so as to generate new conceptual meanings, the employment of a deconstructive way of writing and reading allows for constituting a shift from a descriptive engagement with complexity to that of a normative engagement thereof as expressed in Chapter 5. There is a progression from a descriptive level to a meta-position in which the implications of complexity is critically assessed in terms of its philosophical dimensions. Last but not least, the deconstructive approach warrants a self-critical appraisal of critique: by rendering a critical analysis on the notion of critique, a critique of critique is allowed to take place. This self-reflective critical analysis then performs what it claims: it embodies a mode of critical practice and ensures that the claim that the progression to ‘critical complexity’ as a form of critical practice is warranted to be an authentic claim.

The nature and course of the progression of the dissertation’s engagement with both the notions ‘complexity’ and ‘critique’ is explained in the next section.

6. Structure of the study: three ways of reading the problem of complexity

In light of the positive possibilities that the study of complexity poses for engaging with the difficult problems of the world, it seems like a contradiction to present a title that suggests that this ‘solution of complexity’ can be problematic. In this respect, this dissertation sets out from a self-undermining point of departure (this starting point is also influenced by the deconstructive logic that permeates this dissertation). On the one hand, the dissertation upholds the argument that a complexity approach coincides essentially with a critical practice that exposes the breakdown of traditional scientific assumptions about the nature of the world and our models thereof that assume congruent representations of the world. On the other hand, however, the complexity approach does not offer us a fool-proof method to counter the workings of reductionist positions (as expressed in positions such as scientific realism and logical positivism), even though theories of complexity generally claim to offer exactly such a possible alternative strategy.

Building on this possibility of presenting an anti-reductionist position, the upsurge in the popularity of complexity and the current flare-up of popular and scientific interest in the notion of complexity makes it “one of the fastest growing topics of research in the natural and social

sciences" (Allen *et al.* 2011:1). The extent of this development effuses the impression that a concise definition of what is meant by the concept "complexity" is available. It furthermore also suggests that a unified 'Theory of Complexity' or 'Science of Complexity' exists from where specialists and practitioners in all the various fields of expertise draw their assumptions from. Such a presumption could not be further removed from the truth. A closer engagement with the seminal literature that informs what is understood to be known as 'Complexity Theory' unveils the fact that not only is there no mutually agreed upon definition of the notion 'complexity,' there is also no unified 'Theory of Complexity' that clarifies and prescribes how the different concepts that are related to the study of complex phenomena should be interpreted and framed.

Subsequently, the use of the word 'problem' in the title of this study suggests that the notion of complexity is a complex and problematical matter in itself. To be sure, the word 'problem' introduces a double bind in its relation to complexity: it recognises that the complex nature of the world is problematic, but simultaneously it suggests that 'the solution' that complexity theory offers is not *unproblematic*.

Thus, a first reading of the title focuses on the *meaning* and delineation of complexity as a concept. On another level, the wording of the title can also be read to mean that the notion of complexity can be viewed as a problem in the sense that it poses a challenge for "traditional disciplinary assumptions and boundaries" (Allen *et al.* 2011:1). This second and double meaning of the "problem of complexity" can be linked to what complexity *does*. The presence of complex phenomena is an unsettling force that undermines the scientific assumptions on which traditional theories of knowledge are based. In this respect, the acknowledgement of complexity unsettles and questions the foundations and legitimacy upon which whole schools of thought have been built. And here the link to the notion of critique is made. By questioning the conditions for generating knowledge about the world and by exposing the limits of what we can know, the nature of complexity is revealed to be linked to the Kantian idea of critique.

Thus, it will be demonstrated that the problem of complexity is not a problem that can be studied in isolation, but that a probing into the nature of complex phenomena opens up a number of other related problems. In this dissertation it is suggested that the implications for acknowledging complexity spill over to problematising the notions of knowledge (discussed in Chapter 2), the notion of critique (discussed in Chapter 3) and eventually they pose challenges to our modes of thinking (discussed in Chapter 4). Read on one level, it might seem that these four problems (i.e. the problems of complexity, knowledge, critique and thinking) stand

somewhat disconnected and unrelated to one another. However, the four thematic problems are shown to be embedded in a broader philosophical context that cannot be ignored. Read on a second level, it can be shown that not only are these four problems not unrelated to one another, but that they are linked on a number of levels as will become apparent in the structure of the study.

The dissertation will demonstrate that the acknowledgement of complexity is not just an inconvenient obstacle for the modelling strategies of natural scientist, but that the difficulties and implications thereof can be translated into existing philosophical problems. On a third level, the four different problems can be interpreted as belonging together based on a golden thread that runs through them all, this thread is recognisable in the acknowledgement of the limitations and shortcomings one faces in the attempt to come to terms with complexity (namely, that even a so-called complexity approach does not escape the traps of reductionism as discussed in Chapter 2). This simultaneous triple reading of the problem of complexity can be explained in more detail as discussed here below.

6.1. First level of reading: the problems of complexity exposed

The composition and structure of this study reflects and departs from the double meaning that is hidden in the title of the dissertation. The study consists of three parts that reflect the triple reading strategy as explained here above. The three parts reflect a progression in the development of the notion of the *problem* in this study. Not only the notion of complexity progresses, but the nature of the problematic also develops alongside the conceptual development. There is a steady progression built into the structure of the study that suggests a certain development in defining the kind of problem that we are dealing with when engaging with complexity.

A first level of reading engages in a straightforward manner with the problems that the study of complexity poses. These are described and dealt with in three Parts.

6.1.1. Part I: Observing complexity

In this section the problem of the phenomenon of complexity is examined on the level of observing complexity empirically. Complexity is discussed in terms of viewing it as an object of

study and the related difficulty of defining it, finding some conceptual grip with which to deal with it and how the study of complexity is influenced by the nature of the object under scrutiny.

Chapter 1 focuses in particular on the conceptual difficulties that mar discourses of complexity. It aims at laying down a firm basis for the rest of the study by problematising the conceptual and phenomenal (or empirical) descriptions of the notion 'complexity' and the consequential formation of a number of 'theories of complexity.' In the first place this chapter serves as a kind of introduction to the larger field of study that concerns itself with the notion of complexity in general. It strives to explain the different theories that populate the field of study in order to aid the reader in finding her way conceptually. The chapter also gives an overview of the conceptual origins of complexity in terms of its shared history and development in the fields of General Systems Theory, Cybernetics and the study of Artificial Intelligence.

In the second place, the chapter discusses the physical characteristics of complex phenomena in order to start formulating general trends that characterise theories of complexity. This is done in order to propose a 'General Theory of Complexity' (as opposed to a 'Restricted Theory of Complexity') that could serve as the guiding paradigm for the purpose of thinking about complexity in this study. From the characteristics of complex phenomena it can be derived that the knowledge generating assumptions and practices of the traditional Cartesian and Newtonian paradigms do not hold in the face of complexity. Consequently, the act of recognising complexity has important implications for studying and generating knowledge thereof.

Chapter 2 elaborates on this problem and relates how an acknowledgement of complexity influences and challenges traditional scientific theories and practices. The chapter embarks on the problem of knowledge by exposing the limitations and shortcomings of the Newtonian paradigm in light of scientific discoveries made in the last century. The breakdown of the Newtonian paradigm is described in terms of the developments and insights from various scientific fields and illustrates how life after Newton offers more realistic interpretations of how our epistemologies can reflect (or fail to reflect) our knowledge of the world. The notion of reductionism is a key concept in this chapter. It is argued that even though theories of complexity generally oppose reductionist assumptions in scientific reasoning, one does not get away without reducing complexity in the attempt to form theories and models about it. An argument is put forward that a General Theory of Complexity offers the conceptual means with which the inevitability of reductionism can be faced and overcome.

The chapter suggests that a theory that acknowledges and exposes the forms of reduction that are at work in them can be called post-reductionist theories. It is explained why the use of the term 'post-reductionist' is not similar to the notion of postmodernism and how this position offers a passage through the conceptual difficulties that mark postmodern theories. A post-reductionist understanding of knowledge changes the way in which we conceive of the concept, as well as how we engage with the process of generating knowledge. Most of all, such a position exposes the limits to our modelling and theory building endeavours. The problem of complexity is thus directly linked to the process of questioning and problematising the ways in which we can know and represent the world. This undertaking can be compared to the kind of problem that Kant strived to address in his critical project in which he aimed to find and describe the conditions under which reason could access knowledge of the world.

6.1.2. Part II: Thinking complexity

In this part the dissertation changes its focus by departing from viewing complexity as an object of study. Instead, it uses the insights of Part I to argue that the study of complexity requires a *shift in thinking*. It is suggested that the kind of thinking that suits the task best, can be found in the general economy of thinking as illuminated by Derrida and Morin to culminate in what can be termed 'complex thinking.' From this perspective our engagement with complexity takes on a meta-perspective and provides us with some conceptual tools with which to think in a way that meets the call of complexity.

Chapter 3 sets off by providing an argument for aligning the problem of studying complexity with the poststructural philosophical position and reasons are given for why this coincides with being a critical position. The chapter starts with a discussion of what problems poststructural forms of critique are up against. Based on the 'loss of the outside' that characterises poststructural positions, the problem of legitimacy (as argued by Habermas 1975) is discussed in detail. The focus is then narrowed down by discussing the development of the Kantian critical tradition. The chapter continues by offering a deconstructive reading of Kant's understanding of *judiciary critique* (see section 5.1 in Chapter 3 for an explanation of the term 'judiciary'). A closer look at the concept itself will expose that there is a double bind at play hidden in the heart of Kant's understanding of critique that undermines its original intention and logic. It will be demonstrated that by reading Kant's understanding of critique in a deconstructive way, the notion of critique can be re-defined and expanded to coincide with Derrida's notion of *stricture (*which is inter-changeable with *différance*). Subsequently critique

as *stricture* can be described as being simultaneously a structure and a place of movement in which oppositional groundings could be accommodated and transgressed simultaneously. Reconceived as *stricture* and maintained by a constellation of the *double bind*, the notion of critique requires an alternative logic. This poses another problem, namely the problem of finding a mode of thinking that can deal with this new movement of intelligibility.

Chapter 4 explores the possibility of an alternative mode of thinking by examining the distinction between the terms *restricted* and *general* economy (as used by Bataille and re-appropriated by Derrida). The dissertation proposes that critique as *stricture* can be situated within the dynamic intelligence of the general economy that is governed and constituted by the movement of *différance*. Situating critique as *stricture* within the restless current of general economy, affords critique a new double nature: 1) that of being simultaneously a form of *questioning of* the limitations of inherited thought structures (the Kantian legacy), and 2) it is ascribed the role of being *a strategy of thinking* or a *mode of critical practice* that radically resists totalizing and mastering thought and knowledge systems. In addition it will be argued that this alternative way of thinking corresponds with what Morin calls 'complex thinking' which, when read together with both the critical and deconstructive legacies, can be called 'critical complexity' as formulated by Cilliers (Cilliers 2010, Preiser & Cilliers 2010, Woermann & Cilliers 2012). The notion of critical complexity will be discussed in more detail in Chapter 5. The chapter concludes with an argument from Heidegger, that the abstract endeavor of thinking is inextricably linked with what it means to be human and that thinking and being in the world cannot be separated.

6.1.3. Part III: Experiencing complexity

In this final part it will be argued that another shift is necessary if we are to take the call of complexity seriously and to give some substantive content to the abstract and theoretical claims we have gathered so far. It will be argued that a progression is needed to move from a mode of thinking to a *mode of being*, especially if the normative and self-reflexive aspects are to be considered in a way that makes it possible to apply complex thinking as some unique way of intervening in a complex world. This notion of reading complexity as being able to constitute a mode of being will be discussed in more detail. It is argued that it is this situatedness of being-in-the-world and of *experiencing* complexity that provides us with the key to give more substance to the idea of 'critical complexity' as invented by Cilliers.

Chapter 5 aims to give more substantive content to the notion 'critical complexity.' It is argued that this 'brand' of complexity thinking suggests a radicalisation of our understanding of complexity which is grounded in the normative turn that the study of complexity imposes. The normativity lies in the experience of the 'condition of complexity' which poses a radicalisation of the 'problem of complexity.' Based on Allenby & Sarewitz's (2011) taxonomy of the levels of complexity, it is suggested that our lived experiences of complexity in the world cannot label complexity as a problem to be solved. The reality is that we are facing a *condition* of unsolvable problems and that the challenge lies in knowing how to navigate through the thicket. It is suggested that the notion of critical complexity can help us make sense of the condition with which we are faced. Critical complexity derives its qualification as radical critical practice from the acknowledgement that our understanding of complex phenomena cannot be disconnected from our lived experiences of complexity. Following Cilliers, the chapter proposes three normative imperatives for the purpose of 'muddling through' the quagmire that marks the condition of complexity. These imperatives are: 1) the Provisional Imperative (as drafted by Cilliers originally), 2) the Critical Reflexive Imperative, and 3) the World-disclosing Imperative. The latter draws on Heidegger's (1962) interpretation of 'world-disclosure' and its re-appropriation thereof by Kompridis (2006a, 2006b). It is suggested that these three imperatives might grant critical complexity some unique characteristics by which it can be recognised as being different from, but not in opposition to other forms of poststructural in(ter)ventions.

Finally, **Chapter 6** discusses the critical implications for adopting critical complexity as a strategy of intervention. The chapter offers a summary of the conclusions reached in the study with regards to the problem statement and mentions limitations and possibilities for future research.

6.2. Second level of reading: considering the underlying philosophical problems

On a second level of reading the study reveals that parallel to the more overt strategy of following the successive 'problems of complexity' as discussed above, the study also engages with a number of surreptitious *philosophical* problems that underlie each of the problems mentioned. Accompanying each of the apparent conceptual and thematic problems of complexity, knowledge, critique and thinking, are the underlying philosophical problems that in essence could be regarded to coincide markedly in a number of ways, with the "familiar configuration of problems currently debated under the general heading of 'postmodernism'"

(Knodt 1995:xxxvi). The underlying philosophical problems that will be uncovered in each of the conceptual problems can be summed up as follows:

- Chapter 1: the limit of being able to study, observe and define complexity coincides with the poststructuralist philosophical problem of the 'crisis of representation.' Theories of representation assume a necessary relationship between the symbols or words that we use to create meaning, and the corresponding objects in the world. The symbol or word is said to stand in or represent that which it is standing in for. In Chapter 1 this assumption of the relation between symbol and reality is problematised by arguing that the classical distinction between object and subject (or inside *versus* outside) does not hold, neither does the assumption that our symbols and theories produce objective, deterministic and universal security for our knowledge of complex phenomena. It is argued furthermore, that there is no centralised locus that contains the true meaning of a sign that can ensure that the meaning of the symbol is present to itself. From a complexity approach, meaning arises due to the relational organisation between the components of a system of difference (characterised by the properties of non-linear causation, self-organisation, emergence, radical openness and contextuality), and the meaning is distributed throughout the dynamic network of the system (Cilliers 1998:58–59).
- Chapter 2: As a result of the above, the problem of being able to know and model complexity completely, coincides with poststructural claims regarding the impossibility of the closure or totalisation of knowledge. This challenge is discussed in detail in terms of the impossibility of producing a largest model of complexity and the consequences this implication has for the status of our knowledge claims and the kind of knowledge that can consequently emerge. Furthermore, the difference between a restricted *vis-à-vis* a general understanding of complexity and its relation to Derrida's appropriation of Bataille's definition of the restricted and general economy is disussed (extended in Chapter 4).
- Chapter 3: The problem of critique is defined as being a problem of legitimacy, which can be traced back to the poststructural demand for the loss of legitimate guiding principles. The 'loss of the outside' and the surrendering of an objective position from where to ground knowledge claims and normative standards that inform critical positions remain a huge challenge for any postmetaphysical theory of critique. Consequently, this study dares to come up with a postmetaphysical form of critique that is not so self-critical of its legitimate gounding positions that it cannot perform critical

interventions anymore. The poststructural predicament of having no legitimate name in which critique can be grounded is addressed by suggesting a provisional foothold from where critique can do its work. It is suggested that postmetaphysical forms of critique can find some legitimacy in the name of the limitations that are exposed in our various thought strategies. Hence, we are not left in a position that succumbs to a radical kind of relativism, as is often the case with postmodern theories that oppose all forms of reductionism or Enlightenment thinking.

- Chapter 4: The problem of thinking about complexity suggests that we rethink the traditional logic of binary oppositions. This corresponds to the philosophical question of how meaning emerges in any system of difference and relates to the poststructural demand of dealing with an excess of meaning. The challenge of negotiating between seemingly opposite concepts and ideas is problematized so that one is not left in a position where there is only the option of choosing between some grand either/or. Here the traditional dichotomies between positivism or relativism, objective or subjective meaning, homogeneity or heterogeneity, universal or contingent, unity or diversity, identity and difference, consensus or pluralism are called into question.
- Chapter 5: The normative turn that an encounter with complexity introduces will be discussed in detail in this chapter. The problem of delineating legitimate grounds from where to define normative principles is discussed. It is argued that the gap between 'is' and 'ought' that arises in poststructural normative discourses produces a productive space in which the ethical moment is situated. The ethical imperative arrives so to speak with the uncertainty that accompanies the lack of objective normative principles.

6.3 Third level of reading: the binding factor

Finally, reading the dissertation on a third level exposes the fact that the different problems are woven together by means of one binding and overarching phenomenon. The golden thread that weaves these problems together is the fact that they are all characterised by a number of unavoidable *limits* that we run up against in our pursuit to question the nature of the world when faced with complexity. The **limit** seems to be a steady presence that appears in each of the problems discussed thus far.

As argued in Chapter 3, this study aims to propose that it is the notion of the limit that grants us some temporal or provisional grounding from where to launch a postmetaphysical form of critique against entrenched dogmatic and reductionist theories. In the name of the limit new

critical strategies can emerge that have the potential to resist and disrupt totalising and restrictive economies of thought. Chapter 5 will discuss the notion of the limit in more detail so as to offer some substantial meaning to the notion ‘critical complexity’ as invented by Cilliers. Stated in terms of the critical imperative that is located within the complexity approach, the problem of the limit can be re-articulated to read that critical complexity exposes the limits in our quest to know and study the world.

PART I: OBSERVING COMPLEXITY

CHAPTER 1
THE PROBLEM(S) OF COMPLEXITY

Complexity is a problem word and not a solution word.
(Morin 1992c)

1. Introduction

Research topics on complexity are prolific in contemporary natural and social sciences (Allen *et al.* 2011:1). Although the proliferation of ideas relating to the concept of *complexity* and *complex systems* is relatively recent[4], the task of pursuing the conceptual and historical roots of the notion 'complexity', and hoping to discover the original moment in which one would be able to say that a 'theory of complexity' was born, remains a rather daunting and somewhat impossible task. A search through the ever-growing amount of literature on the study of complex systems and specifically complexity theory also reveals this impossibility. It seems that in the corpus of literature currently available, there is no agreement on when exactly complexity theory came to the fore as a body of writing with unifying ambitions. The only agreement there is, however, is the fact that there is no unifying 'Theory of Complexity' (Chu *et al.* 2003), and that one can trace several conceptual origins rooted in different disciplines that have been combined to form a collective understanding of what we have come to know as being 'complexity theory.'

This chapter aims to provide a firm basis for the rest of the study by problematising the conceptual and phenomenal (or 'ideal' and 'real' according to Morin 1992c) descriptions of the notion 'complexity' and the subsequent formation of a number of 'theories of complexity' (or science of complexity). Morin (1992c:139-140) suggests that systemic terms are ambiguous by nature. There are no clear and simple ways to define and understand the notion of complexity. Drawing on Morin's (1992c:139) argument that these concepts are 'phantom' concepts 'with a

[4] Publications of classic papers that describe notions of complexity in scientific terms began in the 1940s (Midgley 2003a). The work of Waldrop (1993) and Lewin (1993) offered a more popular understanding of complexity that could be applied over a wide range of disciplines (Cilliers 2007:3).

double entrance'[5], the first entrance being 'physical, phenomenal, empirical' and the second entrance being 'formal and ideal' (140), this chapter is structured according to these two entrances.

In the first place, the chapter provides an overview of the development of the notion of complexity in order to address the conceptual ambiguity that exists around the meaning of the notions of 'complexity' and 'complexity theory'. Thus, the first problem of complexity refers to the formal or ideal difficulties one faces in attempting to define the idea of complexity and in constructing a representative 'science' or 'theory of complexity'. From the outside, it may seem that a unified body of knowledge or comprehensive theory of complexity science exists. Confronted with the wide range of literature that deals with the study of complexity or complex systems, one soon realises that various authors mean different things when they use the term 'complexity.' The chapter suggests that it might be more productive to speak of a 'paradigm of complexity' rather than aiming to find one 'grand theory' of complexity. By delineating ten common denominators that are found in a range of theories dealing with complexity, a paradigm of complexity exposes the differences, but also finds overlapping principles that characterise and inform the wider discourse on the notion of complexity.

The chapter proceeds to give an overview of the conceptual origins of complexity in terms of its shared history in the fields of General Systems Theory, Cybernetics and the study of Artificial Intelligence. Simultaneous developments in these three fields of study post World War II, gave great impetus to the advancement of what is today called 'systems thinking'. Linking to the field of systems thinking, theories of complexity and what is often referred to as 'complexity science', came to the fore. This development is discussed in terms of the theoretical divergence that exists between what Morin (2007) and Cilliers (2010a) call 'restricted' and 'general' complexity. The former arguing for defining complexity in terms of reductive, measurable and computable algorithms, the latter arguing for an understanding of complexity that remains mindful to its irreducibility and ambiguity. By supporting an argument in favour of a general theory of complexity, it is explicated in this chapter that the conceptual ambiguity provides

[5] Morin (1992c:139) suggests that systemic concepts are concepts with a double entrance: "the first physical, phenomenal, empirical; the other formal, ideal" (Morin 1992c:139). These two entrances are inextricably linked with one another. Thus, the formal and conceptual theories that we build around our observations and the reality of complex phenomena cannot be isolated from the study of the physical and observable properties of systems and complex phenomena. Morin (140) argues that '(l)ike a phantom it has the form of material beings, it is their spectre; but like the phantom it is immaterial. It links idealism and realism, without allowing itself to be enclosed in one or the other'

some ground for adopting a range of divergent theories in a critical manner when faced with complexity.

In the second place, the chapter offers an overview of the phenomenal (or 'physical' as Morin (1992c) calls it) characteristics of complex phenomena. The division into 'restricted' and 'general' theories of complexity is mainly located in the disagreement on whether or not it is possible to measure and model complexity. The measuring of complexity relates to the empirical observability of the characteristics of complex phenomena. The chapter singles out five important characteristics that are described in more detail. In doing so, the argument is supported, that it is the presence of these characteristics that make complex phenomena irreducible to abstract methods of measurement (such as power laws and computational models) in principle. The nature of the characteristics of complex phenomena challenges us to rethink the clear distinction between 'ontology' and 'epistemology'. The Cartesian metaphysics that distinguishes clearly between object and environment, are also challenged. From the description of the physical characteristics of complex phenomena, an 'ontological crack' (Morin 2008:26) opens up that has serious consequences for how complex systems are studied. The problem of complexity exposes an opening or gap between the reality of the world as such and our descriptions of the world. The problem of generating knowledge (or theories) about complex phenomena will be the focus of study in Chapter 2.

2. The Problem of the idea(l)s of complexity

> *Complexity—the word is everywhere in the field of knowledge. There are complexity institutes, complexity journals, complexity popular science books, complexity management, complexity art, this issue of this journal—and the list could roll on ad nauseam.*
> *Let us begin with a working definition of the term by using it as an adjective—by defining complexity theory as: the interdisciplinary understanding of reality as composed of complex open systems with emergent properties and transformational potential.*
> (Byrne 2005:97)

The contemporary use of the term ‘complexity’ suggests that a unified theory of complexity exists. A closer investigation into the development of complex systems theory reveals that one should rather speak of ‘theories of complexity’ (Morrison 2010, Alhadeff-Jones 2008, Rasch 1991, Chu *et al*. 2003) considering the ‘range of different theories that deal with the implications related to the notion of complexity’ (Alhadeff-Jones 2008:66). The growth in special complex systems research groups, journals and books is so profuse (Byrne 2005:97, Allen *et al.* 2011:1) that one might be led to think that it is possible to speak of a ‘complexity turn’ (Urry 2005) that is taking scientific inquiry by storm. Often the terms ‘complexity science’ are used interchangeably with ‘complexity theory’, ‘complex adaptive systems’ or just even ‘complexity’. The uninformed reader approaching complex systems literature could assume that there is a shared understanding of a ‘unified theory of complexity’ (Chu *et al*. 2003) across the range of scientific disciplines. Such assumptions would be misleading. Not only is there no single agreed upon definition of the meaning of the word ‘complexity’ (Bonabeau 2008:10, Lloyd 2001, Cilliers 2008), there are even different interpretations of the scientific theories that concern themselves with complex systems.

The French complex systems philosopher, Edgar Morin (2008) gives us a hint when trying to define the notion of complexity by drawing attention to the Latin roots of the word ‘complex’. He mentions that the first meaning of the word (complexity) comes from the Latin *complexus*, which means ‘what is woven together’ (6). It seems that even in its etymological form, the notion of complexity tells us that we should not expect a neatly packaged explanation of where it came from and how it came about. The development of a theory of complexity can consequently be described as a ‘weaving together’ of discoveries made in different scientific disciplines over a period of time and encompasses ‘a collection of concerns and methods recognizable as an entity’ (Checkland 1993:5). In his construction of ‘a geography of complexity theory’, Thrift (1999:33) describes ‘complexity theory’ to be a ‘scientific amalgam…, an accretion of ideas, a rhetorical hybrid’ that has not developed from one point of diffusion. As a result, a standard account of the development of a theory of complexity is not available. This does not mean that there are not attempts to chronologically trace the developments and possible origins of this paradigm of thought. There are several such accounts (Waldrop 1993, Meyers 2009), but these accounts are often very one-dimensional and only consider one or two strains of contributing disciplines. Other accounts are more comprehensive (Heylighen 1997, Rescher 1998, Rasch & Wolfe 2000, Ramage & Shipp 2009). In the attempt to try and incorporate all the different strains of influence, one often gets lost in very technical scientific specifics (Bak 1996, Kauffman 1993, Wegener & Randall 2005, Holland 1994), so

that they are rather inaccessible for the reader that is not schooled in a specialised field of complex systems.

As mentioned earlier, it is not possible to pin down one pure beginning in search of the roots of a theory of complexity. In a sense, finding the exact origin and being able to offer a genealogy of how the theory developed, becomes less important than the fact that it developed almost simultaneously in different disciplines in different ways by observing different objects of study.

In fact, there will be a different historical narrative of the birth of complexity theory depending on what kind of complexity is alluded to. In his attempt to answer the question 'What is systems thinking?' Midgley (2003a:xvii–xix) proposes that it is impossible to render a 'neutral' account of the field of study or its history. Apart from the arguments made by for example Foucault (1980) and Latour (1993) that scientific study can never be context free and stripped from social and political influences, the systems movement is furthermore not 'neutral' due to the diverse roots that it shares with so many different disciplines. By analogy, what can be said of the history of systems thinking can be applied to the study of the history of complexity. Although the moment of the birth of complexity eludes us, we are able to determine some general tendencies and discourses that can be tracked down and linked together. Chu *et al.* (2003:20) argue that:

> (a)lthough the early successes of complexity research have indeed invoked a widespread belief into the viability of a Theory of Complexity today many prominent proponents of the science of complexity seem to have reduced their expectations and also doubt the absolute need of a TOC (sic). Their point of view seems to be that the science of complexity can still be productive even if it does not possess a rigorous overarching theory.

Although there is no development of a 'grand theory of complexity', one can however recognise a certain 'economy of concepts' (Thrift 1999:34) that arranges itself around the characteristics of complex systems (see discussion here below) to form a 'commonplace structure of intelligibility' (35). Propagators of the history of complexity usually construct their own account of what mixture of different disciplines contributed to the development of it. What this means for the process of studying the history of complexity is that it is *perfectly understandable* that people pursuing different interests in the systems community will construct its own history in

different ways' (Midgley 2003a:xix, italics in original text). It is also this understanding of the polysemic nature of the histories of the complexity movement that causes its history to be polysemic and not value free.

Checkland (1993:5) suggests that it might be better to think of all the endeavours that have notions of complexity and the study of complex phenomena as their main purpose, as processes that embrace a 'complexity approach' rather than wanting to unite these efforts in a 'grand theory' of complexity. Accordingly Cilliers (2007a:4) suggests that it might be more effective to deal with complexity by adopting a 'complexity attitude':

> Once we realize that we are dealing with complex things, and we accept the consequences of this, our approach to what we are doing, irrespective of how we are actually doing it, will change fundamentally. The 'complexity attitude' may be thoroughly informed by the findings of complexity theory, but not fully determined by it, for if that were the case, complexity theory would have become a new source of final truth and in the process contradict some of its premises!

Checkland's notion of a 'complexity approach' and Cilliers' suggestion of a 'complexity attitude' can be linked to what Morin (1992a, 1992b, 2008) calls a 'paradigm[6] of complexity'. Instead of wanting to conceptualise a general theory of (or theory specific to) complexity, the notions of *approach*, *attitude* and *paradigm* turn the focus of study around in a radical way. The concepts approach/attitude/paradigm allow one to expand the idea(l) of complexity to the extent that it becomes 'capable of informing all theories, whatever their field of application or the phenomenon in question' (Morin 1992a:371) might be. Formulating a complexity approach/attitude/paradigm thus allows one to look outwards and alongside other discourses. From this meta-position complexity's economy of concepts arrange themselves in such a way that they do not stay passively outside or alongside other discourses, but they actively and

[6] Morin's use of the term *paradigm* is based on Thomas Kuhn's meaning of the word. Kuhn (1996) defined paradigm as an over-arching collection of beliefs and assumptions that result in the organization of scientific worldviews and practices. Foucault's notion of *episteme* is also related to the notion of paradigm. Foucault (2001) defined the term *épistémè* very specifically in *The Order of Things* to mean the historical conditions that ground knowledge and its discourses and hence represents the 'conditions of their possibility' (xxiv) within a particular period.

dynamically infect, disseminate[7] and disturb other paradigms of thought with traces of complexity. In order to define other fields of study in terms of a complexity approach, it is necessary that the characteristics of complex phenomena and the implications that these characteristics hold for generating knowledge and for acting in the world, need to be internalised and rooted deeply into the thought structures of the researcher or research project. The way in which the internalisation gives rise to 'complex thinking' will be discussed in chapters 3 and 4. The next section will give an overview of the different roots (or routes) from where the economy of concepts emerged to form a 'common place structure' that can be recognised as theories of complexity that would inform a complexity paradigm.

2.1 Finding Common Denominators in Theories of Complexity

> *Matter has an innate tendency to self-organise and generate complexity. This tendency has been at work since the birth of the universe, when a pinpoint of featureless matter budded from nothing at all.*
> (Coveney & Highfield 1995:10)

As matter agglomerated and coagulated to form galaxies, stars and planets, thoughts and ideas also have the ability to be gathered up to congeal into assumptions, premises, laws and theories. The bright new star of complexity theory (Cilliers 2001:135) is one of the ways in which a new understanding of the world has been developing since the first half of the twentieth century. Although it is not possible to pin-point one specific starting point at which one could estimate when this star was born as discussed above, it is possible however to identify the main tenets of the various components that form part of the rhetorical hybrid (Thrift 1999) of contemporary theories of complexity. In the vast body of literature that deals with introducing complexity theory, a few main tenets are recognizable and can be listed as follow:

1) The history and origins of theories of complexity are directly linked to the origins and developments of **three main fields of study**, namely from that of General Systems Theory, cybernetics and artificial intelligence (Allen *et al.* 2011, Castellani 2009).

[7] The word choice of 'dissemination' here is a cross-reference to the notion of 'dissemination' as used by Derrida (1981) in his argument against the unity of meaning. Dissemination is the force that drives the act of writing to be an 'always pluralizing "germination" without "first insemination"' (Wortham 2010:69).

2) Theories of systems and complexity manifest a **rich diversity**. Different fields of study and different protagonists of systems and complexity hold different ideas and understandings of the significance of systems and complexity (Tong 2007:386). There seem to be two very distinct paradigms, namely 1) a paradigm that claims that a science of complexity has the duty to measure and formalise complexity by means of mathematical computation and 2) the paradigm that argues that complexity cannot be measured and calculated, but remain in principle too complex to model in theoretical equations. These differences will be discussed in more details here below.
3) Theories of complexity are all concerned with the study of complex phenomena in states of non-equilibrium that display **characteristics** of non-linearity, self-organisation, emergence (Thrift 1999:34) and behave in a manner in which time and energy expenditure is irreversible (Coveney & Highfield 1995:9, Cilliers 1998).
4) Theories of complexity are accompanied by a **vocabulary** that uses technical and metaphorical elements to describe the characteristics and behaviour of complex phenomena (Lissack 1999). The following terms are often dispersed in the literature: patterns of organization, implicate order, hierarchy, dissipative structures, dynamic interaction, chaos, attractors, fractals, power laws, autopoiesis, uncertainty, tipping scales and bifurcation points. These concepts did not even exist twenty-five years ago (Capra 2007:14, Nicolis & Nicolis 2009:238) and provide scientists now with a language for dealing with complex phenomena.
5) There is a general acknowledgement that theories of complexity introduce a **paradigm shift** or new scientific paradigm (Maruyama 1978, Prigogine 1997, Walby 2007, Ulanowicz 2009) from the landscape of classical Newtonian/Cartesian science. The **non-reductionist** theories of this post-Newtonian paradigm (Nicolis & Nicolis 2009) stand in direct opposition to positivist science that adheres to a linear, atomist, determinist and reductionist explanation of the world. Theories of complexity propose a systems rationality that supplements and expands the boundaries of our models of knowing the world (See section 2 in Chapter 2 of this study for a more detailed discussion on this assumption).
6) There is a **shift in focus** of study that gives preference to organisation over static structures (Juarrero 2002) and favours 'relationships over entities' (Thrift 1999:33), stochastic above determinist mechanism and studying a phenomenon in its context has become more important than studying isolated objects.

7) Complexity theories propose a language in which to express the **limits of human** understanding in relation to complex natural and social phenomena. From a methodological point of view, the notion of complexity problematises the modelling and measuring instruments and strategies used to model the relation between natural and formal systems (Rosen 1991, Cilliers 2000c, 2001).
8) In recognising the limits of scientific inquiry and our capacity to describe and produce models of complex realities, theories of complexity do not come up with problem-solving tools and clear-cut solution kits, but rather tend to **expose, challenge and problematise** the underlying assumptions that inform conventional theories and practices (Preiser & Cilliers 2010:281).
9) Theories of complexity influence the way in which we do science and how we practically implement scientific findings. Our epistemologies that explain the world are challenged by the notion of complexity. Exploring complexity demands methods of inquiry and knowledge generating practices that draw from a **plurality of epistemologies** or positions (Morin 2008:22, Mitchell 2008). The notion of transdisciplinarity (Thompson Klein 2004) acknowledges that teamwork is indispensable in finding sustainable solutions to complex problems.
10) Discourses of complexity are affecting and **cross-pollinating a variety of scientific fields** of study. Cilliers (2007:3) suggest that the following disciplines have already incorporated notions of the nature of complexity in their discourses: Sociology, Health Care, Political Science, Anthropology, Management and Organizational Science, Sustainability Studies, Economics, Literary Studies and the Arts, in the Social Sciences; Physics, Biochemistry, Biology, Genetics, Ecology, Mathematics and Computational Theory in the Natural Sciences.

In the following section, some of the abovementioned general trends will be discussed in more detail in order to highlight the important binding factors that are prevalent in different theories of complexity. This study adopts the view that these common denominators inform the paradigm of a general theory of complexity.

2.2 The Origins of complexity

For the purpose of this study, the conceptual roots of complexity theories are traced back to developments made in the fields of General Systems Theory, Cybernetics and Artificial Intelligence during the 1940s-1950s. Studying complexity is directly linked to the study of dynamic and dissipative systems that display non-linear behaviour.

In an attempt to offer an overview of how complexity theory developed, Castellani & Hafferty (2009:xi) present a visual map (see figure 1.)[8] to give an overview of the interconnectedness and cross-fertilisation that took place in the development process. Athough Castellani' & Hafferty's map presents a good overview of the interconnectedness of the fields of study and plots out the different inter-disciplinary and cross-fertilisation of ideas very aptly, it is clear that it is not exhaustive. Its main aim is to depict the general and main trends in the historical development after 1940 of each field of study that lead to what we today understand to be the body of knowledge that describe the study of complexity.

[8] The authors are studying the relevance of complexity for social sciences, so the map shows how ideas that started in the natural sciences crossed institutional and disciplinary boundaries to such an extent that the social sciences eventually adopted these fact and implications from the natural sciences. The map can also be accessed online at: http://www.art-sciencefactory.com/complexity-map_feb09_april.html [accessed March 1, 2011].

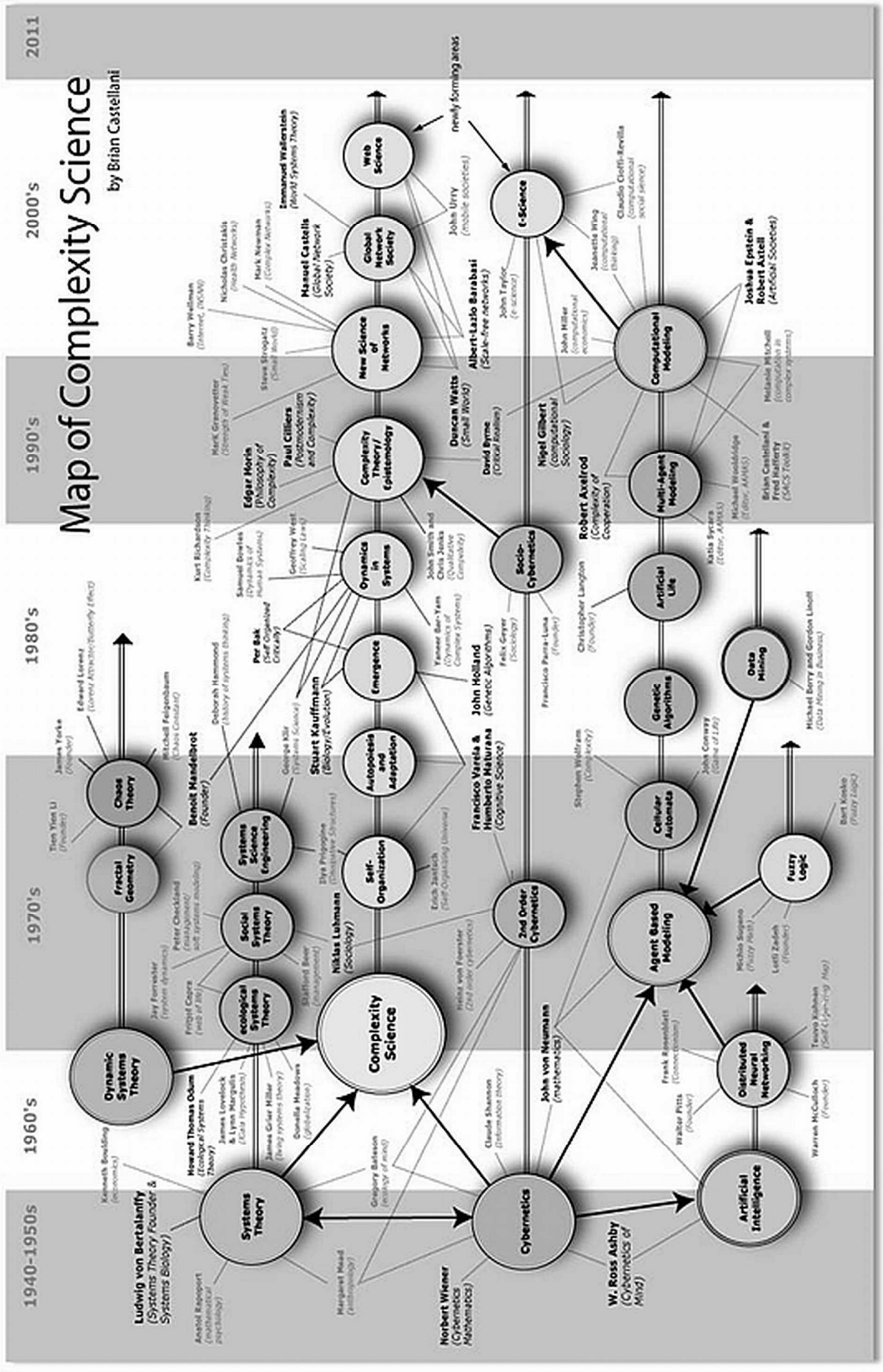

Figure 1: Map of Complexity Science.
Source: http://www.art-sciencefactory.com/complexity-map_feb09.html

In the map the influence of intellectual links amongst the different fields are indicated with a bold single-lined arrow. For each area of research, the leading scholars are also specified. On the map it is visible that the field of complexity developed from three main origins into five main areas of study that run parallel and interconnected with each other. Most importantly, one sees that "complexity science" is one of the main streams of study that developed and as it developed into its own right, it still remains influenced from the other streams running parallel to it. The map depicts that the main topics that characterise the study of complexity are concerned with the notions of 'self-organization', 'auto-poiesis' and 'emergence' and how these concepts can be applied by using a dynamic systems view of complex phenomena such as society, environmental management, business organisations, educational structures, etc.

Connected to the node labelled "Complexity theory / Epistemology", Castellani & Hafferty arrange the names of Edgar Morin, Paul Cilliers, David Byrne (all in bold type), John Smith & Chris Jenkins, Kurt Richardson and George Klir together. There is some truth to this constellation, seeing that Cilliers and Richardson have published papers together regularly[9], the books of Cilliers (1998) and Byrne (1998) were published in the same year and they have worked together on a number of topics (Cilliers & Preiser 2010). Recently much correlation between the work of Cilliers and Morin has also been established (see the discussions in Woermann 2010, Hermanus 2010 and Cilliers 2011:144). In essence, all of these authors (except Smith & Jenkins and Klir) subscribe to a general view of the study of complexity (as opposed to a 'restricted view'—see discussion on this topic later in the chapter under 2.3 and 2.3.1). More importantly, for these authors, the notion of complexity suggests a challenge to the traditional methods of classical science. The notion of knowledge and the status of modelling complex systems are problematised in their work. The implications of acknowledging complexity are shown to have real consequences for how we act, design interventions and understand humanity's place in the world.

On a different level, the map also reveals how the field of the study is overshadowed by male researchers. There are but a hand full of female names on the map and this fact is also displayed at conferences and other scientific meetings and publications related to the notion of complexity. It reflects the reality that the history of the study of complexity developed very much from the domain of the natural sciences and specifically from post World War II physics and cybernetic studies. These fields of study were (and still are) dominated by male scientists

[9] Cf. Richardson, Mathieson & Cilliers (2000); Richardson, Van Uden, Cilliers (2001); Richardson, Cilliers, Lissack (2001); Richardson & Cilliers (2001)

due to the proximity to "math-intensive" fields of science (Ramage & Shipp 2009:4; Larter 2011). Although the names of Margaret Mead, Donella Meadows, Melanie Mitchell, Katia Sycara and Deborah Hammond are mentioned, the map fails to include the name of Isabelle Stengers[10] who worked closely with Ilya Prigogine. In general, it seems that the work of female authors is more palpable in fields of study that apply theories of complexity in some field or other, or in the field of History of Science studies. The following authors' contributions should not be overlooked in an overview of the development of complex thinking: Alicia Juarero[11] (Philosophy of Science), Helga Nowotny[12] (Social Studies of Science), Katherine Hayles[13] (Chemisty and English Literature), Evelyn Fox Keller[14] (History and Philosophy of Science) and Sandra Mitchell[15] (History and Philosophy of Science). The work of these female authors engage with the notion of complexity in critical ways and they illuminate the historical and contemporary importance of the study of complexity for current discussions on the place of science in society and how to find pluralist strategies to integrate scientific knowledge in our endeavours to know the world.

Considering the point of departure as illustrated by Castellani' & Hafferty's map, one sees that the timeline begins with the period 1940–1950. This depiction creates the impression that no conceptual development took place before 1940. Not only does the timeline create the impression of absent activity before 1940, but more importantly, the timeline itself imparts the idea that the conceptual development of complexity and systems thinking only took place in the arena of the natural sciences. Although this is partly true, it does not mean that the social sciences and humanities did not concern themselves with the study of complex phenomena. On the contrary, as Heylighen *et al.* (2007:128) argue, the reason why conceptual configurations of complexity do not feature in for example, the field of philosophy is because "philosophy has somehow always been engaged with complex issues, even if it has not been done in the language used by contemporary complexity theorists."

Hence, even though the period between 1940–1950 marks a period of rapid growth in the conceptual proliferation and conglomeration of trends and ideas as displayed by the outputs of

[10] Cf. Prigogine & Stengers 1984, Stengers 2004

[11] Cf. Juarrero 1999, Capra, Juarrero, Sotolongo & van Uden 2007, Juarerro & Rubino 2008

[12] Cf. Nowotny 1994, Nowotny et al 2001

[13] Cf. Hayles 1990, 1991, 1997, 1999

[14] Cf. Keller 2002, 2000, 2009

[15] Cf. Mitchell 2008, 2009

the famous Macy conferences that served as the conceptual hub during this time (see discussion here below in section 2.2.2), some very important developments transpired in the preceding period leading up to 1940. An eminent clarification of the role that various disciplines had in the conceptualisation of 'the standard account' of knowledge leading to the institutionalisation of disciplines by 1945 is presented in the study funded by the Gulbenkian Foundation that was chaired by Immanuel Wallerstein.

The results of this analysis of the differentiation and specialisation of knowledge were compiled in the report of the Gulbenkian Commission (Wallerstein *et al.* 1996). In this report it is argued that developments in the Natural Sciences seem more evident, because of the primacy that was given to the status of knowledge claims that were made opposed to the status of claims that were made in the Social Sciences and Humanities. The fact that knowledge claims made in Natural Sciences carried more weight and subsequently had a higher classification can be ascribed to the preference that was given to mathematical proofs and universal laws (see discussion of this development in Chapter 2, section 2 called 'The birth of Science and the dreams of rationalism'). This state of affairs is summarised pertinently in the following quote by Wallerstein *et al*. (1996:6–7):

> The need of the modern state for more exact knowledge on which to base its decisions had led to the emergence of new categories of knowledge already in the eighteenth century, but these categories still had uncertain definitions and frontiers.
>
> The intellectual history of the nineteenth century is marked above all by this disciplinarization and professionalization of knowledge, that is to say, by the creation of permanent institutional structures designed to both produce new knowledge and to produce new producers of knowledge.

This categorisation of knowledge resulted in the fact that by the end of the nineteenth century, the various disciplines were distributed in such a way that mathematics and physics occupied the one end of the spectrum and the humanities occopied the other end. In between these two opposing poles the study of social realities (also no known as 'social sciences') was positioned (9–10). One can easily state that this strict division of knowledge constituted a 'tripartite' in the creation of scientific knowledge. The emergence of ideas concerning complexity and the systems thinking movement however, suggests that the harrowing consequences that resulted

from the impact of World War II, caused scientists to work together on large research projects so as to find solutions for overcoming the gridlock that the war imposed on the world. The cooperation between disciplines and the discovery that different fields of study concerned themselves with the same issues that just had different names in their respective fields led to the rapid proliferation and development of ideas concerning systems thinking and complexity. In order to trace the development or evolution of complexity theories, the next section will briefly discuss the three main fields of study from which theories of complexity originated.

2.2.1 General Systems Theory

> *If someone were to analyze current notions and fashionable catchwords, he would find 'systems' high on the list.* (Von Bertalanffy 1968:3)

The trendiness of what is often described as 'systems thinking' (Georgiou 2007) does not only refer to the uproar that it caused in scientific circles post World War II. Von Bertalanffy's quote is as true today as it was then. Many contemporary studies of complexity are directly related to the history and development of Bertalanffy's exposition on General Systems Theory (GST) (Richardson 2004a). The current 'complexity movement' is in many ways not so different from the GST movement in the sense that it shares the GST's ambition to be a cross-disciplinary study of systems that aims to develop "tools and processes to interact with, and intervene in, a modern complex (systemic) world" (Richardson 2004b). In certain disciplines, the notion of systems thinking is still very relevant and there is even a growing interest in this approach in especially fields like Socio-Ecological Systems science, Sustainability research, Ecosystems research, Medicine, Operational Management studies and in more technical fields such as Computer technology.

The names that are most often associated with the development of GST, are those of Ludwig von Bertalanffy (Founder/Biology), Ralph Gerard (Biology), Anatol Rapaport (Biology/Mathematics), Kenneth Boulding (Economics/Peace & Mediation Studies) and James Grier Miller (Psychology/Medicine/Living Systems Theory) (Castellani at http://www.art-sciencefactory.com/List%20and%20Refs%20for%20MAP1.pdf, [accessed March 1, 2011]).

The birth of GST is often ascribed to the work of the systems theorist, von Bertalanffy (1968) who formulated a general theory of systems that could explain the behaviour of all systems in

all fields of science. The word ‘system’ was used to describe those principles that are common to systems in general. Von Bertalanffy (1968:32) had in mind to unite under one heading the ‘organismic’ science that he had observed in his work as a biologist:

> ...there exist models, principles, and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements, and the relationships or "forces" between them. It seems legitimate to ask for a theory, not of systems of a more or less special kind, but of universal principles applying to systems in general.

Von Bertalanffy’s (1968:vii) ‘Allgemeine Systemtheorie’ suggested that with his view on systems, he was proposing a new paradigm of doing science:

> What may be obscured in these developments—important as they are—is the fact that systems theory is a broad view which far transcends technological problems and demands, a reorientation that has become necessary in science in general and in the gamut of disciplines from physics and biology to the behavioural and social sciences and to philosophy.

According to Von Bertalanffy (11), the systems concept comes a long way in the history of scientific ideas, although it was not named as such explicitly. The presence of the system concept can be seen as early as the work of Leibniz and Vico in how they saw history as a sequence of cultural entities or ‘systems’; to the work of Marx and Hegel and how they understood the workings of the dialectic process.

Maybe not so well-known for his ideas about systems theory, Morin (1992c:95–102) nevertheless offers a thorough account of how the notion of system evolved into a scientific paradigm and what implications it has for how we understand the world. Drawing inspiration from the ideas on the possibility of a new kind of scientific understanding by Gregory Bateson and Giambattista Vico, Morin (95) suggests that since the notion of the atom was brought into connection with the notion of *organisation*, the object lost its static composition. Focussing on the importance of systemic organisation, Morin (95) argues that the object’s existence can only be explained in terms of organisation to such an extent that:

> ... the organised object or system whose explanation can no longer be found solely in the nature of its elementary components, but found also in its organisational and systemic nature, which transforms the characteristics of the components. (Thus) we see that the universe is founded, not on an indivisible unity but on a complex system!

In his description of how the concept of systemic organisation proliferates not only into new paradigms of understanding in physics but also in biology, astronomy and sociology, it remains remarkable how long it took for it to develop into a somewhat coherent body of knowledge. Morin also challenges the understanding of general systems theory today, and criticises it for never having contemplated 'the general theory of *the* system; it has omitted deepening its own foundation, reflecting on the concept of system' (98). It seems that the idea of system is to be questioned with more rigour in order to have a better understanding of the deep implications thereof.

A short and handy definition of the concept system points to some principle characteristics of systems: 'an interrelation of elements constituting an entity or a global unit' (98). The two main characteristics that stand out, are 1) the interrelatedness of the components and 2) the global whole that is comprised by the interrelated elements (99). Having done a short historical overview of the many definitions of the notion system, Morin construed that the two abovementioned characteristics are found in all general descriptions of the notion system. He lists them as follows (99):

> A system is a 'set of parts' (Leibniz, 1666), any definable set of components' (Maturana, 1972). A system is a set of unities with relationship among them' (Bertalanffy, 1965); it is 'the unity resulting from parts in mutual interaction' (Ackoff, 1960); it is 'a whole which functions as a whole by virtue of the parts which constitute them' (Rapoport, 1968).
>
> Other definitions indicate to us that a system is not necessarily or principally composed of 'parts'; certain ones among them can be considered a 'set of states' (Mesarovic, 1962), indeed even a set of events (which holds for every system whose organisation is active) or of reactions (which holds for living organisms). Finally the definition

> of Ferdinand de Saussure (who was a systematist rather than a structuralist) is particularly well articulated and evokes especially the concept of organisation by linking it to that of totality and interrelation: the system is 'an organised totality made up of interdependent elements holding together and not able to be defined except one by the other in function of their place in this totality'.

From this conceptual history of the definitions of the notion "system," it is clear that the association of the notions of interrelation and totality are bound together with the notion of organisation. It is through the interrelations of the parts and the way in which they are relationally constituted through organisation, that a system (or a unity that can be defined as a system) becomes recognisable. By adding the notion of organisation to the equation, Morin (99) offers his own definition of system to be 'a global unity organised by interrelations between elements, actions, or individuals'.

Simultaneously to the development of the general theory of systems, advancements in the new field of Cybernetics also progressed rapidly. Often systems theory is identified with cybernetics, but von Bertalanffy (1968:17) argued that this assumption was misleading seeing that '(c)ybernetics, as the theory of control mechanisms in technology and nature and founded on the concepts of information and feedback, is but a part of a general theory of systems'. The following section takes a closer look at this special case of systems that display characteristics of self- regulation.

2.2.2 Cybernetics

A line of study that is most often connected with pinning down the 'origin' of complexity theory, is the discipline known as 'cybernetics'. Although the development of cybernetics has contributed to the work of many different collaborating intellectuals, it is undoubtedly Norbert Wiener who led the scientific and conceptual grounding of the field of study (Ramage & Shipp 2009:20). In his book *Cybernetics: or control and communication in the animal and the machine* (1948), Wiener acknowledged that his inputs were indebted to his collaboration with Arturo Rosenbluth and Julian Bigelow. It is also their joint paper (Rosenbluth *et al.* 1943) that is generally considered to be the 'founding document' of cybernetics (Ramage & Shipp 2009:21). The importance of cybernetics is often described in terms of being the foundations of "an epistemological revolution." In explaining why the dawn of cybernetics brought about a

revolution in thought in many other fields of study, Lafontaine (2007:29) argues that the revolution arose "by rejecting the intrinsic study of beings and things and focusing the analysis instead on interactions between objects, regardless of their nature (physical, biological, artificial or human)."

The neo-Greek word 'cybernetics' was coined by Wiener (1948:11) to describe the "entire field of control and communication theory, whether in the machine or the animal". Wiener (1954:16) stated that the purpose of Cybernetics was to "develop a language and techniques that will enable us indeed to attack the problem of control and communication in general, but also to find the proper repertory of ideas and techniques to classify their particular manifestations under certain conditions". From Wiener's definition the notions of 'control' and 'communication' are postulated as being related phenomena. The relation could be described best in terms of processes of information and 'feedback' (Ramage & Shipp 2009:21). In explaining why Wiener grouped communication and control together, he (1954:16–18) argued that communication would be impossible without the notion of the 'message', which can be defined as "a discrete or continuous sequence of measurable events distributed in time" (Wiener 1948:8). In order to control the actions of a person or a system, it is necessary to communicate a comprehensible message in order to direct behaviour or change in a certain way. Once change has taken place, or the person (or machine) responds in a certain way (feedback), the message sender can be sure that the communication was effective or not (this explains the notion of control). Having defined communication in terms of the notion 'message', the process of feedback became indispensable to describe how information (the measurement of the "degree of organisation" (11) of a system) could direct and change systems and their environments.

The notion of 'feedback' became an important concept in the whole field of cybernetics and is viewed to be one of the key characteristics of non-linear, open systems (Cilliers 1998:4). For Wiener, the notion of feedback could be described in terms of "the control of a machine on the basis of its *actual* performance rather than its *expected* performance" (1954:24). In other words, the notion of feedback describes the process whereby an open system (whether it is a machine like an elevator or thermostat, or a living organism) reacts on information from its environment in order to ensure that the system operates effectively. Changes in the environment (such as a change in temperature) are communicated to the system in a feedback loop and the system re-adjusts (or regulates) its internal organisation to compensate for the external changes. Changes are perceived as information, a "name for the content of what is exchanged with the outer world as we adjust to it" (17). The self-regulatory process that is allowed by feedback can be

recognised as “positive (enhancing, stimulating) or negative (detracting, inhibiting)” (Cilliers 1998: 4). Although both kinds of feedback are indispensable to ensure effective performance of a complex system, Wiener regarded the notion of ‘negative feedback’ as very important to ensure stable and effective control mechanisms between systems and their environments (Ramage & Shipp 2009: 21). As summarised by Rosenbluth et al (1943:20–21):

> All purposeful behaviour may be considered to require negative feedback. If a goal is to be attained, some signals from the goal are necessary at some time to direct the behaviour.
> ... the behaviour of some machines and some reactions of living organisms involve a continuous feed-back from the goal that modifies and guides the behaving object.

For Wiener the notion of feedback was extremely important and was used to such an extent that it created a new “cybernetic classification of beings” (Lafontaine 2007:31). In fact, the concept of feedback provided the “basis for the theoretical elimination of the frontier between the living and the non-living” (31). The foundational principles of cybernetics informed a completely new scientific paradigm that offered a new vision of the world that combined contemporary scientific and technical discoveries (30).

Hayles (1999) offers an extensive overview of how the study of cybernetics especially influenced new definitions of what it means to be human after the new scientific discoveries made in the discipline. Her historical overview (1999:7–27) of how the discipline developed is very comprehensive and she suggests that one can identify three distinct waves of development within the cybernetic tradition:

i) The Foundational era (1945–1960)

During the foundational era, the work of Norbert Wiener (Mathematics), John von Neumann (Game Theory/Cellular Automata), Claude Shannon (theory of information), and Warren McCullogh (Artificial Neural Networks) and many others such as Margaret Mead (Anthropology) and John Pitts (Artificial Neural Networks) formed the basis of the discipline. It was during the esteemed Macy Conferences on Cybernetics (Ramage & Shipp 2009:27–28) which they all attended (sponsored by the Josiah Macy Foundation from 1943–1954) that the central concepts were formulated. As a goal, the researchers aimed at forging a new paradigm that would “coalesce into a theory of communication and control applying equally to animals,

humans and machines ... to demonstrate that a machine could function like a man" (Hayles 1999:7).

An over-arching theme during the foundation era was the notion of homeostasis, which in traditional terms 'had been understood as the ability of living organisms to maintain steady states when they are buffeted by fickle environments' (8). Applied to machines, it meant that machines could maintain 'homeostasis using feedback loops' (8) which were then conceptualised as representing the flow of information. The importance of feedback loops that give the system or organism the ability to adapt to change and self-regulate, was developed in detail in this stage. During this foundational stage, the significance of the open system and its relation to the environment via the exchange of information and/or energy became an important stepping stone for other systemic ideas to follow in the field of study. During the Macy period however, the notion of informational feedback loops quickly led to the idea of 'reflexivity' (8) which entered the field of cybernetics through discussions about 'the observer' (9).

ii) The second era (1960–1980)

The notion of reflexivity and the attempts to incorporate it into the 'cybernetic paradigm at a fundamental level' (10) forms the main theme of the second era. Especially von Foerster (1960, 1962) made it his task to establish how to define systems as such and to redefine homeostatic systems so that the observer can be taken into account. The notion of 'second-order cybernetics' stems from von Foerster's suggestion that the observer of systems can himself be constituted as a system to be observed and thus cybernetic principles are applicable to the cyberneticians themselves. During this time, the biologists Humberto Maturana and Francisco Varela (1980) published their research on autopoiesis and cognition in which they focused on the notion of 'reflexivity in sensory processing and... the dynamics of autonomous biological systems' (Hayles 1999:10). By suggesting that systems are informationally closed, the notion of reflexivity progresses to a view that describes systems as being not only self-organising in terms of how they respond to their environment, but also that they are 'autopoietic, or self-making' (10). According to the autopoietic view:

> … no information crosses the boundary separating the system from its environment. We do not see a world 'out there' that exists apart from us. Rather, we see only what our systemic organization allows us to see. The environment merely triggers changes determined by the system's own structural properties. ... The emphasis is now on the

> mutually constitutive interactions between the components of a system rather than on message, signal, or information (Hayles 1999:11).

As a result information cannot be separated anymore from the organisational properties defining a system. It is also this view of autopoiesis that influenced the work of the sociologist Niklas Luhmann (1995) very strongly when he wrote about society as being divided into an array of complex systems. This understanding of autopoiesis remains contested (see Cilliers 2008b:31) in the light of an understanding of complexity that suggests that dynamic systems are open (Cilliers 1998:4) with boundaries that are not fixed, but of a more dynamic and temporary nature. Arguing that a system can be operationally closed, suggests that the system and its environment are two distinct separate entities. Suggesting that one can actually distinguish between system and environment, openness and closeness is in fact not possible. As Cilliers (2001:141) argues, in complex phenomena the distinction between environment and system is not made by a clear-cut boundary:

> Boundaries are simultaneously a function of the activity of the system itself, and a product of the strategy of description involved. In other words, we frame the system by describing it in a certain way (for a certain reason), but we are constrained in where the frame can be drawn. The boundary of a system is therefore neither purely a function of our description, nor is it a purely natural thing.

Cilliers' view of the nature of the boundary clearly contests Luhmann's notion of autopoiesis. In a sense, Cilliers' understanding of boundaries conforms more to the original idea of second order observation by arguing that the boundary can only be recognised in the dialectical process of observing the system and choosing how to define it. Morin (1992c:179) also suggests that the division between extreme openness and closeness is a misleading supposition:

> There is no absolutely closed system, there is no absolutely open system. Systems, even thermodynamically closed, are "open" from the point of view of gravitational and electro-magnetic interactions; at the extreme, an absolutely closed system, that is to say without the least interaction with the outside, would be by that very fact a system on which it would be impossible to obtain the least information. Conversely, thermodynamically open systems have an original closing

> and re-closing. To conceive of opening, therefore, is to conceive of a corresponding closing.

For Morin also thus, there is a dialectic relation between environment and the system and descriptions thereof. In Morin's (208) view it is the notion of feedback (or the 'recursive loop' as he calls it) that links or 'ties opening to closing.' From such an understanding of the relation between system/environment and openness/closeness through the working of the recursive loop, the process of autopoiesis is transformed into a generative process that Morin (1992a:377) calls 'auto-eco-re-organisation.' His ecological term aims at going beyond a cybernetic understanding of reflexivity (which he argues remains too formalistic (1992c:249)) in order to demonstrate how complex and ambiguous the processes of self-organisation and observation are.

iii) The third era (1980 to the present)

Building on the notion of autopoiesis, the third era of cybernetics is seen to be concerned with the concept of emergence 'when self-organisation began to be understood not merely as the (re)production of internal organisation but as the springboard to emergence' (Hayles 1999:11). The notion of emergence was researched from the field of artificial life when computer programs started to 'allow "creatures" (discrete packets of computer codes) to evolve spontaneously in directions the programmer may not have anticipated' (11). The use of models that explained reality in terms of underlying cellular automata (elementary units that can occupy two states: on or off) is here of importance. Because the cellular automata model supposes that a 'universal informational code underlies the structure of matter, energy, space-time - indeed of everything that exists' an argument can be made that 'information and materiality "can be seen as being" distinct entities' (11, 12) which leads to the notion of virtual reality (or artificial intelligence) as an emergent phenomenon. This notion of emergence remains rather underdeveloped and it will be shown later, that in the case of complex living systems, the concept of emergence cannot be based on the separation of materiality and information and that the nature of complex systems are far too 'unruly to fit into disembodied ones and zeros' (13).

Through combining ideas extracted from both systems theory and cybernetics, the contribution of the Belgian chemical physicist in thermodynamics, Ilya Prigogine should also be mentioned. By means of his theory of dissipative structures (unstable systems) which led to groundbreaking research in self-organising systems, Prigogine proved that complex systems exist in conditions far from equilibrium. Often viewed as also forming a bridge between the natural sciences and

social sciences, Prigogine's work[16] is seen as one of the cornerstones in the development of complexity theory insofar as it asserts the end of the deterministic approach of Newtonian science. As maintained by Prigogine (1983), determinism loses its explanatory power in the face of irreversibility and instability. From here, links are often made to compare the discoveries in science to explain the trends in philosophy where language and meaning departs from a structuralist paradigm and to view poststructuralist theories of language and meaning in a more favourable light.

Discussing the influence of the 'cybernetic revolution' on 'French theory' Lafontaine (2007:32) suggests that:

> Oddly, it was through the structuralist importation of the cybernetics model to France that the paradigmatic rupture came to assume its whole meaning. Not only did Lévi-Strauss draw from the cybernetics universe his 'spirit without subjectivity' model, but the entire project of structural anthropology consisted in interpreting society as a whole according to a general theory of communication. It was in the intellectual stagnancy of postwar France that anthropologist Claude Lévi-Strauss, back from a long stay in the United States, laid down the theoretical bases of his structuralist model.

Cybernetics' strong influence on the French intellectual landscape is also visible in the work of Morin (1992c). His explanation of complexity and complex thinking is strongly founded on concepts that arose from the field of cybernetics, combined with that of general systems theory. Notions of the importance of organisation within systems (or more specifically self-organisation), the irreducibility of complex systems, the effects of feedback loops (cause and effect), the presence of disorder and instability are concepts that all stem from the discoveries made in the field of cybernetics. From the discussion above it becomes clear that trends in cybernetic research offered a prevailing pragmatic foundation to the ideas of system and complexity (Alhadeff-Jones 2008:90). This influence will be a recurring theme throughout the rest of this study.

[16] cf. Prigogine (1983, 1997); Nicolis & Prigogine (1977) and Prigogine & Stengers (1984).

2.2.3 Artificial Intelligence

Building on the discoveries made in cybernetics and its advances made in the study of artificial and virtual intelligence, the field of neural computing also offered important contributions toward establishing a general theory of complexity. Important pioneers in the field are reckoned to be John McCarthy (Mathematics/Founder), John von Neumann (Game Theory/Cellular Automata), Norbert Wiener (Mathematics), Claude Shannon (Information Theory), and Warren McCulloch (Artificial Neural Network). At the Dartmouth Conference in 1956 the term 'artificial intelligence' (AI) was coined for the first time to describe their collaborative efforts which were summarised in the conference proposal. The aim of the field of study was to show:

> (t)hat every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves (McCarthy *et al.* 1955).

Developments in AI were based on the earlier work done in symbolic logic that sprouted from Alan Turing's contributions on describing a formula for computing machine-like operations (Alhadeff-Jones 2008:70). Following on that the development in automata theory (using abstract mathematical machines to solve computational problems) contributed to enhancing the work of McCulloch and Pitts (1943) who, based on their neurophysiological research, succeeded in developing a mathematical description of the neural system. The descriptions of complex operations by means of automata and neural networks offered a 'powerful conceptual tool to represent a possible ontology of organised complexity' (Alhadeff-Jones 2008:70).

The underlying assumption in the field of AI is that the mind is just another machine, however a complex machine. Scientists believed that they could 'reproduce the neuronal structures that make up the brain by creating a rudimentary computer' (von Foerster & Poerksen 2002:106) that were founded on the work of McCulloch and Pitts. In principle AI suggests that by creating complex and advanced modelling programmes the interconnections of neural networks as found in the brain could be mimicked to produce computerised machines that are able to speak, learn and behave in human-like ways. By simulating human neural networks, machines would be able to function in ways that could self-organise its components. The machines would be able to

learn adaptively during their lifespans in order to adjust to new conditions by recognising recurring patterns and disturbances. AI machines have memory and are able to integrate highly complex simulations and equations in order to link different sets of data.

A significant aspect in AI research is the fact that there are a number of competing approaches that co-exist within the field of study (Sun 2000:1). The symbolic approach and the connectionist approach are two competing paradigms worth mentioning (Cilliers 1998:1421)[17] and will be discussed here briefly.

(i) Symbolic rule-based approach

Since the inception of the field of AI, the traditional view of modelling complexity in the neural structures of the brain was the symbolic (or representationalist) approach (Sun 2000:2, Cilliers 1998:15, 59). The computation used in this approach relies on a kind of "symbolic manipulation" (Sun 2000:2) by which a formal system is used to represent the interaction of neurological activity. A model is constructed by means of a physical symbol system (also called a formal system) (3). A formal system comprises "a number of tokens or symbols, ... (that) can be combined into patterns by means of a set of rules which defines what is or is not permissible" (Cilliers 1998: 14). According to Newell and Simon (1976:116), such a formal symbol system has the "necessary and sufficient means" for generating "general intelligent action". The rules governing the configuration of the symbols are "strictly formal, i.e. they conform to a precise logic" (Cilliers 1998:14). In the modelling process, the symbolic approach supposes that the description of a complex system can be "reduced to a set of rules that describes the system adequately" (15). According to Cilliers (59), this approach is a rationalist approach that is essentially reductionist in nature and not flexible enough to take into consideration the nature of the structure and inter-relations of complex phenomena.

(ii) Connectionist approach

Opposing the formal symbol approach, the more recently established connectionist paradigm has resulted from shortcomings in the rule-based approach. Inspired by models of biological neural networks (Sun 2000:2), connectionist models (or neural networks) conceive of intelligence or cognition in terms of the interactions and relationships between neurons (and clusters of neurons), instead of "in terms of deterministic rules" (Cilliers 1998:35). The connectionist approach is based on the understanding that "representations are distributed

[17] A detailed discussion on the difference between the two approaches can be found in Cilliers (1998:58-88).

throughout a large number of processing elements" that can only be modelled by "parallel models" that are interconnected (Sun 2000:2). Cilliers (1998:25) describes the characteristics of a connectionist approach based on the modelling of the behaviour of neural networks, in more detail:

- Neural networks conserve the complexity of the systems they model because they
- have complex structures themselves
- Neural networks encode information about their environment in a distributed form. The notion of distributed representation undermines our understanding of conventional theories of representation.
- Neural networks have the capacity to self-organise their internal structure.

Such a connectionist view offers important insights into the characteristics of complex phenomena. From the study of neural networks, it could be ascertained that complex systems 'consist of large numbers of simple neurons (elements) that are richly connected. The weight associated with the connections between neurons determines the characteristics of the network' (28). Complex patterns that are complex themselves are generated by the network of interrelated components (28).

Discoveries in AI contribute to innovative and groundbreaking technological inventions, but the notion that the human brain and intelligence per se can be simulated completely, is still a misleading concept in the field of studying complex phenomena. Although many complexity scientists believe that in principle, the brain is a rule-based machine and that intelligence understood as such could be simulated in future, the modelling strategies of AI still do not account for all the nested connections of memory, information, and emergent properties that are displayed in human neural networks (34–35)[18]. Whilst AI research has produced very helpful insights in various fields of computer simulation research and technology development, Cilliers (2008:20) argues that 'it will not solve the big problems, just as we have not produced intelligent computers after more than 40 years of intensive research'. The main reason for this limitation of AI can be summed up in a bigger argument that forms part of what is called a

[18] See the discussion on connectionism in Cilliers (1998:25-36) for a more detailed discussion on the notion of why AI cannot succeed in modelling human intelligence completely.

division into two wings within the complexity movement. The reason and nature of this division will be the topic of discussion of the next section.

2.3 Complexity *versus* Complexities

Relating to the contested views of different approaches in the field of AI is the dividedness in the field of research that deals with complexity. As Alhadeff-Jones (2008:67) argues, the term 'complexity' seems to represent a 'unified concept' that appears 'to be progressively reified'. By using the singular form 'complexity theory' or 'science of complexity' one might furthermore get the idea that there is a unified theory or science of complexity. However, as mentioned earlier, this is a misleading assumption that disregards the spectrum of different theories of complexity. It might therefore be even more useful to speak of different kinds of 'complexities'. Looking at the origins of the notion, it is noticeable that this might have been the case, but that these differences were ignored as the research trend developed more popularity.

Reflecting on the development of the notion 'complexity', Alhadeff-Jones (2008:68) and Browaeys & Baets (2003:332) propose that it was the French philosopher, Gaston Bachelard (1934) who was most likely the first person to describe the epistemological consequences of complexity in his conceptualisation of a non-Cartesian approach to science. In his understanding of complexity, Bachelard argued that complex phenomena could not be reduced to their components in order to be made understandable in a 'simple, absolute and objective' (Alhadeff-Jones 2008:68) manner. From his perspective the notion of complexity supposed the 'fundamental non-simplicity' (68) of phenomena that existed as part of a network or system of relations.

A number of years later after Bachelard, Warren Weaver (1948) wrote about the 'boundaries of science' in his seminal paper *Science and Complexity*. He cautioned scientists against an over-confident belief in the power of science to solve all of humanity's problems. Already in 1948, he discussed the limits of traditional scientific methods that involve 'collection, description, classification and the observation of concurrent and apparently correlated effects' (536). In this paper he distinguishes between 'problems of *simplicity*' that relate to the capabilities of the physical sciences to solve problems that are concerned with 'two-variable problems' from problems of *disorganised complexity*. The problem of simplicity relates to the classical scientific models that underline the status of scientific method that relies on objectivity, causal explanation, quantitative data analysis and certainty. Disorganised complexity deals with

'numerous-variable problems suitable for probability analysis' (Wirth 2004:65), when a large number of variables are involved in disordered phenomena on various levels of organisation (Alhadeff-Jones 2008:69). Examples of questions of disorganised complexity are principles such as the 'entropy in thermodynamics, discontinuity in quantum mechanics, (and) the explosive nature of stellar phenomena' (69). It is argued that this kind of complexity that deals with randomness or chaotic behaviour of a very large number of components in a closed, mechanical system can be reduced to statistical analysis by means of computational methods.

Weaver (1948:539) admitted that although this new method that had the capability to deal with disorganized complexity was an 'advance over the earlier two-variable methods' it left a great field of study untouched; 'a great middle region'. Involving a significant number of variables the problems in this middle region lies in the fact that these problems, as 'contrasted with the disorganized situations with which statistics can cope, show the essential feature of *organization*' (539). To distinguish the problem of organisation from disorganised complexity in such phenomena, Weaver used the term *organized complexity* which referred to 'all problems which involve dealing simultaneously with a sizeable number of factors which are interrelated into an organic whole' (539). Examples of such phenomena are problems of biological, medical, psychological, economic, and political nature he argued. The nature of the problems of organised complexity is of such a kind, that they 'cannot be handled with the statistical techniques so effective in describing average behaviour in problems of disorganized complexity' (540). Weaver's distinction between disorganised and organised complexity based on the distinction between calculable and incalculable complexity forms the basis of the disunity that is still present in contemporary theories of complexity today.

2.3.1 The Case for a General Theory of Complexity

In explaining why there was an upsurge in the systems thinking approach, von Bertalanffy (1968:18) suggested that 'the system problem is essentially the problem of the limitations of analytical procedures in science'. The necessity of a systems approach for studying complex and dynamic phenomena became apparent after the classical methods of analysis and isolation proved to be insufficient in solving theoretical problems in 'especially the biosocial sciences, and with the practical problems posed by modern technology' (11–12).

Expanding on this dilemma, von Bertalanffy (19) argues that the application of analytical procedures is only successful when objects under study adhere to the following two conditions:

> The first is that interactions between 'parts' be non-existent or weak enough to be neglected for certain research purposes. Only under this condition, can the parts be 'worked out,' actually, logically and mathematically, and then be 'put together.'
> The second condition is that the relations describing the behaviour of the total is the same form as the equations describing the behaviour of the parts; partial processes can be superimposed to obtain the total process, etc.

Since entities called systems do not adhere to these two conditions, but consist of dynamical interacting parts, the equations that describe their behaviour require a 'set of simultaneous differential equations, which are nonlinear in the general case' (19). The nature of the interactions in complex systems can thus be described to be 'strong' and 'non-trivial' or nonlinear (19). As such, the method of systems theory provides for problems of a more general nature in contrast to the approach of classical science that demand analytical methods of study. According to von Bertalanffy the term 'general' thus includes the study of models, laws and all 'principles which are valid for "systems" in general' (32) irrespective what the nature of the system is, may it be physical, biological or social. What is locked-up in Bertalanffy's use of the word *general* then, is in fact the acknowledgment that principles of systems theory could be transferred from one scientific field to another. By being a general theory, General Systems Theory has the potential to become a bridge between the natural and social sciences (Georgiou 2007:69).

M'Pherson (2003:127) suggests that the split in conceptualising an understanding of complexity arose from 'a steady conflux of the two wings' that emerged in what he broadly calls the 'systems movement'. Morin (2007), Byrne (1998) and Cilliers (2010a) support this view and distinguish between traditional positivist scientific strategies that aim to quantify and formalise complex behaviour (such as the symbolic rule-based approach in AI discussed earlier) that can be labelled 'restricted complexity' and a more 'general' understanding of complexity that resists the quantification, simulation and simplification of complexity. The founders of the Santa Fe Institute[19], Murray Gell-Mann and John Holland became rather famous for the way in which they defined the notion of complexity as the science of complex adaptive systems. This

[19] For more information about the activities and ambitions of the institute see: www.santafe.edu. For an in-depth discussion on how their work relate to a 'restricted complexity' see Woermann (2010:102-105).

definition delimited complexity theory as a field of science that relies on computational tools to model complex systems by means of agent-based modelling and simulation. By reducing complex phenomena to formalisations such as cellular automata, neural networks and genetic algorithms, emergent properties and non-linear behaviour are left out of the equations. The 'complexity science' as practiced by the Santa Fe Institute can be allocated in the category that Morin calls 'restricted complexity' (2007). It supposes that one can recognize complexity by 'de-complexifying it' (10). This kind of approach supports the notion that even though things are complex, it is possible to still find order in it, by measuring it in terms of mathematical models. From this perspective, one is confronted with highly technical jargon that relates to the milieu of chaos theory[20].

Both Cilliers (2010a) and Morin (2007) argue against a positivist, reductionist form of 'restricted' complexity by saying that due to the structural nature of complex systems, it cannot be reduced or quantified. The notion of a 'general' understanding of complexity as suggested by Morin (2007), relates to von Bertalanffy's notion of a general systems theory where 'general' refers to an open paradigm for describing principles that are characteristic of a variety of systems. In this sense 'general complexity' is a view that acknowledges the distinction between what Weaver calls disorganised and organised complexity, but is open enough at the same time to include both kinds of complexity in the understanding of the word 'general'. The notion of 'general complexity' marks a *shift* in the definition of the notion 'complexity theory' and opens the definition up to include many other theories of complexity. As was conceptualised by von Bertalanffy when he formulated his General Systems Theory, the general understanding of complexity brings together various approaches to the study of complexity in order to open a space of dialogue, communication and self-reflection. The case of a general theory of complexity draws on a kind of 'integrative pluralism' that allows a range of scientific practices to be grounded in an 'expanded epistemology of science that embraces both traditional reductive and new multi-level, context-dependent approaches to scientific explanation and prediction' (Mitchell 2009:2). One can say that it describes a kind of complexity that has become critical of itself. Based on the understanding of a general theory of complexity, Cilliers (2010a) introduces the notion of 'critical complexity' to coincide with Morin's general complexity. The notion of critical complexity will be discussed in more detail in this study in Chapter 5.

[20] For more on this type of thinking, see for example Johnson 2007.

By defining complexity in terms of a critical framework or in light of a general understanding thereof, the field of study is opened up and expanded to embrace both the simple, disorganised (or restricted) and organised (or general) forms of complexity. In fact, the general view on complexity moves beyond the dichotomies of opposites and goes further to incorporate also the paradigm of complexity or complex thinking as mentioned earlier. Not only does it consider different epistemologies and methodological practices, but it also gives us the opportunity to think critically about the limitations of these methodologies and their interventions.

As explained here above, it becomes clear that the first problem of complexity, namely delineating the conceptual field thereof, is closely related to the diverse intellectual strands of thought that influenced it through the span of its short history. The notion of a general theory of complexity suggests not only a middle way through the marshland of many competing theories, but also offers a way of embracing (but not uniting) a range of divergent theories in a critical manner. By reflecting critically on the status of these theories and on how open they are to acknowledge their limited range of explaining the world we live in, the concept of complexity as framed from a general understanding thereof remains open and dynamic. It continues to be what Morin (1992c:140) calls, a 'pilot notion' as mentioned earlier and challenges us to remain wakeful of the many pitfalls that await us on the journey towards a finding a more expanded, non-reductive kind of conceptualisation of complexity.

3. Describing complexity

Related to the problem of describing complexity conceptually is the problem of finding a definition of complexity in terms of the physical, phenomenal and empirical characteristics thereof (Morin 2008:139). Despite that fact that there might not be agreement in terms of how to define and conceptualise complexity on a theoretical level, it seems that there is some degree of agreement across different disciplines about the characteristics and behaviour of complex phenomena. The division into different theories of complexity (restricted or general) results from the disagreement regarding to what extent the characteristics are measurable or not and whether or not it is possible to model or simulate complexity.

Having been woven together from the three main fields of study from which theories of complexity developed, namely general systems theory, cybernetics and artificial intelligence studies as mentioned earlier, some general related, but not identical characteristics of complex

phenomena can be distinguished (Emmeche 1997:57). The following section aims to describe a number of the most important general characteristics of complex phenomena:

3.1 Openess

Complex systems are **open systems** and interact with their environment in such a way that it becomes almost impossible to define which component belongs to the inside of the system and which component to the environment. Clearly defining the boundary of the system is problematic and is often 'a function of the activity of the system itself, and a product of the strategy of description involved' (Cilliers 2001: 141). The boundary is permeable and allows for communication and flow of energy between the system and environment. Neither the 'nature' of the boundary nor the 'place' of the boundary is easily definable (146 and Juarrero 2002:100). Another way to describe this principle is to think of the complex system as being 'embedded' within its environment (Prigogine1987:99, Juarrero 2002:98). The survival of the embedded system depends on the dynamic interaction between system and environment.

3.2 Relationality, non-linearity and non-equilibrium

Complex systems are constituted **relationally**. The interactions between the different components within the system and between components in the environment are dynamic and manifold. Cilliers (1998:3–4) argues that the nature of the interactions is "fairly rich" meaning that "any element in the system influences, and is influenced by, quite a few others." The interactions that constitute the system and its relations with the environment are **non-linear** which means that the system's output cannot be measured in direct proportionality in terms of its input.[21] The non-linear characteristic of the interactions in the system has consequences for understanding causality. Traditionally, closed systems follow a linear kind of causality in which input or cause A (whether material, informational or in terms of energy) would have predictable measurable effects on output B, without effecting input/cause A again. The relationship between cause and effect is directly traceable in a clear chain of events. Linear causality accounts for determinist and predictable outcomes in the functioning of closed systems. When all the

[21] Mathematically speaking, a linear function *f*(*x*) is one that can satisfy both of the following properties:

additivity: $f(x+y) = f(x) + f(y)$;

homogeneity: $f(\alpha x) = \alpha f(x)$.

variables are known and a first position or first cause has been established, the effects or outputs can be predicted with certainty in advance. Non-linear interaction explains the fact that in complex systems cause and effect is not directly related to one another in a unidirectional linear fashion. Complex system outputs can function as inputs again and small effects might have large causes and vice versa. (Cilliers 1998:4, 95, 119-120 and 2005a:257). In the words of Kant (1993:555), complex phenomena can be both '*cause and effect of itself*' (italics in original). The notion of non-linearity is therefore a precursor for unpredictability and uncertainty in calculating future behaviour of the system.

Due to the non-linear character of the interactions between the components of the system, the environment and the systems as a whole, the system is asymmetrical and functions in a state of **non-equilibrium** (Cilliers 1998:4, Prigogine 1987:99, Capra 2007). The effect of the relation between non-linearity and far-from equilibrium conditions, is that it causes a 'multiplicity of stable states' in the system which is more robust than the single static state of systems that exist in a state of equilibrium (Prigogine 1987:99). The non-linear relations contain feedback loops of energy, information or material that can be negative (decreasing growth) or positive (increasing growth) and they regulate the system on multiple levels of organisation (Morin 1993:12, Whiteside 2004:361). The survival of the system is dependent on this kind of non-linear relationality.

3.3 Non-homogeneity

Complex systems are comprised by a **number of non-homogenous components** (Cilliers 1998:3, Morin 2008:20). The number of components is not as important as the degree to which the components differ from each other. Complexity is caused by 'the large number of pathways' that enable interaction between the components of the system and its environment and the effects of non-linear feedback loops (Pickett *et al.* 2005:227). Because the interaction between the components amongst each other and between the components and the whole are rich and dynamical, the number of interrelations to observe and measure become incalculable and very complicated (Morin 1994:559). Complex systems are not chaotic systems (Cilliers 2001:139). The elements are structurally organised in (asymmetrical) hierarchies and patterns (143) that can change over time and scale.

3.4 Emergence & complex causality

Complex systems display **emergent** properties. Emergence[22,23] is related to the dynamic nature of the interactions of the components in a system and can be explained in terms of the organisational structure of the complex system. Emergent phenomena "arise from and depend on some more basic phenomena yet are simultaneously autonomous from that base" (Bedau & Humphreys 2008:1). The dynamic character of emergent phenomena is not a property of a pre-established, given whole, but arises and becomes apparent as a complex system evolves over time (Goldstein 1999:50).[24] Traditionally emergence is explained by the statement that 'the whole is more than the sum of the parts' (52). To state it more clearly, this means that the complex whole is characterised by properties and qualities 'which are not to be found in the parts in isolation and, conversely, that the parts possess qualities and properties which disappear as a result of the organisational constraints of the system' (Morin 1974:558). The disappearance of the components' particular qualities is rarely recognised and Morin (1992c:109) explains this matter as a constraint within the organisation of the system. The restrictions that are imposed on the parts in the process of organisation that give rise to emergence can be formulated as 'the whole is therefore, in this sense, *less* than the sum of the parts' (110), (Morin 2007:11). Because the parts are transformed in the process of emergence, the traditional definition of emergence can be extended to include the understanding that emergent phenomena produces a system that can be described as at once being more, less and other than the sum of its parts (112).

Emergent phenomena share certain interrelated, general properties that identify them as emergent (Goldstein 1999:50):

- *radical novelty*: novelty attests to the fact that emergent phenomena are neither predictable nor deducible from lower or micro-level components in a complex system.

[22] Emergence is not a new term and has been discussed in Philosophy as early as Aristotle. In his *Metaphysics* (1952) he is known for the statement that "in the case of all things that have several parts and in which the whole is not like a heap, but is a particular something besides the parts, there must be some such uniting factor." Typical examples of emergent phenomena include the following: consciousness, the immune system, the property of water to be fluid, the notion of 'life' itself (the characteristic that distinguishes living things from non-living things).

[23] C.Lloyd Morgan (1923) notes that the notion *emergence* was first proposed by the British philosopher George Henry Lewes in his work *Problems of Life and Mind* (1875–1879). Juarrero & Rubino (2008) write: "By the first third of the twentieth century, the so-called British Emergentists, a group that, in addition to Morgan and Lewes, includes D'Arcy Thompson, Samuel Alexander and C.D. Broad, along with Herni Bergson and Alfred North Whitehead all noticed features in chemical processes that cannot be explained solely in terms of physics and its laws."

[24] Goldstein (1999), Emmeche et al (1997), Clayton (2006), Hodgson (2007) and Bedau & Humphreys (2008) offer excellent expositions on the current place and understanding of emergence in contemporary theory dealing with the description of complex systems.

Thus, truly novel emergent phenomena are not able to be anticipated before they actually appear.

- *coherence*: emergent phenomena materialise as integrated wholes that are likely to maintain some sense of identity over time.
- *global or macro level*: coherence represents a correlation that spans separate components and therefore emergent phenomena are located and occurs at a global or macro level, in contrast to the micro-level domain of their components.
- *dynamical*: emergent phenomena are not *a priori* wholes but gradually appear as a complex system dynamically develops over time.
- *ostensive*: emergent phenomena show themselves and are ostensively recognized in terms of their purpose and meaningful behaviour.

A consequence of emergence is that the properties of the components within the complex system cannot in principle be predicted from the behaviour of the systems as a whole and vice versa, properties of the systemic whole cannot be predicted, in principle, on the basis of the behaviour of the different components (Boogerd et al 2005).

The notion of emergence furthermore relates to how causation[25] is explained in the broader scientific argument regarding reductionism *versus* non-reductionism (Hitchcock 2010:318). According to strong scientific reductionism, causality is described as a function of causes that originate in a lower level of reality resulting in causal effects in higher levels.[26] This kind of causation is called 'bottom-up causation' and forms the core of the reductionist view in physics.

[25] The notion of 'causality' is an important issue in all scientific endeavours. Generally speaking "(c)auses are separated from effects by searching for correlations between phenomena such that manipulation of one (`the cause) can be shown, in a specific context, to reliably result in specific changes in the other (`the effect') at a later time" (Ellis 2008:69).

[26] The notion of 'levels' is a common classification of reality in the field of Philosophy of Science. Clayton (2006:12) clarifies the use of the notion of 'levels' along these lines:

> The notion of levels of reality harkens back to the philosophy of Neoplatonic philosophy of Plotinus, ... who held that all things emanate outward from the One in a series of distinct levels of reality (nous, psyche, individual minds, persons, animals, etc.). In the present case, however, the motivation for the position is not in the first place metaphysical but scientific: the empirical study of the world itself suggests that reality manifests itself as a series of emerging levels rather than as permutations of matter understood as the fundamental building blocks for all things.

According to a level-view of the world, logic and mathematics comprise the fundamental and universal level, and then follows the physical, the biological and the chemical levels. The last level encompasses the mental and social dimensions.

According to this view, "all can be explained by such bottom-up mechanisms based in the laws of physics, with no remainder (Ellis 2008:70).[27] The implications of bottom-up causality amount to the argument that the behaviour of the whole can be explained in terms of the functioning of its component parts. Emergent properties in complex phenomena such as natural entities and living systems challenge the reductionist view of causation. **Complex causality** in complex systems requires an explanation that allows for simultaneous multiple kinds of causality that includes "various forms of top-down causation" (71). Top-down (or downward) causation (Campbell 1974, Kim 1992) describes the capacity of higher levels of reality to have causal power over lower levels of reality (Ellis 2008:70). The functioning of the whole is described not in terms of reducing it to the different components of the system, but in terms of the properties of the relations of the "interconnected complex whole". (79)[28]. Top-down causation explains emergent behaviour by ascertaining its role or function within the higher levels of structure (79).

By linking emergence with 'downward causation', the assumptions of classical reductionist analysis are put into question. Kim (2008:428-429) describes the argument as follows:

> The classic positivist answer is that the distinctive properties of entities at a given level are reducible to, or reductively explainable in terms of, the properties and relations characterizing entities at lower levels. That is ''reductionism.'' But reductionism has had a rough time of it for the past few decades, and has been eclipsed by its major rivals, ''eliminativism'' and ''non-reductivism.'' These positions agree in their claim that higher-level properties are in general not reducible to lower-level ones, but differ on the status of irreducible higher properties. Nonreductivism maintains that they can be real and genuine properties of objects and events of this world, constituting an ineliminable part of its true ontology.

[27] Ellis (2008:70) explains the relevance of bottom-up causation as follows:

> Bottom-up causation allows a certain degree of complexity to be spontaneously built up in non-equilibrium situations, often demonstrating symmetries and broken symmetries, without higher level guidance. Self-assembly and self-structuring can lead to emergence both of simple structures such as those associated with dynamical system attractors, for example stars and galaxies, and to more complex patterns such a Benard Cells, patterns associated with the reactiondiffusion equation, those occurring in the Game of Life, and biological examples such as ant hills and flocks of birds. These, however, do not extend to truly complex systems such as a single living cell.

[28] Often this explanation of downward causation is also called 'whole-part influence' (Clayton 2006:4).

In other words, downward causation suggests that emergent phenomena are both dependent and autonomous from the processes of the underlying components (Bedau & Humphrey 2008). Emergent phenomena are the effects of the way in which complex systems are structured and a result of how the components interact dynamically, but they also in turn are the causes of changes or behaviour in the components of the system.

Due to the multiple causal processes present in complex systems measuring the effects of emergent phenomena thus becomes increasingly problematic and they do not fit the traditional scientific methods of modelling and analysis (Bammer 2005:13). As a result of the continuous causal processes (Hitchcock 2010:324) in complex systems, the notion of emergence is strongly linked to the notion of self-organisation and is sometimes even defined in terms of it. Goldstein (1999:49) conceives of emergence as 'the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems'. Hence, the notion of emergence is related to the idea of transformation and points to a kind of organisation that transforms and forms simultaneously (Morin 1992c:112). In other words the notion of emergence is inextricably linked to the process of self-organisation in complex systems.

3.5 Self-organisation

Complex systems are **self-organising**[29] systems. Self-organisation can be described as 'a property of complex systems which enables them to develop or change internal structure spontaneously and adaptively in order to cope with, or manipulate, their environment' (Cilliers 1998:90). Inherent in the word self-organisation is the notion of *organisation* which is the bridging concept between all the foregoing concepts. Morin (1992c:99) suggests that the notion of system is incomplete without the notion of organisation which 'ties the idea of totality and the idea of interrelations, the three notions becoming indissociable'. It is also this inextricable character of these notions that characterises the notion of system as being constituted 'as a global unity organised by interrelations between elements, actions or individuals' (99). Linked to this, the system's ability for self-organisation points to the fact that a complex system has an

[29] The term of *self-organisation* was originally introduced by Kant (1993:581, §81) in relation to his notion of teleology and an organism's ability to govern itself or its 'self-maintaining purposiveness'.

For a comprehensive history of the study of self-organisation, see Keller 2009 and Heylighen http://pespmc1.vub.ac.be/papers/EOLSS-Self-Organiz.pdf [accessed 17 Feb 2011]. For further reading on the discovery of self-organisation in science, see Ashby (1947), Bak (1996), Barabási & Oltavi (2004), Eigen (1971), Kauffman (1993), Nicolis & Prigogine (1977), Prigogine & Stengers (1984), Smolin (1997), von Foerster (1960), von Foerster & Zopf (1962).

organising principle that does not need an organiser from outside the system (like a *deus ex machina*) to initiate the way in which the components of the system start to interact with other components in the system and between the whole, in order to transform, bind, produce and maintain the system and the parts that it needs to interact (100–101, 127–134). In other words, self-organisation can be said to be the process whereby structure and patterns appears in a system without a central authority or external element imposing a directive force on the system

Self-organisation is a state of permanent re-organisation, self-assembly and re-generation. The generative capacities of living systems ensure the system's survival even though the individual parts of the system may degenerate. A study of self-organised systems needs to observe and be able to detect the 'processes of self-assembly and self-organization in multilevel systems, operating on multiple spatial and temporal scales through multilevel feedback, in which the internal structure and properties of the component elements are themselves responsive to the dynamics of the system' (Keller 2009:30). Self-organisation also ensures that the system has the ability to adapt in dynamic ways to changes in the environment (Cilliers 1998:91). The system's adaptability is influenced by its ability to have memory and to learn from previous experiences which in turn is responsible for an increase in complexity (91).

The above description of the characteristics of complex systems reveals the underlying tendency that the characteristics are constituted by a constellation of interrelated systemic notions (Morin 1993:13). Not only do the individual characteristics attest to the impossibility of clearly demarking the complex subject for the purpose of observation, analyses and prediction, but also are the characteristics mutually reconcilable with each other (Emmeche 1997:59). The problem of identifying the object of study and determining its behaviour calls for new ways of thinking about the reality (ontology) and methods of analysis with which complex phenomena are approached in order to gain knowledge about such phenomena (epistemology).

The logic of the dynamic relations and organisation of complex phenomena introduces a shift in what the actual object of study is. There is a shift from studying clearly defined essences of objects (elementary units such as atoms and molecules) to the study of organisation and relations. An ontology that favours relations instead of substance is exposed (Juarrero 2002, Ulanovicz 2007:28, Morin 2008:30). For self-organising objects, the structure and form of the object is constituted relationally by means of a generative organising principle which is equally important to take into account during the processes of observation and analysis (Morin 2008:18). Although the process of self-organisation as such is endowed with an autonomy of its

own, it cannot be studied in isolation. Because of the way in which self-organisation depends on the dynamic exchange with the environment, the environment of the complex system 'plays a co-organising role' (19) in the constitution of the complex object. The self-organising object is autonomous, but not self-sufficient. A systemic understanding of the object problematises and challenges the Cartesian metaphysics that proposes a clear distinction between object and environment.[30]

The notion of the complex object causes an 'ontological crack', a 'regression of objectivity, of determinism' that leads to a 'general regression of knowledge' (26). In a sense, the notion of the Cartesian object is restricted by the notion of the complex object. The powerful consequences that a positivist understanding of the object poses to our methods of observation and knowledge production have been constrained. The autonomous object is no longer present, but at the same time present and absent. The demise of the positivist object is however, no reason for alarm. Whilst a complex understanding of the object places limits on the reified object, the generative organisation and dynamic relationality of the complex object opens up and expands the notion of *object*. The limits enable new possibilities for our knowledge generating practices to emerge. The ontological rupture has consequences for how we view the nature of the object and a space is opened in which the problem of observation is linked to the problem of knowledge. From this rupture an epistemological opening (27) emerges.

4. Conclusion

In this chapter the notion of complexity has been problematised in terms of two main concerns. The first problem is that of delineating the formal and ideal conceptualisation of the term complexity and its related theoretical underpinnings. The difficulty of defining complexity and its related field of study conceptually was approached by determining ten common theoretical assumptions that seem to link the diverse body of literature on complexity with one another. In the absence of a unified theory of complexity, these common denominators form the basis for a paradigm (Morin 1992a, 2008) or attitude (Cilliers 2007) of complexity that enables an expanded understanding of the notion of complexity. The paradigm of complexity allows the underlying theoretical assumptions and implications of complex phenomena to cross-fertilise other scientific discourses and practices. Set against this background, it is suggested that the

[30] See Cilliers and De Villiers (2000), Cilliers (2010a), Cilliers & Preiser (2010) and Morin (2008:68–81) for a more detailed discussion on the notion of 'complex identity' and how the complex object differs from a Cartesian understanding of the object and the subject.

problem of complexity is a problem of observation and concerns itself with the conceptual and empirical difficulties of studying complex phenomena. Chapter 2 will engage with the problem of modelling complexity which is related to the difficulty of not being able to observe complexity from an objective point of view.

In this first chapter the origins of the conceptual roots of complexity were discussed in light of Castellani's (2009) proposal that the notion of complexity advanced through the inter-related scientific developments in three main fields of study, namely the fields of General Systems Theory, Cybernetics and Artificial Intelligence. Due to the nature of these fields of study, two distinct schools of thought developed within the complexity movement itself. For the one school of thought, the notion of a 'science of complexity' represents the possibility that complex interactions and phenomena can be calculated and computed in order to offer neatly packed predictions of its behaviour. This reductionist paradigm is described as a restricted form of complexity by the counter-position that argues that it is impossible to measure and calculate all the complexity in open, non-linear systems with emergent properties.

From this counter-position the notion of a general understanding of complexity emerged as supported by Morin (2007) and Cilliers (2010a). By defining the study of complex phenomena in terms of general theory of complexity, the theoretical base from which to conceptualise the notion of complexity is also expanded to include a wide range of theories. From this perspective the notion of complexity remains a 'pilot notion' (Morin 1992c:140) that allows for an integrative theoretical approach that remains critical of the scientific assumptions that emerge from studying complex phenomena. An integrative approach exposes the limits of each discipline and in the process the status of knowledge and knowledge generating practices that emerge in the process are problematised. This enterprise leads to the second problem of complexity, namely the problem of knowledge.

In this chapter the problem of being able to know complex phenomena in principle, was linked to the observation of the characteristics of complex phenomena. Five main characteristics were singled out that do not fit into the Cartesian/Newtonian prescriptions of analysis. By linking the conceptual and phenomenal problems of defining complexity, this chapter demonstrates that the acknowledgement of complexity poses clear challenges to traditional scientific methods subscribing to the Newtonian paradigm.

The epistemological and ontological rupture that developed in the fabric of modern science has serious implications for the way in which we understand our place in the world. The acknowledgement of complexity and the consequential paradigm shifts required in knowing and thinking about reality demands a revision of the rationalistic contemplation and ways of acting. Mitchell (2008:29) suggests that the acknowledgement of complexity and contingency changes the ways in "which we conceive of the world in theoretical terms (*Begriffe*), how we do research about the world and how we act in the world."

The first problem of complexity exposes an opening or gap between the reality of the world as such and our descriptions of the world. This gap leads us to an entrance into the next problem of complexity, namely the problem of knowledge. By expanding the way in which we can know the world, think about it and act in it, philosophers are urged to change their intellectual obligations in order to heal the wounds that false rationality and arrogant ideology imposed on reason and to enable ways of thinking and knowing that will lead to new discoveries, new concepts and new wisdom. The next chapter will focus on the problem of complexity in terms of its implications for our understanding of knowledge and the ways in which we go about to generate descriptions of complex phenomena.

CHAPTER 2
THE PROBLEM OF KNOWLEDGE

> *The world is out there, but descriptions of the world are not. Only descriptions of the world can be true or false. The world on its own—unaided by the describing activities of human beings—cannot.* (Rorty 1989:5)

> *We have taken science for realist painting, imagining that it made an exact copy of the world.* (Latour 1999:78)

> *We have acted as though the external world exists in itself and that our knowledge of it amounts to an accurate photographic picture.* (Morin 2008:90)

> *A central philosophical problem, one that has concerned scientists as much as philosophers, is the relationship between our descriptions of the world and the world itself.* (Cilliers 2000b:40)

1. Introduction

The problem of being able to know reality or the world as it is and being able to find accurate and truthful descriptions of reality goes back to the beginnings of the history of philosophic inquiry. The problem of knowledge already occupied the minds of Plato, Socrates and Aristotle and continues to be one of the main issues in contemporary philosophic exploration. In this light, devoting a few pages of discussion to the problem of knowledge *vis-à-vis* such a rich and long history of questioning seems almost insignificant. However, within the history of Philosophy, the notion of epistemology has been a catalyst for causing ruptures and paradigmatic shifts in the interpretation and formulation of scientific theories, and therefore needs some mentioning. The problem of knowing the world and the act of constructing theories of knowledge about the world through scientific practice remains a field of incessant contestation within the field of Philosophy.

Aiming at finding fitting descriptions of the nature of reality, the classical Cartesian/Newtonian paradigm has served as the standard account since the 17th century (Toulmin 2001, Ulanowicz 2007). Its epistemology departs from the hypodissertation that laws in nature are evident and therefore, discoverable and ultimately completely knowable (Dekker, Cilliers & Hofmeyr 2011). The Newtonian scientific method suggests that things can be well defined by means of isolation, observation and the establishment of regularities that describe an independent object's strict adherence to an underlying logic (Moldonato 2004: 461). It is argued that with this kind of reductionist analysis, abstract scientific theories are able to provide a perfect picture that represents the world like a mirror image (Rorty 1979, Kearny 1988). Positivist science asserts that the "theory of science and the methodology that it suggests are 'isomorphic' with the science and the world they reveal" (Moldonato 2004: 461). This isomorphism assumes that scientific theory and the equations gained by scientific observation that describe the inner workings of natural laws and forces, reflect or represent nature in an accurate manner. From this position, it is assumed that the descriptions that scientific inquiry generates correspond to the nature of reality as it is.

There is thus no gap between the world and the scientific models that explain the world. In this chapter this assumption will be explored in more detail and it will be argued that the Newtonian scientific method is fairly successful in making good descriptions of the world, when dealing with mechanical forces or closed systems. This view is problematic however, when the focus of study is moved to complex systems that are dynamical and open systems. The application of the Newtonian paradigm becomes even more problematic when aiming to describe emergent properties of complex systems where the interactions between the parts of the system and between the system and the environment are non-linear. In such circumstances, the basic principles of the Newtonian paradigm do not hold, and ignoring this misfit has implications for the knowledge generating practices that describe the world.

The discussion will proceed by giving a short overview of the history of the Newtonian paradigm followed by a critical reflection on how it steadily lost ground in face of breaches such as the demise of the status of the atom and principles of certainty. The chapter will investigate what consequences the breakdown of the Newtonian paradigm has for re-thinking ways in which to describe complex phenomena. The notion of reductionism is a key concept in the chapter. It will be argued that even though theories of complexity generally oppose reductionist positions in scientific reasoning, one does not get away without reducing complexity in the attempt to form theories and models about it. It is argued that a general understanding of

complexity as discussed in Chapter 1, allows for a reductionist position that becomes self-reflective about the limitations of our modelling attempts. The notion of post-reductionism is introduced to describe an understanding of knowledge that is cognisant of the difficulties that one faces when dealing with complex phenomena.

2. The birth of science and the dreams of rationalism

Following the Newtonian description of the world on which the modernist paradigm is built, the world itself (or Nature) has been viewed to be 'an objective world independent of us, to which we are responsible in making empirical claims' (Pinkard 2005:27). From his empirical observations Newton (1686) presented a picture of the world that proved that nature reveals itself to us as rationally intelligible. This view reiterated the ideals of the 'intellectual order' of 17th century Europe which "emphasized regularity, uniformity, and above all stability" (Toulmin 2001: 48) and simplicity. Through his 'principle of simplicity' (as stated in Rule 1 of the second volume of his *Principia* regarding the "Rules of Reasoning in Philosophy"), Newton (1686:202) argued that:

> Rule 1: We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.
>
> To this purpose the philosophers say that Nature does nothing in vain, and more is in vain when less will serve; for Nature is pleased with simplicity, and affects not the pomp of superfluous causes.

The above statement expresses the view that truth is revealed in the reduction of things to their greatest simplicity. This important dictum links with 'Rule 9' in his unpublished theological manuscript called *Rules for Methodizing the Apocalypse* in which he explains that it is better to "choose the constructions which, without straining, reduce things to the greatest simplicity, and not in the multiplicity and confusion of things" (Newton quoted in Osler 2000:265). Newton's interpretative methodology of simplicity rested on the assumption that the Solar System was revealed to be "an intrinsically stable dynamical system" which came to be "our visible assurance that the World of Nature demonstrates the Creator's Rationality" (Toulmin 2001:48, 49). Thus, the interpretation that nature could be understood by studying its orderly laws as demonstrated by the perfection of simplicity, formed the basis of the so-called 'Scientific Revolution' in the time from Copernicus to Newton (roughly from 1500 to 1700) (Osler

2000:3). Informed mainly by the work of Copernicus, Kepler, Galileo, Descartes, Boyle, and Newton, the Scientific Revolution is considered to be "the central episode in the history of science, the historical moment at which that unique way of looking at the world that we call 'modern science' and its attendant institutions emerged" (3). Ever since then classical mechanics was deemed the foundation of scientific inquiry that formed the conceptual model of the physical world (Mazzocchi 2008:10). From this conceptual model the matter, shape and movements of objects could be described in terms of laws and algorithms. Scientists and Biologists consequently adopted the Newtonian model on both the ontological and empirical levels (10).

On an ontological level the Newtonian view proposes that objects consist of divisible or elementary parts (Heylighen *et al.* 2007:118) that can be studied by means of isolation or analysis (thus, by separating the parts from the whole and by cutting it up into its smallest parts). Newtonian ontology is thus materialistic and assumes "that all phenomena, whether physical, biological, mental or social, are ultimately constituted of matter" (118). Linked to such a materialistic ontology, is the Newtonian epistemology that asserts that scientific knowledge has the duty to present an objective representation of the natural world (Mazzocchi 2008:10) by means of empirical observation. Such an objective representation of the world allows the scientist to make accurate calculations and predictions of phenomena. Ulanovicz (1999: 129, 2007: 946-947, 2009: 19-24) offers a succinct summary of the Newtonian metaphysic by delimiting five fundamental postulates that underlie the principles of the modern scientific method:

> (1) Newtonian systems are *deterministic*. Given the initial position of any entity in the system, a set of forces operating on it, and stable closure conditions, every subsequent position of each particle or entity in the system is in principle specific and predictable. This is another way of saying that mechanical causes are everywhere ascendant.
> (2) Newtonian systems are *closed*. They admit of no outside influences other than those prescribed as forces by Newton's theory.
> (3) Newtonian systems are *reversible*. The laws specifying motion can be calculated in both temporal directions. There is no inherent arrow of time in a Newtonian system.
> (4) Newtonian systems are strongly decomposable or *atomistic*. Reversibility presupposes that larger units must be regarded as

> decomposable aggregates of stable least units—that which can be built up can be taken apart again.
> (5) Newtonian laws are *universal*. They are applicable everywhere, at all times and over all scales.

Generally speaking, these five postulates form the basis of the modern scientific method. From these postulates it is clear that the universe is seen as being a mechanistic system. In this understanding of the world perfect knowledge can be obtained, because due to the nature of such a universe, it can be cut up in perfect pieces that can be analysed fully with no further consequences. In the 1630s, Descartes' *Discourse* had argued in philosophical terms that Euclid's *Geometry* should be seen as the model for "theories" in all areas of inquiry. Fifty years later, Newton showed that a geometrical model was not just rigorous, but empirically powerful as well, since it apparently resolved many of the intellectual problems that had plagued European thinkers since the publication of Copernicus's *de Revolutionibus* in 1543. If this could be done in Astronomy, was it not possible in other fields? For the next two hundred years and more, this challenge engaged the imagination of talented mathematicians and scholars. The Newtonian/Cartesian model became the foundation of science for European intellectuals (Toulmin 2001: 49) in the 17th century. The traditional scientific method requires that observation and conditions in which experiments occur are based on the conditions of "independent verifiability and reproducibility" (Joel 1983: 5). Related to these conditions are the principles of empirical verification (the importance of independent and objective observation) and deductive reasoning (establishing conditions under which a theory can be proven to be true). These principles and conditions subsume the possibility of a context free (perfectly objective conditions) experiment and the supremacy of the independent object and presume that the universe is composed of unchangeable, timeless properties and laws that govern the forces and elements thereof.

Where the knowledge gathering practices of antiquity attempted to describe the world as such by means of insight and revelation, modern science insisted on the test of confronting theories with actual experience that revealed universal laws obeying a rational order. All theories had to be able to interpret the relationship "between forces or bodies" in such a way that it "presented a world picture of the universe that is reducible to such relationships in all essential respects" (Laszlo 1972: 11). Newtonian science views the objective physical universe to be a uniquely designed "giant mechanism" (11) that obeys universal and rationally determined laws of motion and force. In this understanding of the true nature of Nature, objects are defined as being

"closed and distinct entities" which are to be "defined by isolation in (their) existence, characteristics and properties, independently of (their) environment" (Morin 1992c: 93). From the Newtonian/Cartesian perspective, nature can thus be known by analyzing and isolating the parts of the whole and by breaking down complex sets of objects into their elementary interactions and matter that behave in a universal uniform manner. Science is thus the process of rigorous classification, measurement and the organisation of nature in a universal and rational manner.

The process of describing the world in Newtonian terms 'isolated and inventoried the chemical elements constituting all objects" (93). It furthermore led to the discovery of "the smallest units of matter, conceived first as molecules then as atoms" and consequently "recognized and quantified the fundamental characteristics of all matter mass and energy" (93). For Physics the "object of all objects" was reflected in the discovery of the atom, which represented all that was "pure, full indivisible [sic], irreducible" and constituted the basics of all matter as being "the universal component of gases, liquids, and solids" (93–94). Following the success of Physics, other sciences also attempted to analyse and isolate their objects of study in such ways that would elucidate the pure and inseparable matter of which it consisted. The field of Biology thus conceived of its purest object as that which could be found in the first organism, the cell, which then found its elementary unit as being the molecule (94).

In its ideal to be able to describe the nature of Nature in a rational and universal way, the modernist program of Science revealed its own hopes and dreams for itself. It hoped to find "a Universal Method, a Perfect Language, and a Unitary System of Nature" (Toulmin 2001:67). In this dream the universal methodology of rational Science and the way in which Nature subscribed to the notion of a unitary system that adhered to deterministic laws that governed natural phenomena, needed to be expressed in a perfect universal language. From this perspective language was thought to be a "mirror that reproduced and reflected the structure of Reality and Truth" (69). Thus, the relationship between our descriptions of the world and the world itself became a positivistic relationship where a perfect language would be able to represent the world as it is wholly and without fault or incongruence. Toulmin (69) explains that "the Dream of an Exact Language was also powerful in seventeenth-century Europe. It was shared by scientists and philosophers in many countries, not least the founders of the Royal Society of London." The aim of such a universal language would be to offer a representation of the world that would verify all statements by an appeal to facts determined by experiment. The best way to express such verification was to be expressed in a formal and systematic language

such as mathematics and the language derived there from, namely 'Logic', by which the principles of valid inference and correct reasoning are spelled out systematically.

Although the story of the birth of modern Science seems to be speaking with one voice and in one language, one should not be misguided by its supposed unity. As early as 1715 up to the late nineteenth century, Newton and his followers where faced by a challenge from Leibniz who wanted to dismiss the *Principia* as being impossible based on the mathematical puzzle that mathematicians call the 'Three-Body-Problem' (Toulmin 2001:48).[31] Furthermore there was the ongoing debate between the two traditions of Science represented on the one side by British Empiricism (starting with Newton, building on Francis Bacon and continuing with Maxwell and Rutherford and explicated by John Locke, George Berkeley, and David Hume) and the Continental tradition of Rationalism (started by Gottfried Leibniz, supported by Baruch Spinoza and continuing up to Pierre Duhem) (Toulmin 2001). After 1810, the Three-Body-Problem "tended to fade into the background, being treated as a metaphysical, not a scientific issue" (52), but by re-working and analysing the Three-Body-Problem, it was Henri Poincaré[32] who in his philosophical essays from 1902 challenged the "the world of physical determinism that had been a nightmare for nineteenth-century thinkers" (53). The work of Poincaré on the three-body-problem, his theories on the principle of relativity and Lorentz's transformations paved the way for issues of chaos and complexity that cracked the foundations of the stabile cosmos. From here on, it seems that the Dream of Rationalism proved to remain what it was to be – a dream indeed.

2.1. Disenchantment and the breakdown of the Newtonian paradigm

As the tools by which the nature of Nature could be observed and verified changed, so the descriptions of the world also changed. Myths were replaced by facts and the power of superstition by the consistency of the scientific method. The process of disenchantment (see footnote 2) provided humanity with the tools to replace uncertainty with certainty and the power

[31] "The equations that Newton used to explain the elliptical form of the planetary orbits, and the relative speeds of motion around their orbits were oversimplified. In fact, these theorems proved only that the Law of Gravitation accounts for the motion of *one planet at a time* around a more massive centre of attraction, such as the sun. With this simplification, the equations of motion for a single planet are easily solved. ... Once we introduce to the picture a third body—say, a second planet—the equations are, however no longer algebraically soluble. The best a Newtonian could do was to compute the third body's influence arithmetically, from moment to moment, as a perturbation of the simplified orbit" (Toulmin 2001:50).

[32] See Poincaré 1902, 1905

of prediction. However, contrary to what was first believed, this foundation was not without some faultlines. At the beginning of the twentieth century, overwhelming evidence pointed to the fact that the atom might no longer be the primary unit of matter after all. A strange reversal in the understanding of matter and energy took place in the heart of Physics when the quantum particle was discovered. As Morin (1992c:94, 95) comments:

> The particle not only is in a crisis of order and a crisis of unity, it is undergoing especially a crisis of identity. We can no longer isolate it in a precise way in space and time. We no longer isolate it totally from the interactions of observation. It wavers between the double and contradictory identity of wave and corpuscle. Thus: no longer being a true object, the particle has lost all substance, all clarity, all distinction, sometimes even all reality; it becomes a Gordian knot of interactions and exchanges.

The breakdown of the mechanistic, unified and stable worldview[33] was further shattered by the inadequacy of the Newtonian paradigm to formalise the behaviour and fundamental nature of quantum particles (Dekker *et al.* 2011:941, Heylighen *et al.* 2007:119).[34] One could go into the historical details of what discoveries led to a new view of physics and the world during the beginning of the 20th century, but it is not in the scope of this dissertation to offer such an historical account of the development of quantum physics and science. Excellent accounts thereof already exist in the work of Heisenberg (1958), Feynman (1985), von Neumann (1955), French and Taylor (1978) and Bohm (1989). Of greater importance for this study, is the fact that new discoveries in science itself led to a new view of not only the world as it is, but also to a new vision of how we can know the world—or as it became clearer—not know the world.[35]

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[33] Elaborated accounts on how 20th century discoveries in Physics led to a breakdown in the traditional scientific paradigm can be seen in Kauffman 2008, Smolin 2006, Toulmin 2001.

[34] This development is demonstrated in especially the field of physics as Laszlo (1972:11) suggested: "relativity took over in field physics, and the science of quantum theory in microphysics." Furthermore, the work of Max Plank on heated matter and the radiation emitted by black bodies at high temperatures led to Plank's law of heat radiation. The idea that energy could be emitted or absorbed only in discrete energy quanta was so new "that it could not be fitted into the traditional framework of physics" (Heisenberg 1958:4). In due course Einstein took Plank's hypotheses further and combined it with his theory of relativity, which formed the basis of what would be known later as quantum physics.

[35] The Nobel Prize laureate and physicist, Steven Weinberg (1994) is known for arguing that "(t)he more the universe seems comprehensible, the more it also seems pointless."

Heisenberg (1958:138) illustrated that the shifts in the study of physics can be explained by means of two stages of disillusionment that took place in the history of classical physics. The first was the discovery, through the theory of relativity, that even such fundamental concepts as space and time could be changed and in fact must be changed on account of new experience. This change did not concern the somewhat vague concepts of space and time in natural language; but it did concern their precise formulation in the scientific language of Newtonian mechanics, which had erroneously been accepted as final. The second stage was the discussion of the concept of matter enforced by the experimental results concerning atomic structure. The idea of the reality of matter had probably been the strongest part in that rigid frame of concepts of the nineteenth century, and this idea had at least to be modified in connection with the new experience.

The results of these stages of disillusionment also had implications for other sciences. It served as "a serious warning against the somewhat forced application of scientific concepts in domains where they did not belong" (Heisenberg 1958:138). Consequently in Biology an attempt was made to rid itself from trying to explain the complex interactions that take place in living organisms, with the laws of physics: "new laws had to be postulated—not laws of 'life forces', but laws of integrated wholes, acting as such" (Laszlo 1972:11, 12). Similar conceptual changes can be traced in other fields of study.

What is of importance for our tracing of the roots of complexity theory, is not the scientific and historical detail of these changes, but the fact that a rupture took place in the way in which natural scientists and subsequently social scientists, theologians and other applied fields of study thought about our relationship to the world and about mankind's status in the world. This rupture in the classical scientific view of the relationship between our descriptions of the world and the world itself opened up a new space within which new concepts and theories could take shape and develop. In the gap that existed between the old and the new visions of the world, the seed of what is now known as 'complexity theory' had a chance to take root, to eventually find its way through a combination of new ideas and insights that developed as a result of the rupture that shook science from its "slumber of reason" (Derrida 2001:318).

In his critique of the mechanistic and reductionistic metaphysics of science, Ulanowicz (2009) proposes "a conversion of mind" concerning the Newtonian paradigm. With his focus on the notion of 'ecology', he suggests that we need a scientific worldview that departs from being "wholly dependent on physics and chemistry for its explanations" (3). Building on the work of

Gregory Bateson (1972), Ulanowicz (3) argues that it is crucial to find "complementary narratives of the same phenomena" in order to accommodate the characteristics of complex ecological dynamics. In his understanding of the notion ecology, Ulanowicz (4) argues that "it is possible to identify in perfectly rational fashion where, how, and why ecosystems behaviours depart from conventional dynamics." These differences can be used to develop a logical and coherent perception of ecological phenomena in general and for understanding the idea of life specifically. Looking through the "Newtonian glasses" (4) does not give the full picture.[36] The next section will discuss how the breakdown of the traditional Newtonian assumptions led to the emergence of concepts that inform the contemporary study of complex phenomena.

2.2 Life after Newton

The problem of knowledge is the key issue mentioned in arguments that identify theories of complexity with the paradigm shift that it presents in contrast to the Cartesian/Newtonian tradition of science (Atlan 1993, Browaeys & Baets 2003; Nicolis &Nicolis 2009, Ulanowicz 2009). Discourses that announce the end of certainty (Prigogine 1997, Heisenberg 1958, Morin 1999:43–44, 1974:571), the importance of chance, the presence of emergence and self-organisation all point to the fact that based on a new understanding of reality as mentioned here above, a gap emerged between our descriptions of the world and the world itself (Cilliers 2000c, 2007b). Hereafter, the challenge of knowing complex phenomena is directly linked to the uncertainty that comes from observing and studying complex phenomena as Morin (1974:571) suggests:

> One is no longer confronted with a specific object, governed by simple laws, about which one can make accurate predictions. This uncertainty in regard to measurement, calculation and prediction is due, as we have seen, to: the incommensurability and interlocking

[36] In his project to develop what he calls the "Third Window," Ulanovicz (1999: 129, 2007: 946-947, 2009: 19-24) gives more recognition to the importance of 'process ecology'. According to Ulanowicz (2009), the first window on the world was captured by the Newtonian worldview, and Darwin's view on the importance of history and the development of a species represents the second window on the world. He uses the terms 'window' to avoid the difficulties of using the Kuhnian notion of 'paradigm'. The third window introduces the importance of process ecology which shifts the "emphasis away from objects and focus(es) rather upon configurations of processes" (11). Moreover, Ulanowicz (12) suggests that the notion of ecology is a "new perspective on the nature of evolution (and) provides a very different slant from what currently is being promulgated by scientific fundamentalists such as Richard Dawkins or Daniel Dennet."

> nature of the individual components and the interactions between them; the irregularly aleatory [sic] and irregularly determined character of the self-organizing system from the observer's standpoint; the fact that a capacity for self-organization is capable of evolving, that is of showing innovatory characteristics, to a greater extent the more complex it is.

Connected to the first problem of complexity which was described in Chapter 1 in terms of the process of conceptualising and finding a language in which to talk about the origins and meaning of the term 'complexity', is the first problem of knowledge. Morin (1992c:139) explains the problem as being directly related to the "empirical difficulties" of describing the physical and phenomenal characteristics of complex phenomena.

The challenge of being able to know complex systems and the difficulties it poses for knowledge generating practices is one of the distinguishing characteristics that mark the discourse on complexity (Zadeh & Polak 1969, Allen 2001, Georgiou 2007, Wolkenhauer & Ullah 2007). Suggesting that the logic of Newtonian science is inadequate to explain complex phenomena, Morin (2008:21) points to the fact that inquiries into complex phenomena such as self-organising and non-linear social and ecological systems should adopt a logic that "has to develop itself, and go beyond itself in the direction of complexity" (21). (More on this nature of this kind of thinking will be discussed in Chapter 4). In light of the characteristics of complex and living systems (cf. Cilliers 1998, Morin 1974, 2007, 2008), the reductionist logic of traditional scientific methods is faced with the problem of simplification which seeks to reduce complex systems to sets of laws and universal truths which operate as the foundation of science. The logic of classical science cannot keep up with the generative, flexible and pluralist nature of knowledge that is needed to describe complex systems.

The characteristics of complex phenomena discussed in Chapter 1 challenge each of the five Newtonian postulates (Ulanowicz 1999, 2007, 2009) discussed earlier, in very specific ways. The complex notion of non-linearity stands in direct opposition to the notion of determinism and also challenges a linear kind of causality that is linked with prediction and determinism. Complex systems are open and due to the nature of the boundaries of complex systems as discussed earlier, the system is constituted through the dynamic interaction between the system as a whole and the environment. This in turn challenges notions of homeostasis and symmetry that are linked with closed systems' behaviour. The processes of organisation in complex

systems are not compressible or reversible. They are contingent in time and have a history. Memory is nested within the system in various levels and sub-systems. Local events have influences on the system that bring about change over time in the system. These changes are not fully calculable or predictable.

As such, the metaphysics of complex systems offer an expanded alternative to that of the Newtonian metaphysics that is grounded in a reductionist view of the world. For Ulanowicz (1999, 2007), 'life after Newton' represents a shift or move beyond viewing the world in a mechanistic sense. When dealing with complex systems that defy the grounding principles of the Newtonian view, we are challenged to develop methods and vocabularies that cover a broader horizon when describing the world. In order to arrive at a paradigm that is suitable to deal with ways of knowing that could capture the characteristics of complex phenomena, it is important to be aware of the kinds of reductionism that one is up against in the search for knowledge. The next section will discuss a number of ways in which traditional scientific methods generally employ reductionist practices.

3. The problem of reductionism

> *Reductionism is one of those things, like sin, that is only mentioned by people who are against it.* (Dawkins 1996)

As mentioned in Chapter 1, the acknowledgement of complexity and the paradigm of systems thinking generally take position against reductionist descriptions of the world (Fuenmayor 1991, Harraway 1997). The notions of emergence and non-linearity are often used in the arguments against reductionism and serve as a form of proof that complex systems cannot be described in terms of their isolated parts or in terms of linear forms of causality only (Goldstein 1999, Heylighen *et al.* 2007, Mazzocchi 2008, Mitchell 2009). Having discussed how complex systems undermine Newton's five basic principles, it is clear that reductionist methods of inquiry are not suitable to study complex systems. The recent increase in literature that deals with the notion of emergence, or the "re-emergence of emergence" as Cunningham (2001) calls it, supports the fact that scientists are searching for conceptual frameworks that are able to integrate different kinds of observations and knowledge of complex phenomena that defy strong forms of reductionist scientific paradigms. It is worthwhile to identity the most general different kinds of reductionism in order to know what challenges holistic strategies that acknowledge emergence, are up against.

3.1 Different kinds of reductionism

Traditionally it is held that at least three kinds of reductionist strategies (Sarkar 1992, Nagel 1998, Fang & Casadevall 2011) can be identified that embrace several related philosophical themes. The different kinds of reductionism will be discussed as follows.

3.1.1 Ontological reductionism

This is the kind of reduction that claims that all non-physical phenomena or properties can be explained in terms of matter or that one physical object can be explained in terms of other physical objects (Searle 2008: 70). For example, in the first case, the understanding that all behaviour can be explained by the genetic make-up of a person or that behaviour as such is determined solely by genes and ultimately DNA molecules (Polanyi 1968), is a form of ontological reduction. Another example is the argument that consciousness can be reduced to be an extension solely of the gray matter of the brain and the make-up of neurons, serve to illustrate a kind of ontological or materialist reductionism. In his most recent book, Kaufmann (2008: 3) gives an apt example of what ontological reductionism could look like:

> Reductionism in its strongest form holds that all the rest of reality, from organisms to a couple in love on the banks of the Seine, is ultimately nothing but particles or strings in motion. It also holds that, in the end, when the science is done, the explanations for higher-order entities are to be found in lower-order entities. Societies are to be explained by laws about people, they in turn by laws about organs, then about cells, then about biochemistry, chemistry, and finally physics and particle physics.

Hence, from the viewpoint of ontological reductionism, reality can be explained in full in terms of particles in motion. And even more so, it argues that only particles are "ontologically real entities" from which "everything else is to be explained by different complexities of particles in motion" (3). A philosophical orientation such as physicalism that upholds the idea that the nature of reality is wholly physical, or that all macrostructures supervene on, or is necessitated by the physical microstructures, is another example of ontological reductionism (see Kim 1992 for more details on the assumptions of physicalism).

3.1.2 Epistemological reductionism

This kind of reductionism addresses the reductionism that takes place when one scientific discipline is reduced to the principles of another scientific discipline. “The idea that the knowledge about one scientific domain can be reduced to another body of scientific knowledge” (Brigandt & Love 2008) defines epistemological reductionism. The statement by Francis Crick (1966) that “(t)he ultimate aim of the modern movement in biology is to explain all biology in terms of physics and chemistry” is a superb example of the second instance. Much of the modernist project of science can be explained in terms of this form of reductionism.

The whole analogy of a clockwork universe or that society’s behaviour can be explained in universal algorithms rests on reducing non-mechanical objects to an epistemology that favours physical mechanism and mathematics. As mentioned earlier, the notion of a restricted paradigm of complexity would also fall into this category of epistemological reductionism, seeing that it assumes that complexity can be measured by means of computational algorithms (Manson 2001).In the field known as cognitive philosophy, the work of Daniel Dennet (1995) serves as another example for this kind of reductionism. Drawing heavily on Darwinianism, he claims that complex phenomena such as consciousness or the mind emerge from a lower level of ordered processes via an algorithmic mechanism. As such, the working of the brain, the modelling thereof and the predictions that stem from these computational simulations as developed in the field of Artificial Intelligence (AI) can all be explained in terms of algorithmic activity.

3.1.3 Methodological reductionism

Methodological reductionism is the idea that complex systems are best investigated at the lowest possible level. It follows that experiments should be constructed in such ways that the most basic structures of a phenomenon should be uncovered in order to study causal effects on higher levels of organisation. By disregarding the properties of for example emergent phenomena and by only studying the relations and properties of lower level elements of a system or object, the emergent phenomena are reduced to the individual properties of the components of objects. “Methodological reduction is often traced back to Bacon, who in the early 17th century proposed that principles derived from specific cases might be applied to make general predictions” (Fang & Casadevall 2011:1401). An example of this kind of reductionism would be the case where the study of say stomach cancer is done by means of

observing different cultures of stomach cancer cells in Petri dishes in a laboratory instead of undertaking a transdisciplinary study that would aim to understand how cancer cells are affected when kept inside the body of a human being.[37] Hence, studying the aetiology, progression and symptomatology of the disease at the level of isolated laboratory experiments can be understood to be a reduction of the complexity thereof (Wolkenhauer *et al.* 2009). In this case, reductionism promotes the removal of an object of study (or parts thereof) from its original and customary context. The extrapolation of the results stemming from such experiments to more general or more complex conditions is a misleading practice and results gained from such practices could have dangerous consequences (Mazzocchi 2008:12).

As mentioned above, traditionally and in very general discussion, these three kinds of reductionism can be the distinguished. In the process of dealing with complex phenomena, a fourth kind of reductionism, should be identified that relates directly to the concept of emergence:

3.1.4 Causal reductionism

The notion of causality takes into account the organisation and relations between "any two types of things that can have causal powers" (Searle 2008:71). As discussed in Chapter 1, emergence can be defined in terms of upward and downward causation (Campbell 1974, Kim 1992). The latter describes the ability of higher levels of reality to have causal power over lower levels of reality (Ellis 2008:70). The functioning of the whole is described in terms of the properties of the relations of the "interconnected complex whole" (79). Causal reductionism would deny that emergent properties come about due to the causal powers that are at play. Explaining higher level or macro-level causal relations entirely in terms of lower level or micro-level causal relations is called causal reductionism (Menzies 1988). This can also be described to mean that all emergent properties should in principle be explainable by the causal relations of the properties of the elements of a system.

It is assumed that the causal relations of the elements can be described in terms of the basic laws of nature (551). An example of causal reductionism would be to explain the solidity or fluidity of an object in terms of the causal powers of the "vibratory movements of molecules in lattice

[37] Note: the suggestion that a transdisciplinary approach here undermines methodological reductionism it is not an argument against research done in specialised scientific laboratories. This statement here does not place a value judgment on the work done following different methods. It is just used as an example to maybe even artificially demonstrate what can be understood as methodological reductionism.

structures" (Searle 2008:71) only, instead of considering what influence or causal power the structure of the system as a whole has on the molecules. To summarise thus, causal reductionism denies the existence of downward causation in emergent phenomena.

From the above discussion it can be postulated that scientific reductionism favours a Newtonian scientific paradigm. In order to study machines or the mechanical forces of machines, the reductionist method has proven to be very successful. Explaining the motion of the planets in the solar system by means of Newton's laws, for example, works particularly well. The problem of reductionism becomes evident when reductionist methods are employed to study and characterise complex phenomena such as living organisms and human societies. In Morin's (1999:17) words "the principle of reduction inevitably results in reduction of the complex to the simple. It applies to living human complexities the mechanical determinist logic of artificial machines."

3.2 The blindness of reductionism

As will be discussed in the next section, an argument will be put forward that the enterprise to totally rid scientific practice of reductionism, remains ambiguous. What is more misleading however, and this is the crux of the matter in the reductionism/holism debate, is the fact that strong reductionists do not perceive the act of reducing concepts and practices to be a problematic aspect of scientific practice at all. Moreover, assuming that one phenomenon can be described in terms that reduce it to another phenomenon or to study it in a way that does not recognise its properties for what they are (in the case of complex systems, emergent properties), is not only an inexcusable oversight, but it displays a total disregard for the particularities of the matter at hand. Searle (2008:70) describes this precarious operation of reductionism by arguing that "the basic intuition that underlies the concept of reductionism seems to be the idea that certain things might be shown to be *nothing but* certain other sorts of things" (italics in original text). From such an assumption, "reductionism leads to a peculiar form of identity relation that we might as well call the 'nothing-but' relation: in general, *A*'s can be reduced to *B*'s, iff (sic) *A*'s are nothing but *B*'s" (70).

By disregarding for example, the organisation of the relations between elements in a system, or by neglecting the influence of non-linearity and the dynamic interplay between the system, its parts and the environment, the reductionist paradigm assumes that these properties and activities can be left out of the simulations and equations of its calculations. The deliberate disavowal of

the specific contingencies, context and unique characteristics of complex phenomena leads to a distorted picture of reality and what is more contentious, is the fact that this picture is spuriously presented as nothing-but the omnipotent (Atlan 1993: 6) truth of reality.

It is against this false basis on which the autonomy of the reductionist paradigm is built and the related consequences for understanding the world from this hegemony, that the so-called anti-reductionists and postmodernist theorists appeal and take offense against. The reductionist paradigm that is generally described by the "project of modernity" (Habermas & Ben-Habib 1981: 7), does not pretend that what is left out of the descriptions of its formulas is merely an amendable error of reason. On the contrary, the reductionist claims intentionally disregard what is left out of the picture in order to proclaim a rationality that recounts the world as being orderly and homogenous (Bauman 1992: xiv). By disregarding complexity, contingency, non-linear self-organisation, emergence and connectivity, the reductionist rationality obtains a strategy whereby it can calculate and predict the forces of nature in a way that drives out uncertainty and the unexplainable in incontestable manner. In the name of the reductionist modern project, the nature of reality can be known perfectly by means of "defining, structuring, segregating, classifying, recording and universalising ... the splendour of universal and absolute standards of truth" (xiv). In itself, the mission of wanting to know the world in scientific terms and by rational standards that defy belief in mystical powers as was prevalent in the time of antiquity is not a bad project. However, the problem of defining reality in a reductionist form of rationality becomes problematic when this project disregards its own blind spots in order to conceal its limitations.

Stating that the blindness of reductionism is not a naive disability, but part of the "barbarism" that dictates how knowledge is generated Morin (2008:6) argues that the false rationality that hides behind a forged demeanour of certainty and truth disguises the fact that it offers a kind of rationality that is not willing to admit to the limitations of its knowledge generating methods (Morin 1999:17). Hidden behind this quest for finding a gold standard by which to measure reality is the drive to find an autonomous position of power from where one has the legitimacy to proclaim the ultimate Truth (Bauman 1992:xiv). Reductionist rationality becomes instrumental in all endeavours that claim to be scientific. In the name of reductionist rationality, the darkness of uncertainty and disorder are expelled and *remains concealed* when the light of reason shines on it. The challenge of exposing this defiant concealment is the problematic issue at stake in arguments that favour holism, emergence and complexity.

Theories of complexity are by no means original in their attempts to expose the blind spots of reductionist practices. Philosophers of science such as Popper, Kuhn and Feyerabend are well known for crusading against false claims of objectivity and autonomy. In the critical tradition of Philosophy, the work of Nietzsche, Adorno, Lyotard, Foucault, Latour and Derrida to mention a few, all plea in favour of exposing this false kind of enlightenment. This undertaking is often labelled as postmodernism or poststructuralism. The argument that theories of complexity can loosely be categorised to fit into this paradigm will be discussed in more detail in Chapter 3. In the next section, the study will propose, that a general theory of complexity as discussed in Chapter 1, suggests a position that offers a way through the reductionism/holism dichotomy. It will be shown that although it is a position that is sceptical and critical toward reductionist paradigms, holism as such is not an escape from the snares of reductionism.

4. General complexity: beyond the reductionism / holism divide

In this section it will be argued that it is a delusion to think that it is possible to avoid the seductions and traps of reductionism. By having listed different kinds of reductionism, it might seem that it is possible in principle to find methods and practices that would be able to avoid the premises of reductionist approaches. One might even be led to think that one kind of reductionism is a lesser evil than the other and might devise ways to overcome a more deviant reductionism by employing a more forgivable kind of reductionism. However cunning one tries to be in the process of wanting to avoid the error of being guilty of reductionist practices, it will be argued that it is impossible to isolate the different kinds of reductionism from each other. This is based on the impossibility to isolate matters relating to epistemology, ontology, methodology and causality when dealing with complexity. In the end, it will be shown that ultimately even a position that acknowledges complexity succumbs to some kind of reduction in its attempts to provide a description of the complexity.

The above mentioned four kinds of reductionism are related to one another and in many cases they overlap. To think of them as four separate cases of reductionism however, would present a reductionist move in itself. [38] The reason being, that in the process of describing complex systems, it becomes impossible to distinguish between ontological and epistemological matters. Often the argument against emergence lies in the suggestion that things are only emergent because we do not have enough knowledge about complex phenomena. It is suggested that once

[38] As Morin (2007:5) argues, reductionist intelligence aims to separate, compartmentalise and isolate things from each other.

we have bigger computers or better technology, the emergent properties would be explainable in simpler terms.[39] If it would be possible to speak of "epistemological complexity" and/or "ontological complexity" many problems regarding the nature of emergence would be solved. If complexity would only be epistemological (a problem of knowledge about the phenomena), then we could treat emergence as a placeholder for something that we do not know as yet, but that we will be able to know in future. Such a view foresees no limits to our capacities to know and understand the world. On the other hand, if complexity would be purely ontological, then the problem of emergence would be described adequately by means of a vitalist or mystical approach to knowing reality. Complexity would not be "demystified" (Cilliers 2002:79) and we would not be challenged to look for the answers in rational ways. Cilliers (78–79) tackles this problem head-on and argues that to view the two as separate problems, is problematic in itself. The problem is explained as follows:

> These difficulties are the result, I would argue, of a too simplified, or perhaps even contradictory, understanding of the relationship between our description of the world and the world itself. ... In the end such a sharp distinction between epistemological and ontological issues cannot be maintained. Even if we acknowledge that our descriptions of the world are not perfect, we would like to maintain that they are not merely instruments, but that they enhance our knowledge of the world *as it is*. There is a complex dialectical relationship between the world and our descriptions. When we try to understand the world we are always dealing with ontological and epistemological issues simultaneously. To maintain a clear distinction between the two is the essence of metaphysics (79–80) (italics in original text).

The problem of deciding whether reductionism is ontological or just epistemological (McIntyre 1998, Chu *et al.* 2003, Emmeche 1997:60) is thus a fundamental challenge in the process of knowing complex phenomena. Added to this dilemma, is the problem of methodology and causality, which is also not dissociable from the equation. For the purpose of this study, the corresponding arguments offered by Cilliers (2002, 2007b) and Morin (1992c, 2008) will be adopted, namely that in the process of studying complex systems, it becomes impossible to conceive of epistemology, ontology, methodology and causality as if these were four separate

[39] For examples that support such a view see Nagel 1998 or Hempel and Oppenheim 2008

distinguishable domains.[40] In the study of complex systems, the distinction between epistemological or ontological complexity itself becomes problematised as Cilliers and Morin argue. Following the description of the main characteristics of complex systems as discussed in Chapter 1, it can be argued that our ability to observe and draw knowledge from the physical appearances of complex systems is hindered by the nature of these appearances themselves and consequently, the clear distinction between epistemology, ontology does not hold. The breakdown of the clear distinction beteen ontology and epistemology is supported by Kuhn (2007:162) who argues that "congruent with a complexity perspective, epistemology and ontology are conceived as mutually constitutive", or as stated more radically, it can be understood to mean that our ways of knowing (epistemology) is formative of our being and what we perceive to be real. Bateson (1972:314) also discussed this matter and suggested that:

> In the natural history of the human being, ontology and epistemology cannot be separated. His (commonly unconscious) beliefs about what sort of world it is will determine how he sees it and acts within it, and his ways of perceiving and acting will determine his beliefs about its nature. The living man is thus bound within a net of epistemological and ontological premises which—regardless of ultimate truth or falsity—become partially self-validating for him.

From the understanding that ontological, epistemological, methodological and causal matters cannot be disconnected from each other, it follows that the problem of reduction is not a clear-cut matter. Positions that acknowledge complexity in general oppose strong reductionist assertions, but more often than not, these descriptions of complexity fall in one of two traps. One the one hand, many complexity theorists claim that theories of complexity are totally anti-reductionist and propose a systems view that represents radical openness or a relativist kind of holism that suggests no distinction between the system and its environment. Morin (2008:33) calls this kind of holism a reaction to reductionism that insists on a totality which is "never anything more than a plastic bag enveloping whatever it found any way it could, and ... the more the totality becomes full, the emptier it becomes." This view could be equated to a strong form of constructivism where there is no need for a reliable ontology, seeing that what exists relies totally on our knowledge of reality. Although this view proposes an anti-reductionist

[40] Barad (2007) coined the term "onto-epistemology" to describe the entanglement of ontology and epistemology and speaks of "agential realism" which a kind of realism that is simultaneously epistemology and ontology.

framework, one can see that ironically enough, a reductionist strategy is at work: all ontology is reduced to epistemology.

On the other hand, there are complexity theorists who assert that all complexity can be measured and simulated by means of computational models (Holland 1995). From this point of view, describing and knowing complex phenomena and issues of emergence is a matter of finding the right rules and laws that define the extent of complexity at hand. This restricted kind of complexity assumes that all complexity can be formalised in principle. There is also no distinction between different complex phenomena, for example "cities, the mammalian central nervous system and the human immune system" can all be analysed formally "as if they all share CAS (complex adaptive system) behaviour, without there being any principle differences between the universes of consciousness and those of non-consciousness" (Letiche 2000:545)". In this instance of restricted complexity, it is assumed, as Searle (2008) suggests, that the relations between the components of complex systems are nothing-but quantifiable, measurable entities.

4.1 Reducing complexity: from restricted complexity to general complexity

On account of the above, it is clear that the problem of reductionism is not easy to resolve in unambiguous terms and in fact forms one of the main dilemmas for theories that deal with complexity. Cilliers (2005b:261) rephrases this dilemma by arguing that the problem of complexity reveals itself in a paradoxical manner, by suggesting an inescapable "performative tension". The dilemma of the performative tensions lies in the fact that a *rigorous* understanding of complexity, one that denies total holism and total reductionism *simultaneously*, has to keep in mind that any description of complexity necessarily performs some reduction of reality.

What makes this understanding of complexity different to pure holism or pure reductionism is the fact that one recognises the importance of engaging with both seemingly contradictory positions simultaneously. It is a position that moves beyond reductionism in the sense that it does not polarise reductionism versus holism (or for that matter the related concepts of object/subject, positivist/anti-positivist, fundamentalist/relativist), but it aims to destabilise the dichotomies. This act of destabilisation that opens up the door to uncertainty and the end of the "Grand Narratives" (Lyotard 1979), not only has consequences for understanding reality, but also has consequences for the ways in which we do research and generate knowledge about the world.

In this destabilisation of the dichotomy and in demonstrating that there is no clear-cut polarisation possible when one deals with complex phenomena, one arrives at a point where our engagement of complex phenomena is a combination of the interaction between the nature of the phenomena (ontology), our knowledge of it (epistemology) and the methods that we use to study it. The interaction between our objects of study and our knowledge thereof takes on the form of a dialectical process, as Cilliers (2005a:608) describes:

> The dialectical relationship between knowledge and the system within which it is constituted has to be acknowledged. The two do not exist independently, thus making it impossible to first sort out the system (or context), and then to identify the knowledge within the system. This co-determination also means that knowledge and the system within which it is constituted is in constant transformation. What appears to be uncontroversial at one point may not remain so for long.

Coinciding once again with Cilliers on this matter, Morin (2008:25) agrees that when dealing with complexity, the classical dichotomies "lose their absolute character, or rather change character." Instead of thinking in terms of the "either/or" categories, a "neither/nor" and "both/and" approach is required that links analytical-reductionist thinking and global thinking in a dialogic" (33).[41] As a result of the reciprocal manner in which reality and our knowledge of reality influence each other, the concept of knowledge itself is transformed to a dynamical concept that depicts knowledge generation as an active, perpetual process. This position embraces the notion of a general understanding of complexity as discussed in Chapter 1 and insists on not falling into the trap of providing a "monist solution that would be like the essence of truth" (33). As argued by Morin (2007:27), such a generalised complexity integrates a restricted understanding of complexity, even though a pure "restricted complexity rejects generalised complexity." In the tension of acknowledging and engaging with both opposing concepts simultaneously, a position is reached that does not discard reductionism in exchange for total holism, but a constructive tension remains in which a space is created from where reductionism and the Newtonian paradigm still has its relevance, but "is no longer the only, nor, particularly, the last word" (33) on knowing the world. Or in the words of Kauffman (2008:3) it

[41] More on the notion of 'dialogic' will be explained in Chapter 4 when dealing with the notion of complex thinking.

demonstrates that “reductionism alone is not adequate, either as a way of doing science or as a way of understanding reality.”

By moving beyond the reductionist/holist schism, a general theory of complexity offers a conceptual framework that is not just a strong reactionary move against the Newtonian paradigm. In fact it acknowledges that in certain conditions, this framework works perfectly well to understand certain realities in the world. Moreover, I would like to argue that the position that Cilliers and Morin propose, goes beyond discourses that pronounce “the end of science” (Horgan 1996) or on the other hand pure scientism. Morin (2008:30) even goes so far as to say that “the theoretical, methodological, and epistemological whole that is at once coherent and open” has the ability to modify, transform and enrich our “current concept of science.” The acknowledgment of the problem of reductionism by means of a general theory of complexity provides one with the necessary conceptual tools to think through the breakdown of the Newtonian world. We are not left at some dead end where all scientific endeavours or the nature of reality is just a construction of the human mind. An understanding of the relatedness of the different concepts affords us the possibility to engage in scientific practise that allows it to be “neither absolute, nor eternal” (30), but open to “contingency”, “innovation and creativity” (32–33).

A general theory of complexity points toward the problem of relying on the disassociation of ontology, epistemology, methodology and causality and by doing thus, challenges the “hegemony” of the “classical scientific enterprise” (Dillon 2000:9). At the same time, this new constellation of general complexity does not intend to establish a new golden standard or received view, but remains sceptical and critical of its own position. In the conceptual space that is generated by the performative tension in which a general theory of complexity aims to destabilise the dichotomy between crude reductionism and a totalising holism, a crack emerges from where the theorist can reflect critically on her knowledge generating practices. The fol

lowing section will deal with the implications for modelling complex systems based on the performative tension that characterises a general understanding of complexity.

4.2 Modelling complexity

> *The notion of system is submitted to double pressure, on the one side by an assured realism that the notion of system reflects the real characters of empirical objects, on another side by a formalism for which the system is an ideal heuristic model we apply to phenomena without prejudicing their reality. Yet, we can already inscribe the notion of system, not in the alternative realism/formalism, but in a perspective wherein these two terms are presented as simultaneously complementary, concurrent and antagonistic.* (Morin 1992c:136)

Connected to the ontological and epistemological crack that is exposed in the problem of knowing complex phenomena as discussed above, is the problem of understanding and generating knowledge about the nature and behaviour of complex phenomena. As discussed earlier, the main reason for the impossibility to observe the characteristics of complex phenomena is the shift in focus in terms of the object of study. Traditional Newtonian theories of knowledge are based on a materialist ontology that privileges atoms (or essences) to be the main elements that constitute reality. An atomistic rationalism is connected to a "closed system epistemology of classical physics" (Wilden 1980:243).[42] For closed systems, the relation between reality and the models that represent these systems are merely "mechanical" and "statistical" (243). From a closed systems perspective, the reductionist scientific paradigm fits to reality like its mirror image.

On the contrary, studying complex phenomena requires a systems approach that departs from the traditional, analytical method of science as proposed by Descartes and Newton. The Cartesian methodology requires one to "divide difficulties into as many parts as possible" and "to begin with things which [are] as simple as possible" (Descartes 1637:12 quoted in Whiteside 2004:361). The systems approach does not isolate and reduce the object under study as discussed above, but seeks to explore the functional and relational "dependencies among

[42] Wilden (1980:357) argues that systems can be described as closed when there is no "essential relation of feedback to an environment" and "when any feedback relationship between variables are strictly internal to the system."

structurally integrated components" (361) between the system as a whole, its elements and its environment.

In opposition to the materialist ontology that informs classical theories of knowledge, a systems ontology "makes explicit an ontology that not only puts the accent on relation rather than substance, but also puts the accent on emergence and on interference, as constitutive phenomena of the object" (Morin 2008: 30). Shifting the focus of study from entities to relations between entities constitutes an ontology that is linked to an epistemology that is sensitive to the notion of organisation, which is a characteristic of open systems (Wilden 1980:244, 358). Modelling open systems and finding ways to describe the relations between entities, and even more radically, conceiving of the organisation of the relations between relations (329) results in an entirely new challenge for constructing an epistemology of complex systems (or as Morin 1992c calls it, a 'formalism'). Based on the argument that it is not possible to ensure a clear distinction between ontological, epistemological and methodological claims when dealing with complex systems, the modelling of complex systems will have to be of such a nature that it keeps account of such a "double pressure" as Morin (1992c:136) warns here above.

In his definition of what complexity is, Northrop (2011:xiii) argues that the problem of modelling complexity is essential in defining what we understand under the notion as such and suggests that complexity is a "measure of the *difficulty* in describing and *modelling* a system (thing or process), and thus being able to predict its behaviour" (italics in original). The problem of being able to know complex systems is related to the dilemma of finding ways of modelling complexity. Cilliers (1998, 2000a, 2000b, 2000c, 2001, 2002, 2005a, 2005b) has written extensively on the problem of knowledge and complexity. His main argument suggests that theories of complexity "have important implications for the knowledge-claims we make when dealing with complex systems. To *fully* understand a complex system, we need to understand it in all its complexity" (Cilliers 2005b:258) (italics in original text). Seeing that complex systems are characterized as open systems that interact with their environment in a dynamic way, and due to the fact that the relation of the interactions of the components is non-linear, we would also need to "understand the system's complete environment before we can understand the system, and, of course, the environment is complex in itself" (Cilliers 2005b:258). As Cilliers points out rightly, this is an impossible task to do for any human. In order to extract meaning, and to have any understanding of the system, one has to construct a model in order to have knowledge of the system. A model can be explained as the way in which we frame the system in

order to gather knowledge. The term "model" thus refers to the knowledge generating practices such as observation and interpretation.

Another systems thinker whose work on the notion of modelling complexity has been under explored, but is proving to become more and more important, is that of the theoretical biologist, Robert Rosen (1934–1998).[43] In his paper *On Complex Systems* (1987) Rosen poses a counter-argument to that of von Neumann who suggested that "complexity raises no new issues of epistemological principle" and that it "is of a purely technical character within accepted canons of systems description" (129). Rosen suggested that von Neumann was wrong and that by looking at the modelling relationship of the processes in complex systems, it could be shown that complexity "introduces a fundamental epistemological distinction between simple systems and complex ones; one which, among other things, has some profound consequences for both physics and biology" (1987:130). For Rosen, the notion of modelling complexity could be described by looking at the causal relations between what he called "events which we perceive in the natural world" (130) which he called the natural system, and the inferential rules in formal systems (which are constructed in the 'formal world') we choose with which to describe those events. According to Rosen, the modelling relation (or the main task of 'theoretical science') consisted of establishing congruences between "causal relations in the external world, and implicative relations between propositions describing that world" (130). This modelling relation is based on the "accepted belief that the world has some sort of order associated with it" (Mikulecky 2000:420) and that it is not totally made up of random events. Essentially the mapping relation points to the "process we carry out when we 'do science'"(421) and exposes this process as one in which there can be no biggest model of the world, but only snap-shots thereof (Rosen 1985). In order to explain the modelling relation more concisely, Rosen (1985, 1987, 1991) developed a diagram of a set of mappings to illustrate how the modelling or formalisation of complexity can be done. The diagram is displayed here in Figure 2.

[43] For recent discussions on the importance of Rosen's work, see Mikulecky 2000, Chu *et al*. 2003, Edmonds 2007, Hofmeyr 2007, Noble 2011, Chu 2011,

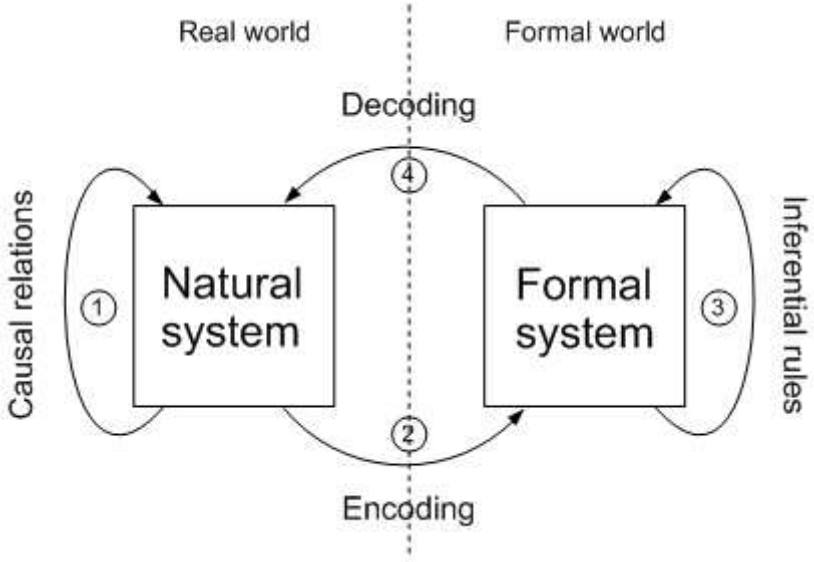

Figure 2: The modelling relation (Rosen 1985, 1987, 1991).

The modelling relation links two related systems, a natural system and a formal system. They are linked with a set of arrows (1, 2, 3 and 4) depicting processes and/or mappings between the systems. The natural system (something that we wish to understand) is made up of those set of observables in the real world that were chosen to be studied. The causal relations between them (arrow 1) are encoded into a formal system to map the inferential rules that govern the regularities between them (arrow 2). Arrow 3 is related to the "implication" of the mapping and "represents some way in which we manipulate the formal system to try to mimic causal events observed or hypothesized in the natural system" (Mikulecky 2000:421). The encoding of the natural system into the formal system is based on a set of choices and can never capture the total complexity of reality. Lastly, arrow 4 alludes to the process of decoding the results of the implication or inferential entailment of the formal system and represents the process of evaluating whether the mapping is good reflection of what happens in the natural system. A percentage of 100% congruence between the natural and formal system would imply that the natural system is a simple system (as opposed to a complex system), because only simple systems allow for the mapping of all the casual relations that constitute the system. The reasoning in the formal system can be decoded into predictions of the natural system or as Wolkenhauer (2007:1) suggests, "(t)he encoding of a natural system should establish a correspondence between the two worlds so that a mathematical argument (theorem, proof) allows us to make statements about natural systems." When the processes of 1 = 2 + 3 + 4 are true, we can say that "the diagram *commutes* and that we have produced a model of our world" (421) (italics in original text). Rosen's main argument behind this mapping is the fact that "the

encoding and decoding mappings are *independent* of the formal and/or natural systems" (421) (italics in original text). This means that there is no point of reference from inside both these systems to tell us which is the correct model and that there are only multiple models to be made to capture the complexity. It highlights the fact that the modelling process is a reduction of complexity and based on a combination of choices and preferences that are simultaneously objective and subjective at once and that modelling could rather be described as "as much an *art* as it is a part of science" (421) (italics in original text).

Rosen based his work and theories on the mathematical modelling of complex anticipatory systems. This is another language that seems far removed from that of the ideas of Cilliers, but the philosophical implications of Rosen's work is closely linked to the arguments of Cilliers and Morin. Especially when considering the fact that Rosen argues that the modelling relation can never produce a largest model seeing that the first step in the modelling process, the construction of the natural system, is based on a number of choices of deciding which observables to include and which to exclude. It acknowledges the fact that it is impossible to include all the components of complex systems, seeing that they are radically contextual and radically open at the same time (Chu *et al.* 2003). This links to Cilliers' (2005b:258) argument that "in order to function as models – and not merely as repetition of the system – they have to *reduce* the complexity of the system" (italics in original text). Consequently some characteristics and variables of the system will always be left out of the description. What is left out of account is not unproblematic, seeing that what is not included could interact "with the rest of the system in a non-linear way and we can therefore not predict what the effects of our reduction of the complexity will be" (Cilliers 2000a:28; 2005b:258). This implies that it is impossible to have complete knowledge of a complex system and that we can only know the system in terms of the models that are used to frame it. The dilemma lies in the fact that the frameworks are chosen by us, the researchers, and coincides here with the notion of self-reflectivity – that we are aware of the constructedness of the frameworks and models. Thus, when making any knowledge claims, it would only be prudent to acknowledge that our models have limits. As Cilliers (2000a:30) argues, the recognition of complexity is not an argument against the use of models, but it exposes the fact that our models are always a reduction of the complexity as discussed earlier, and as such, always imperfect:

> Calculation and modelling will provide us with a great deal of vital information. It will just not provide us with *all* the information. All the models we construct - whether they are formal, mathematical models,

> or qualitative, descriptive models – have to be limited. We cannot model life, the universe, and everything (30).

In addressing the disparity between the reality of complex phenomena and the models we make to describe that reality, Allen *et al.* (2010:46) present the following expedient example:

> A model constructed in terms of aggregate variables is like the famous painting of a pipe by Magritte called: *Ceci n'est pas une pipe* (This is not a pipe). We may look at the picture and recognize that it is a representation of a pipe, but it gives no idea of how the original came into existence, how it is affected by and affects other things, and certainly can never give the pleasure (or the danger) of smoking to anyone. Pedagogically it is interesting, since it enables us to recognise such objects as being pipes (while not being one) and we could certainly play wondrous academic games by considering different styles of "pipe", collecting images and discussing the materials, ancestry, technology that lay behind them. But just as the picture is not the pipe, the mathematical model of the ecosystem or of the economic system is NOT reality and neither are the statistics and databases of all possible measurements of input, output, throughput, or stock. Any model is a particular, culturally based interpretive framework of some piece of reality that will always be incomplete. We have to face the fact that we can never fully create a representation of something that is fully that something, but may nevertheless hopefully allow some useful discussions or insights concerning it.

The acknowledgement of complexity is often referred to as a paradigm shift from the mechanical and statistical models that depict the world in terms of traditional Newtonian science. It exposes the fact that models of complex phenomena are only attempts at depicting reality and it uncovers the limits of traditional theories that propose to offer one grand theory of the world. As Allen *et al*. (46) argue, the acknowledgement of complexity lays bare the dilemma that there remains a gap between our models and the reality they intend to depict. An irreducible difference exists between the nature of complex reality and our descriptions thereof (Canguilhem 1994:294). By acknowledging that knowledge of complex systems can never be complete, one is confronted with the "unavoidability of the limitations of human understanding"

(Cilliers 2002:77). The study of complexity thus points to the fact that the character of our representations of reality are at most "idealized and partial"[44] and they suggest "that there will never be a single account that can do all the work of describing and explaining complex phenomena" (Mitchell 2007:7).

This argument could be rephrased in terms of the reductionist dilemma as mentioned earlier, to read: in order to have knowledge of complex phenomena, we have to embrace reductionist strategies to be able to say anything meaningful about complex systems at all. Furthermore, the acknowledgement of this dilemma is an acknowledgement of the blind spots that are left out of the equations. Likewise, the recognition of complexity is not an argument against reductionism, but it exposes the fact that our knowledge of complex phenomena are always (whether we intend it to be so or not) a reduction of the complexity. There is a shift in attitude. Limitations, error and blind spots are acknowledged and not concealed. The reduction is made explicit and confrontation with emergence is not obscured or denied. Cilliers (2005b:263) argues that this shift towards a more "modest" attitude does not mean that we have to take a "weak" approach or "cringe in false modesty", but that we can still make "clear, testable assertions." On the contrary, "(t)he fact that our knowledge is limited is not a disaster, it is a *condition* for knowledge. Limits *enable* knowledge" (263).[45]

The argument that limits enable knowledge is in congruence with the work of the Dutch philosopher Cornelis Anthonie van Peursen (1972). In his phenomenological interpretation of reality, van Peursen (1972) argues that the notion of the 'horizon' constitutes a limit that is imposed on our visual capabilities. This limitation of our visual capacities is the enabling factor that ultimately makes sight (or our 'perception' of reality) possible. In his exploration on the philosophical importance of the notion of 'horizon' and how Kant and Husserl discussed it, van Peursen (1972:215) noted that the horizon can be seen as the "line demarcating the limit of the field of vision" and refers to the line "where vision ends." His interpretation of the horizon as enabling limitation is taken from the etymological roots thereof which can be traced to mean 'delineation.' Hence, the horizon delineates our field of vision and in the process allows the act of seeing to take place. Seeing is therefore only a delineated or limited way of seeing.

[44] Mitchell (2007:8) explains the notion of 'idealization' as follows: "causal models are abstractions that will always remain idealizations. By making simplifying assumptions regarding the noninterference of other potential causes, causal models describe only what would be expected in idealized circumstances."

[45] See also Allen (2001) and Cilliers (2005a) for a more detailed discussion on the relation between knowledge and constraints.

Furthermore, this line that marks the horizon is not a limit against which one collides, but represents an ever-shifting boundary. Van Peursen (211–212) also suggests that the horizon is not an object that is situated outside of the human subject, but is simultaneously located inside as well as outside the observer. This characterisation of the horizon coincides very well with the description of the boundary of complex systems as discussed in Chapter 1. The horizon is thus constituted as a result of the dynamic interaction between the observer and the observed and it situated in both at once.

As such the horizon is never fixed but moves and changes according to our position in reality (224) but moreover, without this limiting line, it would not be possible to see at all. Hence, vision is only possible as an effect of the horizon and can be redefined as a form of 'limited seeing', because it is impossible to see everything. Van Peursen (219) argues that "the horizon manifests man's range. For it is the human world which extends as far as the eye can reach, framed by the horizon." There is a double bind inscribed in the nature of the horizon, namely that of the "unattainable limit and room for progress" (219) which also relates to the notion of a hinge or a graft as will be discussed in more detail in Chapter 3 of this study.

5. Post-reductionism and general complexity

In this section the second problem of knowledge will be discussed. The first problem of knowledge was defined in terms of the "epistemological rupture" (Bachelard 1934) that takes place from moving to understand the world in terms of a reductionist Newtonian paradigm to an understanding that is cognizant of complexity and the implications this has for our knowledge producing practices such as the modelling of complexity. In light of the above, the second problem of knowledge can be framed in relation to a post-reductionist understanding of knowledge. The notion of knowledge as such becomes problematised. It is argued that knowledge generating practices and the notion of knowledge itself changes when faced with the challenges of complexity. In this section, the notion and conditions of a post-reductionist form of knowledge will be discussed. Seeing that such a position has not been given much attention in contemporary literature on complexity, this section will set out to provide a number of characteristics by which one can define a post-reductionist understanding of knowledge *vis-à-vis* the study of complexity.

From the line of argument that Cilliers (2000c, 2002) supports, it would seem that the above mentioned rational for modelling complexity would be a fairly common sense approach in the

study of complexity, especially when the characteristics of complex systems are taken into account. Nonetheless, the vast array of publications on complexity proves the opposite. It seems that the natural inclination for scientists engaging with research in complexity is still to revert to the restricted paradigm of strong reductionism. Scientific practice that concerns itself with the measurement of complexity and efforts that attempt to find laws of complexity (Morin 2007: 10) that are able to predict complex behaviour still have the upper hand in current research trends (Bak 1996, Johnson 2007, Arthur 2010, Singh 2010). As discussed earlier, these attempts fall in the paradigm of a restricted understanding of complexity and as Morin (2007: 9) explains, encompass "the fractalist conception and chaos theory" perspective of explaining complexity. According to Morin (9–10), these attempts to find formal models of complexity have proven to be very advantageous for the development of new modelling techniques and expertise and it might have opened possibilities for interdisciplinary cooperation, but it leaves one still in the domain of the classical tradition. Morin (10) elaborates on this argument as follows:

> When one searches for the "laws of complexity", one still attaches complexity as a kind of wagon behind the truth locomotive, that which produces laws. A hybrid was formed between the principles of traditional science and the advances towards its hereafter. Actually, one avoids the fundamental problem of complexity which is epistemological, cognitive, paradigmatic. To some extent, one recognizes complexity, but by decomplexifying it.

The essence in this error of reckoning that one can deal with complexity by means of "decomplexifying" it in terms of laws and predictable dictums, lies in the assertion that what is left out of calculation is not of importance. However, as Cilliers argues, this is of utmost importance. In a nutshell, it comes down to assuming that what is "irrelevant to analysis did not have an essential bearing on the functioning of the system as a whole" (Human & Cilliers 2011: 4). The restricted view considers its "models of complex systems to be comprehensive since they (are) based on the essential, underlying properties or structure of such systems (4)" instead of being cognisant of the way in which the system is constituted as a whole with emergent properties that are irreducible to the constituents of the system.

A general theory of complexity exposes the apparent "comprehensiveness" as insufficient and faulty in principle. Instead an argument is put forward in favour of a general understanding of complexity that acknowledges the inevitability of our knowledge to be a reduction of

complexity. Reducing complexity and simultaneously acknowledging that our knowledge is a reduction of complexity follows a different logic than that of the pure reductionist strategy. Moreover, Morin (2007:10–11) argues that "(i)n opposition to reduction, (general) complexity requires that one tries to comprehend the relations between the whole and the parts. The principle of disjunction, of separation (between objects, between disciplines, between notions, between subject and object of knowledge) should be substituted by a principle that maintains the distinction, but that tries to establish the relation." Hence, general complexity points towards a new epistemology of complex systems which examines the *relationships* between the parts as well as the parts themselves.

Considering the above argument, one could state that a general understanding of complexity follows the logic of reductionism that becomes aware of itself. This study proposes that it could be called *post-reductionism*, analogous to a definition of post-modernism that describes itself not as something that simply comes *after* modernism, but rather as modernism becoming aware of its own blind spots (Kearney 1998:21). Such a self-reflexive kind of reductionism which forms the basis of a general theory of complexity has the potential to destabilise fossilised dichotomies. It has the ability to disarm the animosities of opposing paradigms without uniting them into a grand monist truth. Ultimately a reflexive general theory of complexity forms the basis from where new forms of critique can be launched to invigorate stale and oppressive forms of scientific practice. The possibility of such a position will be discussed in more detail in Chapter 5 in which the conditions for a critical framework of complexity will be explored. In the next section, the implications of post-reductionism for knowledge generating practices will be investigated.

As argued here above, the notion of post-reductionism could be utilized to refer to the status of the knowledge generating practices and modelling outcomes in the study of complex systems. It acknowledges that in order to have knowledge of complex phenomena, one is compelled to reduce the complexity at hand, but that the reductionism will be made transparent and elucidated. This approach is contrary to the logical positivist approach of classical Newtonian methods that intentionally disregard the importance of the implications of its reductionist practices. It was also argued, that the post-reductionist position is not a position that excludes or dismisses the importance of Newtonian science. Post-reductionism can be understood as the Newtonian mind that becomes aware of its own limitations.

Within the broader framework of a general theory of complexity, the restricted classical approach is conceptually included and supplemented with more holistic and reflexive approaches. The notion of post-reductionism is not as strong as the concept of *anti*-reductionism and allows for a broader concept of "rationality" to be incorporated instead of a radical kind of constructivism or relativism which is often connected to the notion of *anti*-reductionism. Post-reductionism is also not equitable with *epistemological anarchism* (Feyerabend 1975, 1981) which suggests that any method is as good as every other in generating acceptable scientific results (Mitchell 2007:8).[46] In a sense, post-reductionism advocates for a kind of middle ground between strict positivism and strong forms of constructivism. Moreover, the post-reductionist position does not try and uphold the dichotomy, but attempts to view the two conditions as a couple locked, inseparably, in a dialectical bond (something similar to what François Lyotard had in mind when he argued that one can't be modern without being post-modern first) (Bauman in Dawes 2011:132). Contrary to a radical understanding of the notion post-modernism, post-reductionism does not partake in the legacy of the so-called "loss of reference" tradition with its dislocation of "epistemological security" (Rasch and Wolfe 2000:8). A certain point of reference remains—namely the relation to a complex reality. And the picture of the real is "one of a complex interaction between dynamic, open, stratified systems, where particular structures give rise to certain causal powers, tendencies or ways of acting" (Mingers 2000:1261–1262). Hence, post-reductionism aligns itself to a form of critical realism which states that the world as we perceive it is not only a construction of our knowledge generating practices thereof. The basic assumption of critical realism states that reality (or *being*) is rooted in the ontological domain and that our knowledge thereof is "socially and historically conditioned in the epistemological domain" (1260).[47] These assumptions are congruent with the inseparable link between ontology and epistemology as mentioned earlier.

Framed as a kind of "epistemological rethink", a post-reductionist position instigates a "paradigm shift from the Newtonian model that has dominated science, to an appraisal of complexity that includes both holism and reductionism" (Mazzocchi 2008:13). This appraisal of complexity coincides with a general theory of complexity as mentioned earlier and discussed in

[46] The notion of relativism comes from Feyerabend's statement that "anything goes". Mitchell (2007:14) explains it as follows: "In the absence of foundational standards of justification, Feyerabend argues that any and all forms of argument are acceptable in science. Some versions of social constructivism (see Collins 1982, 1985; Latour 1988; Woolgar 1988) can be taken to promote 'anything goes' pluralism, at least as far as truth is concerned."

[47] For a more detailed discussion on the links between complex systems and critical realism, see Mingers (2006).

Chapter 1. More on this strategy of thought that locks opposites in a kind of 'dialectical bond' will follow here below.

The post-reductionist position has certain epistemological implications. Consequently knowledge of complexity demands new concepts and new dialogues that are mindful of the consequences and implications of its own self-awareness (Hurst 2010:232). However as Cilliers (2010a:41) warns, "(g)eneral complexity on the other hand, argues for the limits of all approaches to complex systems and urges that we acknowledge these limits and recognise that we need *a new language* in which to do this, a language which moves beyond Enlightenment ideals of neutrality and objectivity" (my own italics). Contemporary literature on complexity shows that a wide variety of more inclusive attitudes have been tried and developed to deal with the limitations of traditional approaches. New vocabularies are in the process of materialising as they seek to give content to these approaches. The following (non-exhaustive) list of concepts are examples of scientific practices and conceptual paradigms (or theoretical frameworks) that aspire to acknowledge a post-reductionist position in their knowledge generating practices: transdisciplinarity (Nicolescu 2000, Thompson-Klein 2004, Max-Neef 2005), integrative pluralism (Mitchell 2007, 2009), the logic of complexity (Morin 2008), complex thinking (Cilliers 2007, Morin 2008), critical systems thinking (Flood & Jackson 1991), operational research (Churchman 1970, Mingers 2000), qualitative comparative analysis (Byrne 2010), resilience and adaptive cycles (Holling 2001) and action research (Midgley 2003b). From these concepts and practices, novel approaches and specialised fields of knowledge (Mazzocchi 2008: 14) are already emerging. In Chapter 5 a selected number of these approaches and concepts will be examined in more detail and their importance in constructing an approach that can be delineated as 'critical complexity' will be elaborated on. The following section will explore in more detail what implications a general theory of complexity that can be described as post-reductionist in nature, has for our knowledge of complex systems.

5.1 Implications for the nature of knowledge

The reductionist understanding of knowledge suggests that the act of *gaining* knowledge leads to a state of *having* knowledge. In this sense knowledge is understood as something that is "reified, turned into something that 'exists'" (Cilliers 2002:80) independently from the subject (as assumed in theories of knowledge that are based on the assumptions of scientific realism, for example). [48] For Cilliers, such a definition of knowledge fits the notion of "data" or

[48] Cf. Mingers (2006:14).

"information" (80), but not knowledge. Instead, knowledge should be understood as being the "result of a process of interpretation" (80) The argument about the contextuality of knowledge and the fact that we can only speak of knowledge when the faculties of understanding and the interpretation of data is involved is developed in more detail in Cilliers (2000, 2002). The following section aims to explore how the notion of knowledge that emerges as a result of interpretation and contextualisation can be rethought in light of a post-reductionist understanding of knowledge generating strategies that are cognisant of complexity.

5.1.1 Hybrid knowledge

The nature of knowledge generated by the Newtonian logic of analysis and disjunction differs from the nature of knowledge constituted by the study of complex phenomena. Since the Newtonian logic cuts and separates, knowledge generated from such a methodology presupposes a clear definition between object (what is being analysed) and subject (the person doing the cutting). There is an implicit assumption that the object is out there lying in waiting (Canguilhem 2004:43) to be discovered. Once discovered and described, basic consistencies and lawful behaviour can be captured to form a coherent and ultimate truth concerning the object. Hence, it is believed that objective, universal and timeless knowledge is possible in principle. There is also a clear understanding of what the disjoined parts can do under certain conditions and complete knowledge about the parts assumes blindly that perfect knowledge of the whole is possible. Knowledge in the Newtonian paradigm is therefore based on atomised facts that stand out as being pure and static or determined (Kuhn 1996:26) and once woven into a theory that can be regulated, compared and falsified; it becomes part of the canon of scientific literature. All other forms of knowledge that do not adhere to these principles fall outside the scientific *doxa*. By taking into consideration the nature of complex systems as described in Chapter 1, it becomes apparent that the Newtonian method of generating facts does not hold. New knowledge-gathering strategies are to be sought that depart from analysis and disjunction.

Becoming aware of their limitations and inadequacies, post-reductionist knowledge-gathering strategies are challenged to study the relations of the parts with the whole in such a way that the interdependencies of the parts to the whole and *vice versa* are made clear. Failing to display clear distinctions between object and subject, system and environment, presence and non-presence, the knowledge-gathering process of complex systems is exacerbated by ambiguities that are not to be regulated in principle. In order to be able to know complex phenomena, an epistemic border needs to be crossed (Schlindwein and Ison 2440:27). Practically this means

that the very notions of the concepts we use such as part/whole, subject/object, system/environment needs to change. These notions still suffer from being understood as static and clearly definable concepts. Complexity challenges the very fibre of these fossilised meanings. In explaining how the notion of "part" should be re-thought when dealing with complex systems, Canguilhem (2004:296–302) gives an explanation based on the example of re-defining cells in terms of cell theory:

> The organs and systems of a highly differentiated organism exist not for themselves or for other organs and systems, but for cells, the countless anatomical radicals, for which they create an internal environment whose composition is maintained in a steady state by a kind of feedback mechanism. The part depends on the whole that exists solely in order to maintain it. ... the structure of the whole organism is subordinate to the functions of each part. Made *of* cells, the organism is also made *for* cells, for parts that are themselves less complicated wholes. (italics in original text).

From the above example one gathers that the relation of the parts to the whole is one of "integration" (Canguilhem 2004:299). The parts can no longer be seen or defined as separable from the whole. In other words, the part can only be called a part "in its undissociated state" (301). Canguilhem compares this understanding of the whole/part relation to Hegel's remark found in "his *Logic* that it is the whole which creates the relation among its parts, so that without the whole there are no parts" (301). Defined in systems terminology, it implies that the forces of downward and upward causation, non-linear feedback and an acknowledgement of emergence is not to be dismissed when we re-think the definitions of concepts that comprise complex systems. The *meaning* of the concepts themselves is defined by their relation to other concepts and the way in which they are dynamically organised in the system. This teleological structure of the complex system thus defies the Kantian understanding of the notion of "concept". For Kant, concepts are *a priori* transcendental constitutions (310) which represented reality and all its observables as a given fact. The meaning of a concept could be linked to a corresponding object (or force or cause) in the real world. However, the logic of complex systems shows that concepts are not determined *a priori*, but that their meaning is constituted by their relations with other concepts and that therefore their meaning cannot be fixed. Consequently our knowledge of complex phenomena cannot be *a priori* pure or determined.

Knowledge of complex systems defies and challenges the notion of "pure scientific" knowledge that is based on objective facts resting on conceptually fixed (determined) understandings of the objects under study. Traditional scientific knowledge privileges the notion of pure knowledge above and against the notion of hybrid (to be read as meaning mixed, contaminated, subjective, local or unscientific) knowledge. Philosophers such as Latour, Foucault, Lyotard and Feyerabend have verily argued that all knowledge is hybrid by nature and that the practice of generating scientific knowledge cannot be isolated from the politics of science (i.e. funding matters, research directives, and institutional scientific policy) and the role of the observer. Although theories of complexity can be situated within the philosophical tradition belonging to these authors, the definition of hybrid knowledge as used in this study, can be defined in a different manner.

The meaning of the concept "hybrid" here includes all of the above descriptions thereof which suggest that knowledge as such is a combination of many different kinds of knowledge and that not one kind of knowledge can be privileged above another kind of knowledge. In addition and more importantly, the meaning of hybrid implies that the concepts, upon which our knowledge is based, are hybrid in nature as discussed above and explained in the example of Canguilhem's exposition of cell theory. The notion of hybrid that I want to put forward here, acknowledges that knowledge of the parts implies knowledge of the parts in relation to the whole and *vice versa*. Hybrid knowledge suggests that our knowledge generating practices should change in such a way that it captures the relations of integration. This kind of practice can then be extended to apply in all other fields of investigation that deal with dichotomies such as system/environment, subject/object, local/universal, cause/effect, etc.

As a result, hybrid knowledge itself cannot be static or fixed, but provisional and dynamic in nature (Cilliers 2002:80–81). Hybrid knowledge produces theoretical systems "in which there is always a surplus of signification and in which meaning is therefore open, infinitely disseminated, and ultimately uncontainable" (Shershow 2001:473). Moreover, the surplus of meaning that is generated by such a general economy of knowledge suggests that the world is not "finally limited or restricted enough to be graspable by thought" (473). The limits of knowledge are exposed and hybrid knowledge is proved to be post-reductionist in the sense that it becomes aware of its true nature.

5.1.2 Difficult knowledge

Not only does the acknowledgement of complexity combined with a reflective attitude on the limits and blind spots challenge our understanding of how to define the notion of knowledge, but it redefines the notion of knowledge to be a complex process itself as stated above. The process of generating knowledge, storing and using it becomes a dynamic complex system. A static understanding of knowledge is undermined. The new understanding of knowledge as a complex system exposes the difficulty of "having" knowledge that seems complete and contained. Moreover, by defining knowledge as a complex phenomenon, it acquires s all the characteristics of complex systems as described in Chapter 1. From this it can be gathered that the act of generating knowledge and defining the status of knowledge is reframed in terms of a dialectical process where what we know cannot be disconnected from the knower, how it is used and how changes impact on it. The status of knowledge changes from something that is "complete and related directly to prediction" (Allen & Torrens 2005:582) or as being "atomised facts" to being reconfigured as "constituted within a complex system of interactions" (Cilliers 2000c:8).

Arguing for such an understanding of knowledge reduces that status of knowledge from something that is certain, self-contained and static to being uncertain, provisional, open to change and dynamical. It is also because of its status of being constituted as part of a complex system, and the fact that it becomes aware of its limits and incompleteness, that Lather (2001: 486) calls it "difficult knowledge":

> Asking hard questions about necessary complicities, inadequate categories, dispersing rather than capturing meanings, and producing bafflement rather than solutions, I put deconstruction to work as 'difficult knowledge', knowledge that works against security and certainty by inducing breakdowns in representing experience. Here accepting loss becomes the very force of learning and the promise of thinking and doing otherwise.

Difficult knowledge characterises the understanding that there is a dialectical relationship between "knowledge and the system within which it is constituted" (Cilliers 2000c:9). The difficulty of disconnecting the processes from one another is expressed in the notion of difficult

knowledge and it exposes the problematic of not being able to discern where the boundaries between the two are. The following argument by Cilliers (9) illustrates the point fittingly:

> The two do not exist independently, thus making it impossible to first sort out the system (or context), and then identify the knowledge within the system. This codetermination also means that knowledge and the system within which it is constituted are in continual transformation. What appears to be uncontroversial at one point may not remain so for long.

This understanding of knowledge corresponds with a post-reductionist understanding of knowledge (being aware of its limitations) and is also compatible with a poststructuralist (more specifically a Derridean) understanding of knowledge. Poststructuralism understands knowledge as "historically and reciprocally affected by practice within contingent conditions of time" (Lather 2001:479). Often the poststructural argument is taken to be a relativist position, but as Lather (479) argues, "it is not about offering a competing ontological frame, but about looking at the historical, philosophical and cultural construction of frames." By putting the autonomy of knowledge in question, difficult knowledge does not argue in favour of relativism, but exposes the false sense of confidence that there is in proposing that knowledge can be pure and complete. Hence, rejecting the totality of knowledge or truth or possibility to represent something fully, does not mean that one rejects knowledge or truth or the possibility to represent. The dialogical nature of difficult knowledge allows us to have our truths and facts, but it challenges us to know the limits thereof and to re-evaluate it every time we use it and to re-invent it if necessary.

Difficult knowledge then also regards the incompleteness of scientific knowledge. Referring to the notion thereof, Morin (1992c) invents the word 'en-cyclo-peding' as to mean to place knowledge in cycles. This dialogical notion of Morin connects with the notion of Derrida's understanding that everything is interpreted, so there is no original *arche* knowledge. Meaning is always already derived from past interpretations and will change as it moves into the future (Culler 1983:103). Derrida's questioning of logocentrism, the positivist ideal that knowledge can be based on an "ultimate origin, telos, centre or principle of truth which grounds meaning" (Wortham 2010:89), corresponds directly with the notion of difficult knowledge. In *Specters of Marx* (1994) Derrida introduces the notion of "hauntology" to displace the notion of ontology in order to illustrate the replacement of the priority of knowing with not-knowing. By introducing

the figure of the ghost, Derrida (1994) argues that it is the spectral that makes possible reproduction even as it also fragments reproduction and ruins the very possibility of reproduction's apparent guarantee to represent that which is no longer there fully. The notion of the ghost (that which is haunted) pushes against the boundaries of thought and our ability to know and explores the liminal space between knowing and not-knowing. The ghost represents the absence of something real and even more so, meditates between worlds. Difficult knowledge takes on this haunted format that Derrida ascribes to the ghost and exemplifies how knowledge can only be spectres of reality. It can never fully comprise reality.

Hence, the spectral nature of difficult knowledge exposes the tension between the desire to understand and the openness to what exceeds knowledge. The difficulty lies in the performative tension once again, as mentioned earlier, of being in the space where knowing and not-knowing meets one another. It is here where the normative dimension of epistemological practices comes into being. In order to have some form of knowledge, we have to decide how to frame our object of study. This framing rests on a choice and the moment of decision is not constituted objectively or from an uncontested terrain. More on the ethical nature of the notion of framing and choosing which frame to use, will be discussed in Chapter 5.

6. Conclusion

In this chapter the problem of being able to know complex phenomena was discussed in terms of two major concerns. The **first problem of knowledge** was discussed in terms of the disenchantment and breakdown of the Newtonian/Cartesian scientific paradigm. The chapter elaborated on the limitations of the Newtonian paradigm as it was highlighted in developments in the fields of physics, mathematics and biology during the first half of the 20th century. From this perspective the demise of reductionism emerged from its own blind spots. One can almost say that its short-comings were proven by exposing contradictions in the rules and principles of analysis that are needed in the production of the rules and assumptions that constitute modern science *per se*. Scientific developments in the study of complex phenomena offered a kind of immanent critique on the modernist strategies of positivism and reductionism.

The fact that the logic of classical science does not hold when confronted with the study of complex phenomena problematises science's ability to know reality in principle. It exposes the fact that there remains a gap between our knowledge of the world and the world as such. This argument was explained in more detail by the discussion on the possibility of modeling

complexity as reinforced in the arguments by in particular the work of Cilliers, Rosen and Morin. Furthermore, the acknowledgement of complexity suggests that our theories of knowledge should verify and expose this incongruence between our models of the world and the world. It was discussed that reductionist practices conceals this incongruence knowingly, but ignore the consequences that this may entail willingly.

Four different kinds of reductionism were discussed and it was highlighted that there is not one kind of reductionism that poses as a lesser evil to employ in our attempts to find correct descriptions of the world. The core of reductionism assumes that certain things or processes can be reduced to certain other things or processes by ignoring the differences between them. The deliberate disavowal of specific contingencies or characteristics leads to a distorted picture of reality. This blindness of reductionism, it was argued, is not a naive disability or oversight of the state of things, but constitutes the barbarism (Morin 2008:6) that is inscribed in the hegemony of the classical scientific enterprise (Dillon 2000:9). It was argued that the kinds of reductionism that is at work in Newtonian science, is adequate to describe and model closed systems that follow the logic of a linear causality, but that complex phenomena cannot be studied, modeled and explained by such a logic.

The argument was put forward, that although holistic strategies that oppose reductionist positions assume that one can escape reductionism, it is impossible to do so. Even the project of holism is a reductionist endeavor in the sense that all ontology is reduced to epistemology and experience. By suggesting a general understanding of complexity, the study proposes that all knowledge of complex phenomena is a reduction of complexity as explained by Cilliers (2000c, 2002). To have meaning and to be able to know complex systems, we have to reduce complexity in order to be able to say or know something thereof. Morin's notion of general complexity reiterates the impossibility of positions that acknowledge complexity as a complete opposite to reductionism by suggesting that the notion of general complexity includes the logic of a restricted notion of complexity. A generalized understanding of complexity recognizes the fact that all models and knowledge that deal with complex phenomena is a reduction of complexity. The difference between the general and restricted understanding of complexity lies in the fact that the general framework recognizes the limits of its own endeavors and incorporate a self-critical acknowledgement of its own blind spots. It was argued that the reduction of complexity and the simultaneous acknowledgement of this limits of our capacity to know complex reality, adheres to a different logic than that of a pure reductionist strategy.

Linked to the notion of general complexity, the study proposes that it might be more productive to suggest that studies of complex phenomena represent a position that follows a logic of reductionism that becomes aware of itself. The term *post-reductionism* was introduced to describe this shift in attitude towards a self-reflexive kind of reductionism, which can be posited to form the basis of a general theory of complexity. In this move, an impasse is found to move beyond the binary oppositions of reductionism and holism. The study continued to argue that a post-reductionist position attempts to overcome the accusations of being relativist and at the same time does not adhere to a strong kind of constructivism. Posed as a kind of epistemological re-think, it falls in the category of being a complex concept (Hurst 2010:244-246) that manages to "bring together co-dependent elements that also oppose and undermine one another." Thus, it suggests a thinking together, but not identical, of reductionism and holism.

The nature of a post-reductionist position suggests that one thinks differently about the nature of knowledge as such. Hence, the **second major problem of knowledge** can be linked to the implications of a post-reductionist position. It is suggested that the nature of the concept of knowledge changes when faced with complex phenomena. Instead of being understood as a static state or object, knowledge itself is taken up in the economy of complexity. Knowledge itself can be re-defined to be part of a dynamic complex system. The study suggests that knowledge emerges as a kind of emergent property as the result of processes of interpretation and contextualization. A post-reductionist understanding of knowledge, re-interpreted as being part of the logic of complexity, has certain implications for the way in which knowledge is generated and processed. The study poses that a post-reductionist form of knowledge can be described best in terms of the notions *hybrid knowledge* and *difficult knowledge*. Both these two notions focus on the dynamic nature of knowledge and how our knowledge of complex phenomena can never be final, pure or complete, but only provisional and a weaving together of different kinds of knowing and not-knowing.

This different understanding of a self-critical, reflexive kind of knowledge that is constituted by means of its own limitations serves as an injunction to start thinking anew about the presumptions and basic structures on which knowledge claims and theories of knowledge are built. The study proposes that it is in light of the limits of our knowledge generating practices and inability to know complex phenomena fully; that the post-reductionist position calls for a renewal in thought about the critical practices that evaluate and judge the status of our theories of knowledge and the implications they have for knowledge generating practices.

The next chapter will focus on the problem of knowledge as constituting a critical dimension within the logic of post-reductionist and a general understanding of complexity. By focusing on the limits of being able to know complex phenomena, Chapter 3 will explore what the implications of acknowledging this limitation are and how the complexity approach can be linked with Kant's understanding of critique, which also exposed the limitations of reason's capacity to be able to know reality. It will be argued that the problem of knowledge as discussed in this Chapter shares some similarities with Kant's critical project in specific and the critical tradition in philosophy in general. The importance of the notion of the limit will also be discussed in terms of its implications for developing a new conceptual understanding of the notion of critique.

PART II: THINKING COMPLEXITY

CHAPTER 3
THE PROBLEM OF CRITIQUE

1. Introduction

The following two Chapters that comprise Part II of this study will introduce a progression in the study of the problem of complexity as argued in the general Introduction of this study. By building on the insights of Chapters 1 and 2, Part II will shift its focus by departing from viewing complexity as an object of study. Instead, Part II will adopt the implications of applying the 'complexity approach' (as argued in Chapters 1 and 2) to explore the concept 'critique' (Chapter 3) and the notion of 'thinking' (Chapter 4) in more detail. This shift introduces a meta-perspective from where we can situate ourselves so as to reflect on the thought strategies that frame the questions related to these concepts. From the meta-perspective, the problem of complexity can be defined as being a problem that is related to our modes of critical thinking. The next two chapters aim to provide us with some conceptual tools with which alternative modes of thinking can be forged so as to meet the call of complexity.

Drawing on the notion of a post-reductionist and general understanding of complexity as discussed in Chapters 1 and 2, an argument can be put forward that the acknowledgement of complexity implies a *critical position*. As argued in Chapter 2, an acknowledgement of the inevitability of our knowledge to be a reduction of complexity that informs a general understanding of complexity displays the necessity of an ever present form of self-critique that remains vigilant about the limits of our processes of modelling complexity. In Chapter 3, it will be suggested that it is this self-awareness of the limitations of being able to know complex phenomena in principle (as suggested by a post-reductionist position), that provides us with the conceptual means with which to develop an expanded definition of the concept "critique" by which the critical project of philosophy can be supplemented.

As mentioned, Part II of this study is marked by a departure from focussing on complex systems per se. A shift in focus is introduced in order to understand on what level and why the study of complexity can be seen as *philosophically relevant*. In the same way a film camera can offer a panoramic view of a landscape and then focus in on a specific object or theme, Part II of this study resembles a 'zooming in' on the philosophic issues that emerge in the study of complex phenomena. Part I of this study provided the wider background and context for understanding

complexity conceptually and what implications the study of complex phenomena has for our knowledge thereof and the ways in which we go about accessing that knowledge. In Part II, the focus will not be concerned with complex phenomena as such, but instead on how a general theory of complexity can function "more usefully as a lens for observing than as a specimen for studying" (Allenby & Sarewitz 2011: 5).

The main focus of Part II will be concerned with the implications of adopting a 'complexity approach' for defining (a) the notion of critique (to be discussed here in Chapter 3) and (b) the notion of "thinking" as such (Chapter 4). In order to make the jump from a general understanding of complexity and the implications it has for our ways of knowing the world to the notion of critique, this chapter will start with a bridging section (see point 2 here below) that aims to align the complexity approach with that of the critical tradition in philosophy as initiated by Kant in the 18th century in general and with poststructuralism in specific. This transition is necessary so as to situate general complexity in the tradition of critical (in the Kantian sense) theorising. As will be discussed in point 2 below, the critical nature of the complexity approach can be aligned with the philosophical position best known as poststructuralism in general and deconstruction more specifically. The problem, however, of this similarity, is the fact that these positions are often criticised for their inability to offer any kind of legitimisation from where any form of critique can be launched (see discussion of this dilemma at point 3 below). In Chapter 3, this dissertation aims to offer some form of legitimisation (or passage through this dilemma) by drawing on a deconstruction of Kant's understanding of critique. By suggesting a re-definition of the notion of critique to mean 'critique as stricture' that operates at the limits of our understanding, some form of grounding is discovered. This interpretation of critique is then later linked to the experience of complexity in Chapter 5 which presents another form of grounding or legitimacy that undermines metaphysical certainties but at once also suggests the impossibility of a total loss of the outside. Hence, situated in the double bind of the *stricture*, the notion of critique re-defined as 'critique as stricture' suggests a way in which the dilemma of postmetaphysical forms of critique can regain some ground again.

As argued, this deconstructed notion of critique is derived from Kant's understanding of critique. For this reason Chapter 3 aims to demonstrate that there is a generic similarity with the Kantian notion of critique as argued in his work *Critique of Pure Reason* (1998, originally published in 1781). For this purpose, Chapter 3 offers a close reading of the first of Kant's critique and in a sense the discussion of critique is limited to Kant's understanding and appropriation thereof. This is done for a specific reason, so as to expose the fact that there is

some alignment of Kant's critical project—of establishing the limits and possibility of reason's capabilities to know the world—with the assumptions and implications of acknowledging and studying complex phenomena. Consequently the chapter refrains from offering a discussion on a genealogy or development of critique after Kant. Neither will the various roles and definitions be explored as found in the tradition of critical theory or as appropriated by the critical philosophers after Kant individually (e.g. Hegel, Nietzsche, Heidegger). The study will also not consider the different definitions of critique as can be defined in terms of its nature and function as done for example in the excellent exposition of Kwant (1962). Despite the fact that the tradition known as 'critical rationalism' as propagated by Popper (1963) in his very famous work *Conjectures and Refutations: The Growth of Scientific Knowledge*, also deals with the status and justification of claims to knowledge, this line of argumentation will not be followed in this study. The study and understanding of critique will be limited to Kant's understanding of critique as presented in his critical project in general and more specifically as explained in his *Critique of Pure Reason*.

Following the justification for arguing why the complexity approach can be located within the critical tradition of philosophy after Kant, the study engages with current debates about the 'problem of critique' (section 3). It is suggested that defined from a poststructural position that exposes the metaphysical foundations upon which grounding norms of critical positions are based, theories of critique are marked by some crisis regarding the loss of external or objective grounds from where to justify 'in what name' critical interventions could be launced. The nature of the 'crisis of critique' is linked to the assertion that critical positions that question metaphysical forms of legitimising norms and conditions of validity leaves one with a non-foundational, non-essential type of critique that necessarily then compromises the function of critical inquiry and as often argued, succumbs to a performative contradiction (Habermas 1975). Hence, the problem of legitimisation is discussed in the light of this dilemma and it is then suggested that by doing a close reading of Kant's notion of critique we might find a way out of the predicament.

Thus, sections 4 and 5 offer a detailed account of Kant's notion of critique and its consequent definition thereof as that which resembles a judiciary trial. This definition is discussed in particular and the study then continues to demonstrate how a deconstructive reading of this notion of critique could go against itself to produce a new meaning of critique that exposes the double movement that is located in it conceptually. The study unpacks the new meaning in terms of the double movement and inscribes the ideas of 'stricture' and 'hymen' as coined by

Derrida to the notion of critique. This exposes a conceptual shift that constitutes a change in how one can think of critique (see Chapter 4).

This dialectic nature of critique is exposed in this shift and the implications of such an expanded understanding of the notion of critique as stricture is discussed in more detail. The study proceeds to argue that based on this expanded understanding of critique as stricture and/or hymen (or movement that also ascribes to the meaning of 'force field' or 'constellation') new possibilities of legitimisation that do not succumb to metaphysical foundations are exposed by considering the limits of opposing and binary oppositions. More attention will be given to this understanding of legitimacy in Chapters 4 and 5.

2. The critical dimension of complexity—situating complexity as form of critique

In this section the implications for acknowledging a 'complexity approach' (Checkland 1993:5) or 'attitude' (Cilliers 2007:4) or 'paradigm' (Morin 2008) as argued in Chapter 1 of this study will be discussed in order to build a bridge between complexity and the critical philosophical tradition in general and poststructuralism more specifically. And as argued in Chapter 2, the complexity approach necessarily has to be a critical approach if its main concern is unmasking the limitations of how we can know and study complex phenomena.

From this perspective, it is suggested that by gleaning from a general understanding of complexity and by extrapolating its central implications to form a complexity approach (or 'worldview'), a new meta-position opens up from where other related concepts can be re-interpreted. The following points highlight a number of important philosophical implications that could form the basis for delineating some guidelines that should inform a complexity approach:

1) Complexity is a systemic property. A complex system does not exist independently from the parts that constitute it (Casti 1986:146, Preiser & Cilliers 2010:267). Hence, complexity is simultaneously a combination of the attributes of a system (ontological) as well as a "function of our present understanding of the system" (Cilliers 2008b:44) (epistemological). This implies that there is **no objective position** from where to study complex phenomena. Moreover, the traditional **division between subject and object**

cannot be maintained (Cilliers 2011:143, Morin 2008:22).[49] In philosophical terms, these insights situate the study of complex phenomena theoretically within a general postmodern[50] paradigm of thought (Cilliers 1998, Dillon 2000, Heylighen *et al.* 2007, Lafontaine 2007, Popolo 2007, Walby 2007) and more specifically as reflected within the field of study that is known as **poststructuralism** (Cilliers 2011:145–147, Hermanus 2010, Luhmann 1993, Rasch & Knodt 1994: 6, Woermann 2010). From such a position it is not possible to launch knowledge generating practices or epistemological theories from some objective or "external historically advanced position" (Rasch 2000:9). With the loss of objectivity, all knowledge is partial knowledge (see Chapter 2) and there can be no meta-position that legitimises the framing practices that we use to frame knowledge. The observation of complexity challenges all framing practices and exposes theories of scientific explanation for being just that—theories and not closed, real things in themselves.

2) Complex systems are **radically open and contextual** (Chu *et al.* 2003, Chu 2011). This implies that complex systems exist and operate under conditions "that make the control and prediction of complex systems very difficult" (Chu *et al*. 2003:28). These characteristics have implications for the possibility of modelling and knowing systems and as discussed in Chapter 2, it implies that not only is there no perfect object model of a complex system, but the difference between the borders of system and environment

[49] It is to be noted that the impossible division between subject and object does not imply a radical kind of constructivism where there is no object anymore. In fact, the paradigm of complexity proposes a more nuanced distinction and argues that it "supposes the world and recognises the subject," but simultaneously "it positions one and the other in a reciprocal and inseparable way" (Morin 2008:23). In other words, the subject and object are both constituted relationally and are thus structurally linked. Morin (2008:91) argues that this view can be best described by the notion 'co-constructivist', which means, that "we construct the world itself which, as it were, lends us a hand." This view coincides with the assumptions of a critical realist position as explained by Mingers (2006) and as discussed in Chapter 2 of this dissertation.

[50] There are several interpretations for the term 'postmodern'. Cilliers (2005b), Woermann (2010) and Hermanus (2010) have offered detailed arguments why a *rigorous* understanding of the notion 'postmodern' does not subscribe to a position that implies a non-reflective justification for relativism or anarchy. This study subscribes to a rigorous or sophisticated interpretation of the notion 'postmodern' that points toward a position that recognizes the blind-spots in an over confident understanding of modernist rationality. Informing this understanding of the notion 'postmodern' is the work of Lyotard (1979) in which the 'grand narratives' of modernism are distrusted (Sim 2001:12) and where there is a self-critical attitude towards the limitations of modernist rationality (Bauman 1992). The rigorous (or "radical") interpretation of postmodern is often marked by its interest in "otherness, *différance*, the decentering of the subject, in fragments, fissures, in power/knowledge regimes" and is distinguishable from "older varieties of reactionary anti-modernism" critique (Bernstein 1991:5) (italics in original text). However, the problem of finding and justifying grounding positions for norms, judgements and for legitimising critical interventions still remains a challenge—even from a more rigorous post-modern position (see discussion in section 3 of this Chapter). See Fraser 1988 for a detailed discussion of this dilemma.

collapse to such an extent, that it is impossible to determine a neutral position from outside the system to observe and study the system. This fact relates to discourses that argue for the 'loss of the outside' or 'loss of reference' as Rasch and Knodt (1994:4) argue:

> The modernity of science is marked by the famed and often lamented "loss of reference," i.e., the assertion that science can no longer lay claim to represent the world as it is and can therefore no longer serve as a non-contingent, authoritative source of knowledge.

The loss of reference or 'decentring' of structure is described by Derrida (2001:354) as

> the moment when in the absence of a centre or origin, everything becomes discourse—provided we can agree on this word—that is to say, a system in which the central signified, the original or transcendental signified, is never absolutely present outside a system of differences.

Philosophically speaking, this implication places the complexity paradigm congruent to **postmetaphysical** positions that deny the possibility of knowledge based on transcendental categories or notions of truth, consciousness, being or alterity (Mullarkey 2006:2, Rasch and Knodt 1994:5). Philosophic approaches that recognise the shift from transcendence to immanence are expressed in the work of philosophers such as Gilles Deleuze, Niklas Luhmann, Jacques Derrida, Alain Badiou, Michel Henry and Francois Laruelle (Mullarkey 2006). Following the assumptions of the postmetaphysical lineage, the complexity apprioach challenges the traditional understanding of "immanence and transcendence" (4) to such an extent that we are to re-think the grounds on which scientific knowledge can be justified and valued.

3) The shift in the focus of study from material components to **relationships** and **organisation** as the complexity approach suggests, implies that traditional notions of causality and methodology are challenged. The characteristics of complex phenomena as mentioned in Chapter 1, but especially the notions of *self-organisation*, *non-linearity* and *emergence* point to the fact that there is **no centralised point of control** from where complex systems are organised. The fact that it is due to the dynamic nature of

the interaction between the various elements of the systems' components and between the interaction of system and environment, suggests that there is no one original cause that leads to the development or existence of complex phenomena. There are only numerous different and simultaneous causes that interact dynamically that lead to the existence of complex phenomena. Hence, there is no centre and no main or original organising principle that can be traced as the single locus of control or mechanism that explains the existence of complex phenomena. The process of self-organisation also demonstrates the fact that in a complex system, "each part/process is at once cause and effect, a means and an end" (Wolkenhauer & Muir 2011:359). Or in other words, complex systems are "self-referential, every part owes its existence/explanation to the organization of the remaining parts" and a remarkable feature of complex (and especially living) systems is that "their parts interact, modify and create themselves so as to realize an autonomous self-fabricated, self-organized whole" (Wolkenhauer & Muir 2011:359). This loss of central and linear control and form of causality in the organisational process of complex systems, can be equated with the understanding of 'decentred structure' that is associated with structuralism as described by De Saussure (1974) and Levi-Strauss (1966). However, Cilliers (2011:44) suggests that structuralism can be related to a restricted understanding of complexity (see Chapter 1) seeing that "similar to approaches in restricted complexity, they believed that if you worked hard enough, you could uncover the structure of the system, and thus 'get it right'."[51]

In contrast to a restricted view, the **poststructural** position that radicalises this de-centeredness of meaning or organisation, namely deconstruction, suggests that "the(se) structures of differences can never be determined and, therefore, that meaning can never be completed" (Parusnikova 1992:32). Hence, the poststructuralist impression of organisation is a further development or radicalisation of the structuralist view of Saussure and conceives of organisation (or meaning) as "never present in the sign; meaning is always dispersed within the totality of signs and generated by a totality of unstated tactics" (32). For Cilliers (2011:144), the logic of poststructuralism and in particular the movement of **deconstruction**, expresses the organisation of general complexity very appropriately:

[51] This relates to the assumptions of a restricted understanding of complexity that claims that complexity can be quantified and calculated. From a structuralist position, this could be interpreted that the meaning of things can be closed down and fixed (Cilliers 2011).

> The very structures which make meaning possible introduce distortion in the system of relationships. These structures, sometimes called hierarchies, can therefore not be final, but are in constant transformation, both through external intervention and by their own dynamics. This process is what is often called 'deconstruction'—a term which has nothing to do with destruction.

and

> A complex system can be seen as a network of dynamic nonlinear relationships. These relationships can be equated with Derrida's notion of traces. The dynamics of the system is a result of all the interactions in the system, but since this interaction also consists of multiple simultaneous nonlinear feedback, with a constant flow of energy through it, it operates in a state far from equilibrium. This perpetual activity is in effect a form of *différance*. This notion is extremely useful to describe the way in which the emergent properties of the system can manifest themselves, yet be in constant transformation (147).

The importance of the similarity to deconstruction is an important insight and will be discussed in more detail in Chapter 4.

Because the study of complex phenomena entails the study of emergent properties of elements that constitute the system through self-organisation, causes can become effects and *vice versa*. The unpredictability of the effects of that which is left out of our models and the ways in which that which has been excluded could influence the system. This leads to the suggestion that our models can only be modest reductions of reality. This in turn serves as the motivation for cultivating a **critical self-reflexivity** in our knowledge generating practices and methodologies. Hence, the complexity approach will have to be concerned with the practice of pinpointing the blind spots in scientific methodologies. From this acknowledgement our methodologies and ways of thinking about the world can only be realised in terms of thought strategies that can function "with and in uncertainty" (Morin 2008:96). This does not mean that any kind of thinking is good enough for tackling complex problems (the problem of relativism), but that a kind of thinking which Morin (97) calls '**complex thinking**' is needed. It is a kind of thinking that "thinks itself" (97) and can operate with a logic that incorporates contradictions (Morin 1974). More of this kind of thinking will be explored in Chapter 4.

In summary, from the above mentioned implications it can be construed that the complexity approach is congruent with a poststructural logic that:

1) problematises the traditional distinctions between subject and object or inside and outside,
2) problematises theoretical positions that rely on strict transcendental categories or abstractions of reality,
3) acknowledges the loss of a central locus of control; the logic of self-organisation that gives rise to emergent properties and resonates with the logic of *différance* as described by deconstruction,
4) dismisses a positivist (or as Derrida (1976) calls it 'logocentric') kind of rationality and subscribes to self-critical thought strategies that aim to expose and undermine the frames of thought that constitute such strict forms of reductionism.

Consequently, the significance of the abovementioned implications forms the basis of the argument, that the complexity approach "overturns several standard conceptual and explanatory defaults, and (it) enables posing and exploring new questions and explanatory frameworks" (Bickhard 2011:91). This simultaneous 'overturning' of old (or current) and 'exploring' of new explanatory frames suggests a that there is a critical preoccupation inherent within the logic of the complexity approach that displays some similarity with the critical tradition in philosophy in general and more specifically with the poststructural strategy of deconstruction. By situating the paradigm of a general understanding of complexity within poststructuralist theories, a space is created in which the acknowledgement of complexity constitutes a critical position (Alhadeff-Jones 2010a, Alhadeff-Jones 2010b Cilliers 2011:151). Not only does this imply that one can define the acknowledgement of complexity as a form of critique, but moreover, that the notion of 'critique' as such is put under criticism when observed through the lens of complexity. This linking of the notion of complexity to critique can be matched by Kristeva's (1986) attempt to call the emerging field of cybernetics as presented in the work of Wiener's research on models, a resource for developing a "science of critique" that could be extended to mean a "critique of science," and in particular a critique of scientists' efforts to pacify an unruly world with orderly models.

Since the complexity approach has now been delineated to coincide with the philosophical problems that underlie a poststructuralist position in general, the following section will aim to highlight what the implications of claiming a postmetaphysical orientation has for an

understanding of the notion of critique. These implications are not unproblematic. However, postmetaphysical positions are often proposed to resist strong reductionist positions without considering the full extent of the claims that underlie postmetaphysical positions. Here I want to express clearly that it is the aim of this dissertation to highlight the implications of embracing a postmetaphysical position and to offer a way through the dilemmas that are connected to it. At the end of this dissertation it should be clear that allegiance to the complexity approach does not justify a radical form of nihilism or postmodernism in the quest of being a position that is critical toward reductionist positions. What should become clear, however, is that although the complexity approach coincides with a poststructuralist position (that is critical of metaphysical commitments), it at once also admits that such a position is not unproblematic in terms of finding legitimate principles from where to justify any critical inquiry. Ultimately, this study proposes a post-reductionist position that suggests that even poststructural theories have limitations and by not taking these limitations seriously, poststructuralist positions could undermine their own emancipative and critical ideals. The following section explores the implications of postmetaphysical claims concerning the notion of critique in more detail.

3. The problem of critique

> *No measure remains for the measure of all things.* (Adorno 1978, from *Minima Moralia*, Aphorism 39)

> *How can a philosophy of immanence critique its outside? Must it only describe everything it sees, or can it not also prescribe what is exemplary for it? If it is to be critical rather than just descriptive, then on what new set of values will its 'judgments' be based and how will these values be established?* (Mullarkey 2006:9)

This section sets out from the argument that a postmetaphysical interpretation of the notion of critique should be a endeavour that is aware of what the full extent of its claims imply for understanding the notion of critique. By embracing a postmetaphysical position blindly, certain problems are overseen. This section aims to expose the problems that emerge from subscribing to a postmetaphysical understanding of critique. The problem of embracing a postmetaphyscial understanding of critique is twofold. The first problem is related to finding a legitimate 'right' from where critical inquiry can launch its analysis—thus the question of 'critique in the name of

what?' needs to be answered. The second problem is related to the difficulty of defining what the target of a critical position should be—thus the question of 'a critique *of* what?' needs to be answered. These two questions are inextricably linked with one another, but constitute at the same time two very distinct areas of inquiry. This chapter aims to answer the first question by setting the question against the problem of legitimacy as found in the poststructuralist dilemma which is marked by the 'loss of the outside.' The second question is set against an understanding of Kant's interpretation of critique which established itself as a critique of reason's limitations to know the world objectively. Furthermore, the chapter will suggest that a deconstructive reading of Kant's notion of *judiciary critique* (see point 5.1 in this chapter) will reveal a new or displaced definition of critique which allows us to think the two questions together and to arrive at a concept of critique that can be read as 'critique as stricture.' This definition of critique suggests that the critical task involves both the asking of 'critique of what?', and 'by what means critique can be implemented?'. Thus, critique as *stricture* represents the *means (or mode) by which* the critical enterprise can take place. A practical dimension is added. Critique as stricture thus implies both a critique of the limitations of our rational knowledge claims and at once a strategy by which to probe and transcend those limitations.

Re-counting the possible difficulties one is faced with by subscribing to postmetaphysical forms of critique, recent literature on the notion of critique suggests that "the search for new critical directions" is driven from "a sense that critique has become stagnant—has fallen into crisis or malaise" (Chryssostalis and Tuitt 2005:1). In her book called *Philosophy in Turbulent Times*, Elisabeth Roudinesco (2008) argues that the lack of critical thought and the "necessity to relativise heroism" is marked by intellectual activity that only knows how to "classify, rank, calculate, measure, put a price on (and) normalize... in the name of a bogus modernity that undermines every form of critical intelligence grounded in the analysis of the complexity of things and persons" (xi). Pointing to a number of philosophers (e.g. Foucault, Sartre, Derrida) who through their work and lives refused to "serve the project to normalize the human being—a project that, in its most experimental version, is no more than an ideology of submission in the service of barbarity", Roudinesco (2008:xi) reminds us that the last word on the critical project has not yet been spoken.

To explain in more detail, it seems that the 'crisis' critique faces today stems from the historical changes it underwent since the inception of the critical project with Kant. The problem of *postmetaphysical* critique more specifically, is directly related to the problem of the "loss of the

outside" as discussed earlier, which in turn can be identified as a problem of legitimisation as famously argued by Habermas (1975) when he started to build his argument against Adorno's (2001) notion of *Kulturkritik*. This problem of legitimisation is well explained by Benhabib (1986:14) when she writes that

> (a)ny philosophical program which still seeks to formulate minimal criteria of valid knowledge and action, which still develops concepts of normative legitimacy transcending specific language games, is accused of continuing the failed program of the Enlightenment (MacIntyre), of privileging epistemology (Rorty), or of perpetrating the fictitious meta-narratives of the nineteenth century (J.-F. Lyotard).

The insistence of the drive behind poststructuralism to reject any foundationalist position from where to ascertain the validity of criteria for legitimising or justifying the acceptance of certain norms remains a challenge to the critical tradition. Much of Lyotard's work in the *Postmodern Condition* (1979) for example, is devoted to discussing the possibilities of legitimisation in the absence of grand narratives. If the postmodern (and by implication the postmetaphysical) position is marked by the disappearance of legitimising grand narratives, the question arises of "where, then, he asks, does the legitimisation reside in the postmodern era" (Fraser & Nicholson 1988:87). When the legitimacy of a certain discourse or definition of truth becomes "plural, local, and immanent" (87) legitimisation "descends to the level of practice and becomes immanent in it." Moreover, there are no "special tribunals set apart" (87) from where the legitimacy of accepting and institutionalising certain norms can be assigned as assumed by the project of modernity. This problem of legitimisation has also crept into the critical project of philosophy. If there is no outside or meta-position from where critique can assume a basis in which to situate its grounding norms, then the whole critical project falls prey to relativism and indifference or to what Sloterdijk (1987:xxxii) calls the "self-abdication of critique." By asking the questions "What can critique achieve today? What can it still hope for in a time that is so sick of theory?" Sloterdijk (1987:xxxii-xxxiii) suggests that in the process of Enlightenment critique, the critical project has undermined its own impetus. By having exposed the foundations from where the norms of critique could be legitimised, the loss of the outside also implies that "there is no standpoint for a description, no central perspective for a compelling critique." He continues to describe the dilemma even more poignantly (Sloterdijk 1987:xxxiii):

> In the shattered world of multiple perspectives, the "grand views" of the whole, in fact, belong more to simple souls than to those who are enlightened and educated by the given order of things. No enlightenment can occur without destroying the effect, thinking-from-a-point-of-view, and without dissolving conventional morals. Psychologically this goes hand in hand with a scattering of the ego, literarily and philosophically, with the demise of critique.

It is this hollowness of critique that tries to "drown out its own disillusionment" (Sloterdijk 1987:xxxvi) that marks the problem of current forms of postmetaphysical critique. Moreover, along the way critique has lost its ability to perform exactly what it set out to do originally, namely to be a cutting force that lays bare the conditions of possibility under which reason can know and judge the world in which we live. The implications of modernity critique that led to the loss of grand meta-narratives and objective positions from where to ground a critical position, is summed up succinctly by Rasch (2000:10) as follows:

> If the modern landscape lacks not only an authoritative and transcendent God but also His transcendental substitutes (reason, nature, the subject, history), then how is moral, legal, or political authority to be achieved where competing spheres of influence and interest doggedly maintain their own autonomy and own claims to authority?

With the loss of a fixed foundation on which critique could be grounded, forms of postmetaphysical critique has not only run into the difficulty of finding alternative concepts or groundings from where to justify a non-foundational, non-essentialist critique, but moreover, the notion of "critique" itself has been compromised. In the process of wanting to avoid transcendental categories and metaphysical positions from which it launches its judgements, critique has lost its conceptional ground from which it could offer any substantive norm or name in which to incur judgement. It seems that the end of the age of 'grand narratives' and the 'death of God' also silenced critique's capability to start a revolution in philosophical thinking. Fear that the modernist project might be revoked by the ghost of utopia and the accusation that one might actually know what a perfect society should look like, slumbers inside the notion of critique. Shunning away from such metaphysical claims robbed poststructural forms of critique from the possibility to bring forth a "philosophy of heroism" (Roudinesco 2008).

Postmetaphysical forms of critique are often criticised to subscribe to a form of pluralism that is "as anarchistic as anything goes" and as "nihilistic as 'nothing matters'" (Hoy 2005:231) or that it inevitably succumbs to falling into the trap of the performative contradiction.

By aiming to avoid running into such a dilemma, this dissertation aspires to develop a postmetaphysical understanding of critique that is 1) aware of the problem of legitimacy that it faces and 2) capable of negotiating its way through the either/or binary oppositions that it faces. Hence, it is the task of this dissertation to develop a postmetaphysical form of critique that is aware of its own disillusionment seeing that not only has the notion of critique suffered under the scrutiny of poststructuralist strategies, but this problem of legitimisation has infiltrated and ruptured philosophical inquiry as a whole. The critique of reason and the poststructuralist intention to dismantle the legitimacy of "grand narratives" not only exposes a self-undermining contradiction in the critical tradition, but furthermore leads to the crisis of legitimation as discussed earlier, so that one is left with the challenge of finding an answer to the question of 'critique in the name of what?' The next section will discuss the implications of this dilemma in more detail.

3.1 Critique in the name of what?

In his exploration of the relationship between critical philosophy and world politics, Beardsworth (2007:47) suggests that "the last twenty-five years of critical thought has been fuelled by this difference of approach*(es)* to the critical nature of 'critique'." In the famous discussion between Habermas (representing the German, modern, rational and fundamental camp) and Derrida (allocated the camp of being French, postmodern and relativist) during the 1980s, the role of philosophy and its ability to engage critically with arguments and texts serves as a good example. Their discussion opened up a space in which representatives of these respective paradigms found ample ammunition to shoot at each other relentlessly. Some even found reasons for deciding when to regard something as serious philosophy or not based on different understandings of reason and its ability to know the world by means of critical inquiry.[52]

[52] The whole modern/postmodern *querelle* is not a theme on which I would like to elaborate here—enough has been done in that regard already. However, I think it is important to not pass by this rupture too hastily. Richard Bernstein (1991:2) emphasises that the modern/postmodern rupture could result in "a radical break that calls into question all philosophical projects." In his book entitled *A New Constellation* (1991), Bernstein opens up the can of worms and very successfully illustrates how the survival of

In the midst of the confusion and obfuscation of this debate it was noted that the notion of critique itself suffered and became to be no more than a mere practice of "pretentious gesturing—flouting even the most minimal standards of clarity and rational argumentation" (Bernstein 1991:6). Instead of engaging in the exercise of evaluating "strengths and weaknesses, insights and blindnesses, 'truth' and 'falsity'" from a critical distance, intellectuals have become "groupies who seize(d) upon the latest fashionable trends" (6). As a result of the modern/postmodern, rational/irrational, universal/contingent, fundamental/relative polemic, the nature of this chasm or rift beseeches us to take a closer look at the "question of critique itself" (6). The question of what critique is, is already a critical question, just as the question 'what is philosophy?' is already a philosophical question itself (Van Niekerk 1980) or as Critchley (1999:123) argues, "(t)he vocation of the philosopher is *critique*" (italics in original text). The nature of critique thus lies at the heart of the modern/postmodern chasm: the act of criticising one standpoint against another assumes that we have established and affirmed norms on which to judge and evaluate our affiliations. Moreover, the act of criticising or negating cannot be disengaged from asking "what precisely is being affirmed and why?" (Bernstein 1991:7).

Hence, the challenge of this study is defined by the possibility to develope a new understanding of critique (a challenge this dissertation takes seriously) that intends to find an answer to the question "critique in the name of what?" or as Kearney (1984:118) suggests, finding a solution to the "problem of a criterion of evaluation" and legitimisation. This is necessary, because the rejection of a transcendental position or guiding principle leaves the 'critical subject' without any "objective or absolute yardstick" (118) with which to find criteria on which to base forms of critique. Hence, the calling into question of the very grounds on which critique can base itself exposes a blind spot within the critical intention: what is being affirmed (the norms and conditions for critique to be valid) is also immediately undermined. Subsequently the tradition of critical philosophy is left in a postmetaphysical position from where there is an "inability to occupy a position from which society could be surveyed in one all-encompassing glance"

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philosophy as such relies on taking the Kantian notion of critique seriously. The rupture will not be a fruitful one if one continues to engage in responses that are characterised by "total ignorance and uninformed silence, polemical attacks and endless internal commentary and textual analysis" (Bernstein 1991:6). It is only by reviving and replacing unreflected and superficial forms of critique with a dynamic notion of critique in the sense that Kant practised it, that "critical engaged dialogue" that "requires opening of oneself to the full power of what the 'other' is saying can take place. Such an opening does not entail agreement but rather the to-and-fro play of dialogue" (6).

(Rasch 2000: 11). It seems that one is drawn into "a grand Either/Or: *either* there is a rational grounding of the norms of critique *or* the conviction that there is such a rational grounding, is itself a self-deceptive illusion" (Bernstein 1991:8). This is not a problem that can be disguised or argued away, but needs to be addressed directly as one of the most important limitations of endorsing postmetaphysical positions.

Hence, the problem and crisis of critique is situated in the fact that a postmetaphysical inquiry into the nature and role of critique as concept and practice exposes the inherent "self-understanding of critique" so that one needs to ask the question: 'critique in the name of what?' As Bernstein (1991:8) furthermore suggests, "the very grammar of critique requires some standard, some measure, some basis for critique". As Derrida (1984:118) also notes, one "cannot conceive of a radical critique which would not be ultimately motivated by some sort of affirmation, acknowledged or not."

Hence, it is from this predicament that this dissertation wants to offer a new understanding of the notion of critique so as to revitalise and re-position the critical project. In order to address the problem of legitimacy and to find a possible answer to the question 'in the name of what?' this study will be turning to Kant, seeing that as Butler (2009:777) reminds us, "when one is undertaking a critique, one is not simply supplying the legitimating ground of any project of knowledge, but one is asking a set of questions about how that mode of self-legitimation takes place. Those questions are: 'in *what way?*' and 'by *what right?*'

This chapter aims to answer the two questions Butler suggests. In order to answer the question of "in what way?" I will explore the context in which Kant developed his notion of critique and it will be shown that his specific labeling of *judiciary* critique can be deconstructed to direct us to a new way of understanding the notion of critique. The question "by what right?" will also be answered by suggesting that read together with Derrida's notion of *différance*, some kind of legitimization can emerge 'in the name of the limit', seeing that Kant's intention behind his critical project was driven by the question as to "how to limit our knowledge inquiries so that we would not be constantly ending up in dogmatic or skeptical conclusions. On what legitimate basis can we know?" (Butler 2009:777). In order to arrive at the answer to these questions as posed by Butler the following section will offer a close reading of Kant's understanding of the concept of critique.

4. Kant and critique

> *Our age is the genuine age of criticism, to which everything must submit.* (Kant 1998:101, A xi)

Any philosophical discussion concerning the notion of critique would be incomplete without having assessed how critique was used and defined by Kant and how it influenced the direction of critical philosophy thereafter. At the heart of Kant's understanding of critique was the task of calling reason "to undertake anew the most difficult of all its tasks, namely that of self-knowledge, and to institute a tribunal which will assure to reason its lawful claims and dismiss all groundless pretensions" (Kant 1998:101, A xii). For the purpose of this study, a focus on the Kantian understanding of critique will be undertaken with the purpose of demonstrating that the complexity approach and its implications for being able to know (or rather *not* know as discussed in Chapter 2) complex phenomena is not far removed from Kant's conclusion that critique amounts to the calling into question of reason's capacity to know reality. A close reading of Kant's definition of critique will be done so as to expose how his definition turns upon and deconstructs itself and in the process opens up possibilities to ascribe new meanings to the notion of critique.

The search for appropriate forms of legitimisation is not something that is novel in a time that is marked by postmetaphysical commitments. Commenting on Kant's characterisation of the concept of critique, Butler (2009:777) reminds us that the search for legitimisation lies at the heart of Kant's critical project, seeing that he was trying to sort through those kinds of bases that would prove to be legitimate and which could be proven according to reason as opposed to those that could not:

> In the *Critique of Pure Reason,* Kant lays out several meanings and functions of critique, including the dethroning of metaphysics, the overcoming of what he called the reign of tedium (a perpetual altercation between skepticism and dogmatism), an effort to supply sufficient grounding for the sciences, the attempt to establish a tribunal through which all claims to knowledge might pass, the way toward civil peace, a public means for adjudicating knowledge claims, a solitary means for adjudicating knowledge claims, a way of deriving knowledge claims from a priori principles, and a way of

> distinguishing such claims from empirical ones as well as speculative ones. Critique is also described as a kind of revolution, what he calls a revolution at the level of procedure, a progressive path for science, a way of enforcing rightful claims, of protecting the public against harmful doctrines (especially those that involve contradiction, groping *[Herumtappen]*, and excess), and a way of resisting popularity and yet serving the public.

Hence, the importance of Kant's understanding of critique is revealed by the turning point that it created in the philosophical tradition of his time. The first of the three critiques, *Critique of Pure Reason* was the result of an attempt to reconcile two opposing paradigms in his time: rationalism on the hand (as espoused by Descartes, Spinoza and Leibniz) and empiricism on the other (as championed by Locke, Berkeley and Hume) (Guyer & Wood 1998:1, 2). Moreover, in his *Critique of Pure Reason* Kant had in mind to demonstrate that human freedom, read as "the ultimate value served and advanced by the moral law" (Guyer & Wood 1998:2), could be understood to be fully attuned with the truth of modern science. As such, the *Critique of Pure Reason* aspired to lay the foundations for proving the "certainty of modern science and the possibility of human freedom" (2) simultaneously.[53] By delineating the limits and foundations of scientific knowledge, Kant attempted to prove that we could conceive of ourselves as "rational agents who are not constrained by the deterministic grip of nature but can freely govern ourselves by the moral law as practical reason requires" (13).

Kant's transcendental idealism[54] as explained in *Critique of Pure Reason* provided him with the means to find a "middle course between empiricism and rationalism" (Scruton 1997:20). Not

[53] For Kant, the question of human freedom was deeply related to morality. In a sense his whole project intended to unite the foundations of science so as to prove the possibility of *a priori* knowledge. His project endeavored to demonstrate that "morality could not be grounded in empirical facts about what is pleasurable and what is painful, and that its principle must come from pure reason instead" (Guyer 1992:11).

[54] Scruton (1997:29) explains that the word "transcendental" points to an argument which "transcends the limits of empirical enquiry, so as to establish the *a priori* conditions of experience." We must thus distinguish the "transcendental, from empirical argument." Transcendental objects "transcend experience" and are not "causally related to what is observable." Transcendental idealism implies "a very special kind of harmony between the capacities of the knower and the nature of the known. It is because of this harmony that *a priori* knowledge is possible." As Guyer & Wood (1998:7-8) argue: "Kant's dissertation that space and time are pure forms of intuition leads him to the paradoxical conclusion that although space and time are empirically real, they are transcendentally ideal, and so are the objects given in them". Generally speaking, this means that "it is only from the human standpoint that we can speak of space, time and the spatiotemporality of the objects of experience, thus, that we cognize these things not as they

only did Kant aim to provide an alternative to the dogmatism of these two opposing schools of thought of his time, but he also wanted to emphasize how his own critical stance differed from several other opposing critiques (Guyer & Wood 1998:2). Kant's project of exposing the possibilities and limitations of knowledge stems from his intention to provide an alternative to especially the empiricists' claim of experiential knowledge. In essence, Kant was occupied with finding a new definition of *metaphysics* that would differ from traditional accounts thereof. As he opens the Preface of *Critique of Pure Reason*, Kant (1998:99) argued that:

> Human reason has the peculiar fate in one species of its cognitions that it is burdened with questions which it cannot dismiss, since they are given to it as problems by the nature of reason itself, but which it also cannot answer, since they transcend every capacity of human reason. ... The battlefield of these endless controversies is called metaphysics.

The importance of Kant's re-definition of the traditional understanding of metaphysics will be discussed shortly here below.

4.1 A 'metaphysics of metaphysics'

Kant's concern with metaphysics was expressed in his search for the foundations and limits of knowledge and that such an endeavour could provide a proper foundation for metaphysics (Guyer 1992:34, 36). For Kant, the role of metaphysics was to "provide not knowledge of God, providence, immortality, but a science of the limits of human reason" (37). Hence, Kant's *Critique of Pure Reason* can also be translated to be a critique of traditional metaphysics (Ameriks 1992:249). In order to understand Kant's assumptions about the limits of knowledge, it is important to know that Kant's notion of metaphysics was linked to, but extended the ontological question of being able to know "das Ding an Sich". In the traditional rationalists' view, the field of metaphysics was linked directly to ontology and it was assumed without question that one could know "das Ding an Sich" directly. Kant however, suggested that the notion of metaphysics should exceed such a traditional understanding of ontology. In his critique on the assumptions of the traditional view, he argued that absolute space and time (perceived as reality) is "not some adumbration of schema of the object, but only a certain law

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are in themselves but only as they appear under the conditions of our sensibility" (Guyer & Wood 1998:8).

implanted in the mind by which it coordinates for itself the sense that arise from the presence of the object" (Guyer 1992:10). He proposed that metaphysics cannot be involved with studying reality as such, because we cannot assume that we have direct access to reality. What we can know about reality can only be 'appearances' or 'phenomena' (Guyer 1992:10) of reality and metaphysics entails the discovery of the nature of these appearances that are made intelligible to us by reason.

In other words, Kant's reconfiguration of his notion of metaphysics can almost be viewed as being a "metaphysics of metaphysics" (Van Niekerk 1980:164) through which the possibilities and limits of reason can be established. In a sense, the focus is shifted from the general ontological question regarding things in the world as such, to a meta-metaphysical argument "that our knowledge must be limited to mere appearances" (Ameriks 1992:260) of things (amounting to a shift from *noumena* to *phenomena*). Thus, for Kant, metaphysics was concerned on the one hand with the fact that "our representation of things, as they are given to us, does not conform to these things as they are in themselves, but rather that these objects, as appearances, conform to our manner of representation" (Kant 1998:112, B xx). On the other hand, if foundational scientific principles like universal causation can only be claimed for the appearances of things, it means that there is a possibility that "things as they are in themselves may not be governed by these laws, [but] by other laws" (Guyer 1992:12). Moreover, the issue of being able to know reality, in the first place, is a question about the nature of reason. For Kant this twofold nature of reality[55] was important in order to display that if we consider that "the realm of things in themselves lying behind the appearances of the empirical world not only contains a necessary being but, more important, contains free and not merely determined actions", then there is at least a possibility for the notion of freedom (Guyer 1992:16) to be probable.

[55] Kant's understanding of metaphysics and the nature of reason has important implications for status of knowledge generation. For Kant, his theory of knowledge (metaphysics) means a radical change in the epistemological attitude, seeing that "objectivity" can only be understood to be objectivity-related-to-subjectivity:

> As for objects insofar as they are thought merely through reason, and necessarily at that (at least as reason thinks them) cannot be given in experience at all – the attempt to think them (for they must be capable of being thought) will provide a splendid touchstone of what we assume as the altered method of our way of thinking, namely that we can cognize of things a priori only what we ourselves have put into them (Kant 1998:111, B xviii).

From this understanding, metaphysics is in a real sense, a theory of cognitive subjectivity. Objectivity cannot be dismantled from subjectivity (Höffe 2004:47).

Hence, there is a departure from traditional conceptions of ontology to what Kant describes in his "transcendental aesthetic"—a "science of all principles of *a priori* sensibility" that constitutes his "transcendental logic" (Kant 1998:156, B 36). The transcendental logic suggests a "new science" that "does not deal directly with objects of empirical cognition, but investigates the conditions of the possibility of our experience of them by examining the mental capacities that are required for us to have any cognition of objects at all" (Guyer & Wood 1998:6, and also footnote 54 in this chapter). Kant (1998:696, A 841/B 869) distinguished between the "speculative and the practical use of pure reason" which could be translated into "either metaphysics of nature or metaphysics of moral." By 'metaphysics of nature' (relating to speculative reason) he referred to all those concepts that could express the theoretical cognition of all things. The 'metaphysics of moral' (linked to practical reason) in turn referred to all principles that could determine action and omission in *a priori* manner.[56] Kant's reformulation of metaphysics represented a method by which to designate *a priori* cognition of concepts that formed principles for knowing and acting in the world. As Kant argued, the "**metaphysics of nature**" considers "everything insofar as it **is** (not that which ought to be) on the basis of *a priori* concepts" (698, A 845/B 873) (bold in original text).

Moreover, Kant re-employed the term 'metaphysics' to refer to the "system of pure reason" (what is usually known as 'science') and explained that its main use is to "comprehend the investigation of everything that can ever be cognitized *a priori* as well as the presentation of that which constitutes as system of pure philosophical cognitions of this kind, but in distinction from all empirical as well as mathematical use of reason" (Kant 1998:696, A 841/B 869). In formulating and distinguishing synthetic *a priori* knowledge as not only possible, but "but absolutely prerequisite as a means of escaping both the rationalist prison-house of abstract ideas and the sceptical dead-end to which empiricism had led" (Norris 1997:47) the Kantian epistemology claimed to have achieved a Copernican revolution in philosophical thought (Kant 1998:110, B xvi, Guyer & Wood 1998:70, Norris 1997:47).

Hence, the notion of critique in Kant's scheme of things was equated with the act of appraising the faculty of reason with regards to all which could be known *a priori*. The act of investigating

[56] This was an important distinction for Kant, seeing that by discerning between speculative and practical reason, morality could be re-defined and casted to be understood as a kind of "lawfulness of actions which can be derived entirely from a priori principles" (Kant 1998:696, A 842/ B 870). Kant asserted that it was of the utmost importance to isolate or distinguish between cognitions that differ from each other based on the nature of their origin in order to guide the proper use of understanding what can be known *a priori* and what can be known only *a posteriori*.

the systematic interconnection of pure reason (science) could also be called metaphysics (Kant 1998:696, A 841/B 869). Subsequently, for Kant the notion of critique was closely connected to his understanding of metaphysics which acted as a kind of 'censor' in order to "secure the general order and unity, indeed the well-being of the scientific community" so as to prevent "its cheerful and fruitful efforts from straying from the chief end, that of general happiness" (Kant 1998:701, A 851/B 897).

4.2 Critique in the name of reason by reason

Any further exploration of the intricate distinctions that Kant made to develop his transcendental logic would fall outside the scope of this study, seeing that it would take up at least a number of chapters to do justice to the sophistication thereof.[57] For the purpose of this study it is sufficient however, to highlight how he made these distinctions as discussed above, in order to draw on the insights from the underlying logic that informs Kant's work—namely, the drive to find a method of critique that can investigate "the faculty of reason" (Kant 1998:696, A 841/B 869) and the foundations on which systems of knowledge can be constituted. What is of utmost importance for this study, was Kant's concern "with the conditions of possibility for human knowledge and experience in general, and also—by the same token—with those conditions as applied to the natural sciences" (Norris 1997:47). In this relation a critique of pure reason implies in essence, searching for the possibilities of reason to know its own faculty or competence. Reason becomes the medium through which we are able to know the appearances of reality (Van Niekerk 1980:164). In this sense, the notion of critique is interpreted to mean a scrutiny of the conditions of possibilities of reason by reason itself. In this understanding of metaphysics and the nature of reason, critique is developed and extended to become the self-knowledge and self-critique of pure reason based on critique's task to establish the limits of reason's own capabilities (164). Often this act of establishing the limits is seen as something negative, but even Kant suggested that it is at once both negative and positive or as Hanssen (2000:5) explains, Kant saw his critique as "draw(ing) limits, both in the sense of prohibitive limits (*Schranken*) and enabling bounds (*Grenzen*)." The act of verifying the limits is thus not a static and final act, but active and continual and as Culler (1998:124) argues, "(a)ttempts to describe limits always make possible a displacement of those limits."

[57] Excellent expositions on Kant's understanding of metaphysics have been done by Picht (1969), Allison (1983), Ameriks (1992), Guyer (1992) and Höffe (2004).

It is precisely this understanding of Kant's critical project that can be used to establish some grounding for a proposition that the study of complex phenomena can be articulated as a critical endeavour. When comparing the grounds for critique in both Kant' and theories of complexity's concern with the capabilities of reason, the following similarities can be recognised: (1) the perpetual self-critique of reason concerning the foundations that constitute systems of knowledge and (2) establishing the possibilities and limits of what is knowable. By questioning the conditions for generating knowledge about the world and by exposing the limits of what we can know, the critical self-conception of a general theory of complexity reveals some similarity to the concerns that inform theories within the broader field of Critical Philosophy. To be more precise, it is the acknowledgement of the inadequacy to know 'das Ding an Sich' or 'complexity in all its complexity' that produces an opening for critique to come alive. By acknowledging that knowledge of complex systems can never be complete, one is confronted with the "unavoidability of the limitations of human understanding" (Cilliers 2002:77, and cf. Allen 2001).

Based on the preceding comparison it is plausible to establish a *mutual concern* between the critical project as established by Kant and the critical implications for studying complex phenomen. The critical self-conception of a general theory of complexity shares a certain interpretation of the notion of critique as expressed by the Kantian critical project. This similarity is located in the general concern with the conditions and possibility for knowledge that characterises the tradition of critical philosophy and the complexity approach. It is the above-discussed interpretation of critique that will inform the use of the word critique for the rest of this study.

5. Critique (re-)defined

The revolutionary force of Kant's work is located in the fact that the outcome of the critical project not only shed new light on how we can know the world, but it also changed the way in which we think about what we can and cannot know. Kant calls his critical philosophy "eine Umänderung der Denkart" (Höffe 2004:49). A revolution of thought itself has taken place. Kant suggested that after his critical project, even the role of the philosopher changed from being a *Vernünftkünstler* (roughly translatable as an "artist of reason")—someone who in mathematical fashion speculates about things—to that of resuming the role of lawmaker over human reason (Höffe 2004:38). Whether one agrees with this shift in the role of the philosopher is not as important as the fact that it is the notion of the critique that causes the gap and opening that

enables this transformation. The way in which Kant's critiques changed the course of philosophy thus points to the importance of the transformative role inherently found in critique. Not only has critique changed the direction of a whole tradition of thinking and knowing, but it also is closely related to the role philosophy has in exposing our ways of knowing and thinking about ourselves and our place in the world.

5.1 Critique as judiciary trial

The Kantian legacy has become the basis and drive behind many other forms of critique within the critical tradition. It is not the intention of this study to offer an exegesis on the different forms of critique found in the consequent traditions as displayed by the dialectics of Hegel, the ideology critique of Marx, "Nietzsche's merciless sharp knife and shattering hammer of genealogy, Foucault's blunt knife of a newly fashioned effective history" (Hanssen 2000:11), Adorno and Horkheimer's immanent critique and negative dialectics, "Heidegger's ontological need to rupture humanism", resulting in the "thinking (of) Being" (Bernstein 1991:2) and Derrida's deconstruction. However, I do want to link the role of critique as found in all the above-mentioned philosophers' writings, to the notion of *Vernunftkritik*. Although they all wanted to get away or differ from Kant in some way or another, what they have in common with Kant, is the task of laying out the limits and self-evidence of the rational project. Consequently it seems that the goal of the critical project cannot be separated from its engagement with the conditions, claims and immanent limits of the Enlightenment project and the 'rage against reason' (Bernstein 1991:31). The critique of reason and its conditions for being able to know the world, has also become the hinge on which philosophy has been caused to rupture in different binary oppositions—whether it be the abyss between analytical and continental traditions or in the process of claiming truth and the verification thereof within traditions or whether between the modern and postmodern territories as mentioned earlier.

Having established that Kant's reconfiguration of metaphysics implies a 'metaphysics of metaphysics' (Van Niekerk 1980:164) or 'metaphysikkritische Metaphysik' (Höffe 2004:31) by which the possibilities and limits of reason to know the world can be established, the notion of critique also becomes a form of 'metaphysics' in itself. The questions and answers about (*meta*) the conditions and possibilities of reason to know reality (*physika*) establishes another or new metaphysics in the process. Critique (the process of finding questions and answers) and metaphysics thus goes hand in hand and one could argue that as long as one engages in critique, one is concerned with metaphysical questions. One could put forward the argument, that from

Kant's interpretation critique is dialectical in nature and that it is an immanent form of critique that continuously aims to re-establish the possibilities and limits of what is knowable. In the name of reason, the blind spots of reason are examined.

The implementation of the word *Kritik* in the titles of Kant's three Critiques, refers to an understanding of the word as found in the tradition dating back to Cicero and the appropriation thereof in relation to the interpretation of '*ars critica*' (as read in French during the 17th century) to mean 'critique' (Höffe 2004:35). As Höffe (2004) argues, this notion of critique as it was found in theatre and art criticism, was appropriated by Kant and employed in a manner contrary to the common use of the word, which was understood to mean 'disapproval', 'objection' or 'disagreement.'

In addition, Höffe (2004:35) explains that the term *Kritik* in Kant's critical project should be interpreted to coincide with the process of judgement or thorough examination of facts as found in a court of law. Kant's interpretation of critique as form of judgment unmasks the assumptions of traditional metaphysics in the same way criminal proceedings examines the false intentions and statements of the accused. Hence, the examination of the possibilities and limits of reason resembles a judiciary trial (Höffe 2004:35, Van Niekerk 1980:164). And as Bernstein (1991:6) contends, a judicious critique is "the type of critique where one seeks to do justice to what is being said *and* also 'steps back' in order to evaluate critically strengths and weaknesses, insights and blindnesses, 'truth' and 'falsity'" (italics in original text). Related to this interpretation of the notion of judicious critique, the task of the critic can be explained as that of being a "good judge" who can evaluate the "authenticity, truth, validity or beauty of a given subject matter" (Benhabib 1986:19). For Kant, the use of the judiciary metaphor gave him the opportunity to put a case forward that philosophical method should not exclusively use the mathematical method as standard model for verifying truth claims. The mathematical method relies on concepts based on clear definitions that form axioms that are then proved or disproved according to certain rules (Höffe 2004:287). Although there is nothing to be said against the rigour of this analytical method, Kant argued that relying on the 'dogmatic' mathematical method alone does not capture the 'polemic' nature of the critical process (Kant 1998:642, A 738/ B 766), seeing that it is only through a rigorous process of dialectical reasoning that the inner antinomies and contradictions in the nature of reason itself can be judged (Höffe 2004:291) to form synthetic judgments in a speculative sense. Kant (1998:644, A 740/ B 768) argued:

> Now by the polemical use of pure reason I understand the defence of its propositions against dogmatic denials of them. Here the issue is not whether its own assertions might perhaps also be false, but only that no one can ever assert the opposite with apodictic certainty (or even with greater plausibility).
>
> and
>
> One can regard the critique of pure reason as the true court of justice for all controversies of pure reason; for the critique is not involved in these disputes, which pertain to immediate objects, but is rather set the task of determining and judging what is lawful in reason in general in accordance with the principles of its primary institution.
> Without this, reason is as it were in the state of nature, and it cannot make its assertions and claims valid or secure them except through **war**. (Kant 1998:649, A 751/B 779, bold in original text).
>
> also
>
> He who brings with him nothing but dogmatic weapons to resist the attacks of his opponent, and who does not know how to develop the hidden dialectic which lies no less in his own breast than in that of his counterpart, sees illusory grounds that have the advantage of novelty step forth against illusory grounds that no longer have the advantage but which instead arouse the suspicion of having abused the credulity of the youth (Kant 1998:651, A 755/ B 783).

Of course with the above arguments, Kant had a kind of uncritical dogmatism (in mind when he formulated that the critical method should resemble a judiciary trial instead of a mathematical analysis. Kant (1998:658, A 769/ B 797) furthermore suggested that the critique of reason resembles a 'sceptical procedure' and that the critic takes on the role to be the 'taskmaster of the dogmatic sophist.' In order to secure a fair trial, Kant proposed at least eleven conditions to be adhered to (Höffe 2004:291).[58] These eleven conditions (as listed in

[58] Höffe (2004:292) lists these principles or "*Vorbedingungen*" to a fair trial as follows: 1) the elementary right to freedom of critique instead of prohibitions or censorship, (2) the elementary right to equality

footnote 58), which will not be discussed in more detail here, assume some basic principles for the sceptical procedure. Moreover, these conditions guarantee that based on an adherence to them, the method of critique could bring forth universal laws that would serve as *foundation* for developing principles and norms for transcendental truths. In a sense, these conditions that Kant proposed were not scrutinised but taken as a neutral point of departure or as grounding position. However, this kind of foundationalism is what the poststructuralist position opposes. What is of more importance for the purpose of this study is the fact that one can ascribe a double function (*Doppelaufgabe*) (Höffe 2004) for critique based on Kant's understanding thereof, namely that of being simultaneously a *method* and a *tool* with which to establish the conditions and boundaries of its own workings. This double function is a key feature that will be used to introduce a new understanding of critique that is cognisant of the acknowledgement of the claims of a general understanding of complexity.

5.2 Critique as method and tool: discovering the double movement

Already here the method of critique, which Kant calls a process of free and public examination of the cognitive capabilities (*Erkenntnisvermögen*) of reason (Höffe 2004:53), functions both as **method of analysis** (cutting open, rupturing) and as **bridge** that aims to join and weld opposing paradigms together. Hence, a "double function" (*Doppelaufgabe*) is situated in the acts of (1) legitimising and (2) limiting the capabilities (*Erkenntnisleistungen)* that are locked up in human cognitive capability (*Grundvermögens*) (Höffe 2008:1-2). As **method** (or mode of practice) critique has to demarcate the possible achievements and limits of reason by means of a transcendental philosophy (Höffe 2008:2). Hence the notion of critique is to be understood as a method, which concerns itself not with the elaboration of the knowledge of things (ontological knowledge/*Erkenntnis*), but with our ways of knowing (epistemological possibilities/*Erkenntnisart*). As method, tha practice of critique resembles a judicial process by which at once the possibilities for the justification **and** the cognitive capabilities (*Vernunftvermögen*) of reason are on trial. Thus, the nature of reason is on trial under the judgement of reason itself.

(meaning that nobody or nothing can escape the right to be criticised), (3) the basic principle of democracy is adhered to, (4) the principle of public speech / freedom of speech should be adhered to, (5) the principle of honesty instead of dishonesty, (6) all procedures should adhere to the principle of impartiality and (7) general human reasonableness grounded in (8) lawfulness and (9) the duty to fulfil the law (*Zwangsbefugnis*) according to (10) principles of the duties of freedom (such as "Do not harm the rights of others" or "act in such a way so that the rights of all others are secured") as to (11) secure to the public welfare of the community.

By understanding critique as method it becomes clear that critique is not only a method by which opposing paradigms are dialectically exposed in a free and public trial, but it also reveals itself to be a **tool** by which wholes are ruptured and ruptured wholes (ruins) are bound together. The possibility to bind and to rupture simultaneously is demonstrated in the intention that lies behind Kant's three Critiques. With his critical project, Kant aimed to unite opposing positions into a single transcendental theory that would cover all aspects of what it is to be human. In the process of weaving together a complete and thorough philosophy that takes into consideration conflicting grounding principles, a paradox emerged that Kant did not know how to account for. Instead of having a completed and united picture emulating the limits and conditions that regulate our ways of knowing the world and directing us how to act in it, Kant found that the process of integrating conflicting positions resulted in *rupturing* the unity of philosophy as a whole. Philosophy was again divided into questions and concepts that concern *nature* on the one hand (as was established in the *Critique of Judgment* (1993) and those issues that concern the norms and conditions for *freedom* on the other hand. In *Critique of Judgment* Kant once again attempts to bridge the divide in order to establish a complete and reconciled philosophy. But as even Kant later acknowledged, "the frame of the critical project cracks at each of its corners. What opens there is what Kant himself sometimes calls an *Abgrund*, ... a Kluft, an abyss, cleavage or cleft" (quoted in Krell 2000:35).

The unexpected rupture that emerged and disrupted the quest for reconciliation in Kant's critical project reveals a certain logic that can be equated with the double movement found in a deconstructive event (Derrida 2001:351).[59] Based on the unexpected paradoxical double movement that reveals itself within the conceptual logic of critique as tool, the study will now continue to investigate whether there are further meanings hidden in the concept critique. The probing will take on the form of a deconstructive reading of the concept. This can be justified by the inherent logic of the double movement that has been discovered to linger in the heart of the critical project as discussed above.

5.3 Deconstructing critique: simultaneous rupture and reconciliation

In what follows, a deconstructive reading of the concept critique will take place so as to examine whether a new understanding thereof is possible in light of the above. An analysis into

[59] See Derrida (2001:351): "Let us speak of an 'event,' nevertheless, and let us use quotation marks to serve as a precaution. What would this event be then? Its exterior form would be that of a rupture and a redoubling."

the nature and meaning of the word "critique" reveals that the concept itself deconstructs[60] when its roots are traced back to the meaning Kant ascribed to it in his critical project. *Kritik* in Kant's critical project signifies a thorough examination as found in a court of law as discussed above.

However, a closer look at the concept 'critique' reveals that *in addition to* signalling the act of passing judgement, it also means 'incisive cutting' (Hanssen 2000:4, Alhadeff-Jones 2010:48). This second interpretation emerges from the etymological meaning of the word 'Kritik'. Derived from its Greek roots *Krinein* and *kritikos*, the concept 'Kritik' can be translated to mean "to cut, rift, separate, discriminate, but also to decide" or "passing judgment" (Hanssen, 2000:4). A deconstructive reading[61] of the notion of 'critique as judgement' shows that the interpretation of critique that coincides with the process of judgement ruptures itself when the German form of the word 'judgement', namely *Entscheidung* (meaning 'decision' or 'judgement'), is considered. A certain self-division (or deconstruction) occurs which can be explained as follows:

When the German term 'Entscheidung' is orthographically divided into '*Ent-*' plus '*-scheidung*', it literally becomes to mean '*de-*' plus '*separate*', thus: to de-separate or to put an end to *Scheidung*, therefore, to bring together or reconcile. Hence, the self-cutting overturns the hierarchy (to judge/to cut) and a new or supplemented understanding of critique arises. A displacement takes place. Not only does it become apparent that what seemed to be the primary term 'to judge' is dependent on 'to cut', but when we overturn the hierarchy and use the secondary meaning 'to separate' (or 'to rupture'), the displacement reveals the double bind that is present in the concept of critique: at once it means to judge and cut apart, but also to de-separate, thus to bring together and reconcile. And here the logic of the 'and' becomes apparent as Derrida (2000:282) proposes that "deconstruction introduces an 'and' of association and dissociation at the very heart of each thing, ... it recognises this self-division within each concept." Reflecting on the double bind that is present in the conjunction as expressed by the word 'and', Derrida writes that it "is resistant not only to association but also to serialization,

[60] Gasché (1994:26) describes the operation of deconstruction as to "represent the moment where, in a text, the argument begins to undermine itself; … or the relation of a message of communication to itself that, thus, becomes its own object; or finally, the self-revelation and indication by the text of its own principles of organisation and operation".

[61] "Through the play of this separation between the two markings, it will be possible to carry out at the same time a deconstruction by inversion and a deconstruction by positive displacement, transgression." (Derrida & Houdebine 1973:35)

and it protests against a reduction which is at bottom absurd and even ridiculous...” (Derrida 2000:283). He continues:

> ‘And in the beginning, there is the *and*.’
> What is there in an ‘and’? And I wonder what a deconstruction can do with such a little, almost insignificant word (Derrida 2000:282).

The key for this new impetus lies in the ‘and’ that is also located in this deconstructed understanding of critique. Not only does the ‘and’ join seemingly unrelated paradigms of thought or concepts, but as Derrida reminds us, it also represents a gap between the two traditions. I want to propose that the double bind of the gap and the bringing together causes a rupture in the unsurpassable dilemma of the somewhat stale critical project. From this rupture the possibility of a dynamic form of critique is born that is also mindful of complexity. A liminal space is opened in which the critical tradition is challenged to negotiate new ways of thinking and knowing that may infuse ‘critique’s grammar’ (Pavlich 2005) with new vigour.

Hence, it is exactly in this double bind that the inner logic of the notion of critique is exposed to be what Derrida calls a ‘stricture’ that characterises the new displaced form of the concept critique. Derrida (1998:36) proposes that it is

> … this double bind (that) is the question of analysis itself. Not that one must assume the double bind. By definition a double bind cannot be assumed; one can only endure it in passion. Likewise, a double bind cannot be fully analysed; one can only unbind one of its knots by pulling on the other to make it tighter, in the movement called *stricture*.

Falling into the same category as Derrida’s other terms such as *différance*, *trace*, *supplement*, the *double bind* and *stricture* are not “substitutions for a truth” or “one-place function” (Hobson 1998:162). It is this sense of *stricture* that inhabits the notion of critique: the constant movement of bringing together and pulling apart, that I want to re-inscribe into the notion of critique. It is also this understanding of the concept that is linked with the notion of *complex thinking;* a way of thinking derived from a complex systems perspective (more of which will be discussed in Chapter 4).

6. Critique as stricture and the logic of the double bind

Re-interpreted in light of the notion of stricture as mentioned above, critique's role as judge, supplemented with the deconstructed meaning to rupture and bring together at once becomes the new expanded meaning of critique. In contrast to the understanding of critique as fault-finding (or process of judgement as found in a legal trial), negative evaluation, legitimate dismissal or disapproval, the deconstructed Kantian term, namely critique as stricture now represents a critical understanding of critique. Critique as stricture unfolds to be marked by a process of production: a certain mode of questioning is developed whereby we are asked to rethink the task of criticising as being a relentless process of critical practice. It is a practice in which we pose the question of the limits of our most sure ways of knowing (Butler 2002). As a mode of radical questioning, of unsettling self-evident answers, of meddling with established relations of power, it is simultaneously a reflexive, self-critical process. As Butler (2002:218) argues, such a re-defined understanding of the role of critique means that the primary role of critique will not be to "evaluate whether its objects—social conditions, practices, forms of knowledge, power and discourse—are good or bad, valued highly or demeaned, but to bring into relief the very framework of evaluation itself." Thereby, the notion of critique as stricture constitutes a *radicalisation* of the Kantian understanding of critique. This radicalisation of critique in turn characterises the idea of 'critical complexity' as explained in more detail in Chapter 5.

In addition to the above radicalisation of the Kantian notion of critique, critique as stricture is marked by the movement of the double bind that corresponds with the inner logic of Derrida's understanding of *différance*. He explains it as follows:

> This double bind, this double and unanalyzable constraint of analysis is at work on the examples of all the figures called undecidable that imposed themselves under the names of *pharmakon*, supplement, hymen, différance and a great number of others, which carried with them predicates that are contradictory or incompatible *between* themselves, in their very between, in their interlacing, their chiasmic invagination, their *sumplokē*, or their *Geflecht* (Derrida 1998:30) (italics in original text).

The notion of stricture can be described as a kind of *Geflecht* (see the relatedness to the notion of 'complexity' to mean "that which is woven together by Morin (2008)) that resembles, but is

not reduced to, a dialectical movement, because the kind of binding or bringing together that takes place in this double movement, is "indeed an irreducible binding (*Verbindung*)" that "does not bind together either presences or absences; it does not proceed either from an activity (for example intellectual activity) of from a passivity (for example, sensory passivity)" (Derrida 1998:28).

Furthermore, the notion of stricture is of course also a kind of a word play on the notion of "structure" which is a philosophical buzzword in the structuralist tradition. With the change of one letter from structure to stricture, the logic of stricture simultaneously also undermines the notion of structure as something that is fixed and closed. Through the play of the double movement that inherits structure, the "structure of the structurality of structure to the possibility of being deconstructed is an opening or movement within structure itself (Lucy 2004:135).

Linked to the notion of structure being understood as the working of stricture, is the very idea of the *hymen*. The hymen is another term in Derrida's science of writing that operates with the same "syntactical resources of undecidability" (Derrida 2004:224) such as that of *différance*, *stricture*, and so forth. Derrida's figure of the hymen describes the movement of stricture very well as described by Lucy (2004:50):

> The hymen as the veil or tissue in general (and not exclusively a membrane belonging only to women) occupies a sort of 'non-space' between an inside and an outside, yet it also helps to determine the differences between inside and outside as determined differences. Without such a movement there could be no position: you could never take up a position from 'inside' somewhere (subjectivity, say) or be accused of standing on the 'outside' of a thing (the truth, for example). So this figure of the hymen describes this movement or work of joining and separating, connecting and dividing – it describes what happens in the non-locatable, non-determined 'place' of the in-between.

The nature of the hymen carries a general sense of being a 'membrane' or 'tissue' and is reminiscent of a certain type of 'sewing', 'weaving' or 'spinning' (Derrida 2004:223). This effect of being produced as a medium is "an operation that both sows confusion between opposites and stands between the opposites at once. What counts here is the between, the in-

between-ness of the hymen" (220). From this liminal position, the hymen becomes the medium that "outwits and undoes all ontologies, all philosophemes, all manner of dialectics" (Lucy 2004:48) and starts to effect the distinction between outside and inside. As such, the hymen is at once a limit and border—that which keeps things apart, but also allows entrance. The double bind is at work here as well: it simultaneously separates and brings together.

By inscribing the notion of stricture with its logic of the double bind into the notion of critique, the logic of critique is expanded to include both an analytical and dialectical function. Critique as stricture is thus characterised by a constant "*undoing*, *desedimenting*, *decomposing*, *deconstituting*" of "sediments, *artefacts*, presuppositions, (and) institutions" that insists on the "unbinding, disjunction, dissociation, the being 'out of joint'" thereof (Derrida 1998:27) (italics in original text). The act of analysis that is captured in the tension of stricture resembles Kant's judiciary task of critique of cutting and severing when one revisits the meaning given to it by Derrida (3) who understands it to be the "untangling, untying, detaching, freeing, even liberation" of and from a knot or "*Verstrickung*". It is through this notion of the double bind, the radical and constant kind of analysis or "hyperanalyticism" (35) that marks or identifies the "method" of deconstruction undoubtedly.

The dialectical double movement however differs from a Hegelian or Kantian dialectic as Derrida (28) argues that "it does not stem from an aesthetic, or analytic, or a transcendental dialectic, (e)ven as it follows an argumentation that resembles, for example, the Hegelian critique of Kantian formalism and analyticism." The double movement of constant cutting and weaving together is a radical kind of analysis (or as Derrida (29, 35) suggests "hyperbolicism of analysis") that is not resolved or completed in a kind of *Aufhebung* or transcendental aesthetic. The logic of the double bind that constitutes the deconstructive drive "supposes a tension, above all, an internal tension" (26). This tension is described by a movement that gives rise to "neither an analysis nor to a syndissertation, neither to an analytic nor to a dialectic. It provokes both the analytic and the dialectic to infinity, but in order to resist them absolutely" (26). Stricture allows the movement between opposites "without stalling into oppositions" (Hobson 1998:163). Furthermore, the unresolved tension of the double bind aims to overcome the traditional notion of analysis, which means "to cut apart" that is so inscribed in the practice of Newtonian science as mentioned in Chapter 1. The logic of the stricture thus also undermines the process of cutting (unbinding or analysis) as being finalised or made objectively by exposing the fact that "(t)he possibility of unbinding is also, of course, the only condition of possibility for binding in general" (Derrida 1998:33).

6.1 On the liminality of critique: a new constellation

The relevance of understanding critique as stricture that operates with the logic of *différance*, is located in the fact that critique changes from being something that operates from a certain position that is confronted with the problem of legitimisation, to that of becoming a kind of dynamical *movement* instead. Consequently critique as stricture can be described as being simultaneously a structure and a place of movement in which oppositional groundings could be accommodated and transgressed simultaneously. As such then, critique is not characterised to be an activity with a specific starting point that moves toward obtaining some kind of utopia or emancipated state of being and knowing, but instead it becomes an undermining movement which occupies a "'non-space' between an inside and an outside, yet it also helps to determine the differences between insides and outside as determined differences" (Lucy 2004:50) simultaneously. Critique as stricture operates "hymenographically" (49) as a kind of movement without which "there can be no position" (50) since it can only operate as a description of what happens in the "non-locatable, non-determined place of the in-between" (50) where the distinction between what is outside and what is inside has been made less clear.

Expressed in the language of deconstruction, these ideas sound very abstract and "ungrounded", but when one read them in conjunction with the assumptions of a general understanding of complexity, they become more concrete. For example, as discussed in Chapter 1, the recognition of complexity undermines the strict distinction between ontology and epistemology and the definition of the boundary of the complex phenomena problematises the idea of being able to clearly demarcate which part of the system belongs to the system and which part to the environment. When seen from a complexity approach, the logic of *différance* as expressed in the notions of stricture and hymen becomes rather appropriate to start understanding what kind of fibre the movement of critique should be made of when dealing with the postmetaphysical challenges concerning complex phenomena.

Re-thinking critique to be a dynamic movement that operates in the in-between or liminal places where neither subjective or objective observations and knowledge can be secured, relates to what Bernstein (1991) and Jay (1993) call a new 'constellation' of critique that operates as in a 'force field'[62] of ideas.

[62] The notions of *constellation* (Benjamin 1977) and *force field* (Benjamin 1999) are metaphors taken from Walter Benjamin's work and its appropriation thereof by Theodor Adorno. In his inaugural lecture of 1931, Adorno (1977:120) explains the constellation in cognitive terms, as the answer to a question:

In light of the above, one can put forward an argument that by means of the double movement that is inscribed in the Kantian understanding of critique, an expanded interpretation of understanding critique as stricture links the notion of critique with the dialectical process, but also expands and subverts it. The logic of critique as stricture gives critique a dialectical function, but also at the same time dismantles the idea of an *Aufhebung* in Hegel's sense.[63] The notion of 'constellation' or 'force field' as described by Bernstein (1991:8), suggests a way in which the trap of the *Aufhebung* can be overcome:

> 'Constellation' is a 'juxtaposed' (position) rather than an integrated cluster of changing elements that resist reduction to a common denominator, essential core, or generative first principle. 'Constellation' is deliberately intended to displace Hegel's master metaphor of *Aufhebung*. For although we cannot (and should not) give up on the promise and demand for reconciliation, I do not think we can any longer responsibly claim that there is a final reconciliation - an *Aufhebung* in which all difference, otherness opposition and contradiction are reconciled.

It lies in the nature of the opening up to one another, the space in which critique is allowed to act and move, that there will always be surprising contingent "ruptures that will dis-rupt the project of reconciliation" (8). It is in the nature of the stricture (structure) of critique as a movement, and as a result of the interaction and the radical instabilities amongst the different elements, that the resistance to reduction is constituted. An "awareness of the depth of the

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> . . . philosophy has to bring its elements, which it receives from the sciences, into changing constellations, or, to say it with less astrological and scientifically more current expression, into changing trial combinations, until they fall into a figure which can be read as an answer, while at the same time the question disappears.

[63] This simulation is not the same as the entrenched understanding of the 'abstract negation' that is enforced by propositional logic from which "perspective the true and the false are eternally opposed to each other" (Bernstein 1991:300), but rather a 'determinate negation' which can be explained as the kind of "negation where the result of negation is conceived as it is in truth, where a new form has thereby immediately arisen, and in the negation the transition is made through which the progress through the completed series of forms come about of itself" (300). The determinate negation works with a kind of logic "where a given moment is at once negated, affirmed and superseded" (300); hence the determinate negation is at once critical and constructive. One can think of it as a strategy of thought with which Hegel is thought against himself. With the metaphors of constellation and force-field the 'grand metaphor of *Aufhebung*' (309) and total rupture and reconciliation is displaced.

radical instabilities" teach us that "we have to learn to think and act in the 'in-between' interstices of forced reconciliations and radical dispersion" (9).

Bernstein (1991:9) calls our attention to another metaphor that is important for Adorno that can be appropriated in the effort to find our way in the in-between places, namely the notion of force field (*Kraftfeld*):

> A force-field (*sic*) is a relational interplay of attractions and aversions that constitute the dynamic transmutational structure of a complex phenomenon. This is also an extremely fertile metaphor for 'comprehending' the 'modern/postmodern' situation, For I want to show that this situation can be characterised as a dynamic 'relational interplay of attractions and aversions'. The task of comprehension today requires doing justice to the delicate unstable balance of these attractions and aversions.

The way in which the notions of the force field and constellation are combined by this style of thinking overcomes and displaces a reconciliation that would have total unity (or *Aufhebung*) as goal. This is also the notion of reconciliation that I would like to suggest lies in the double nature of critique. The notion of the force field's "relational interplay of attractions and aversions" combined with the constellation's "juxtaposed cluster of changing elements" offer us a metaphor to imagine what the space looks like in which critique as force-field (relating to critique as stricture) and constellation (relating to critique as hymen) operates.

I want to suggest that we should understand the notion of force-field and constellation not as something that we can apply as scientific method. Although the tools for forging such a method is implied in it as we saw with Kant and the whole critical project, it might be more appropriate to view the redefined notion of critique as force-field and constellation, as a way-of-thinking and a *mode of critical practice* when it comes down to negotiating the in-between spaces. This **conceptual shift** allows us to see the notion of critique as an attitude (or practice) and a way of thinking that assists the navigator in her attempts to dare to sail into and beyond the gap in between seemingly opposing paradigms. When our critical strategies develop into ways of thinking and ways of engaging with complexity that surpasses the rupture/reconciliation binary logic, the metaphors of stricture (force field) and hymen (constellation) become the **limits** in which reason can apply its cognitive capacities to know.

By being mindful of the fact that the in-betwixt is a force-field of clustered and juxtaposed aporias and irreducible propositions and principles, our way of thinking is challenged to change in such a way that it resists total reduction and total reconciliation simultaneously. In the name of this simulated kind of thinking, the affirmation of a critique that has the capability to rupture and reconcile at once is found.

6.2 Critique in the name of the limit

Regarding the dilemma critique faces in answering the question 'in the name of what,' I want to propose that the notion of critical complexity (see Chapter 5) operates 'in the name of the limit' that is always gazing at us in our scientific and theory-building endeavours (Cilliers 2000c, 2010).

The re-casting and grounding of critical complexity in the name of the limit, implies that the "logic of judgement is displaced by an ethics of encounter with the limit" (Chryssostalis 2005:21). Hence, in the name of the limit critique finds a foundation from which to affirm and negate norms simultaneously. The foundation however is not a fixed firmament that allows for permanent cornerstones of critique to be laid down, but rather provides stepping-stones from which to launch critical interventions. This implies that critique is not foundationless, but at the same time it does not become so cast in stone that it cannot be uprooted. It considers both "the singularity" of a certain instance, but does not deny the "exemplarity of universality" (Hoy 2005:179). Often such a position is misunderstood to mean that the credibility of the concept is put in question and that such an understanding undermines the possibility to be effective at all. However, this is not the case. What changes is the *focus of the philosophical task*. Not the notion of critique is undermined, but "any pretentions to the self-certainty of a foundationalist starting point for" (Derrida 1998) legitimising norms is put under scrutiny. In practice it means searching for valid critical interventions *together with* (heed the "and") an acknowledgement of the limits and shortfalls thereof. As Culler (1989:225) argues about the nature of limits that act as constraints, "(t)he acknowledgement of inadequacy is also an opening to criticism, analysis and displacement."

To be sure, critique as stricture becomes the very practice that exposes the limits of our epistemologies, by making the horizon appear in relation to its own limit. As such, this understanding of critique might not be bringing forth revolutions or emancipatory uprisings, because it does not prescribe what the content of the critique should be. Instead, critical

complexity *presupposes* the conditions for specific forms of critical intervention to take place. Only after the limit of a certain dogmatism or event has been established, and the possibilities for critique has been constituted by means of cutting or bringing together, the critical intervention can take on a specific and concrete form. Thus also the positioning as a *post-critical* form of critique. Other than ideology critique, post-critique does not have a clear picture of how a true or emancipated society should look like and cannot offer critique in the name of those apparitions. Consequently it is also not reactionary in nature.

Ultimately it is the encounter with the limit in Kant's sense of it and even acknowledging the limits of critique that allows the legitimisation of norms and values in whose name to act from. The limit as understood to be constituted by the logic of *différance* in general and as described by the metaphors of *stricture* and *hymen* in particular, allows one to define the limit but at the same time transcend and undermine its status. The limit understood in this sense is not a fixed static foundation, but an identifiable place constituted through the interaction between seemingly opposing binary oppositions. Hence, the limit is not understood to be a limitation, but as a "point of a 'possible crossing over'" (Chryssostalis 2005:19) or "boundary" (Cilliers 2001). This understanding of the limit also co-insides with that of Kant when he argues that the act of establishing limits is being both positive and negative and that critique can be seen as drawing limits, both in the sense of "prohibitive limits (*Schranken*) and establishing bounds (*Grenzen*)" as explained by Hanssen (2000:5) earlier.

Hence, from this new definition of the notion of critique as proposed in this study, the act of criticising not only results in the bridging of opposing paradigms, but simultaneously disrupts and ruptures unified ideas and totalitarian dogmatism. From this perspective the job of critique is never completed. Critique as stricture takes on a dynamic character that has the ability to remain alive whilst operating in the tension of the force field. As an intervention, critique becomes a relentless undercurrent of resistance that never rests. In the name of the "limit" critique becomes a productive force that is inspired by the logic of the double bind of the "and". It is not limited to one voice, but speaks and acts from many voices. It is fuelled by the "horizon of impossibility" to envision "new social and political constructions" that "acknowledge rather than cover over" the "cracks of our universe" (Chryssostalis 2005:20). And who knows, it may even dare to overturn and denounce "current exponents of barbarity" as Roudinesco calls it as discussed in the beginning of this Chapter, in the hope of evoking ways in which we can learn to think for tomorrow and "learning how to live, finally" (Derrida 2007).

7. Conclusion

This chapter started with an elaboration on the implications of adopting a complexity approach so as to demonstrate that the acknowledgement of complexity—understood as a post-reductionist endeavour (discussed in Chapter Two)—constitutes 1) a critical position that shares some shared similarity to Kant's critical project and 2) shares some concerns about the problem of legitimation as found in poststructural theories of knowledge. Moreover it has been shown that the complexity approach is congruent with poststructural positions that 1) problematises strict distinctions between subject and object and loss of a foundational outside position from where to legitimise grounding norms, 2) problematises theoretical positions that rely on transcendental categories or abstract truth claims about reality, 3) acknowledges the loss of central control and 4) dismisses logocentric reason that relies on uncritical reductionist assumptions.

The complexity approach's concerns with the limits of being able to know complex phenomena and the questioning of the conditions for generating knowledge claims concerning complex phenomena, introduce a critical self-conception in its assumptions. It is this claim about the inadequacy to know complex phenomena that proposes the possibility of exposing the ideals of the complexity approach as having some shared concern with the critical philosophic tradition as developed by Kant.

Following the critical thread that can be traced in the complexity approach, the Chapter engaged with the so-called "problem of critique" that is present in poststructural theories of critique. Identified as a problem of legitimisation, the predicament that critique faces after the demise of the 'grand narratives' and 'death of God', remains one that challenges current poststructuralist theories of critique. With the loss of an objective and unwavering foundation from where the critique could gather its grounding norms, critique is faced with its own 'self-abdication' as Sloterdijk (1987) remarks. By exposing the metaphysical claims on which the norms of critique are grounded, poststructural forms of critique are robbed from the possibility to have a yardstick with which to measure the criteria with which it is grounding its allegations. As Adorno (1978) argued, *no measure remains for the measure of all things*.

Challenged to find an answer to the question 'critique in the name of what' (Bernstein 1991), a close reading of the notion of critique as presented by Kant's notion of critique as found in the *Critique of Pure Reason* was undertaken. It was argued that Kant's critical project aimed to lay

bare the limits and foundations for reason in its quest to know and explain reality. A main concern in this process of Kant was to re-define traditional notions of metaphysics and to provide a 'metaphysic critical understanding of metaphysics' (Höffe 2004) that formed the basis of his transcendental idealism. In the process he took stock of and delineated the possibilities and limits of reason with regards to all appearances that could be known *a priori*. For Kant, the notion of critique was a metaphysical question that concerned itself with finding a method by which the faculty of reason could be investigated. Kant's critique of pure reason implied a search for the possibilities of reason to know its own competence and critique was defined as the process of establishing the conditions and limits of reason by reason itself. The argument proposed in this chapter highlights the fact that it is Kant's understanding of critique as the perpetual self-critique of reason concerning its own limits and possibilities that co-insides with the implications of the complexity approach.

Still focussed on Kant, the Chapter explored how Kant's definition of the notion of critique as resembling a judiciary process could inform an expanded understanding of critique. It was shown how a deconstructive reading of this notion of critique could go against itself to produce such a new possibility of understanding critique. By having considered the etymological and orthographical meanings of critic in its German form *Kritik*, it was demonstrated that a double movement operates at the heart of the notion that undermines its original understanding of that of being a cutting or separating force that could also be interpreted as being a decision (*Entscheidung*). The double movement inherent in the concept exposed that taken literally, *Entscheidung* means that which brings together and thus the displaced meaning of critique can mean 'that which cuts and brings together simultaneously.'

The double movement is characteristic of the logic of the Derridean notion of *différance* and it was argued that Derrida's notion of stricture is a fitting metaphor with which to describe the movement of the logic that was shown to be present in the meaning of critique. It was argued that a new meaning of 'critique as stricture' could be grafted to the deconstructed understanding thereof. It was also demonstrated that the notion of stricture is closely related to that of *hymen*. Subsequently it was suggested that these two notions provided some form of legitimisation by which critique could be re-defined as a kind of movement that is dynamic in nature and not a static linear process like that of a judiciary trial. It has some similarity to being a dialectical force, but at the same time also subverting the notion of the *Aufhebung* in Hegel's sense. Supported by Bernstein' and Jay's appropriation of Benjamin's metaphors of 'constellation' and 'force field' and argument was put forward that critique understood as stricture (which has

similarities to force field) and hymen (with similarities to constellation) offers us a metaphor with which the liminality of critique can be understood.

Critique as *movement* (characterised by stricture) constitutes a conceptual shift with which the problem of legitimisation can be negotiated. Through this move, critique becomes a dynamic process of constant cutting and bringing together of seemingly opposing paradigms and it unsettles the strict distinctions that are assumed by each opposing paradigm. Critique as stricture tests and provokes the limits of each paradigm and resists the total reduction of one to the other or the total reconciliation between them simultaneously. As such, critique cannot be grounded in any one of the opposing paradigms, but is constituted and legitimised by belonging to neither wholly, yet partaking in both at once. Through its liminality, critique can answer the question 'in the name of what' by addressing the limits of each paradigm. And in doing so, find its legitimisation of claims in the inadequacy and limits exposed in each paradigm.

From the above it can be concluded that critique as stricture that operates with the logic of the double movement becomes a force that seeks to at once rupture and reconcile and overcome the ways in which we seek to know the world. Only when we make this conceptual transition, "only when we break with all finitized attempts to shun the self-contradictory character of the concept will we be able to grasp" (Bernstein 1991:299) the transformative nature of the kind of thinking that is necessary to keep philosophy vital and vigilant.

As in the case of complexity theory, this new critical constellation assumes a modest position that is aware of the limits of its thought strategies, its ways of knowing the world and of philosophy itself. In that sense, the new constellation also coincides with Kant's original intention behind his critical project—namely to show the limits of how we can know, act and judge in the world. Understanding critique as force that has the ability to at once rupture and reconcile, as well as a thought strategy that can endure in a force field of attractions and aversions, we are given a way through the in-between of extreme positions. Such an understanding of the notion of critique equips us to resist choosing between the one or the other and allows us to know the other in terms of whom and what it is and not to reduce it to our negations and binary oppositions. Such a position allows us to move and work in a space between rupture and reconciliation—"the space that is the *topos* in which critique thrives" (Bernstein 1991:318) that also allows a gap that remains open for an 'Enlightenment to come' (Derrida 2003). In such a space critique becomes the method, tool and force that compels us toward a reform of reason and thought.

In the next Chapter, it will be argued that this expanded understanding of critique that operates as a movement driven by the logic of the double movement, calls for a reform in thinking. The study will explore how critique as stricture could inform a way of thinking that calls itself 'complex thinking' as suggested by Cilliers (1998, 2007) and Morin (1974, 2007, 2008). Complex thinking is the type of thinking that can be connected to the general economy of the double movement, which suggests that, the concept and its counterpart (the yes and the no) is thought simultaneously. In Chapter 5, more consideration will be given to the notion of 'critical complexity' that will investigate the practical and substantial implications for understanding critique as stricture in the light of complex thinking.

CHAPTER 4
THE PROBLEM OF THINKING COMPLEXITY

1. Introduction

> *Because we are beginning to write, to write differently, we must reread differently.* (Derrida 1976:87)

> *The most important task today is, perhaps, to learn to think in the new way. … Let me say that I don't know how to think that way.* (Bateson 1972:462)

A strong emphasis throughout the study thus far, is the suggestion that the complexity approach calls for adopting a different kind of thinking in our pursuit to understand the world and our place therein. As Derrida argues by analogy (see his quote above), different ways of writing about the world imply that we need to reflect critically on our strategies with which we approach the subject-matter at hand. And as Bateson quoted here above agrees, this can be a very daunting task. Having focussed on how the complexity approach is related to a critical and poststructural position within philosophy, the main intention in this chapter will be to explore what kind of thought strategy needs to be embraced so as to come to terms with the logic of 'critique as stricture' as argued in Chapter 3. Operating within the logic of the double movement (or *constellation* in Adorno's terms), the new expanded understanding of critique as stricture calls for a type of thinking that is compatible with the dynamic process of simultaneous cutting and binding that has the potential to undermine the strict distinctions that underlie the logic of binary oppositions.[64] Often this alternative 'both/and' strategy of thought (as suggested by the notion of critique as stricture) is criticised for falling into the trap of proposing a position that defies the law of non-contradiction. This argument will be countered based on an enquiry into the nature of the Derridian understanding of the notion of the 'concept' as such and how meaning arises in a system of differences.

In this chapter it will be argued that the kind of thinking that is best suited to deal with the alternative reasoning strategies of the critical constellation as described in Chapter 3, is the kind of thinking that allows for the movement of the 'general economy' as portrayed in the

[64] See footnote 3 in the Introduction concerning the use of the word 'logic' in this chapter.

deconstructive thinking of Derrida, the critique of Enlightenment thinking as developed by Horkheimer and Adorno and as demonstrated by the notion of ‘complex thinking' as proposed by Morin.

In order to reach such a form of thinking, it is important to look firstly at the “problem of thinking” that informs particularly strong kinds of reductionist (or logocentric) thought strategies. This will be done by discussing the difference between Georges Bataille’s notions of ‘restricted economy’ and ‘general economy’ and how these concepts were appropriated by Jacques Derrida and Edgar Morin in turn.

The chapter starts with a discussion of the ‘problem of thinking’, which amounts to the argument that the study of complexity is a call to reflect critically on the thought strategies that inform our theories and practices with which we approach the study of complexity. Thereafter the notion of ‘restricted economy’ as coined by Bataille is examined in terms of Derrida’s reading thereof. Consequently it is suggested that the kind of thinking that is distinctive of enlightenment rationality is a good example in which the restricted economy is at work. It is then demonstrated that Kant’s notion of the transcendental logic (which is typical of the enlightenment rationality) is also based on a restricted economy of thought. The discussion continues by reflecting on Horkheimer and Adorno’s critique of enlightenment rationality in which it is evident that their analysis is also directed towards the effects of the restricted economy in society. A short digression is then made to explore Adorno’s conception of ‘autonomous art’ and his suggestion that it has emanicipatory possibilities because it resists the logic (or productive processes) of the restricted economy. It will be argued that Adorno’s notion of autonomous art can be seen as a precursor for Derrida’s notion of différance that exemplifies the general economy.

The chapter then continues with an examination of the notion of the general economy. It is argued that the general economy is not a rejection of the restricted economy, but an expansion (or supplement) and opening up thereof to difference and excess. The discussion engages with Derrida’s argument that the ‘logic of *différance*,’ which typifies the life force of the general economy, does not conform to the logic of binary oppositions.

The chapter draws to an end with a discussion of Morin’s appropriation of the notion of restricted and general complexity and it is claimed that also his re-appropriation of Bataille’s terms gives us a critical tool with which to think and talk about the nature of complexity in a

more rigorous way. Finally, the chapter concludes by suggesting that the notion of critique as stricture and constellation can be situated within the general economy and that it therefore distinguishes itself markedly from Kant's critical method, which is positioned in the restricted economy. By locating critique as stricture within the general economy, its role changes from being *a questioning **of*** 'cherished opinions and inherited doctrines' to being a kind of critical thinking that is *underway* (see discussion on Heidegger in section 2). Operating within the general economy, critique as stricture is consequently at once a questioning of and a strategy of thinking that remains restless in its pursuit to destabilise mastering narratives.

2. The problem of thinking

> *What is called thinking? We must guard against the blind urge to snatch at a quick answer in the form of a formula. We must stay with the question. We must pay attention to the way in which the question asks: what is called thinking, what does call for thinking.*
> (Heidegger 1976:48)

> *Indeed, one must understand this incompetence of science which is also the incompetence of philosophy, the closure of epistémè. Outside of the economic… thought is here for me a perfectly neutral name, the blank part of a text, the necessary indeterminate index of a future epoch of differance. In a certain sense, 'thought' means nothing. Like all openings, this index belongs within a past epoch by the face that is open to view. This thought has no weight. Thinking is what we already know we have not yet begun; measured against the shape of writing it is broached only in the epistémè.*
> (Derrida 1976:93)

The notion of what it means to think is not an unproblematic or neutral concern in the study of philosophy. The famous Cartesian dictum of "Cogito ergo sum" or "I think, therefore I am" has influenced a whole tradition of philosophy in which the modernist project of prioritising reason as the primary locus from where we can access objective knowledge is grounded. In the modern

metaphysical scheme, the notion of thinking describes the process whereby objects are represented in terms of the "assertion of propositions by a subject" in which the "axiomatic proposition and the founding representation is *cogito sum*" (Krell 1993:344-345). In this respect, the name 'thinking' has been given to those mental acts of calculation, categorisation, planning, problem solving and prediction so as to serve the logical and technological explanations that are inscribed in enlightenment rationality. Often the attempt to redefine the notion of thinking outside this strict economy of rationalism is criticised for the ways in which calculation and rigour are swapped for moody daydreaming (reverting to myths or poetry) and fiction. It seems that what remains is still the choice between the grand either/or or all/nothing distinction. The challenge we are faced with in this chapter is to try and define a kind of thinking that escapes the strict logic of the Cartesian legacy, but that does not fall prey to some individual subjective and incoherent explanation of the world. At the same time, we are challenged to bridge the divide that the logic of binary oppositions places before us. And it is in this respect that Heidegger (1976) claims that we have not yet begun to think at all and that we might have to discover anew a kind of thinking that can break through this closed circle of the *either/or* paradigm.

In his book called *What is thinking?* (1976), Heidegger suggests that we should not be swift in trying to find a standard and final answer to the question of what it means to "think." He continues by proposing that "(t)hinking is unlike any other act insofar as it is an act at all. It is a calling in more than one sense of that evocative word" (xii). Moreover, it is suggested that "thinking is questioning and putting ourselves in question as much as the cherished opinions and inherited doctrines we have long taken for granted" (xii). Throughout his book, one recognises that for Heidegger, there is an intimate link between thinking and questioning. This link between what it means to think (or to *investigate*) and to question (or to have a *critical attitude*), is expressed succintly in his famous work *Being and Time* (1962). The following quote justifies some attention:

> Every inquiry is a seeking [Suchen]. Every seeking gets guided beforehand by what is sought. Inquiry is a cognizant seeking for an entity both with regard to the fact that it is and with regard to its Being as it is. … Any inquiry, as an inquiry about something, has *that which is asked about* [sein *Gefragtes*]. But all unquiry about something is somehow a questioning of something [Anfrage bei . . .]. So in addition to what is asked about, an inquiry has that which is interrogated [ein

> *Befragtes*]. In investigative questions—that is, in questions which are specifically theoretical—what is asked is determined and conceptualised. … Inquiry itself is the behaviour of a questioner, and therefore of an entity, and as such the character of Being (Heidegger 1962:24) (italics in original text).

Ultimately, for Heidegger (1976:8), the act of thinking can be explained in essence as a kind of *being underway*. It is not characterised by arriving at some ultimate end with neatly packed solutions and answers to questions. The question about 'what thinking could be?' is furthermore always directed anew by inverting the question and considering rather, "What is it that calls on us to think?" (160). For Heidegger, our being in the world and the question about what it means to think is intimately interwoven with what it means to be human and those instances in the world (of being in the world) that call upon us [Gefragtes] to think and direct us to "what there is to-be-thought" (161) or questioned [Befragtes] (Heidegger 1962:24).

With Heidegger's argument in mind, we can argue that complexity is one of those things in the world that calls upon us [ein Gefragtes] to think on it. And the fact that we can use the complexity approach to question the cherished opinions and inherited doctrines we have long taken for granted (Kompridis 2006a) suggests that a critical approach also calls us to think *anew* about the implications of 'what there is to-be-thought' when complexity enters into the equation of what it means to being in the world. As it will become clear in this chapter, no easy answer will emerge. At most we will arrive in a place where we can suggest that the notion of 'complex thinking' provides us with some devices with which to live up to the call of complexity.

2.1 The calling of complexity

The 'calling' of complexity [or *Gefragte* àla Heidegger] is best described by the nature of the *problems* it puts in our way as discussed in Chapters 1 and 2 of this study. This can be summed up in short as follows:

i) The study of complexity poses various challenges to the traditional so-called Newtonian scientific approaches that rely on reductionism, determinism, universalism and a positivist form of rationalism.

ii) The impossibility of being able to have complete knowledge (or a largest model) of complex phenomena was also discussed in detail and following the implications it

has for knowledge generation it was argued that this leads to the understanding that the set of beliefs or basic assumptions that inform a complexity approach is congruent with poststructuralist theories in general and allows for new critical constellations to emerge.

iii) Similar to Kant's critical project that was motivated by reason's limitations to have direct access to the world of the thing-in-itself, the study of complex phenomena questions the "dispositional stance about nature and organisation of the world, together with beliefs about how best to investigate it" (Kuhn 2007: 156).

Hence, the critical imperative that inhabits the complexity approach challenges the way in which we think about concepts and calls for a "different way of thinking about and describing the nature of the world, and human knowing and understanding" (157). In the same way that Kant's critical philosophy was grounded on a new way of thinking about what human reason is able to know or not, the study of complexity also suggests a different way of thinking for finding new ways and methods of modelling and understanding complexity.

At the heart of this new way of understanding lies the contradiction that informs a general understanding of complexity as argued in Chapters 1 and 2 that coincides with the logic of the double movement as discussed in Chapter 3, namely that the complexity approach entails that one has to *simultaneously accept and reject* the principles of reductionist approaches (Hiett 2001). Or as Derrida (1976:93) formulates the dilemma, (see quote at the beginning of this chapter), that thinking can only take place *within* the epistémè. There is no thought possible outside our already acquired tools of thinking. The 'problem of thinking complexity' thus lies in asking how we can reconfigure the tools that we have, so that we are not trapped in a closing off of our epistemologies, but that we reinvent them (and not discard them) so as to insure that our knowledge generating systems remain open enough to bring forth novelty and new knowledge of the world.

Practically this means that we know that we only have the strategies and principles of classical science (as articulated in extreme cases of Newtonian/Cartesian scientism) with which to approach complexity, but at the same time we are cognisant of the fact that the moment we apply those strategies in our methods of modelling complexity, we reduce complexity and we are faced with the limits of our explanatory tools. However, accepting that the reductionist strategies cannot account for a complete description of complexity, is not the same as dismissing its analytical power altogether. This would amount to a crude form of subjectivism

and relativism as rightly argued in the traditional debates. As argued in Chapter 2, a post-reductionist position that becomes aware of the limits of its strategies of reduction is self-reflexive and suggests an "'epistemological rethink' to be informed by a kind of thinking that includes both holism and reductionism" (Mazzocchi 2008:13). This appraisal of post-reductionism suggests a strategy of thought that locks opposites in a kind of dialectical double movement that is characteristic of the working of *différance* as discussed in Chapter 3.

This chapter intends to engage with the problem of "how to choose" which strategy of thought will be most fitting to engage with complexity from a somewhat different point of departure. Often, debates about which kind of thought strategies provide better methodologies for grounding scientific claims on, focus on the dichotomies between positivism and relativism (Habermas 1987, Bernstein 1991), between myth and reason (Derrida 1982b) or between understanding (or 'verstehen' as claimed in the human sciences) *versus* explanation ('erklären' as claimed by the natural sciences) (Van Niekerk 1989). In this chapter, however, a different dichotomy will be explored, namely the distinction between the restricted economy and the general economy as developed by Bataille (1988, 1991) and appropriated by Derrida (1982a, 2001) and Morin (1974, 2007). In this dichotomy, the notion of *restricted economy* can be compared to a strategy of thought that engages in a linear way of thinking (as encountered in the Newtonian/Cartesian tradition of science) which amounts to the assumption that knowledge can be complete and absolute—or in other words, that a closed 'epistémè' is possible as suggested by Derrida (1976:93). The notion of 'economy' as used here, can be equated with 'thought strategies' (or 'ways of reasoning' as suggested in footnote 3 of the Introduction) as will be explained later in section 3 of this chapter. The restricted economy is the description of a number of wide-ranging practices and strategies that all resemble reductionist approaches, thus it spans all thought strategies that are informed by the Newtonian/Cartesian paradigm and would include the following positions, for example: positivism, enlightenment reason, foundationalism, behaviourism, logocentrism, Aristotelian logic, physics, functionalism, and so forth.

It is often assumed that all other opposing positions would amount to better or alternative strategies of thought and that one could just 'do better' by rejecting the reductionist and positivist strategies. And this is exactly where we land up in the pitfalls of trying to negotiate between binary oppositions. The predicament, or 'problem of thinking', however, lies in this juxtapositioning of binary oppositions, because as poignantly framed in the words of the English writer Gilbert Chesterton (1927):

> The real trouble with this world of ours is not that it is an unreasonable world, nor even that it is a reasonable one. The commonest kind of trouble is that it is nearly reasonable, but not quite. Life is not an illogicality; yet it is a trap for logicians. It looks just a little more mathematical and regular than it is.

Thus, as our everyday experiences and practices in science tell us, the Newtonian/Cartesian paradigm works well in solving a multitude of problems, and it would be impossible to do away with its methodologies completely. The challenge thus lies not in only discovering and developing oppositional ways of thinking about or studying complex phenomena, but in finding ways of using an array of different ways of thinking simultaneously without reducing the one to the other and without pitching them as complete binary oppositions of one another. And it is here that the notion of the general economy provides us with a device with which to navigate the impasse. As deduced from the term 'general', it does not present the opposite of 'restricted', which would have had to be 'unrestricted'. Instead it points to a generalisation rather, to a supplement. In a sense, it is the expanded and displaced meaning of the opposition between restricted and unrestricted. This will be discussed in more detail in section 4 later in this chapter.

Moreover, it points to the thinking together of assumed oppositions, without reducing the one to the other and at the same time thinking them differently together. This logic has been explained in the section dealing with the logic of the word 'and' and coincides with the notion of stricture and constellation as discussed in Chapter 3. In this chapter, the resemblance between 'general economy' and the Derridean notion of différance will be discussed in more detail to elaborate on how the term 'general' does not represent the opposite of restricted. It will be explored in what sense general economy can be understood to be an expansion of restricted economy, so that we can actually face the predicament of being able to 'simultaneously accept and reject the principles of Newtonian science' as argued by Hiett (2001:117). It will be shown that it is exactly this dilemma or *aporia* in Derrida's sense that opens up a space in which the 'problem of thinking' will not be solved by 'snatching at a quick answer in the form of a formula' as Heidegger (1976:48) warns us, but by learning how to think anew by 'being underway' (8), being guided by the call of complexity.

3. Economic thinking

Going back to Kant's critical philosophy and following the assumptions of modernism, it is noticeable that one of the main concerns of philosophical thinking is an engagement with the quest to know reality and to find ways in which to ground knowledge so that our theories and methods of understanding the world form a unified representation thereof. In the process of finding ways to overcome the problem of legitimacy as discussed in Chapter 3, modern thought strategies aim to find a basic principle of organisation that can serve as foundation upon which all systems of knowledge could be organised into a "closed, stable structure or system (architectonic, hierarchy, or teleology)" so as to be a "regulative ideal, and a measure for our progress" (Hurst 2004a:248). As discussed in Chapter 2, this project leans heavily on defining a kind of rationalism that is grounded in the unquestionable authority of the Newtonian worldview and the quest for certainty and predictability that is found in the principles of determinism, universalism and positivism. In what follows, it will be argued that the mode of thinking that supports the modernism project can be labelled 'economic thinking' as described by Derrida.

Although the notion of economy is a very important concept in Derrida's work—in fact, one can say that it permeates all his writings in some way or another and that it is inscribed in all his non-concepts such as différance, trace, supplement, hymen, iterability and his critique on the metaphysics of presence—it is by no means privileged by him alone. In Nietzsche the idea of economy appears in his notion of 'economies of force', in Freud we encounter the 'economy of desire', in Hegel there is the critique of the 'political economy' and in Levinas there is the notion of a 'just economy' in his writings on ethics (McCain 2006:1). The work of George Bataille, however, has a very important influence on Derrida's use of the concept 'economy.' In his multi-volume work, *The Accursed Share*[65], Bataille (1988, 1991) uses the distinction between a 'general' and a 'restricted' economy[66] to discuss the impossibility of a clear-cut dialectical process which assimilates all excess back into the system.[67] Underlying the notion of economy in Derrida's work, however, is the notion of movement (as opposed to a "static, or

[65] Cf. Bataille, G. 1988 (orig. 1949). *The Accursed Share, Vol. 1*, New York: Zone Books.
Bataille, G. 1991 (orig. 1949). *The Accursed Share, Vol. 2 & 3*, New York: Zone Books.

[66] As mentioned in Chapter 2 of this study, Morin also gets his ideas of a 'restricted' and 'general' complexity from his engagement with Bataille's work.

[67] See Human (2011b) for a detailed discussion on the difference between the 'restricted' and 'general' economy as used by Bataille, Derrida and Morin and how it relates to the understanding of critical complexity.

fixed state of being") and it entails the processes of "change, relationality and exchange" (McCain 2006:2). The 'movement of differentiation' (2) that becomes so important in Derrida's system of writing and the creation of meaning are also based on this understanding of economy. The notion of *economy* furthermore replaces and supplements the term 'logic' (see footnote 3 in Introduction of this study) in Derrida's thinking and is used as an alternative concept to describe the thought process whereby meaning is created.

3.1 Bataille and Derrida on the movement of economy

For the purpose of this study, the term 'economy' as understood and used by Derrida and Bataille will inform the meaning of the concept. The Derridean understanding of the concept economy furthermore refers to a system of thought that relies on the ideas of "exchange, of circulation, of return" (Derrida 1992:7). Elaborating on his definition of 'economy' Derrida (6-7) argues:

> Among its irreducible predicates or semantic values, economy no doubt includes the values of law (*nomos*) and of home (*oikos*). *Nomos* does not only signify the law in general but also the law of distribution (*nemein*), the law of sharing or partition (*partage*) … . As soon as there is law, there is partition: as soon as there is *nomy*, there is economy. Besides the values of law and home, of distribution and partition, economy implies the idea of exchange, of circulation, of return. The figure of the circle is obviously at the centre, if that can still be said of a circle … . This motif of circulation can lead one to think that the law of economy is the-circular-return to the point of departure, to the origin, also to the home. (italics in original text)

Hence, as Spivak (1976: xlii) explains in the *Translator's Preface* of *Of Grammatology* (Derrida 1976), the notion of economy "is a metaphor of energy—where two opposed forces playing against each other constitute the so-called identity of a phenomenon", but however "... it is not a reconciliation of opposites, but rather a maintaining of disjunction." Thus, the notion of 'economy' is employed to describe a movement that informs a thought strategy that "strives to incorporate and systematise every component in a calculable network of interrelations" (Hurst 2004b:46) in order to produce meaning.

In his essay *Resistances*, Derrida (1998:29) writes about the 'movement of deconstruction' to explain the working of the double bind and explains that "[a]t the heart of the present, at the origins of presence, the trace, writing, or the mark is a movement of referral to the other, to otherness, as a reference as différance" (27). The movement of economy is the force (29) that:

> *drives* [pousse] deconstruction to analyze without respite the analysistic and dialecticistic presuppositions of these philosophies, and no doubt of philosophy itself, what resembles there the drive and the pulse of its own movement, a rhythmic compulsion to track the desire for simple and self-present originarity. (italics in original text)

The notion of economy can therefore be said to form the structurality of thought by which the elements of a system (such as language for example) interact dynamically so as to create meaning. It acknowledges the inter-relatedness of components in a system and describes the process or movement of differentiation that takes place. It also emphasises Derrida's (1976:93) argument, that without economy, no thought is possible and that "thinking can only be broached" from within our systems of knowledge.

It is possible thus, as Human (2011b:49) suggests, to think of the notion 'economy' as "strategies or different systems of thinking." It would also be conceivable to apply the notion 'economy of thought' to refer to an 'approach' or even a 'paradigm', seeing that:

> [a] paradigm of thought requires that the theories or propositions which constitute it retain a certain coherence, a certain allegiance to limits which allow some components but exclude others. As a matter of fact, paradigm shifts are often initiated upon the upsetting or disruption of such limits. These economies of thinking exclude that which does not suit the *nomos* or reason guiding the model, guiding the return to the origin and consequently that which disrupts this *oikos*. For example, the shift which occurred from modernism to postmodernism was founded on the disruption of the taken for granted foundation of modernism, namely that of an accurately reducible world, by an economy of analysis which argued for an excess to such a foundation (49).

From the quote above and from Derrida's description of 'economy' earlier, one can argue that the term *nomos* refers to the 'rules of play' or allowed *sequence of steps* that should be followed to validate a formal set of premises to yield a true statement, for example. The term *oikos* is used to refer to the 'paradigm' of thought that follows from the collection of guiding rules or model. The notion of economy captures the dynamic nature of the processes that work together to build and create patterns of thought that eventually constitute dominant philosophical traditions or paradigms.

Derrida has noticeably been influenced by Bataille's (1988, 1991) distinction between a 'restricted' and a 'general' economy. The influence is most evident in Derrida's essay 'From general to restricted economy: a Hegelianism without reserve', in *Writing and Difference* (2001), and in the essay 'Différance' in *Margins of Philosophy* (1982a). Following Bataille, Derrida also distinguishes between two kinds of economies that characterise the movement and energy that underlie the processes of differentiation that give rise to different thought strategies. This distinction is discussed pertinently in his essay 'Structure, Sign and Play' in *Writing and Difference* (2001) where he engages with the work of Levi-Strauss:

> There are thus *two interpretations of interpretation*, of structure, of sign, of freeplay. *The one* seeks to decipher, dreams of deciphering, a truth or an origin which is free from freeplay and from the order of the sign, and lives like an exile the necessity of interpretation. *The other*, which is no longer turned toward the origin, affirms freeplay and tries to pass beyond man and humanism, the name man being the name of that being who, throughout the history of metaphysics or of ontotheology–in other words, through the history of all of his history–has dreamed of full presence, the reassuring foundation, the origin and the end of the game (Derrida 2001:369) (my empahsis).

The *one* interpretation of interpretation that seeks to 'decipher' and dreams of a 'truth or an origin' describes the 'restricted economy' and is often linked to the notion of 'utility' (Pawlett 1997) or 'labour' (Derrida 2001:328) that works toward getting rid of instances of 'excess' and expenditure 'without reserve' (315) (or in Derridean terms, 'play') in the system of meaning. The *other* interpretation which refers to the general economy, is no longer bound to the 'origin', is less formalised and open to the possibility of the excess of 'freeplay'. The difference between the two kinds of economic thinking will be explained in more detail below by referring on the

one hand to Derrida's interpretation of Bataille's notion of restricted economy and on the other hand, by way of illustration, to Horkheimer, Adorno and Marcuse's idea of 'enlightenment rationality' as argued in their critical theory of industrialised society.

4. Restricted economy

As derived from Bataille, the notion of 'restricted economy' offers a revealing point of entry for analysising the movement of thought that characterises the instrumental rationality of the 'enlightenment tradition' (Pawlett 1997) (or reductionism as described earlier in Chapter 2 of this study). Drawing on economic metaphors that describe the production rules of capitalist societies, the strategies of the restricted economy are best described as follows:

> Restricted economy is geared towards production and expenditure for the return of profit. It is an economy of determinate meaning and established values. General economy is not an economy of exchange, but of waste, of expenditure without return, of sacrifice of the destruction, without reserve, of meaning (Trahair 2001:161).

and

> A restricted economy assumes that the central economic issue is *scarcity*. Such an economy therefore emphasises production, operates by means of exchange and circulation, and does so in expectation of profit and return. A general econnomy, by contrast, assumes that the central economic issue is *surplus*. Such an economy therefore operates by means of gifts, sacrifices and reckless expenditure, and does so in the expectation of loss without return (Shershow 2001:469) (my emphasis).

The 'economism' of the restricted economy thus tends to focus on how the rules of production can be structured so as to insure that scarce resources are employed productively within the circular system of consumption and exchange. All excess of expediture should re-enter the system of production and exchange so as not to go to waste. As Habermas (1984a:90) commented in his essay on Bataille, "capitalism is characterised by the fact that all surpluses get reinvested, that is, they are spent again productively; the process of accumulation is guided by imperatives of the self-realisation of capital." Waste and excess are consequently minimised and taken up back into the system of production.

Hence, in terms of being an explanatory strategy of knowing, the underlying rationale of the restricted economy is the drive toward producing a structured, universal and closed system of production and exchange that produces a form of absolute knowledge that promises "an absolute formal mastery" (Derrida 2001:345). Moreover, the notion of the restricted economy suggests a prescribed methodological 'technicity' (Derrida 1988:93) of thought that follows a certain pattern or chain of instructions whereby some grand master narrative or 'principle of reason' is created. There is an indication of some systematic process that structures a kind of thinking that guarantees a machine-like applicability and repeatability. It is predicated and sustained by a finite system of rules (or coding) (8) that govern the processes of circulation and exchange of meaning so as to represent a model of reality.

More specifically, the restricted economy is characterised by Derrida (1982a:19–20) as the mode of thinking that:

> ... conserves the stakes, remains in control of the play, limiting it and elaborating it by giving it form and meaning... . [T]his economy of life restricts itself to conservation, to circulation and self-production as the reproduction of meaning.

From Derrida's reading of Bataille it can be gathered that the logocentric theories of traditional philosophic systems all fall within the scope of being 'restricted theoretical economies' (Shershow 2001:472). Moreover, the restricted economy is characterised by systems of thought that configure the interactions between their components and other systems as *always meaningful* and lay claim to the fact that notions of multiplicity and indeterminacy are *always contained* and *accounted* for within the meaning making processes. This description of the restricted economy suggests that epistemological systems are closed systems that are guided by a linear kind of causality. As argued in Chapter 1, such systems are not affected by the external influences of un-knowable or incalculable components that are not taken up in their processes of production and consumption. The restricted economy furthermore assumes that a strict distinction between what belongs to the process of the economy (inside) and what does not (outside) is possible. The economising force of the restricted economy is always looking at ways in which to incorporate and bring under the power of commodification or calculation those things that could possibly undermine the economising strategies.

Another way to look at such systems, is the recognition that they "construe the world as finally limited or restricted enough to be graspable by thought; and they assume that intellectual work will be rewarded with the wages of knowledge" (473). It is as if such restricted economies of thought could be interpreted as being forms of "epistemological capitalism, in which knowledge, like any other resource, is produced, accumulated, conserved, and expanded" (Shershow 2001:473). The analogy of the commodification of knowledge here reminds one of the Enlightenment critique of Horkheimer and Adorno and this link will be followed in more detail later in this chapter.

Ultimately Bataille used Hegel's notion of the speculative dialectics that amounts to the *Aufhebung* as ultimate form of knowing and truth, as basis for his critique of a restricted economy. Derrida however, goes further and aims to show that all traditional theories in philosophy that concern themselves with the nature of Reason and the foundations and origins of metaphysics are based on a restricted economy of thinking. This becomes clear in his deconstruction of the work of in particular Kant, Hegel, Husserl and Heidegger.[68] In the following section Kant's account of reason as portrayed in his *Critique of Pure Reason* will be used as an example of a restricted economy of thought.

4.1 Kant and the restricted economy of reason

> Liberation from superstition is called enlightenment . . . it must be very difficult to preserve or instil in someone's way of thinking (especially the public's) that merely negative element which constitutes enlightenment proper. (Kant 1996, 5:294)

The quote above is from Kant's famous essay, "What is Enlightenment?" (1996, originally published in 1784). It is conceivable that, more than any other philosopher of his day, Kant's thinking stands out as the epitome of Enlightenment rationality. Derrida's engagement with Kant is often misunderstood to mean that his deconstruction of Kant paves a way for 'relativism' or that it 'sounds the death of reason' (Lucy 2004:66). However, the main concern Derrida has with Kant, is the latter's "faith in the purity of 'transcendental' questions, which ask after the conditions, the preconditions or the presuppositions of knowledge" (66). Relating to

[68] Engaging with Derrida's deconstruction of all these thinkers will not fit into the scope of this study. Derrida systematically rereads their work in great detail and traces of his engagement with them are present in his whole œuvre. For a very consice and summative discussion on how he deconstructs Kant, Hegel, Nietzsche and Husserl, see Hurst 2008:19–44.

the discussion of Kant's *Critique of pure Reason* in Chapter 3, the following section will investigate how Kant's notion of critique as method for establishing the limits whereby reason can know the world, can be said to fall into a restricted economy of thought. Establishing this will become important for putting forth an argument later in this chapter, that Derrida's deconstructive strategy and ultimately the notion of *critique as stricture*, as presented in Chapter 3, is exemplary of a general economy of thought and therefore an expansion on Kant's restricted economy of critique.

In his quest for 'metaphysical security', Kant imagined that he could establish the foundations and origins of metaphysics and certain knowledge concerning phenomena by "specifying a rationally guaranteed order" (Hurst 2008:23) of thought by means of his transcendental logic. As argued by Lucy (2004:67), Kant's transcendental logic holds that "epistemological pursuits should be conducted on the basis of *a priori* transcendental rules of inquiry." Although Kant argues against the possibility of knowing the thing-in-itself (*noumena*) (see discussion of this in Chapter 3), his notion of knowledge of the *phenoumena* is based on the mind's ability to have direct access to it—thus, the mind is present to the *phenoumena* and the rules of inquiry that guide the possibilities of reason to know, form a closed system of knowledge. In Kant's thinking there is also a very strict separation of 'immanence and transcendence', so that knowledge claims can be made based on some form of 'coded rule' that guarantees universality and objectivity (67).

According to Kant (1998: A306/B363–A308/B365), the logical role of reason could be located in the formal process of considering propositions under ever more general principles in order to systematise, unify, and "bring to completion" the knowledge given through the real use of the understanding (*Vernunft*). This activity can be described as one that "seeks 'conditions' for every condition" (Grier 2012). Therefore, the demand for the unconditioned can be seen to in essence be a demand for ultimate explanation, and connects with the rational instruction to secure systematic unity and completeness of knowledge. Reason, in other words, is concerned with the process of ultimately accounting for all things. As Kant articulates this interest of reason in the first *Critique*: "Find for the conditioned knowledge given through the understanding the unconditioned whereby its unity is brought to completion" (1998: A308/B364). Fundamental to Kant's transcendental logic is this requirement for systematic unity and completeness of knowledge that is integral in the very nature of reason.

As discussed in Chapter 3 of this study, it can be argued that Kant's notion of critique as strategy aims to reveal the conditions of the possibility and the origins of metaphysics and hence, the limits of reason. In his pursuit of the conditions of the possibility of metaphysics, he constructs a transcendental logic in which pure synthetic judgements *a priori* are not only possible, but *necessary* for his logic to work. According to Harvey (1986:4) the notion of the synthetic *a priori* affords Kant with the grounds to claim the following:

> (i) the actuality of pure mathematics and pure physics indicates that we can and do make pure synthetic cognitions *a priori*; and (ii) the fact that we make these judgments reliably, therein constituting knowledge which is objectively valid, indicates a certain closed system of categories 'which can be articulated fully' and which are inherent in the nature of the Understanding itself.

Kant wanted to be sure that his transcendental logic would be able to establish the conditions for the possibility of a science of metaphysics that could rest on the assumption that the principles and categories that guide the ideas of reason entail "a certain completeness—indeed, a closure" which is unavoidable and perfect (5). The completeness is 'necessarily assumed' (5) so as to make metaphysics a legitimate science that is universally valid (see discussion in Chapter 3). The importance of this necessity is noticeable in the following quote by Kant taken from his *Prolegomena* (1950:75):

> Metaphysics has not only to do with concepts of Nature, which always find their application in experience, but also with pure rational concepts, which never can be given in any possible experience whatever. Consequently, it deals with concepts whose objective reality… and with assertions whose truth or falsity cannot be discovered or confirmed by experience.

Kant's reliance on the universal and objective claims that his metaphysics bring forth, is indispensable for his aim to "find the ultimate, essential, transcendental condition that grounds everything, or conditions the possibility of all the non-essential rest" (Hurst 2004a:256). As Kant (1950: 60) assuredly claims, "(a)nd thus we have at last something definite upon which to depend in all metaphysical enterprises." Kant's insistence to have a 'definite' and thus reliable basis for metaphysics is also apparent in his 'principles for the use of Understanding'. This was

expressed in the regulatory role of his "Ideas of Pure Reason" (Kant 1998) whose function it is to guide our use of the concepts but not to thereby constitute knowledge or experience.

Furthermore, not only Kant's *metaphysics* can be said to be guided by the movement of the restricted economy, his *Critique* expressed as the search for the conditions of the possibility of metaphysics also represents a restricted economy of thought. As discussed in Chapter 3, the Kantian notion of critique suggests an inquiry into the limit of reason's ability to have synthetic *a priori* knowledge of the world. This judiciary method resembles a dialectical 'sceptical procedure' whereby facts are evaluated in a fair trial by means of giving correct judgments. As mentioned in Chapter 3, the conditions for securing the fair trial (see Höffe 2004:291) guarantee that based on an adherence to them, the method of critique could bring forth universal laws that would serve as *foundation* for developing principles and norms for transcendental truths. This assumes a closed process of establishing absolute principles and impenetrable limits to what could be judged and whereby the 'unconditioned' could be brought into the system of the 'conditioned' so that knowledge could be absolute and complete. As Harvey (1986:15) suggests, the critical process is governed and ruled by a number of conditional principles and they set the 'bounds of legitimacy' by which reason can know the world and they secure the autonomy of reason based on this 'closure' which allows for the "self-sufficiency ascribed to Reason."

As will become clear later in this chapter, it is exactly Derrida's concern with the Kantian understanding of metaphysics (of presence) that spurs on his deconstructive intentions. Derrida endeavours to expose how the 'closure' that Kant so desperately needs is only made possible by the exclusion of the unconditioned and the gap that remains in the representation between *noumena* and *phenomena*. As Harvey (1986:17) claims: "(t)he point, for Derrida, is that what has been effaced in Kant's system and in the entire history of metaphysics is its very conditions of possibility–the sign itself as essential." Derrida's concern with the "metaphysics of presence" and his notion of "différance" is directed at the restricted economy present in Kant's (and others') metaphysical system. As mentioned earlier, Derrida's neologisms such as différance, trace, supplement, dissemination, and so forth, all demonstrate the traces of the presence of the absent 'unconditioned' and recognises to what extend such closed systems of knowledge require their legitimacy based on the exclusion of those concepts and forces that do not fit into the calculations of the restricted economy.

In the history of thought there are of course several examples of such restricted economies of thought that assume the possibility of absolute and true knowledge. As mentioned earlier, the

history of metaphysics traditionally falls into this category of thought. Derrida further engaged with other thinkers such as Levi-Strauss, Saussure, Habermas, and Luhmann precisely because he wanted to demonstrate how all-encompassing the economies of their systems of thought were in the process of wanting to exclude traces of 'play', 'noise', 'excess' and 'waste'. Derrida (2001:345) argues that this kind of *mastering of thought* points toward a strategy that amounts to "erasing the excess of nonmeaning (sic) and to falling back into the closure of knowledge."

Derrida, nonetheless, was not the first philosopher who concerned himself with the way in which such strategies of thinking intended to consume and direct our understanding of what it means to be human in a way that made humans into rational, calculating machines. In the section below, the work of Horkheimer and Adorno will be discussed in order to demonstrate how their critique of enlightenment rationality can also be re-defined as a critique against a restricted economy of thought in general. The work of Adorno on the notion of autonomous art will be discussed in particular to show how his concept of art is built on the intention to undermine and escape the restricted economy of enlightenment reason as displayed in the mass culture of industrialised societies. In this reading together of Derrida and Horkheimer & Adorno, a certain similarity is shown to exist between deconstruction and the critical theory of the Frankfurt School based on their critique of exposing the mastering strategies of Enlightenment thinking as a restricted economy of thought.

4.2 The restricted economy of Enlightenment thinking

> *Derrida never met Adorno. But when he was awarded the Adorno Prize he gave a speech in the Paulskirche in Frankfurt, which in its train of thought could not have been closer to Adorno's spirit, right down to the secret twists of Romantic dream motifs.* Habermas (2006:308)

Akin to Derrida's dismantling of the idea of the 'mastering' strategies of the restricted economy which he found in Kant, Horkheimer and Adorno's assessment of the enlightenment's project can also be read as a form of critique against mastery. In fact, the opening lines of their book, *Dialectic of Enlightenment* (2001:1) illustrate that this critique against a restrictive and mastering economy forms the essence of their Enlightenment critique:

> Enlightenment, understood in the widest sense as the advance of thought, has always aimed at liberating human beings from fear and installing them as masters. Yet the wholly enlightened earth is radiant with triumphant calamity. Enlightenment's program was the disenchantment of the world. It wanted to dispel myths, to overthrow fantasy with knowledge.

Horkheimer & Adorno (1) furthermore argue that knowledge acquired by such means is not only excluded from the "influence of wealth and power but would establish man as the master of nature." In *Dialectic of Enlightenm*ent Horkheimer & Adorno offer a genealogy of modern enlightened reason that pursues to demonstrate firstly, that it is through and through a form of instrumental reason, and, secondly, that this formation of reason now structures the dominant practices of social life. As consequences of enlightenment ideals to dispel myth and subjectivity grew stronger, the 'disenchantment' of nature and the rationalisation of reason developed into a universal justification for rational foundations that had as its goal the unification and control of all knowledge (5) (see also discussion on Weber's (1946) use of the term 'disenchantment' in footnote 2 in the Introduction of this study). The pursuits of control in instrumental reason are instigated by the 'fear of the outside' and the drive to be free of all fear:

> Humans believe themselves free of fear when there is no longer anything unknown. This has determined the path of demythologisation, of enlightenment, which equates living with the nonliving as myth had equated the nonliving with the living. (...) Nothing is allowed to remain outside, since the mere idea of the 'outside' is the real source of fear (11),

and

> Enlightenment finally devoured not only symbols but also their successors, universal concepts, and left nothing of metaphysics behind except the abstract fear of the collective from which it had sprung (17).

From the above it is obvious that Horkeimer & Adorno's analysis of the implications of instrumental reason shows how its machine-like operations can be compared to the all-consuming rationalisation of the restricted economy. In the process of wanting to incorporate all

of reality and fear of the unknown into the process of the exchange of production and consumption, enlightenment thinking becomes another mastery of thought in Derrida's sense. Also noticeable in their critique of enlightenment rationality, are the many economic metaphors of labour, utility and production that were used extensively by Horkheimer & Adorno (2) to describe the restricted kind of knowledge that enlightenment rationality generates:

> Technology is the essence of this knowledge. It aims to produce neither concepts nor images, nor the joy of understanding, but method, exploitation of the labour of others, capital. ... Only thought which does violence to itself is hard enough to shatter myths. ... There shall be neither mystery nor any desire to reveal mystery.

and

> For enlightenment, anything which does not conform to the standard of calculability and utility must be viewed with suspicion. (...) Enlightenment is totalitarian (3–4).

Commenting on the kind of thinking that was produced by the instrumentalisation of reason Horkheimer and Adorno (19) complained that:

> Thought is reified as an autonomous, automatic process, aping the machine it has itself produced, so that it can finally be replaced by the machine. Enlightenment pushed aside the classical demand to '*think thinking'*. (...) [m]athematical procedure became a kind of ritual of thought... and made thought into a thing—a tool, to use its own term. (my emphasis).

It is the reification of thought that characterises the rigid nature of the restricted economy that is emphasised by Horkheimer and Adorno. This rigidness in thinking is also recognisable in what Kearney (1984:9) calls the "restrictive nature" of the attempts of formal logic (or the Anglo-American analytical tradition within Philosophy) to "purge philosophical language of its metaphysical or critical dimensions in order to reduce it to the cut-and-dried clarity of formal logic or the common-sense accessibility of ordinary language."[69] On the notion of the

[69] Kearney draws this insight in particular from the work of Herbert Marcuse who in *One Dimensional Man* (1964) had the following to say about the restrictive nature of the reduction of language to formal logic:

exclusivity and primacy of logical laws and the formalisation of language, Horkheimer and Adorno compare the extent to which thought was mechanised and instrumentalised very directly to a restricted economy:

> The technical process, to which the subject has been reified after the eradication of that process from consciousness, is as free from the ambiguous meanings of mythical thought as from meaning altogether, since reason itself has become merely an aid to the *all-encompassing economic apparatus* (23) (my emphasis added).

The formalisation of reason through logical laws amounted for Horkeimer and Adorno to the "expulsion of thought from logic" (23) in the project of unifying all knowledge under the ideals of progress and control. From all the numerous quotes above, it is obvious that the control of instrumental reason represents a form of domination that is all consuming. However, as is the case with Derrida, Horkeimer and Adorno's critique of instrumental reason is not an argument in favour of the abandonment thereof. The dialectic of enlightenment lies in the fact that enlightenment came to 'rescue' humanity from myth and unreason, but at the same time, a kind of economy is at work within the heart of enlightenment, so that the negative side thereof, is the instrumentalisation thereof. This movement of negative dialectic inscribed in the essence of the enlightenment, is driven by the circular and linear mechanisms of the restricted economy.

For Adorno in particular, it was the notion of 'art' that could be a source of overcoming the rigidity and positivism of the restricted economy that threatened to pull everything into its strategies of rationalisation. In art Adorno saw a way of resisting the technological domination and dehumanisation that is characteristic of the one-dimensional character of contemporary

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> The almost masochistic reduction of speech to the humble and common is made into a program… . Thinking (or at least its expression) is not only pressed into the straight-jacket of common usage, but also enjoined not to ask and seek solutions beyond those that are already there… . One might ask what remains of Philosophy? What remains of thinking, intelligence, without any explanation? However, what is not at stake is not the definition of the dignity of philosophy. It is rather the chance of preserving and protecting the right, the *need* to think and to speak in terms other than those of common usage—terms which are meaningful, rational and valid precisely because they are *other* terms (123) (italics in original).

The golden thread in Marcuse's critical theory of society is the exposure of the one-dimensional character of the restricted economy of thought as it displays itself in the "methodologies of behaviourism, positivism and common-sense empiricism" (Kearney 1984:72).

societies. A short diversion on how Adorno conceived of this opening up of the restricted economy through art will be undertaken in the following section.

4.3 Opening the restricted economy: Adorno and autonomous art

In Adorno's (2001) critique of the mass culture industry of society, the following critical line of thought is followed to arrive at his concept of autonomous art. Under the influence of instrumental reason (viewed as the objective form of action which treats the object simply as a means and not as an end in itself) capitalism is rationalized (or economized in the restrictive sense) to the extent that it affects all of life's spheres. The production and consumption of cultural goods are driven by economic and political motives. The pleasures offered by the culture industry are only an illusion and the real motive behind production and consumption is the quest for making more profit and the further exploitation of the masses. The culture industry becomes integrated into capitalist society. Under the domination of capitalism and the uniformity of cultural consumption, everything becomes identical, stereotypical and standardized (thus: following a restricted economy of thought). Adorno's immanent critique of culture exposes the fact that it does not live up to its inherent promises to society. Instead of offering quality entertainment, liberation of the unconscious, diversity, spiritual nourishment and emancipation of institutionalised conformity, as promised, the culture industry becomes another form of economic and structural domination (Geuss 1998).

In agreement with Hegel, Adorno argues that art has a higher vocation that amounts to more than just providing entertainment.[70] Adorno even goes further than Hegel (who has a very positive view of the world) and suggests that art's vocation lies in the fact that it should be "radically critical, negative not affirmative" (300). With the term negative, Adorno means that

[70] In order to understand Adorno's theory regarding the role of art, it is useful to look at the ideas that influenced his concept of art. There are mainly two strands of thought that form the basis for Adorno's thoughts on art. The one strand is associated with Kant's understanding of art which "put great emphasis on the autonomy of art, and the irreducibility of aesthetic judgements to any other kind of judgement" (Geuss 1998:297). This implies that art operated in terms of its own laws which are generated by itself. The claim that art is autonomous implies that art is capable of producing "free-standing forms that are inherently significant and worthwhile" (297).

The second theoretical influence on Adorno's understanding of art is that of Hegel's. Hegel differentiates between 1) art in the everyday sense and 2) art in its "highest form of vocation" (297). So-called everyday art refers to art that is being produced in order to display skillful production, technical abilities and to appear rational in order to give humans pleasure. Art in its highest vocation on the other hand, is seen as a "potential way of reconciling humans to their society as a whole by telling them the truth about society" (297). In a sense this formulation of art can be equated with the role philosophy itself needs to play in society.

the criticism should be an internal form of criticism, meaning that it should direct its criticism towards the internal principles of society. The concept of "negative criticism" does not equate to the notion of art as being a form of propaganda directed to influencing or mobilising people towards political action. The efficiency of propaganda could be measured in terms of whether the propaganda worked or not and standardised forms of what is good forms of propaganda would be set up. Strictly speaking, this would "reduce art's autonomy and subject it to the categories of instrumental thinking" (Geuss 1998:301). Adorno's notion of a radical criticism and negative art suggests that works of art should innately be useless. This argument can be linked to a justification for why a general economy is a kind of critique (see discussion in section 7 of this Chapter). As autonomous art opens up the restricted economy and serves as a form of radical criticism, so general economy (or critique as stricture) is a kind of opening up of restricted forms of critique. A negative art should "present an 'image' (*Bild*) of a kind of meaningfulness and freedom which society promises its members, but does not provide" (301). When art has no meaningful, rational function, it internally violates the principles of the Enlightenment project. Adorno thus ascribes to art a kind of dialectic characteristic. It is as if art should open up the possibility of freedom by offering immanent critic in cultural and social matters. Autonomous art engages in a critique of society by means of its uselessness, which is committed to itself, for itself. In aiming not to change political ideals, it has the possibility to actually do so.

In *Aesthetic Theory* (1984), a posthumously published work, Adorno is concerned not only with such standard aesthetic preoccupations as the function of beauty and sublimity in art, but with the relations between art and society. Duvenage (2003:43) explores this relationship between art and society and comments as follows: "Adorno writes 'Art works are less and more than praxis.' Art is more than praxis because by turning away from it, art denounces the narrow-mindedness and untruth of practical life." The principle of art's autonomy thus provides the pre-conditions for its emancipatory role in society.

Following Hegel's idea that art should reconcile humans to their society by telling them the truth (see footnote 70 of this chapter), Adorno argues that the way in which art can tell the truth and create awareness, lies in the understanding that autonomous art is "by its very nature inherently irritating/stimulating" (Geuss 1998:308). Hence the locus of the rationality of art lies in the *form* of the artwork that can have this effect. This understanding of rationality is distanced from instrumental rationality. Adorno's (1984) concept of *aesthetic rationality* can be viewed as a "critical restatement of Hegel's philosophy of art" (Harrington 2004:165). Following Adorno,

autonomous art exposes truth in a very real and material way, and not in an ideal way as posited in Hegel's philosophy. Adorno's notion of dialectical negativity furthermore challenges Hegel's understanding of the dialectical process, which is driven by the "conception of syndissertation between theses and anti-dissertation" (167). Hegel's dialectic amounts to a form of identity-thinking or restricted economy as quoted by Derrida. For Adorno, autonomous art has the inherent possibility to interrupt this process and thus "has a potential to redeeming reason from reason's instrumental relation to reality" (167). By demanding negation, autonomous art has the potential to liberate the dimensions of the false sense of wellbeing, which the culture industry tries to sell to society.

Against this background the artwork reveals through its structures the irrational, false and instrumental character of the existing world, and by way of aesthetic syndissertation it anticipates the possible reconciled order (Duvenage 2003:43). Hence, Adorno's perspective of autonomous art conceives an alternative form of reason, an *aesthetic rationality* in which the artwork constitutes a model for a 'rational' and emancipated society, suggesting the possibility of a non-oppressive social reconfiguration.

From the discussion above, it can be argued that Adorno's notion of autonomous art suggests a form of thinking (and doing) that simultaneously escapes and opens up the logic of the restricted economy and in its radical negativity, takes on the form of an ultimate kind of 'excess' or 'waste' in Bataille's sense of it. Adorno's notion of art can be seen as a kind of precursor to Derrida's non-concepts like *différance*, trace and supplement that also have this undermining or opening up of the restricted economy in mind (see discussion on the economy of difference later in this chapter). In a sense, the excursion on Adorno's notion of autonomous art served as a kind of bridge to the discussion that follows below on the notion of the general economy and how it is constituted through the movement of *différance*.

The aim of the next section is to describe the operation of the general economy in more detail so that it will become clear that the notion of critique as stricture can also be said to adhere to the general economy of thinking.

5. General economy: still an economy, but a different economy

> *To think is not to get out of the cave; it is not to replace the uncertainty of shadows by the clear-cut outlines of things themselves, the flame's flickering glow for the light of the true Sun. To think is to enter the Labyrinth... . It is to lose oneself amidst the galleries which exist only because we never tire of digging them; to turn round and round at the end of the cul-de-sac whose entrance has been shut off behind us—until, inexplicably this spinning around opens up in the surrounding wall's cracks which offer passage.* (Castoriades 2007: ix)

The argument in favour of a general economy is not a straightforward and easy argument to make. As in the case with complexity thinking, the notion of general economy is often understood to reject the 'logic' of the restricted economy. Nothing can be further from that assumption. Once again, as the recognition of complexity is often (wrongly) used to construe arguments in favour of holism so as to oppose reductionism (see my argument in Chapter 2), it is also wrongly assumed that the notion of general economy stands in direct opposition to a restricted economy. What I will try and demonstrate here is that as argued in Chapter 2, the position in favour of a general theory of complexity is not a rejection of a restricted understanding of complexity but rather a recognition of the limitations of the restricted paradigm. Equally so, the *general economy* is not to be interpreted as a rejection of the restricted economy but instead, a recognition of the limitations thereof.

Moreover, it will be shown that the double movement as found in the notion of différance is at work in the general economy. Built into the conjunction 'general' and 'economy,' is still the term 'economy.' Thus, it signals a *different* economy, but still *an* economy. This can be understood along the same line of argument as given in Chapter 2 where it was argued that all knowledge of complexity is still a reduction of complexity, but a different kind of reduction. Therefore, the notion of *thinking* is also by analogy always bound to some kind of *economy of thought*, seeing that the rejection of the notion of economy (as related to a strategy of thought) would imply chaos, noise, random ideas and incoherence—or in short, madness. The quote by Castoriades above reiterates the same logic as the argument that to think does not mean to get out of the cave, but to learn to enter the labyrinth. In a sense, the general economy of thought is

representative of the movement that characterises this kind of strategy one needs to negotiate the winding ways of the labyrinth.

5.1 Being underway in the labyrinth of the general economy

Returning to Bataille's use of the term general economy, it seems that in essence it suggests a resistance to the restricted economy. Bataille's fascination with 'excess' and wasteful practices resembles such an abandonment of economy.[71] For Bataille, the presence of excess and waste implied the opposite of the restricted economy and a resistance to the forces of the circulation of production and consumption. Read more closely, however, for Bataille the notion of general economy signalled an unrestrained indulgence of unproductive consumption without reserve. On the contrary however, it seems that Derrida's understanding of the general economy and of the notion of excess is more nuanced, bearing in mind that he accuses Bataille of being more Hegelian than Hegel himself (Derrida 2001:319). With that he means, that Bataille's understanding of the general economy is still based on a binary logic in which the dialectical process functions as a negation and syndissertation of binary oppositions. As Derrida 2001:348 writes:

> The Hegelian *Aufhebung* is produced entirely from within discourse, from within the system or the work of signification. A determination is negated and conserved in another determination which reveals the truth from the former. … The *Aufhebung* is included *within* the circle of absolute knowledge, never exceeds its closure, never suspends the totality of discourse, work, meaning, law, etc. Since it never dispels the veiling form of absolute knowledge, even by mainting this form, the Hegelian *Aufhebung* in all its parts belongs to what Bataille calls 'the world of work,'… . The Hegelian *Aufhebung* thus thus belongs to restricted economy. (italics in original text)

[71] See Richardson (1994) for a comprehensive account of Bataille's notion of general economy and the importance of 'expenditure'. In short, it can be argued that contrary to traditional economic theories of society that are based on the notion of 'scarcity' Bataille contended that when anthropological data is taken into an account, it can be argued that the opposite is true:

> Bataille considered that life is essentially energy that strives to expend itself uselessly. As it founded itself in work, so humanity has needed to control this basic principle of life. … From this perspective, classical economics has been based on the assumption that fundamental to human society is the need to protect scarce resources. Bataille questions this assumption by emphasizing the importance of useless consumption and the fact that in at least, some societies, perhaps even all societies prior to capitalism, it was the needs of consumption that were considered primary, not those of accumulation (Richardson 1994:71-72).

In Derrida's explanation of différance, however, concepts do not acquire their meaning in such a closed dialectical process of being related in a manner that places them in an either/or binary opposition. Their meanings are affirmed by a simultaneous *both/and* economy (both restricted and general simultaneously) as well as under the influence of the double bind. This is argued more clearly in his reply to Kearny's (1984:112) question on "what does the whole problematic of the closure of Western 'logocentric' philosophy and the limits of our language tell us about the modern age in which we live"? To which Derrida (1984:113) answers as follows:

> My own conviction is that we must maintain two contradictory affirmations at the same time. On the one hand we affirm the existence of ruptures in history, and on the other we affirm that these ruptures produce gaps or faults (*failles*) in which the most hidden and forgotten archives can emerge and constantly recur and work through history. One must surmount the categorical oppositions of philosophic logic out of fidelity to these conflicting positions of historical discontinuity (rupture) and continuity (repetition), which are neither a pure break with the past nor a pure unfolding or explication of it (Derrida 1984:113).

Derrida's response quoted above is an excellent reformulation of Bataille's notion of the general economy for it captures the idea that a general economy is not the opposite of a restricted economy and does not negate or reject the idea of an 'economy' as a whole. Instead, the notion of 'aneconomy' as used by Derrida in *Given Time: I. Counterfeit Money* (1992:9) would rather be the opposite of and resistance of 'economy'. As it becomes evident in his interpretation of the gift, the *aneconomic* is that which defies being taken up into the economy of exchange and resembles rather the notion of 'excess' as related to Bataille's theory more closely. Derrida uses it to refer to the workings of the gift that opens up and ruptures the closed circularity of the economy:

> One cannot treat the gift, this goes without saying, without treating this relation to economy, even to the money economy. But is not the gift, if there is any, also that which interrupts economy? That which, in suspending economic calculation, no longer gives rise to exchange? That which opens the circle so as to defy reciprocity or symmetry, the common measure, and so as to turn aside the return in view of the no-return? If there is gift, the given of the gift (that which one gives, that

> which is given, the gift as given thing or as act of donation) must not come back to the giving (let us not already say to the subject, to the donor). It must not circulate, it must not be exchanged, it must not in any case be exhausted, as a gift, by the process of exchange, by the movement of circulation of the circle in the form of return to the point of departure. If the figure of the circle is essential to economics, the gift must remain aneconomic. Not that it remains foreign to the circle, but it must keep a relation of foreignness to the circle, a relation without relation of familiar foreignness. It is perhaps in this sense that the gift is impossible. Not impossible but the impossible. The very figure of the impossible.

In Derrida's thinking, it is the notion of the gift (which he calls the 'aneconomic') that resists the circularity of production and exchange. Here it can be seen that for Derrida, the gift (or aneconomic) is the undeconstructable excess that stands outside our systems of meaning and respresents that which is not calculable in terms of the rationalising strategies of the system.

Hence, from the above, it can be argued that Derrida's reformulation of general economy could be interpreted to mean the *middle way* between a restricted economy and aneconomy. For Derrida, general economy implies already the thinking together of restricted economy and the aneconomic and is that kind of concept that exists in the space of a continual tension or double bind that brings both together, but that does not reduce or reconcile the one with the other. As such, it is the displacement of the *Aufhebung* (Derrida 2001:346) or the dialectical relation between the restricted economy and aneconomy. Redefined in terms of the deconstructive strategy's movement, we can say that the general economy is the *displacement*[72] that is born from the deconstruction of the hierarchy between the restricted economy and the aneconomy.[73] In other words, the general economy is not anti-economical, but firmly situated within the structure of economy. As Derrida (1981:27) claims, différance is a concept of economy, since there is no economy without *différance*, it is the most general structure of economy itself.

[72] The first moment of what may be observed as a deconstructive strategy comprises of tracing and identifying a hierarchical opposition. In the second moment, the hierarchy is reversed by uncovering and undoing the rhetorical operation responsible for the ordering of the hierarchy. The third movement is made as the displacement whereby it is shown that a new deferred and different meaning emerges due to the unresolved tension that exists in relationship between the reversed concepts (cf. Culler 1989:88).

[73] It is important to note that this interpretation that I represent here, differs markedly from the interpretations that Hurst (2010) and Human (2011) put forward for explaining the general economy and its relation to the restricted economy.

The notion of the *aneconomic* is a recognition of the *excess* that makes the general economy work by means of opening it up to the logic of différance that continually works against the closure of knowledge. Thus, from the above it can be deduced that 1) the notion of general economy is not a rejection of the restricted economy, 2) general economy is a way of thinking together the restricted economy and the *aneconomic* (excess) in a productive tension (or force field) and 3) general economy operates within the movement of différance and the double bind (the nature of the double bind was discussed in detail in chapter 3).

Point 1) was discussed in detail at the beginning of this section. Our focus will now be directed to the discussion of points 2) and 3) in what follows.

5.2 Thinking the general economy as displacement

> But the work of writing and the economy of différance will not be dominated by this classical conceptuality, this ontology, or this epistemology. On the contrary, these furnish its hidden premises. Différance does not resist appropriation, it does not impose an exterior limit upon it. Differance began by broaching alienation and it ends by leaving reappropriation breached. Until death. Death is the movement of différance to the extent that that movement is necessarily finite. This means that différance makes the opposition of presence and absence possible. Without the possibility of différance, the desire of presence as such would not find its breathing space. That means by the same token that this desire carries in itself the destiny of non-satisfaction. Différance produces what it forbids. Makes possible the very thing that it makes impossible (Derrida 1976:143).

The argument that we should "maintain two contradictory affirmations at the same time" lies at the heart of the general economy as interpreted by Derrida. It is even more radical than Bataille's understanding thereof, which mainly suggests that a general economy is characterised by an excess of expenditure that cannot be incorporated into the restricted, closed circulation of production. Derrida's logic of 'both/and' instead of 'either/or' (Bernstein 1991) is an important starting point for thinking about the general economy re-defined as that which is situated in the tension (force field) of the new displaced understanding thereof.

In order to understand the movement of this new 'both/and' economy, a firm grasp of the notion of *différance* is necessary, considering the fact that such a way of thinking is often under fire for breaching of the law of the excluded middle (either A or not-A). In what follows, I aim to show that what Derrida means with his thinking of two contradictory affirmations together, is not a breach of the law, but read together with his notion of the double bind that informs the non-concept of *différance*, an expansion of his insistence that différance *does not* operate with the same logic (mode of reasoning) as the restrictive economy that structures the organisation of the binary paradigm. As Hurst (2010:234) argues, the (restricted) binary paradigm assumes that concepts are determined "within a closed system of other determined concepts" in which the meaning of concepts can be understood to be isolated, fixed and arranged in "established orders of priority … thereby constructing problems of manageable compass that are reducible to coherent theoretical frameworks and measures" (234). For Derrida, however, the economy that organises his system of meaning does not produce "unity of the signifying form" (1988:10) (which is ultimately a restrictive economy), but moves in such a way to undermine and undo all forms of unity, fixed meaning or completeness (thus, coinciding with the general economy). He writes extensively on this in his 'Afterward' in *Limited Inc.* (1988) from where the following quotes are taken:

> First of all, I never proposed "a kind of 'all or nothing' choice between pure realization of self-presence and complete freeplay or undecidability."
>
> Above all, no completeness is possible for undecidability. This, I have often stated, is to be understood in a variety of senses. For the sake of schematizing, at least three meanings can be distinguished:
>
> 1. One of them determines in a manner that is still too *anti*dialectical, hence too dialectical, that which resists binarity or even triplicity (see in particular *Dissemination*).
>
> 2. The other defines, still within the order of the calculable, the limits of decidability, of calculability or of formalizable completeness.
>
> 3. The third remains *heterogeneous* both to the dialectic and to the calculable. In accordance with what is only ostensibly a paradox, this particular undecidable opens the field of decision or of decidability (115–116).

When Derrida refers to an 'all or nothing' choice between 'freeplay' and 'self-presence' he is of course pointing to the logic of the excluded middle and contends that such a choice would succumb to a binary logic on the one hand, and on the other, to the understanding that both meanings of the two differing concepts can be isolated and fixed. Thus, he explains that the movement of the double bind cannot be contained by a 'binarity' (such as a dialectic) or even a triplicity, but adheres to a logic that recognises a 'plurivocity' (Derrida 1976:74) of meanings. The term 'heterogenous' in this quote refers to Bataille' use of the word and points toward the irreducibility of meaning.[74]

Commenting once again on the nature of the oppositional logic and its relation to the general economy, Derrida (1988:117) argues as follows:

> To this oppositional logic, which is necessarily, legitimately, a logic of 'all or nothing' and without which the distinction and the limits of a concept would have no chance, I oppose nothing, least of all a logic of *approximation* [*à peu près*], a simple empiricism of difference in degree; rather I add a supplementary complication that calls for other concepts, for other thoughts beyond the concept and another form of 'general theory,' or rather another discourse, another 'logic' that accounts for the impossibility of concluding such a 'general theory.'
> This other discourse doubtless takes into account the conditions of this classical and binary logic, but it no longer depends entirely upon it. If the proponents of binary opposition think that the 'ideal purity' to which they are obliged to appeal reveals itself to be 'illusory,' as you say, then they are obliged to account for this fact. They must transform concepts, construct a different 'logic,' a different 'general theory,' perhaps even a discourse that, more powerful than this logic, will be able to account for it and reinscribe its possibility. This is what I try to do. I try to show not only that the ideal purity of the distinctions proposed (by Searle, for example) is inaccessible, but also that its practice would necessitate excluding certain essential traits of what it claims to explain or describe and yet cannot integrate into the

[74] The word 'heterogenous' was used by Bataille to characterize "all those elements that resist assimilation to the bourgeois form of life and the routines of everyday life, just as they evade the methodical grasp of the sciences" (Habermas 1984a:80). For more detail on Bataille's interpretation of the notion 'heterogeneity' see Bataille (1988) and Richardson (1994:37-41).

‘general theory.’

The key for understanding Derrida’s notion of the ‘general theory’ as mentioned here above, lies not in inventing a logic that could manage to overcome the law of the excluded middle, but in a ‘logic’ that recognises that a binary logic can only work *as binaries* when the concepts are taken to be ‘still within the limits of the calculable… or formal completeness.’ A recognition of the incompleteness and openness of the meaning of concepts cannot work in such a binary opposition. Instead, and this is the point that Derrida makes with his ‘experience of différance’, in a general theory of meaning, concepts are “heterogeneous to the philosophical concept of the concept” and are concepts that “mark(s) both the possibility and the limit of all idealisation and hence of all conceptualisation” (118). One of the aims of the deconstructive strategy is the undoing of the purity and unity of concepts. Moreover, as Derrida (1984:110) explains what he means with his non-concepts, the “non-concept cannot be defined in terms of oppositional predicates; it is neither *this* nor *that*; but rather this *and* that (e.g. the act of differing and of deferring) without being reducible to a dialectic logic either.” (italics in original text).

Derrida’s critique of Saussure’s theory of signs offers us some more insight into just how concepts are redefined as being impure and how meaning remains disseminated, unbound and not calculable.

5.3 The economy of difference

The following discussion on the notion of difference and the underlying general ‘logic’ that informs an economy of difference will be guided by Cilliers’ (2010a) interpretation thereof for whom Derrida’s deconstruction of Saussure’s theory of the sign[75,76] provides us with a key insight into Derrida’s understanding of the notion of the concept. The main thrust of the argument unfolds as follows:

For Saussure, linguistic components in a system of language are assigned meaning not by means of rules, but by their difference in relationship to other components in the system. Thus, meaning is not inscribed because of some essential characteristic or *a priori* identity of a sign, instead, meaning is the result of “the relationship between all the signs in the system” (Cilliers

[75] For a detailed discussion on Derrida’s deconstruction of Saussure’s theory of signs, see Cilliers 1998:38-44.

[76] See Saussure (1974) for his theory on the structure of the sign.

2010:56). In Saussure's (1974:67-69) system the relationship between the signifier and the signified is an arbitrary one and it exists as a convention in language and forms a closed unit of representation. Therefore, according to Saussure, the interaction between different signs can be described as stable. The meaning determined by its stable set of relationships of difference resembles a closed system of meaning (Cilliers 1998:43). In principle it means that the relations of difference are still grounded by a binary logic where the meanings of signs can be closed and stable. The difference can be seen to be one-dimensional and calculable.

Derrida's critique of Saussure's description of the sign[77] is directed at the closed nature of the sign and its tendency to operate within the tradition of Western philosophy that he calls the 'metaphysics of presence' (Derrida 1976:23). For Derrida, the Western tradition of philosophy assigns principal value to presence (143), and determines the notion of being exactly in these terms. The metaphysics of presence consequently describes the "conceptual (but also practical) conditions of possibility within which the thought, texts and histories of this tradition emerge" (Wortham 2010:103). The primacy of presence is expressed in a number of ways: by the assertion that the sign has two components, the signifier and the signified, of which the signified is mental. Thus, through the connection to the signified, the sign is always present to the speaker when it is used regardless of the fact that its meaning is a result of the organisation of the system of differences. In addition, the subject is present to itself in thought or speech, seeing that speech is closer to the mind and meaning can be established without mediation. As a result the primacy of presence articulates and advances itself in terms of a series of (binary) oppositions: speech is contrasted to writing (where writing is assumed a copy of speech and not a reliable source of meaning, seeing that the speaker is absent and cannot confirm that the reader interprets the correct meaning), presence is primary to absence, masculine is more significant than feminine, work is better than play, inside privileged to outside and so forth" (Wortham 2010:104). Through the movement of deconstruction, Derrida demonstrates that the historically determined necessity of privileging one term above another is in fact only a historical necessity and not a logical necessity (Gross 1986:33).

Derrida, thus, recasts these differences between signs not in terms of a binary opposition as discussed above, but they are redefined as "originary and constitutive" (Wortham 2010:104). The notion of différance and all its related neologisms such as trace, supplement, play, iterability and dissemination are put to work to undermine the binary opposition of the logocentric logic. This is done by a deconstruction of Saussure's notion of the sign and breaking

[77] Cf. in particular Derrida 1976:27–72

it down into a decentred collection of signifiers. By arguing that every signified can also act as a signifier that is open for re-interpretation in terms of its difference in the system of meaning, all meaning is a result of the "network of relationships framed in a certain way" (Cilliers 2010:59). The deconstructed sign is an "entity without any positive content, (b)ecause it is constituted by nothing more than relationships, it consists only of traces" (Cilliers 1998:44). Hence, Saussure's representational theory of meaning is replaced by a relational theory of meaning. This shift can be compared to the shift that takes place when an atomistic theory of science is replaced by a systems theory of science (see Chapter 1 in this study). Thus, it is only in a vacuum, for example, where A could be the absolute binary opposition of non-A, but since all meaning arises through a network of relations of differences, the notion 'difference' cannot be equated to mean 'opposition' as Cilliers (2010:59) argues:

> To say that A differs from B is not to say that B is not-A. There may be a lot of similarities between A and B, they may differ only in some small aspect. As a matter of fact, there has to be at least some common element between them. Furthermore, is it possible to even talk about the difference between only two things? As long as we deal with just the two things, the difference between them is boundless, or to put it differently, it would not be possible to give content to the difference between A and B, if the two are the only entities taken into consideration.

From the above it is evident that since the meaning of a sign is constituted by the play of differences in a system of signifiers, there is no binding signified that prescribes some absolute, present meaning to a sign. The notion of presence is undermined and the sign no longer stands in the place of an absent signified, but is always already a trace through différance of another trace, the differences between two signifiers.[78] Meaning is thus the result of "différance and dissemination, through a complex play of signifying traces" (Derrida 1984:125). Meaning arises because of the necessary constraints that are exerted onto the signifiers within a specific system in a specific moment in time.

[78] In explaining what the notion of *trace* means, Derrida (1976:60) writes:

> The trace is not only the disappearance of origin-within the discourse that we sustain and according to the path that we follow it means that the origin did not even disappear, that it was never constituted except reciprocally by a nonorigin, the trace, which thus becomes the origin of origin.

Or in other words as emphasised by Derrida (1976:61), signs and concepts can only differ from one another in terms of the traces that constitute them, and not in terms of absolute complete units:

> Without a retention in the minimal unit of temporal experience, without a trace retaining the other as other in the same, no difference would do its work and no meaning would appear. It is not the question of a constituted difference here, but rather, before all determination of the content, of pure movement which produces differences. The (*pure*) *trace is différance* (italics in original text).

The meaning of a sign at a specific point in the history of the system is, therefore, "that which satisfies all the current constraints placed on it through all its relationships in the current context, i.e. as determined by the current boundary (59)." In other words, there is no fixed, present and complete meaning of a sign or concept possible. For concepts to differ in a binary logic from each other, it would imply that the process of differing would have to mirror and track all the ways in all the moments in time in which they differ from each other to pose as being the total opposite of the sign. And this would be an impossible calculation to undertake. (This argument is similar to the argument that to model complexity in its complexity, the model would have to be as complex as the system it is modelling. See Chapter 2 for a discussion on this matter).

Therefore, when Derrida speaks of the fact that one can only speak of difference in terms of some similarity and difference at the same time, it refers to the series of synchronic and diachronic differences that are incorporated through time and space within the structure of the new deconstructed sign extended through all the temporal and special positions of the sign. This is argued as follows:

> The play of differences supposes, in effect, syntheses and referrals which forbid at any moment, or in any sense, that a simple element be *present* in and of itself, referring only to itself. Whether in the order of spoken or written discourse, no element can function as a sign without referring to another element which itself is not simply present. This interweaving results in each 'element'—phoneme or grapheme—

> being constituted on the basis of the trace within it of the other elements of the chain or system (Derrida 1981:26).

Hence, there can be no binary oppositional logic and the general economy embraces this irreducible heterogeneous production of meaning of simultaneous difference (spatial aspects) and deferral (temporal aspects) that lies at the heart of différance. The double bind at work in différance is elucidated pertinently by Gross (1986:33) when she argues that "(d)ifférance is the difference between difference and identity; it is both their condition and surplus, their grounds of possibility and their unacceptable, transgressive rupturing limit." Hence, once more the logic of the 'and' is at work as described in Chapter 3—simultaneously cutting, binding and weaving within the tension of the force field.

Read in this double way of writing, différance can be said to be the "condition of logocentrism, which seeks to deny or disavow its subversive play; yet différance at each moment also threatens to undermine or exceed logocentrism" (33). By analogy, it can thus also be argued that the relation between the restricted and the general economy is such that the general economy is the condition of the restricted economy; yet the general economy at each moment also threatens to undermine or exceed the restricted economy. And in this sense, the general economy is not a rejection or binary opposition of the restricted economy, but the both/and *displacement* of the differences between them that are suspended in a dynamic tension or force field of interaction that creates a kind of thinking that is cognisant of that which can open the restricted economy to the reality of complexity.

6. Complex thinking and the movement of general economy

Earlier in this chapter it was mentioned that Derrida was influenced profoundly by the work of Bataille. Edgar Morin is another French intellectual who also read the work of Bataille and used many of his concepts to give a language to his thinking on the notion of complexity. In an essay entitled *Restricted complexity, General complexity* (2007), Morin puts forward an argument in which he distinguishes between two ways of engaging with complexity: the restricted way of thinking that claims that complexity can by quantified, calculated and modelled with absolute certainty and the general understanding of complexity that remains open to those features of complex systems that defy predictability, quantifiability and absolute knowledge thereof (see Chapters 1 and 2 for a more detailed discussion on this).

In this article Morin makes the same argument as Derrida, and remains adamant that the notion of general complexity does not reject or deny a restricted understanding of complexity, but proposes a way of thinking that is mindful of the generative nature of complexity, the organisational relationships that constitute complexity and the incompressibility of complexity. On the contrary, the same cannot be said of the restricted approach. Morin (2007:27) argues:

> Unfortunately, restricted complexity rejects generalised complexity, which seems to the former as pure chattering, pure philosophy. It rejects it because restricted complexity did not make the epistemological and paradigmatic revolution which complexity obliges.

Furthermore, Morin argues that the restricted view of complexity accounted for important advances in developing new modelling techniques in its aim to formalise, standardise and quantify complexity, but "one still remains within the epistemology of classical science" (10).

> When one searches for the 'laws of complexity', one still attaches complexity as a kind of wagon behind the truth locomotive, that which produces laws. A hybrid was formed between the principles of traditional science and the advances toward its hereafter. To some extent, one recognises complexity, but by decomplexifying it (10).

Clearly Morin equates the notion of 'epistemology' here with the idea of economy and extends it to mean a certain strategy of thinking. When he speaks of general complexity, he mentions that "an epistemological rethinking," is required in order to "impose a principle of distinction and conjunction" (10). Hence, for Morin the notion of general complexity implies the simultaneous cutting and joining as mentioned in Chapter 3 when we spoke about the notion of critique as stricture. His notion of general complexity overlaps with Derrida's understanding thereof, although they use different languages to speak about it. Morin gives a name to this kind of thinking that is mindful of general complexity and calls it 'complex thinking' (1974, 2007). When read together with Derrida, one notices that Morin's concept of complex thinking matches Derrida's idea of *différance*.

Morin (1974) goes even further and suggests that the general economy of complexity works within a different economy than that of traditional theories of formal logic (here he is referring to the formal study of the discipline of logic as proposed by Copi (1968)). He calls it 'the logic

of complexity' (1974:573) and locked up in this concept, is the notion that the general economy of complexity is not the opposite of logic or a non-logic, but in the same way that the general economy is still an economy but a different economy to the restricted economy, the logic of complexity is not a call for rejecting logic, but a call to expand it and open it up to the heterogeneity of complexity:

> The logic of complexity is ill at ease with the rigid frameworks and principles of our logic. It is characterised, as Elsasser puts it, by 'the absence of pervasive rigid categories'. … In it most essential moments it escapes the binary logic of all or nothing (573).

Reflecting on what Morin refers to as "complex thinking" in his description of generalised complexity, he argues that the art of thinking lies not in describing opposites when making knowledge claims, but in thinking both at the same time. It is in this way of thinking that "the dialogic is not the response to these paradoxes, but the means of facing them" (Morin 2007:20). By considering "antagonistic, contradictory, and at the same time complementary" (Morin 2008:33) approaches, the 'logic of complexity' takes on a paradoxical character. This statement (of thinking antagonistic, contradictory concepts together) is often interpreted to suggest a breaching of the law of the excluded middle, cast in the light of the double bind and différance that is inscribed in the concept 'general' as argued above, it would become clear that also for Morin, his notion of 'logic of complexity' does not conform to a binary and restrictive economy.

Influenced by this double reading of Derrida and Morin, it is possible to interpret the idea of 'complex thinking' as the embodiment of both *différance* and the *double bind*. It alludes to a kind of thinking that takes place in the force field where the tension between differences are upheld, brought together and kept apart at the same time. Thus, the logic of complexity allows us to have our truths, our knowledge and models of the world, but it challenges us to know the limits thereof and to re-evaluate it every time we use it and to re-invent it if necessary (cf. Cilliers 2005).

7. The economy of critique as stricture

Drawing on the above discussion concerning the relation between the restricted and general economy and the implications these have for our thought strategies, an argument can finally be put forward that critique as stricture or constellation (as discussed in Chapter 3), operates within the currency of the general economy.

I want to suggest that we should understand the notion of critique as stricture and constellation not as something that we can apply as scientific method, although the tools for forging such a method is implied in it as we saw with Kant and the whole critical project, but rather as a kind of thought-strategy when it comes down to negotiating the labyrinth of different epistemologies. This **conceptual shift** allows us to see the notion of critique as a *way of thinking* or a *mode of critical practice* that assists the navigator in her attempts to dare to sail into and beyond the gap of binary oppositions. When our thought strategy becomes a critical one that surpasses the rupture/reconcilliation binary logic, the metaphors of critique as stricture and constellation become the limits in which reason can apply its cognitive capacities to know.

The role of critique is thus changed from providing a measure or standard against which to judge norms and notions of truth, to that of becoming a resisting force that undermines and frustrates totalising projects and calls in question the binary oppositions through which knowledge about reality is mastered. In this manner critique becomes an intervention, a resistance to conformity, a tool that can bring the totalising strategies into crisis. It disrupts secure foundations, interrupts the functioning of discourses, not to substitute them with more accurate alternative epistemes, but to reveal the complexity, contingency and violence of our ‘regimes of truth’ (Foucault 1979). Critique may thereby be understood as an exercise (or practice) of exposing constellations of reified binary oppositions and mastering narratives.

Moreover, critique as stricture cannot be an absolute negative critique in the sense that it just resists any kind of affirmation blindly. It aligns itself to some positive affirmations whilst simultaneously knowing that the moment of affirmation also implies the transgression thereof. Its scepticism towards a blind faith in the power of reason and totalising discourses that suggest a unity of science or reification of knowledge on the one hand, is mirrored by the same measure of scepticism towards total negativity that amounts to a irresponsible kind of nihilism or relativism. By being mindful of the fact that the in-betwix is a constellation of clustered and juxtaposed differences and irreducible propositions and principles, our way of thinking is

challenged to change in such a way that it resists total reduction and total reconciliation simultaneously. In the name of this simulated kind of thinking, the affirmation of a critique that has the capability to rupture and reconcile at once is found.

Not only does the logic of complexity join seemingly unrelated paradigms of thought, but it simultaneously also represents a gap between different traditions. I want to propose that the double bind of the gap and the bringing together of seemingly contradictory traditions causes a rupture in the dilemma philosophy faces today. From this rupture the possibility of interruption is born where a liminal space is opened in which all orientations are challenged to critically negotiate new ways of thinking and knowing. In this space, the logic of complexity can be seen as a "mode of philosophy" or a kind of thinking that could negotiate a way through the dilemma of 'the end of philosophy' (Badiou 2006:33). To use the language of speech-act theory, the logic of complexity acts not as a constative, but as a performative—as "a kind of thinking that does the impossible" (Wolfe 1998:126). The logic of complexity takes on a dynamic character that has the ability to remain alive whilst operating in the tension of the paradoxical stricture. As a mode of thinking and a mode of practice, it at once becomes a relentless undercurrent of interruption that never rests. The interruption is characterised by the recognition of the limitations that each different orientation of thought has to offer.

At the same time, complex thinking and the general economy of critique do not intend to institute a new golden standard or received view, but remains sceptical and critical of its own position. In the conceptual opening that is generated by the performative tension in which the logic of complexity negotiates between crude reductionism and totalising holism or stringent forms of rule-making and interpretation, a crack emerges from where dichotomies are destabilised and exposed.

From this position of interruption a gap opens up from where new possibilities of critique can emerge. Moreover, I would like to argue that this position of interruption offers us a way through discourses that pronounce "the end of science" (Horgan 1996) and philosophy. We are not left at some dead end where all scientific and philosophic endeavours or the nature of reality is just a construction of the human mind with no relation to an outside. An understanding of the relatedness of the different orientations affords us the possibility to engage in philosophic practise that amounts to an endeavour that is neither absolute, nor eternal, but open to excess, innovation and creativity. From this point of view, critique as stricture becomes a mode of 'being underway' in Heidegger's sense, of questioning and thinking. The movement of the

general economy that is inscribed within the critical imperative inherent in the complexity approach teaches us how to "learn thinking" by "radically unlearning what thinking has been traditionally," so that we do not "deceive ourselves and rashly bypass the pressing questions" (Heidegger 1976:8). In a more existential sense, the general economy of critique can be understood to simultaneously mean a "critique–of" (being a strategy of questioning) as well as to mean "critique–as" (becoming a mode of critical practice). It is this double understanding of critique that allows us a kind of thinking that is more thoughtful to the questions of what it means to be human in a complex world. And this is an important asset, because, to end in the words of Heidegger (1976) who argued that our modes of thinking characterise the nature of what it means to be human and the more thoughtless we are, the less human we are. Complex thinking and its critical imperative allow us to be more thoughtful and open to the call of questions relating to injustice, exploitation and different forms of oppression. Hidden in the heart of complex thinking is the possibility of thinking differently about what it means to be human in a world that is changing more rapidly than we can control.

8. Conclusion

This chapter explored the nature of the 'problem of thinking' in terms of the dichotomies that emerge in the process of searching for an appropriate mode of thinking to deal with the study of complexity. It was argued that the problem of thinking lies in the predicament that we cannot do away with the traditional analytical tools of science as presented by the Newtonian paradigm. At the same time, using those tools imply a severe reduction of complexity. Discarding them is not an option, hence we are challenged to find a mode of thinking that allows us to keep the conceptual tools of the analytic tradition, but at the same time allows us to question and expand on the limitations that they pose. This possibility was explored in terms of the distinction between the restricted and general economy as developed by Bataille originally and appropriated by Derrida and Morin eventually.

The characteristics of what the notion 'economy' means in terms of Bataille' and Derrida's interpretation thereof were discussed. It was suggested that the notion of economy coincides with the processes of production and exchange that take place as found in knowledge generating strategies. The restricted economy was explained in detail to mean more specifically that kind of economy that strives to reduce, calculate and formalise all the resources in its system of thought so as to decrease excess and expenditure. It was argued that enlightenment rationality served as an excellent example of the operations of the restricted economy. Consequently Kant's

transcendental logic was examined to illustrate how it can be characterised as a restricted economy. A discussion of Horkheimer & Adorno's enlightenment critique followed as an illustration of how their critical theory of society also engaged with the effects and implications of the restricted economy. It was argued that Adorno's conception of 'autonomous art' aimed to provide some resistance against the limiting effects of economisation.

The chapter continued by discussing the features typifying the general economy in detail. It was argued that the notion of general economy is not the binary opposition of restricted economy, but rather an expanded and supplemented configuration of the restricted economy. The binary opposition of restricted economy would be an un-restricted aneconomy, stripped from all processes of meaning making and thriving in chaos and randomness. This cannot be said of the general economy, which still operates within the structure of the economy, but is a different economy. It was demonstrated how the notion of general economy is better thematised in its relation to différance and the stricture of the double bind which allows a kind of thinking that can think in a both/and manner. The argument that such a mode of thinking falls prey to the law of non-contradiction was countered by an argument on how difference in a system of meaning emerges. Following Derrida's critique of Saussure, it was argued that when différance is at work, concepts lose their ability to be closed off units or signs in which the meaning is present to the sign. The general economy of difference undermines such an understanding of concepts and breaks the meaning of the concept open to the play of différance. As a result of the fact that meaning can only emerge as the dynamic differing and deferring of meaning amongst a network of traces, concepts cannot differ from one another in binary fashion. Hence, the both/and mode of thinking is justified and posed to belong to the operation of the general economy.

The chapter concluded that Morin's appropriation of general economy to mean general complexity coincides with Derrida's interpretation of general economy. Morin moreover suggests that general complexity is best studied with a mode of thinking that he calls 'complex thinking'. It is a kind of thinking that is defined by the operations of the general economy and allows one to think restricted and general complexity together. Finally, it was argued that the expanded concept of critique as stricture could also be considered to operate with the logic of general economy. Consequently, critique as stricture takes on the role of being at once a *form of questioning* of the limitations of inherited thought structures, and is ascribed the role of *being a strategy of thinking* that is critically *underway* in Heidegger's sense. This double nature of critique enables us to face our 'problems of thinking' by allowing us to be more thoughtful and open to the call of complexity in the world.

The next chapter will discuss how ‘complex thinking’ and the inherent critical imperative as argued above, can be embodied more concretely in practical terms. As a kind of being underway, complex thinking and critique as stricture combines into an experience of complexity that is very sensitive to what it means to be human in a world in which the restricted economy still seems to be the dominating strategy of thinking in the quest for managing and controlling the problems of the world. The possibility of creating the notion of ‘critical complexity’ will be explored in more detail in Chapter 5.

PART III: EXPERIENCING COMPLEXITY

CHAPTER 5
CRITICAL COMPLEXITY: THE NORMATIVE TURN

1. Introduction

> *A critical theory prepared to fully embrace its romantic self-understanding, would be a critical theory more capable of responding to its own time, and more attuned to the needs of its time. Is there anything more urgent today than to resist the sense that our possibilities are contracting or that they are exhausted? And is there anything more important for critical theory to do, any way to be more receptive to its calling, than to once again take on the task of disclosing alternative possibilities, possibilities through which we might recapture the promise of the future—through wich we might recapture the future as promise?*
> Kompridis 2006a:280.

Throughout the preceding chapters, it was argued that the problem of complexity reveals the *limits* of our inherited ways of making knowledge claims about the nature of the world and our methods of modelling the causal relations we observe in it. It was demonstrated that the insights of studying the characteristics of complex phenomena, as developed in the natural sciences, have important implications for contemporary philosophical problems. A link was made between a general theory of complexity and the postmetaphysical philosophy as portrayed particularly in the thinking of Derrida's notion of deconstruction.

Furthermore, the study proposed a certain progression in the process of encountering complexity. Part I focussed on providing an overview of complexity and its genealogy through the various stages of development and the engagement thereof remained on a descriptive level and we could pose the problem as a being a *problem of observation*. Part II shifted the focus from studying the notion of complexity as such, to a meta-position where the implications of acknowledging complexity formed the lens through which we could look at other problems and issues related to the philosophical aspects thereof. It was argued that the acknowledgement of complexity leads to a certain way of thinking and engaging with the world to such an extent that

we could formulate a complexity approach that eventually panned out into a mode of thinking that we called 'complex thinking.' The nature of the problem was located on the level of being a *problem of thinking*. In this chapter, the level of the problem of dealing with complexity will be transferred to the level of being a problem of experiencing complexity. This encounter challenges us to reflect critically on our mode of being in the world, which will be argued here, is inevitably a normative problem.

This chapter sets out from the convergence of reading the concept of complexity together with Kant, Derrida, Adorno (in a lesser sense), Cilliers and Morin on the problem of being able to think differently about the notion of critique. I am suggesting that the juncture between complex thinking and the critical impetus that was uncovered in the logic of critique as stricture, presents a nexus whereby this 'brand' of complexity can be called 'critical complexity' as invented by Cilliers (Preiser & Cilliers 2010, Woermann & Cilliers 2012). This chapter aims to give more substantive content to the notion of critical complexity. It will be argued that critical complexity introduces the radicalisation of a general theory of complexity as discussed in the previous chapters, seeing that it presents the *normative turn* (Fischer-Lescano 2012) of a general theory of complexity that is based on the lived experience of complexity in the world. Not only does it suggest a paradoxical conceptual space in which we can explore the possible ways of resisting reified and totalising thought strategies, but it also considers how to move from a mere abstract kind of thinking to the pragmatics of what it means to encounter complexity in the world. Moreover, critical complexity also radicalises the concept of critique, so that the stricture of critique becomes a self-critical force that is always already present in all our interventions of resistance. A reflective and normative turn is thus also introduced in the notion of critique. It will be argued that the role of critique will change to become a form or mode of *reflective disclosure* as opposed to being a kind of unmasking of reductive or reified ways of thinking.

The chapter starts by re-defining complexity as a condition as opposed to a problem. This is done by elaborating on the argument made by Allenby & Sarewitz (2011) in this respect. The chapter then introduces the notion of critical complexity in the light of its invention by Cilliers. Moreover, it is argued that the 'project' of critical complexity needs some clear markers by which it can delineate itself from other critical positions. In aid of this assertion the chapter introduces three imperatives or (normative) regulating principles that could give some substantive content to the process of encountering complexity in the world. These imperatives are called 1) the Provisional Imperative, 2) the Critical Reflexive Imperative and 3) the World-disclosing Imperative. The latter draws on Heidegger's (1962) idea of 'world-disclosure' and its

re-appropriation thereof by Kompridis (2006a, 2006b). The chapter concludes with an argument that critical complexity offers us a way with which to think together different paradigms without reducing them to one another or dismissing one for the other, so that we can be in a position to explore different and novel ways of being in a world marked by the condition of complexity.

2. From the problem of complexity to the condition of complexity

The argument that the problem of complexity should not only be studied in terms of the conceptual and empirical challenges that it poses for our knowledge generating and thought strategies is built on the understanding that it is our experience of encountering complexity in the world—on a social, political and institutional level—that remains the most difficult challenge to respond to. This section will discuss the notion that real-life complexity cannot be thought of as problem to be solved, instead, it should be thought of as an unsolvable condition as argued by Allenby & Sarewitz (2011). This understanding of complexity departs from the modernist idea that problems are things to be solved on our way to Utopia. By re-casting the problem of complexity as the condition in which we find ourselves on this planet, we are challenged to imagine different ways of coping with it in light of its inescapability. Complexity as condition is not something to be solved, but calls us to re-think what it means to be human in relation to all other aspects of our existence. It this sense, it inaugurates a normative dimension into our encounter with complexity and suggests that we remain radically critical about all attempts to solve complexity with a master plan or one theory-of-everything. The argument of Allenby and Sarewitz (2011) that we should reconfigure our understanding of complexity as a *problem* to that of being a *condition* will be explained by delineating their argument in more detail.

In their book *The Techno-Human Condition*, Allenby & Sarewitz (2011) explains that the notion of complexity is inextricably linked with our lived experiences thereof in the world. The book as such is a critique of the notion of a strict or reductionist understanding of trans-humanism and the idea that humans can be enhanced technologically to the extent that we can become 'better' humans.[79] The current study cannot engage with this argument in more detail here, although it is definitely relevant to the argument of how far we will allow ourselves to be influenced by new developments in the technological sphere, which in itself has many challenging ethical considerations to engage with. More relevant to this study however, is their

[79] For an in-depth account in favour of trans-humanism see Kurzweil, R. 2000. *The Age of Spiritual Machines*. New York: Penguin.

argument that we are living in a world that is marked by what they call 'Level III complexity.' This level of complexity is distinguished from 'Level I' and 'Level II' complexity. A short excursion into following their argument on the "taxonomy of levels of technological functioning" (36) will serve to prove the relevance of the importance of Level III complexity for our argument here concerning the redefinition of complexity as condition, which can be traced back to the experience of complexity in our everyday lives.

According to Allenby & Sarewitz (2011), Level I complexity refers to the way in which technological devices are designed with the aim to serve the notion of instrumental rationality. As they argue, "technologies are meant to do things, to accomplish particular goals or tasks" (36). What is important to note however, is that these are "cause-and-effect-machines, linking human intent to a particular consequence via the embedded function of the technology." The argument suggests further that all technologies however, inhabit two rather independent realities at once, the first reality is that of "the immediate effectiveness of the technology itself as it is used by those trying to accomplish something" (37). The other reality is that of "systemic complexity" (37) which constitutes Level II complexity. Level II is characterised by the social, political and economical systems in which the Level I technologies are embedded. The example they use is that of a jet airplane. The mechanism of the plane itself and the way it is designed and built fall into the category of Level I complexity. It is marked by a 'bounded functionality' with clear linear causal motives and purposes: namely to fly people from A to B in a manner that is effective and safe—that is the reality of its immediate effectiveness. The other reality, which is systemic, includes the sub-systems in which they are embedded such as the "airline corporations, the government security apparatus as applied to air travel, and market capitalism in route pricing, to name a few—that, acting together, create emergent behaviour that cannot be predicted from the behaviour of individual, Level I aircraft units." (38). The functionality of the aircraft is now less bounded and in fact it is locked into the support and regulatory systems that allow it to be functional and operational. It recognises the fact that technologies "do not act in isolation; they are connected to other technologies, and to social and cultural patterns, institutions, activities, and phenomena that may interact in ways that no one is able to predict or control" (39).

At Level I there is a specific goal-directedness detectable and traceable in the function of the technological artefact. At Level II, the goals may still be visible, but they are embedded in a number of different systems, which have many different and varying goals and the success of a certain technological artefact is measured by looking at how many of these multiple goals can

be attained. At Level III, however, there are no unifying goals that can be kept apart (66). Here complexity is described in terms of the unintended outcomes of Level II complexity where technologies surprise us

> ... because they introduce into society novel capabilities and functionalities whose uses are constantly being expanded and discovered—capabilities and functionalities that interact with other technologies, and with natural and social phenomena, in ways that cannot be known in advance (39).

Returning again to the example of the jumbo jet, the consequences of its existence for the global transport system can only be explained in terms of a constellation of other outcomes, such as how it co-evolves with changes in environmental and economical resource systems, with consumerism, with how business is being done and what opportunities open up for individuals to travel the world. Allenby & Sarewitz (65) argue that Level III "technological systems need to be understood as transformative Earth systems." Thus, they are characterised not only by complexity, but by radical contingency in which

> ... the values, frameworks, and cultural constructs on which we rely are undermined by the technology they have made possible, and prediction and even judgment become dependent on a context that is always shifting, and on meanings that are never fixed.

The notion of 'Earth systems' captures the recognition that we are living in an anthropogenic world in which human, built and natural elements interact in ways that "produce emergent behaviours which may be difficult to perceive, much less understand and manage" (63). At this level technology is a 'transformative wave' that hovers above us, ready to crash down—not just on an organisational or political or cultural dimension, but on an existential dimension. Allenby & Sarewitz (59) moreover suggest that interventions that employ technologies in a Level I context—where a means-end rationality is followed—cannot be plausibly extended to tackle the 'wicked problems'[80] that exist at Level III. The intention to solve Level III problems

[80] The concept 'wicked problem' was coined by Horst Rittel and Melvin M. Webber in 1973 to define a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise. The term 'wicked' is used, not in the sense of evil, but alluding to its resistance against solutions. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems (cf. Rittel, H., Webber, M. 1973. Dilemmas in a General Theory of Planning. *Policy Sciences*, 4: 155–169.).

with Level I or II analyses is not just a technical error, but amounts to being a 'category mistake' (60). Wicked problems are problems that have no solutions and the enlightenment approach to solve problems in the name of progress, is a Level I approach. As Allenby & Sarewitz (169) argue, when you inhabit Level III, "you are experiencing 'conditions,' not 'problems,' and conditions are not states to be cured; they are at best, to be accepted, understood, and wisely managed."

This rather elaborate explanation of Allenby & Sarewitz's argument serves the purpose to introduce the argument that our experience of complexity is embedded in what they call Level III complexity. It serves to draw our attention to the fact that on the level of lived experience, we are encountering complexity not as a problem anymore, but as a *condition*. This has important implications for how we think of what it means to be human in a world marked by such a condition and the notion of critical complexity has to address this undeniable reality.

3. Preparing the way towards Critical complexity

In the canon of literature that comprises the study of complexity, the notion of ethics is rarely mentioned. Cilliers (1998, 2005b) and Morin (2008) are some of the few authors who have brought the notion of ethics into the picture. As Kunneman (2010:132) notices in his discussion of Cilliers and the place of ethics in his work on complexity, "Cilliers is one of the few complexity theorists explicitly acknowledging the central importance of normative and ethical issues for complexity thinking and trying to do justice to them." And as Kunneman (132) also argues, Cilliers has developed a 'lean' conception of the 'ethics of complexity' based on "questions of ethical responsibility in the face of complexity and on the central importance of differences and of the respect for differences." For Cilliers (2005b), the ethical moment in the study of complexity emerges from the fact that there is no objective theoretical position (or 'frame of frames') from where one can decide whether we are using the correct model to capture the complexity that we are encountering. Almost analogous to Kant's distinction between *noumena* and *phenoumena*, Cilliers argues that it is impossible to model *complexity-an-sich* in a correct and all encompassing way. The pretension that our models are congruent with reality is only possible by *ignoring* those uncaptured variables that have not been taken into consideration in the calculations and encodings of our models. Cilliers (2005b:258) explains this situation as follows:

> The knowledge we have of complex systems is based on the models we make of these systems, but in order to function as models—and not merely as a repetition of the system—they have to *reduce* the complexity of the system. This means that some aspects of the system are always left out of consideration. The problem is compounded by the fact that that which is left out, interacts with the rest of the system in a non-linear way and we can therefore not predict what the effects of our reduction of the complexity will be, especially not as the system and its environment develops and transforms in time.

For Cilliers, the fact that we cannot ignore that which is left out of our calculations (think here of the working of the restricted economy) introduces the normative element in our study of complexity. This view is summed up in the following key insights of Cilliers (2005b)

> The failure to acknowledge the complexity of a certain situation is not merely a *technical* error, it is also an *ethical* one. (256)

This view of Cilliers coincides with Allenby & Sarewitz's (2011) argument that the practice of addressing Level III complexity with Level I intervention strategies is a category mistake.

Moreover, as Cilliers (2005b:264) argues:

> The view from complexity entails that we cannot have perfect knowledge of complex systems. We cannot 'calculate' the performance of, for example, complex social systems in their complexity; we have to reduce that complexity; we have to make *choices.* Normative issues are, therefore, intertwined with our very understanding of complexity. Ethical considerations are not to be entertained as something supplementing our dealings with social systems. They are always already part of what we do. One could attempt to deny that and operate as if one can deal with complexity in an objective way—as if we can calculate everything—and thereby avoid the normative dimension. But this denial of the ethical becomes an avoidance of responsibility and is, of course, ethical in itself, albeit a negative (and much too prevalent) ethics.

With this specific understanding of the ethical or normative dimension that is implicated in the study of complexity, Cilliers has set himself apart from almost all other complexity thinkers. For the study of complexity and that intellectual community, the work of Cilliers has been ground breaking. However, within the *philosophical* community, Cilliers has received frequent critique for his contribution, seeing that *philosophically* speaking his ethical view is not that different to those views that can be aligned to say any other postmetaphysical ethical theories as for example found in the work of Derrida (1981, 1984, 1993), Cornell (1992) or Bauman (1993). This critique is expressed by Kunneman (2010:134) in his discussion of Cilliers' notion of ethics, for example, when he asks:

> … why we should prefer his ethics of differences above—for example—an ethics of care, or the discourse ethics propagated by Jürgen Habermas (1984) and Sheila Benhabib (1992), or the feminist inspired "nomadic ethics" advocated by Rosi Braidotti (2006), or for that matter, the aggressively "masculine" ethics connected with the Hip-Hop scene, or the "tribal" ethics practiced with great brutality and with great economic success by Italian Mafia-families? In my opinion, the conceptual strategy developed up till now by Cilliers makes it difficult to offer a satisfying answer to these questions. In my eyes the central difficulty is his allegiance to a general *theory* of complex systems as the basis for his ethical enquiries.[81] (italics in original text)

As a reply to his critics, Cilliers was challenged to come up with an ethical position that would give more content to his rather 'lean' interpretation thereof so as to distinguish it from other similar philosophical stances on ethics. Although there is a clear alignment with the deconstructive understanding of ethics, Cilliers wanted to 'do better' in terms of coming up with a more substantive notion of ethics that could be implemented in social and political interventions. For him a possible solution could be found by introducing the notion of 'critical complexity' (which could also be called the 'ethics of complexity' as suggested by Kunneman)

[81] The references Kunneman refers to are the following:

Habermas, J. 1984b. *Theory of Communicative Action, Vol. 1.* Boston, MA: Beacon Press.

Benhabib, S. 1992. *Situating the self: Gender, Community and Postmodernism in Contemporary Ethics.* New York, NY: Routledge.

Braidotti, R. 2006. *Transpositions: On Nomadic Ethics.* London: Polity Press.

by which he wanted to link the normative with the critical imperative that is combined in the study of complexity as discussed in Chapter 3 of this study.

The notion of critical complexity was invented by Cilliers during the last three years of his work before his untimely death in 2011. He often spoke about it in lectures and presented an outline of what the notion could mean at conferences. More substantive content about what critical complexity should mean in practice, was never published. The only reference to what was the initial phase of thinking about a 'critical complexity' can be found in the last chapter of the book he edited with the author (Cilliers & Preiser 2010). It was never planned that this chapter would be part of the book, but it was included on request by the publishers in order to provide a conclusion and binding factor for a book with a number of different and wide-reaching discussions on the notion of complexity, difference and identity and its relevance for the study of Business Ethics. As we discussed what would be included and excluded in the chapter, Cilliers could be convinced that the section on the 'Provisional Imperative' (274–276) should feature in the chapter. There was a hesitance to do so, seeing that this section contained the core of what would form the framework for a next book that would explore the notion of critical complexity more substantively. Unfortunately that book will remain unwritten and it remains the task of the next generation of complexity thinkers to develop this project in more detail.[82]

Fortunately another paper could be published posthumously with his colleague, Minka Woermann (Woermann & Cilliers 2012) in which the critical position was elaborated more in terms of its normative component. In this paper it is claimed that the 'ethics of complexity' is a "structural element of complexity thinking" (408) in which the 'self-critical rationality' (as Morin (2008:48) calls it) of complexity thinking is revealed. As argued by Woermann and Cilliers (2012), the self-critical rationality is a consequence of encountering complexity and the irreducible nature thereof. This self-critical rationality is best described by a 'double consciousness' that is introduced into our scientific endeavours and can be explained as a "consciousness of itself and an ethical conscience" (Morin 2007:21). Moreover, it is this double way of thinking, which is found in the general economy of complexity and in the logic of the double bind (as described in Chapter 4) that informs the normative turn of complex thinking that can be called 'the ethics of complexity.' Since, as Woermann & Cilliers (2012:406) argue:

[82] For some introductory work on expanding on the idea of critical complexity, see Woermann 2010, Hermanus 2010, Human 2011a.

> It implies an acknowledgement of the implications that a general view of complexity holds for both the status of our models and for our attitude towards these models, and compels us to remain perpetually vigilant in the face of uncertainty. Vigilance demands a continual and critical evaluation and transformation of our claims and practices... .

This perpetual vigilance marks the shift toward a radical position that is characterised by a relentless form of self-critique of all our affirmations, negations and interventional practices. The persistent form of self-critique can here be read to be interchangeable with the notion of 'critique as stricture' which is upheld and maintained in the force field of the double bind as argued in Chapter 3 of this study. Drawing on the logic of the general economy, we are reminded that the tension in the force field can only be maintained by the 'renewable openness' (Woermann & Cilliers 2012:406) that is allowed in the circular production of meaning making. As was argued in Chapter 4, this openness is obtained by the permeable nature of the limit that enfolds our thought strategies, but moreover also by allowing the freeplay of excess, and that which cannot be pulled into the processes of production and exchange as prescribed by the logic of economic thinking.

Thus, based on the above preliminary ideas that serve to form some delineation of what critical complexity could mean, it seems that two main issues are of utmost importance, namely 1) the *normative aspect* that is inscribed in our encounter with complexity and 2) the perpetual reflective nature of critique that an encounter with complexity calls forth.

In light of the above, the aim of this chapter then, will be to give some more content to the *invention* of critical complexity so as to address a legitimate practical question that is often asked in discussions about complexity and its philosophical implications, namely: what is so unique about critical complexity and its particular kind of critical reflexivity that distinguishes it from other postmetaphysical intellectual positions that are sensitive to issues of pluralism, difference or injustice as can be found in for example in the work of deconstruction or feminist critique or traditional critical theory for that matter? It would be important to answer the question of whether the difference between critical complexity and deconstruction for example, is just a matter of 'using a different style for doing the same thing' or whether they present different theories and if so, what are the appropriate ways of accounting for the difference between them? These questions are difficult to answer, but they are legitimate and I hope that as the Chapter proceeds, it will become clearer that critical complexity cannot only be

delineated to 'be something for itself and by itself', but also can it serve as a point of crossing over. Thus, to be a 'hymenal' theory of sorts that has its own infrastructure or texture, it must be constituted in such a way that it also allows influences from other theories to co-construct it. Ultimately, I hope to show that critical complexity can provide a point of meeting and even occasionally of crossing, whereby like-minded ideas and theories could meet, be infected with one another and then depart with some distinct change due to the encounter that took place.

4. Inventing critical complexity

In this section I want to introduce the argument that critical complexity calls us to stretch the reach of the implications of encountering complexity to the level of where we move from a 'mode of thinking' to a 'mode of being.' It will be argued that it is only possible to speak of normativity and critical self-reflection in relation to a way of being, which includes but simultaneously exceeds our modes of thinking. Critical complexity can only come alive and get more substantive content when linked to the question of 'what it means to be human' in a world characterised by difficult and unsolvable complex problems. By being open to the experience of complexity in the world, the problem of complexity gets a third meaning that is grounded in the level of our lived experiences of being in the world.

From this interpretation, the title 'The problem of complexity' is opened up to a third level. It can be interpreted not only as a conceptual and theoretical problem based on the difficulties of defining and studying it and by considering what problems it poses to our modeling and thought strategies, but the problem is expanded to consider also what problems the *experience of complexity* (or of complex problems) bring on our way and what this implies for acting in the world. In a sense, this shift is exemplary of the comment made in Chapter 4 that suggested that the logic of complexity acts not as a constative, but as a performative—as "a kind of thinking that does the impossible" (Wolfe 1998:126). If thinking must transpire into doing, then we need a more substantive 'infrastructure' or ensemble of a "set of conditions which brings the ideality of the whole or the a system both into reach and out of reach, and which articulates the limits—that is, that from which something begins but also where it ends" (Gasché 1994:7). In short—we need to fill the notion of critical complexity with more substance if we want to suggest that it has the possibility to infuse and even to transform our acting and being in the world.

4.1 The difference that makes a difference

> *Every invention supposes that something or someone comes a first time …. once invented, so to speak, invention is invented only if repetition, generality, common availability, and thus publicity are introduced or promised in the structure of the first time.*
> (Derrida 1989:29, 51).

Derrida's discussion of the concept of invention quoted here above, summons us to situate and to give some form of 'common availability' and 'structure' to the notion of critical complexity as invented by Cilliers. As Gasché (1994:8) argues in discussing Derrida's (1989) interpretation of the notion of invention, an invention must be unique for it to be an invention. Furthermore, "by definition a radically new, noncalculable, even aleatory invention must escape all programming" (8). Moreover, invention implies an "inaugural event" and an "advent (*avènement*), if we take the latter to mean an inauguration for the future of a *possibility* or of a *power* that will remain at the disposal of everyone" (9) (italics in original text). Hence, we are summoned to 'inaugurate' the notion of critical complexity in such a way, so as to give some marked structure to it so that it can be recognised as something different and unique. And thus in this light, the study will proceed to put out some markers that could identify critical complexity as the possibility of being something different to other forms of critique and to show in which ways it can have a discernable 'infrastructure' (Gasché 1994)[83] of its own and in which ways it presents a "difference that makes a difference" (Bateson 1972). Considering that "for a difference to make a difference, … its uniqueness must be wrenched from and negotiated within a system of convention" (Gasché 1994:21).

As stated in the beginning of this study, there can be no essential definition of what is meant by the construct called 'critical complexity', seeing that such an endeavour would attempt to reify the phenomenon. Thus, the inauguration of this invention might 'come for a first time', but it will nevertheless *not* be the last word on it.

[83] Gasché (1994) uses the word 'infrastructure' to replace the concept of 'theory' in his discussion of trying to define how one can describe what deconstruction is. The word 'infrastructure' points to the collection of an 'economy of concepts' (Thrift 1999) that can be gathered together to form a philosophical position. However, the notion of infrastructure does not assume a program or a method and does not suppose some sort of binding theory, but at minimal, a recognizable structure. Gasché (12) contends: "this infrastructure can never be turned into a result or conclusion. Yet the impossibility of cupping it in one's hand does not exclude, but rather impels the elucidation and construction of this impossibility."

Looking at the combination of the words 'critical' and 'complexity', one notices a boundaried tension that is revealed in the term critical complexity: it signals the convergence of critique and complexity as expressed in the general economy of the double bind: *complexity and/as critique*. In this sense, it indicates an engagement with both complexity and critique. And as argued earlier, it will be demonstrated that critical complexity proposes a radicalisation of the notion of general complexity and critique as stricture at once by disclosing a normative and reflective turn in both these notions.

In discussing the features of the postmodern 'state of mind', Seyla Benhabib (1992:2) remarks that postmodernity is manifested through a 'fractured spirit' and argues that there is "a current mood of scepticism… based upon an understandable disillusionment." I want to propose that the notion of critical complexity also holds potential to address this fractured and disillusioned spirit, which is simultaneously ever open to the possibility of new and different fractures. Critical complexity reveals the cracks in the smooth surface of scholarship within the field that calls itself 'complexity science' on the one hand, and the critical philosophical project on the other hand. The cracks surface by a tearing open or rupturing of meanings so as to release new possibilities.

4.2 Ethics in the name of the limit: The normative turn

Developing an 'ethics of complexity' has its own challenges. However, as a form of post-metaphysical ethics, these challenges are not unique to the process of defining an ethical position that recognises complexity. In her discussion of the 'quandry of ethics' Hofmeyr (2005:9) argues that this problematic is expressed in the fact that "(w)e live amidst the large-scale fragmentation of our previously held systems of orientation or frames of meaning-giving reference. We are left with mere fragments." The problem of finding legitimate grounds from where one can justify acceptance of certain norms and rejection of others is based in the fast proliferation of a 'pluralism of authorities' (10). Adding to this, Kunneman (2010:134) argues that there are several other postmetaphysical theories out there that deal with the problem of the loss of the outside or the so-called 'death of the transcendental subject' that makes it impossible to find a legitimate point from outside our systems of knowing from where to justify what norms are acceptable and which are objectionable. It will not be the focus of this study to engage with a series of current discussions regarding the status of different postmetaphysical ethical theories. Many other authors in other fields of study (such as post-

development studies, post-colonial studies, post-feminist studies, pro-pluralism theories, critical legal theory, etc.) also grapple with the same question, as stated in Chapter 3, of finding a position from inside our knowledge systems from where to develop legitimate norms and criteria or governing principles that can serve as footholds for deciding what norms we choose or not.

Thus, the dilemma that all poststructural ethical theories face, is the problem that there is no *a priori* principle that can be followed that could guarantee that the norms and criteria we choose will produce ethical behaviour or that justice might flow from it. This problematic is expressed clearly in Fraser's (2008:406) critique of poststructural theories of justice when she states that the so-called 'loss of the outside' amounts to the fact that "the basic parameters of justice are contested" and that it results in a lack of "authoritative standards for assessing the merits of justice claims." Stated in different terms, allegiance to a poststructural position implies that there is no transcendental Archimedic point that can provide us with something to hold unto. This amounts to the dilemma of relativism which claims that what might be seen as ethical in one system might be seen as un-ethical in another and leads to the problems associated with the notion of ethical or moral pluralism which amounts to the view that there are several values which may be equally correct and fundamental, and yet in conflict with each other.[84]

Hence, adopting poststructural ethical theories are not without problems and a denial of the limitations of these thought strategies amounts not only to being a technical deficit, but implies an ethical oversight. The implications of trying to find legitimate justifications for adopting ethical standards after having denounced all objective or transcendental positions is summed up very poignantly by Praeg (2010:259) in his discussion of the hegemonic powers that are at work in developing countries and how they position themselves in a globally changing world of power relations:

> There is no "outside" of/to a global complex network. This means that the signifiers hitherto used in order to invent and legitimize such systems of differentiation from the outside—God, time, autonomy, evolution, rationality, Freedom, Democracy and so forth—have and will increasingly become drawn into the system, revealing in the process their immanent role as always already having been

[84] For a classic work on the notion of moral pluralism see Rawls, J. 1992. *A Theory of Justice*. Oxford: Clarendon Press.

> constitutive of a surface play of domination (Foucault 1970). Contorted remnants of previous legitimations, they will increasingly give rise to a symptomatic relativism: whose rationality? Whose concept of freedom? Whose notion of democracy? Whose freedom fighter and whose terrorist? When this occurs we will have moved, in the terms of analysis offered here, from a politics to an ethics. More precisely, we will have witnessed the end of (modernist) politics and a return of/to the ethical.

What is highlighted in Praeg's quote is the fact that the ethical is not to be found in the moment of organised politics or in any moralising strategies. There is a change in focus on when ethics enters into the picture. This view aptly describes the way in which the ethical turn takes place in the formulation of the notion of critical complexity: when meaning emerges relationally in a system of differences, the ethical moment is born when we have reached the limits of our computing or equalling out strategies. When we know which decisions or strategies lead to what results or outcomes, we don't need 'ethics', but moral codes of conduct protocols or best-practice manuals. The ethical moment can thus be re-defined as being situated in the moment in which we take the leap from that which can be known to that which is uncertain or unknown. Derrida (1999:280) calls this leap into the unknown the moment of 'undecidability' and he describes it as follows:

> I have to prepare a decision to know where I can go as well, as consciously as possible, but I should acknowledge that between the accumulation of knowledge and the moment I make a choice, I take a responsibility, I make a decision, there is an infinite abyss because of the heterogeneity of these moments. That is why I so constantly insist on the undecidability, which does not mean you are simply paralysed and neutralised because you don't know what to do. Simply, in order for a decision to be a decision it has to go through a moment when irrespective of what you know, you make a leap into the decision. This leap into the responsibility is an infinite one and you take a decision only in a situation when there is something undecidable, when you don't know what to do. You don't *know*. That is, if you knew what to do, there would be no decision, you would have already done… .

What is very clear from the above quote is the fact that the ethical moment is born once we enter into the gap of the infinite abyss which is created by the limits of our models. Here, once again, the decision is made in the name of being faced with the limit—as discussed in Chapter 3. Being face to face with the limit forces a change to how we define the notion of ethics. *Ethics in the name of the limit* now also has to function within the general economy of thought. From such a perspective, the ethics of the limit denies the rigid following of a set of programmed sequences of choosing between one or another binary opposition (as can be found in expressions of moral decisionism of which the discourse ethics of Habermas (1984b) is exemplary).

Hence, as a start, it can be suggested that critical complexity is informed by a kind of normative turn that emerges from an understanding of ethics that is defined in terms of its situatedness of being 'in the gap' where it is faced with the unknown—or stated differently—the limit. Moreover, such an understanding of ethics calls the moral agent not to choose between *either* a transcendental position *or* a pragmatic one. Rather, it requires from the agent to *enter into the ambiguity* of the both/and logic of the general economy. This argument is echoed by Baudrillard (1994) when he argues that poststructural notions of ethics can only stand a chance of achieving any form of credibility if it becomes a strategy of *radical antagonism*, a play upon reality, the issuing of a challenge to the real, an attempt to put the real on the spot. Thus, the logic of stricture and the force field of the double bind remain inescapable also for re-thinking the notion of ethics when faced with the limits of what we can know and in deciding how to act. The next section will explore how critical complexity can in particular be recognised and distinguished from other similar theoretical positions due to the radical antagonism that it calls for in our processes of thinking and acting in the world.

5. The three imperatives of Critical complexity

The relevance of critical complexity lies in the unique contribution that it offers in its attempt of trying to find more appropriate ways in which to respond to ethical matters in terms of a both/and general logic of complex thinking. Once we start re-evaluating what a norm or a criteria or even the notion of justice means in terms of this logic of the double bind, we might find ways to overcome the either/or dichotomy between either a foundationalist or a anti-foundationalist or a universalist versus a contingent/individualist position. It will be argued here that Cilliers' notion of the 'provisional imperative' offers such an example of how to think differently about an imperative in such a both/and way.

Furthermore, I want to put forward an argument, as stated in Chapter 3, that we are not left hanging in some conceptual and theoretical void, but that the relation to a complex reality also gives us some foothold from where to consider new criteria for acceptable norms. The fact that we may not know what the fibre of reality is made of or how emergent phenomena arise in complex physical systems does not alienate us from what it means to be living in a world where complex problems exist; I will argue that in our encounter with complexity, we can generate new criteria for norms that are cognisant of the world's complexity. Here the notion of transforming complex thinking into a mode of being will be discussed based on Kompridis' (2006) idea of *reflective disclosure*. From such an understanding of complexity we learn that 'we are always in trouble' and that our strategies of intervention have to consider the fact that we can only provide answers in terms of stepping into the tension of unresolved difficulties and the plurality of internal differentiations within the world. By suggesting that we could adhere to the three imperatives of critical complexity an argument is put forward that we do not stand empty handed in our processes of 'muddling through' (Allenby & Sarewitz 2011) complexity, but that we can devise some guiding principles with which to negotiate the 'agonistics of the network' of being underway in a complex world.

Drawing on Cilliers' qualification that the notion of a critical position that acknowledges complexity should include 1) the *normative aspect* that is inscribed in our encounter with complexity and 2) the *perpetual reflective nature* of critique that an encounter with complexity calls forth, I want to suggest that critical complexity should be recognisable as an invention by at least three discernible imperatives. These imperatives could be characterised as follows:

1) The Provisional Imperative
2) The Critical Reflexive Imperative
3) The World-disclosing Imperative

Derived from Kant's use of the notion of the 'categorical imperative' the argument for suggesting three imperatives is a continuation of Cilliers' idea of the provisional imperative and its use in formulating a provisional imperative is explained by Preiser & Cilliers (2010:274–275) as follows:

> The logic by which Kant deduces the categorical imperative can roughly be described as follows:[85] for a moral principle to be universally valid, it has to be purely abstract and formal. It cannot be constructed empirically, or take contingent matters into account. The only rule which conforms to this specification has to be something like "follow this rule". But since the moral rule Kant is looking for has to be universally valid, he can reformulate this abstract rule to something like "follow only rules which are universal", or "follow only those rules which you would always also want others to follow". By combining the purely formal principle with the notion of universalisability, Kant can generate a formulation which actually does say something about ethics.
>
> There are many problems with the categorical imperative (see e.g. Kant/Paton 1948). The main one is the result of the very attempt to be universal: the categorical imperative itself cannot generate contingent ethical principles; it can only be used as a kind of test for principles which already exist. In this way, Kant's position is a critical one. He does not actually know what the right or the good is, but he knows which strategy of thinking to follow in order to attempt to produce it. The categorical imperative thus does not provide us with a substantive ethics, but it does urge us to adopt a certain attitude.

Based on the above explanation, the imperatives can be interpreted to serve as some guiding force in the process of choosing action and although the categorical imperative "cannot indicate what principles are good, right, and deserving of respect, it does provide a strategy for evaluating our contingent principles" (Woermann & Cilliers 2012:407). Subsequently, the imperatives cannot provide us with rules for action, but they say something about our attitude or choice of framework of thinking that we use when engaging with normative matters informed by complex thinking.

[85] The development of the categorical imperative is done in *Groundwork of the Metaphysics of Morals.* See for example the translation and discussion by Paton (Kant/Paton 1948).

5.1 The Provisional Imperative: general economy all the way down

The notion of the provisional imperative is worked out based on the notion that complex systems are open systems and are constituted by complex causal relations of rich and dynamic non-linear interactions which imply that we cannot have complete knowledge of complexity (as discussed in Chapter 2). Without complete knowledge, all our models of complexity are just a reduction of complexity and hence, we can only have knowledge in terms of a certain theoretical framework. There will never be a largest model of a complex system (Rosen 1991) and therefore we can only claim provisional knowledge of all complexity. This seems to be true in principle and can form a kind of a non-foundational fundamental truth in a paradoxical manner. This non-foundational fundamental position however, is not delineated in an *a priori* way and is not located outside of our systems of knowledge, but positioned inside our possible frames of studying and knowing complexity. It forms a certain immanent truth and provides some foothold from where to approach all other knowledge claims. Moreover, the provisional imperative is characterized by the fact that it operates with the logic of the general economy and is constituted by the movement of thinking the double bind 'all the way down.'

Based on the discussion above on the nature of the Kantian notion of the categorical imperative, the conjunction of the 'provisional imperative' seems like a contradiction, especially when keeping in mind that the notion of the imperative suggests something absolute and unchanging. And this is exactly the effect that the provisional imperative wants to call forth. It demonstrates complex thinking in action in the sense that it corresponds to the both/and logic of the general economy as suggested in Chapter 4. In a sense, the imperative of provisionality undermines the Kantian logic but at the same time it installs it. The four main requirements of the provisional imperative as thought out by Cilliers (cf. Preiser & Cilliers 2010:275–276), can by described as follows:

1. Justify your actions only in ways which do not preclude the possibility of revising that justification.
2. Make only those choices which keep the possibility of choice open.
3. Your actions should show a fundamental respect for difference, even as those actions reduce it.
4. Act only in ways which will allow the constraining and enabling interactions between the components in the system to flourish.

As can be seen from the above, all of these statements are self-undermining and operate with the logic of complex thinking as discussed in Chapter 4. Inherent in all of them is a radical antagonistic tension, which demands that one makes decisions based on the both/and logic characteristic of the general economy. Moreover, all four of these statements demonstrate perpetual sensitivity to excess, difference and diversity. They are formulated in a way that keeps the possibility of openness alive and neither of them can be closed off in terms of a self-contained axiom. The provisionality built into each requirement ensures that it is possible to revise judgements as soon as it becomes clear that they have flaws, whether it be under specific circumstances or in general. The possibility for re-invention and re-formulation is kept open.

An example of how the provisional imperative can be employed can be found in the work of Nancy Fraser (2008) with her idea of 'parity of participation' which is a regulatory principle in her theory of 'reflexive justice.' The principle of parity of participation "serves as a standard for evaluating justice claims" in various social and political domains. In each domain, "only those claims that promote parity of participation are morally justified" (406). Effectively this means asking continually whether all parties concerned "have equal chances to participate fully, as peers" and it interrogates social arrangements with the aim to "uncover, and criticise, entrenched obstacles to fair engagement" (406).

Furthermore, the provisional imperative shows some similarity with von Foerster's (von Foerster & Poerksen 2002:37) 'ethical imperative' which goes like this: "Act always as to increase the number of choices." For von Foerster the ethical imperative was derived from an understanding that it is more responsible to give people more alternatives to choose from, because it might open up more possibilities for people to act responsibly. And in a way, they all point to the undecidability or impossibility of the moment of choosing as discussed earlier.

From the above it is clear that the provisional imperative is a radicalization of complex thinking which operates in the general economy. This ensures that the moment of decision remains a practice that can only take place in the gap between multitudes of irreconcilable gaps. As with the four requirements of the provisional imperative, one sees that the implementation of these requirements necessitates a perpetually critical attitude. The next imperative will address the critical attitude that should form part of the infrastructure of critical complexity.

5.2 The Critical Reflexive Imperative: critique all the way down

In order to valorise and employ the first imperative, a radical critical attitude is necessary. The second imperative draws on the radical form of perpetual critique that was discussed in Chapter 3, where it was proposed that critique as stricture poses a valuable construct by which the notion of critique is expanded and supplemented to keep up with the logic of the general economy. In the process of engaging with critique as stricture as a kind of relentless self-reflexivity, it is necessary that we ask ourselves the following questions again and again. This attitude is expressed eloquently by Kompridis (2011:1068) in his discussion on the role of critique:

> What do we expect of critique? What is supposed to happen, to the world, to us, when critique is exercised? Conversely, what does critique demand of us, not only as its addressees but also as its authors? In other words, in what does the normativity of *critique* consist?

Framed in this way, these questions are quite distinct from and should not be confused with, or come after, the question of which normative principle(s) should serve as the foundation of any model of critique. This implies that there is some kind of normativity also at work in the process of exercising critique. The notion of self-reflexivity suggests that even our notions of critique are to be submitted to tease out and expose the normative ideals and principles that form and shape its practices. The notion of a radical reflexivity implies a critical practice that is capable of questioning its own rules and procedures. Such vigilance can only be ensured by continually being self-critical about the ways in which we make distinctions between certain ideas and concepts and imply that we remain aware of how we construct our normative criteria.

Thus, in light of the above, the Critical Reflexive Imperative might sound like this:

1) Distrust most strongly that which you believe most deeply.[86]
2) Expose the limits and overturn the boundaries of the grounding principles on which theoretical assumptions are constructed.
3) Eschew the quest for solutions and foster possibilities that ensure continual learning.[87]

[86] Derived from Allenby & Sarewitz (2011:187)

[87] Derived from Allenby & Sarewitz (2011:162, 167)

The critical reflexive imperative proposes a 'critique of critique' and calls for a disruption of all "methodological smugness" by "calling into question the very grounds of critique" (Hoy 2005: 229). The critical reflexive imperative calls for a radicalisation of the critical tradition to embrace reflexivity—thus for critique to become aware of its own limitations. It suggests a post-critical position (Hoy 2005). The post-critical position defines critical complexity as "an unconditional right to ask critical questions not only about the history of the concept of man, but about the history even of the notion of critique, about the form and authority of the question, about the interrogative form of thought" (Derrida 2002: 204). Hence, the critical reflexive imperative suggests that critical complexity enters into the radical agonistics of critique as stricture in which "post-critique is thus self-critique all the way down" (Hoy 2005: 228).

The critical reflexive imperative directs one to the fact that critique as stricture exposes our practices of reification and remains a call to re-evaluate our own framing practices. The critical reflexive imperative articulates and exposes a mutual critical concern between a general theory of complexity and critical theory (as represented by the Frankfurt School of Critical Theory) with exploring the limits of metaphysical assumptions. With its emancipatory ideals and its questioning of the status quo the critical reflexive imperative undertakes to critically analyse the hidden assumptions on which other schools of thought or scientific theories are built and attempts to uncover strategies of reification (Fischer-Lescano 2012). With the same impetus, the critical reflexive imperative asserts to expose the limitations of totalising theories and scientific paradigms as mentioned in Chapters 2 & 3 and as a result pleads for *modesty* when we make knowledge claims. A modest attitude supports the idea that knowledge of complexity is always incomplete and that we can never arrive at a point where we have learnt all there is to know (Cilliers 2005b). It fosters an open-ended scientific approach that links to the provisional imperative's assumption that knowledge of complex phenomena can only claim to be provisional, hybrid and difficult knowledge (see discussion in Chapter 2). By framing our knowledge generating practices as provisional in principle, we are prompted to remain necessarily distrustful so as to never become too pleased and self-satisfied with our theories and scientific accomplishments.

Commenting on the notion of how our framing practices should be scritinused, Fraser (2008:407) suggests that self-critique is a reflection on the 'injustices of misframing' and it implies a position "where the frame itself is in dispute." The reason for this being so, is as Allenby & Sarewitz (2011:114) argue, because " (t)he complexity we are discussing confirms an unavoidable relationship among the observer, the frame of reference, and the extraction of

partial and contingent truths from underlying complex systems."

The unavoidable problem of 'framing' is echoed in Derrida's (1979) deconstruction of Kant's third Critique, the *Critique of Judgment (1993)*, where Derrida focuses on the idea of the *parergon* to problematise the notion of the limit which represents the act of framing or drawing distinctions. This is articulated very clearly in the following passage:

> The Critique is a work (*ergon*) in several ways; as such, it must center and frame itself, delimit its ground by distinguishing itself, by means of a frame, from a general background. However this frame is problematic. I do not know what is essential and what is secondary to a work. Above all I do not know what this thing is which is neither essential nor secondary, neither proper nor improper, which Kant calls *parergon*, for example, the frame. What is the place of the frame? Does it have a place? Where does it begin? Where does it end? What is its inner limit? Outer. And the surface between the two limits. I do not know if the passage in the Critique which defines parergon is itself a parergon. (Derrida 1979:26) (italics in original).

This argument of Derrida overlaps with the discussion of the limit as understood from a complexity approach where it is argued that such a strict isolation of what is 'inside' or 'outside' our systems of meaning cannot be upheld due to the understanding that complex systems are open systems and that the borders are permeable and less rigidly defined in terms of space and time (Cilliers 2005a). Hence, our best intentions to delimit certain standards or critical criteria are infected and undermined by the fact that they are always related to other frames of thinking and can never be complete or perfect. The process of framing must therefore be submitted to a continual self-critical reflection.

The argument to critically re-evaluate our processes of framing and to be open to the possibility of continual learning is also mentioned by Morin (2004) who writes about the necessity to constantly interrogate and investigate our framing strategies. He uses the term *autocritique* to refer to the normative dimension that can be found in our practices of questioning. Hence, his notion of complex thinking goes hand in hand with reflexivity and suggests that one remains self-critical, always open and creative, always eager to challenge the fundamental assumptions underlying any system of thought.

Oriented to the possibility of wanting to make a difference, another imperative is necessary if we want to suggest that critical complexity should provide us with the possibility to think and act differently through practices of critique, negotiation and renegotiation.

The imperative to give up the quest for 'solutions' and to strive toward practices that foster continual learning is supported by the imperative to remain self-critical. In other words, it means that the unpredictability and complexity of the challenges we face are best met through "a capability to adjust in real time, which in turn means we must have options available when our planned paths go off in wildly suboptimal directions" (Allenby & Sarewitz 2011:162). We are encouraged to think about alternatives, so that we can learn how to adapt quickly and agilely to new and unpredicted conditions. Identifying multiple paths forward, and developing options before they are needed, will dramatically improve our ability to bring about change and transformation.

The provisional and the critical reflexive imperatives need to be grounded in our experience of complexity. It will be argued that the world-disclosing imperative will provide us with the means with which to ground the above principles in some kind of meaningful action as it provides the potential to investigate how humans are situated in the world of lived experiences.

5.3 The World-disclosing Imperative: the condition of complexity

As discussed in the introduction to this chapter, critical complexity marks a progression in the study of the problem of complexity in the sense that it acknowledges the embeddedness of our lived experience of complexity. It recognises the fact that our way of being in the world cannot remain unaffected when we advocate the idea that the study of complexity challenges us to critically reconsider our traditional modelling and thought strategies.

The inclusion of Allenby & Sarewitz's (2011) argument that we are facing the *condition* of complexity furthermore serves to highlight the fact that our encounter with complexity has to be a world-disclosing encounter. This means that we cannot just deal with complexity on the level of studying it with the aim to calculate and control it (Level I) or to interpret how it affects our social, political and economical institutions (Level II), but we have to engage with it in ways that confront us with questions about how our understanding of being in the world is constituted. The failure to acknowledge the complexities of the world, to deal with them as if our simple scientific models are adequate, is not only destroying the world, it is destroying our

humanity. As we slip more and more into a linear, instrumental kind of thinking which relies on oversimplified models of society, economics and even scientific understanding, we become more like those models: linear, one-dimensional, machine-like, self-centred, heartless. In light of the above, the call of the condition of complexity (as stated in Chapter 4) is a call to proceed differently in this world.

The task of the world-disclosing imperative carries some relation to Heidegger's notion thereof in its conceptualisation. The notion of 'world-disclosure' is of course a concept that was described extensively by Heidegger in his landmark book *Being and Time* (1962). Although this study will not engage with an in-depth discussion of how world-disclosure operates as conceptualized by Heidegger, it will be argued that it is a concept that holds many resources for future exploration. The discussion of the concept here will be dealt with mainly in terms of its re-appropriation thereof by Niklas Kompridis, who in recent years suggested that the notion of critique (and specifically the field of critical theory) could be reformulated as 'reflective disclosure' (2006a, 2011). At the center of this repositioning of critical theory is a normatively reformulated interpretation of Heidegger's idea of 'world disclosure.' In this regard Kompridis reconnects critical theory to its normative and conceptual sources in the German philosophical tradition and sets it within a romantic tradition of philosophical critique.

The links between the notions of *reflective disclosure* and world-disclosure will be explored briefly in terms of Heidegger's argument that it is part of human nature to be world disclosers. In Heidegger's phenomenological hermeneutics, the term 'world' differs from Kant's understanding of the world, which relates to a reality that is made of things-in-themselves that are separate from the self. With Kant there is a strong subject-object separation. For Heidegger, the term 'world' is understood to exist *prior* to any separation of self and world and does not refer to our perceptible environment, objectively considered as it can be observed empirically. His understanding of the term 'world' relates more to what might be called our personal world or the world of lived experiences. As Palmer (1969:132) explains, it is not the world of "all beings but the whole in which the human being always finds himself already immersed, surrounded by its manifestations as revealed through an always pregrasping, encompassing understanding." Heidegger's understanding of 'world' is radically subjective (because of the conflation of self and world) in the sense that "every entity in the world is grasped as an entity in terms of world, which is always already there" (132). There is a paradoxical double bind at work in what we can call the general economy of Heidegger's understanding of world:

> World is so encompassing, and at the same time so close, that it eludes notice. One sees right through it. Unnoticed, presupposed, encompassing, world is always present, transparent and eluding every attempt to grasp it as object (133).

What this understanding of world amounts to, is the recognition that we encounter ourselves as immediately and unreflectively immersed in the world of our concerns rather than as standing over against an "external" world of objects. The subversion of the subject/object dichotomy opens up an understanding that things in the world (including ourselves) are marked by a kind of unobtrusiveness and they only become noticeable when some form of breakdown occurs. As Palmer (133) argues, Heidegger uses the example of the broken hammer to elucidate this condition:

> At the point of breakdown, we may observe a significant fact: the meaning of these objects lies in their relation to a structural whole of interrelated meanings and intentions. In breakdown, for a brief moment the meaning of the objects is lighted up, emerging directly from world.

When the hammer is broken (and no other hammering tool is available to complete the task at hand) we find ourselves standing before a *Tatsache* that we cannot make sense of. The moment of breakdown stops us in our tracks and all our everyday immediate "hands-on" (*zuhanden*) ways of coping with the world of our practical concerns undergoes a "transformation" (*Umschlag*) in which we come to experience ourselves as isolated subjects standing reflectively before a world of external objects, which we thereby come to experience as standing over against us in the mode of something objectively "on hand" (*vorhanden*) (Heidegger 1962:408-409). In other words, Heidegger (249-250) does not deny the reality of the subject/object relation but, instead, points out that our experience of this subject/object relation *derives from* and so *presupposes* a more fundamental level of experience, an elemental modality of engaged existence in which self and world are united rather than divided. As Palmer (133) explains, the "being of something is disclosed not to the contemplative analytical gaze but in the moment in which it suddenly emerges from hiddenness in the full functional context of world." Hence, Heidegger's understanding of 'world' offers us a good way of understanding Allenby & Sarewitz's notion of 'condition.' Understood in this way, complexity is that which is always already part of the world and in moments of crisis or breakdown, it is unconcealed for what it is.

Heidegger's idea of *alétheia*[88] (disclosure) aims to make sense of how things in the world appear to human beings as part of an opening in intelligibility, as 'unclosedness' or 'unconcealedness.' For Heidegger 'being-in-the-world' characterizes *Dasein*, which is the open space where being reveals itself in various ways by coming out of concealment into 'truth' (*alétheia*)[89]. Moreover, for Heidegger the act of thinking is defined not as "the manipulation of what has already been brought into disclosure, but as disclosing what was hidden" (Palmer 1969:149). For the purpose of our argument, the details of Heidegger's very sophisticated argument are of no concern—that would require a whole study by itself. What is relevant for this study, however, is the fact that the idea of world-disclosure can be grafted onto the concept of critique to present a view "that recognises its contingency and persistence, its disclosedness and opacity, its horizon-opening and horizon-receding character" (Kompridis 2011:1064). Moreover, for Kompridis (1994) the notion of world disclosure refers, with deliberate ambiguity, to a process which actually occurs at two different levels. At one level, it refers to the disclosure of an already interpreted, symbolically structured world, namely the world that is, within which we always already find ourselves. At another level, it refers as much to the disclosure of new horizons of meaning as to the disclosure of previously hidden or undiscussed dimensions of meaning.

Drawing on the above, it can thus be stated that it is the experience of complexity as a limit concept, that offers us with the opportunity to think critically about how we will be constituted as human beings. It is the experience of complexity as an unsolvable condition that provides us with the prospect to remain open to what it means to be human in the face of our entanglement

[88] For more on Heidegger's understanding of *alétheia*, see *Poetry, Language, and Thought* (1971), which describes the value of the work of art as a means to open a 'clearing' for the appearance of things in the world, or to disclose their meaning for human beings. Heidegger revised his views on *alétheia* as truth, after nearly forty years, in the essay "The End of Philosophy and the Task of Thinking" (1973).

[89] As explained by Inwoord (1999:13–14):

> Early on Heidegger says that *alétheuein* is 'to take out of hiddenness [*Verborgenheit*], to uncover [*entdecken*] (Being and Time: 33, 219); *alétheia* is 'uncovering' (XXI, 162); and *aléthes* is 'unhidden [*Unverborgen(es)*] (Being and Time: 33, 219). This has three implications: 1. Truth is not confined to explicit assertions and discrete mental, primarily theoretical, attitudes such as judgements, beliefs and representations. The world as a whole, not just entities within it, is unhidden - unhidden as much by moods as by understanding. 2. Truth is primarily a feature of reality - beings, being and world - not of thoughts and utterances. Beings, etc. are, of course, unhidden to us, and we disclose them. Heidegger later coins *entbergen*; *Entbergung*; *Entborgenheit*, 'to unconceal; -ing; -ment', since unlike *unverborgen*, they can have an active sense: *aléthes* means: 1. unconcealed [*entborgen*], said of beings, 2. grasping the unconcealed as such, i.e. being unconcealing. But beings, etc. are genuinely unconcealed; they do not just agree with an assertion or representation. 3. Truth explicitly presupposes concealment or hiddenness. DASEIN is in untruth [*Unwahrheit*] as well as truth.

with the technologies and institutions that shape us. This insolvability poses itself as a limit (or horizon in Van Peursen's (1972) and Heideggers' (1962) sense) to us, but as Van Niekerk (2004) argues, the limit is not something that is impermeable:

> Horizons, as the necessary conditions for intelligible observations, are shifting borders; they shift relative to the position of the observer. In that sense, they are both "outside" and "inside." To interpret is not only to register a completed meaning, but to apply that meaning to the existential needs of one's current situation. And to apply necessarily means that one anticipates, conceptualises or invokes the significance or relevance of a meaningful form to one's future existence and well-being.

In light of this rather lengthy discussion, the World-disclosing Imperative can be drafted to sound something like this:

1) Act so that the effects of your actions break open new understandings of what it means to be human.
2) Resist all modes of thinking that could lead to dehumanising strategies.
3) Act in ways that allow for alternative and novel ways of understanding our situatedness in the world.

As a world-disclosing practice, critique should at least disclose how our being in the world is co-constituted by the institutions and technologies that structure our experience of what it means to be human. As Kompridis (1072) argues

> … we can no longer practice critique at a distance from the objects of critique: we are entangled with others in complex ways, in a world that has grown ever more tightly connected—politically, economically, technologically and ecologically.

Translated in terms of what this could mean for situating critical complexity, is the understanding that our forms of thinking and our ways of undertaking critical analysis should be done in such a way that it discloses the limits of totalising strategies, but also that it discloses in which way our concepts and understanding of what it means to be human, is interwoven with

the world in which we live. By suggesting that critical complexity could be linked to negotiating the 'experience of complexity' we are challenged to look for possibilities that would allow us a way of thinking that is *underway* in the world (in Heidegger's sense – see chapter 4) in such a way that the *condition of complexity* is disclosed.

The world-disclosing imperative thus represents practices through which we can imagine and articulate meaningful alternatives to contemporary social and political conditions (for example, by uncovering possibilities that were previously suppressed or untried, or by refocusing a problem in a way that demonstrates its interconnectedness to many levels of complexity) in order to regenerate hope and confidence in the future, proposing new ways to 'go on' differently.

6. Critical complexity: a call to proceed differently

damit es anders anfängt zwischen uns allen
Hilde Domin (2008)

As argued above, the acknowledgement of complexity is a call to proceed differently in this world. Critical complexity proposes a way of 'being-in-the-world' that could help us tackle wicked problems in different ways by offering us with some 'equipment' as to how to negotiate through the messiness of unsolvable problems. It offers us a way with which to think together different paradigms without reducing them to one another or dismissing one for the other, so that we can be in a position to act and intervene differently by giving us temporal coordinates from where to launch critical counter voices that could have some impact in shaping societal and political issues. It can be understood as a 'reasoning art' (mode of thinking) that does not conform to some substantive method or recipe, but a relentless double (or triple or multiple) thinking that enables innovative ways of negotiating our way through complex realities.

Resembling Ricoeur's (2004) argument that a transition should happen in how the notion of understanding should change from defining the act of understanding as a mode of knowing (or thinking) to change into a mode of being, critical complexity is called to help us find a way of being in the world that transcends and radicalises the argument that it is just a way of thinking or an approach. Analogous to Ricoeur's (9) argument that "understanding is no longer the response of the human sciences to the naturalistic explanation," but that it involves a "manner of being akin to being", critical complexity changes the notion of critique from being a response to

the limitations of inherited traditions, to embrace a manner of being. Ricoeur (9) calls this 'revolution' an "ontology of understanding" in which "understanding becomes as aspect of *Dasein's* 'project' and of its 'openness to being'." In the same way, critical complexity should be linked to what it means to be human, to be here (*Dasein*) in the world in order to face the messiness of it. The transition from a mode of thinking to a mode of being can only happen when accompanied by a relentless form a self-critique and critical reflexivity. Drawing further on Ricoeur (11), this can only happen when a subject reflects critically on herself whilst simultaneously interpreting and reflecting on the signs that are coming to us from the world. There is thus a double way of being required that is called to look inward and outward simultaneously. Furthermore, the act of reflection is nothing other than

> … the appropriation of our act of existing by means of a critique applied to the works and the acts which we are the signs of this act of existing. Thus reflection is a critique, not in the Kantian sense of a justification of science and duty, but in the sense that the *cogito* can be recovered only by the detour of a decipherment of the documents of this life. Reflection is the appropriation of our effort to exist and of our desire to be by means of the works which testify to this effort and desire (17) (italics in original text).

Hence, there is a double movement inscribed in the kind of a critical reflection that is at work in critical complexity. The justification for the radical form of critique that is called for, can be radical "only if one seeks in the very nature of reflective thought the principle of a logic of double meaning" (18). As it has been discussed in Chapters 3 and 4 of this study, the double meaning or the logic of the double bind and of différance as inscribed in critique as stricture, provides the justification for a radicalisation of general complexity into critical complexity.

Thus, the notion of critical complexity proposes the possibility to change how we situate and orient ourselves in the world and is attentive to how we can think and act differently in the world. There is a restorative quality hidden in critical complexity, which discerns it from a deconstructive or a general postmetaphysical position. The acknowledgement of complexity requires a relentless awareness and openness to the excess of meaning that serves as a prompt to not fall into a position of resignation and relativism. It calls us to remain vigilant of how the self, the other and society are constituted relationally in the process of co-constructing the world.

Related to the significance or contribution that critical complexity has for the study of philosophy, it can be seen as a response (admittedly one amongst many others) that is sensitive towards the conditions of philosophy's own possibility. And as Kompridis (2006b:3) argues, "to make sense of those conditions is to make sense of its own calling." Futhermore, drawing from its engagement with the natural sciences, as demonstrated in Chapter 1, critical complexity poses an avenue of inquiry that re-establishes the importance of being concerned with the problem of how to recover nature as a source of meaning and orientation. The re-discovery of our connectedness with nature and how we are shaped as human beings in this relation is emphasised in a new light. And last but not least, critical complexity is fuelled by the 'horizon of impossibility' to envision new social and political constellations that disclose rather than cover over the cracks of our universe. And who knows, it may even dare to overturn and denounce current exponents of mastery in the hope of evoking ways in which—as we are reminded by Derrida (2007)—we can learn to think for tomorrow by 'learning how to live, finally.'

7. Conclusion

This chapter set out with the argument that the notion of critical complexity introduces a progression in both the level of understanding complexity as well as at the level of the nature of the problems we are faced with in the experience of complexity. This progression can be traced from Part I where the problem of complexity was explained in terms of the conceptual difficulties that the term itself poses and in terms of the empirical verification thereof. On this level the problem of complexity remained at a descriptive level and suggested that the main difficulties were lodged in finding ways to generate a coherent understanding of complexity. It was argued that at this level the problem of complexity is a problem of observation. In Part II the problem shifted to the investigation of what modes of thinking are necessary to embrace and come to terms with the challenge that the study of complexity pose to our knowledge generating practices. It was argued that on this level, the nature of the problem could be located to be a problem of thinking. A new mode of thinking that could overcome the either/or dichotomy of binary oppositions was suggested as explained by the general economy. The implications for such a mode of thinking were also explored in terms of a re-definition of the notion of critique.

This final chapter suggested another shift in the study of the problem of complexity and argued that our engagement with complexity cannot remain solely on an abstract and theoretical level. The juncture between complex thinking and the critical impetus that can be found in it opens up

a space where the problem of complexity can be transformed to mean 'critical complexity.' The chapter aimed to give more substantive content to this notion that was coined by Cilliers in the last three years of his life in which he worked out the outlines of such a 'brand' of complexity, but never had the opportunity to complete. An important task of this chapter was to provide some defining characteristics to the notion of critical complexity so as to provide some ground why this brand of complexity could be called a unique invention. It was argued that the progression from complex thinking to the experience of complexity in the world could already pose as such a distinction. Furthermore, it was argued that critical complexity proposes a radicalisation of a general theory of complexity (as discussed in Chapter 2) and of critique (see Chapter 3) seeing that critical complexity is marked by a normative and a reflexive turn that takes place when one situates the problem of complexity in light of our lived experiences thereof in the world.

In light of the mentioned radicalisation, the problem of complexity could be re-defined to be an insolvable problem, which could better be described in terms of the notion of the *condition* of complexity. This shift was discussed in detail by following the argument of Allenby & Sarewitz (2011) who suggest a taxonomy of complexity in terms of the relationship between technology and human beings. It was argued that the notion of critical complexity coincides with Allenby & Sarewitz's notion of Level III complexity where complex interdependencies between technology and the human systems they are embedded in, cause wicked problems that are insolvable. From such a perspective it is more realistic to depart from the modernist dream that view problems to be solvable through progress and technological development. The study adopts Allenby & Sarewitz's suggestion that based on a Level III description of an encounter with complexity, it is more sensible to speak of the condition of complexity, seeing that it describes the fact that complexity is here to stay and that we should give up the idea of wanting to find solutions to its problems. The failure to do so will result in a category mistake (Allenby & Sarewitz 2011).

The chapter proceeded by suggesting that the normative turn in critical complexity lies in the fact that it re-thinks the ethical in terms of the irreducible gap between 'is' and 'ought' and that the call to enter the ambiguity of the both/and logic of the general economy marks the ethical moment. From this follows the argument that the choice of critical criteria on which to base ethical judgements should reflect the radical antagonistic nature of the general economy. Guided by this insight, it was suggested that critical complexity can be distinguished by three imperatives that could serve as ethical principles that could guide the process of muddling

through the condition of complexity. These imperatives are called 1) the Provisional Imperative, 2) the Critical Reflexive Imperative and 3) the World-disclosing imperative.

The first imperative stands under the influence of the general economy and suggests that all actions and decisions should be based on principles that work with the both/and logic that undermines the closing off of interventions. The second imperative enforces the radicalisation of the critical position and calls for a perpetually critical re-evaluation of all assumptions that inform our theories and practices. Even our critical positions are to remain under scrutiny of this self-critical imperative. The last imperative compels us to engage with the condition of complexity in such a way, that our practices and theories always disclose the underlying complex reality of our lived experiences in the world. The notion of world-disclosure was explained briefly in terms of Heidegger's interpretation and Kompridis' re-appropriation thereof. According to Kompridis (1994), the notion of reflective disclosure refers to a process that works on two levels, namely on the level of our situatedness in the world within which we always already find ourselves. On another level, it refers to the disclosure of new horizons of meaning and an opening up of previously hidden dimensions of meaning.

Finally, the chapter concluded with the contention that critical complexity constitutes the possibility to figure out ways of knowing and being in the world that could guide us toward proceeding differently. It offers us some conceptual means with which to think together diverging paradigms without reducing them to one another. Fuelled by the horizon of the impossibility to solve the problem of complexity, critical complexity challenges us to never forget what it means to remain human in a world that is marked by institutions and regulations that are just too eager to reduce the complex condition to some solvable or computable obstacle. Moreover, critical complexity proposes the restorative possibility of disclosing new and alternative ways of entering into the radical antagonistic space, which is known as the condition of complexity.

CHAPTER 6
CONCLUSION

> *And if the assumption of responsibility for one's discourse leads to the conclusion that all conclusions are genuinely provisional and therefore inconclusive, that all origins are similarly unoriginal, that responsibility itself must cohabit with frivolity, this need not be cause for gloom.* Spivak (1997:xiii)

1. Summary of the main arguments

The main arguments made in this dissertation can be summarised by considering how the development of the problem of complexity progressed over Parts I–III. This study embarked in **Part I** with the statement that the study of complexity presents a problem for the traditional scientific strategies by exposing the breakdown of the Newtonian/Cartesian tradition in light of recent discoveries in the natural sciences. This problem was explained in terms of the shift in focus that is required in our attempts to study the characteristics of complex phenomena in general and more particularly in light of how these characteristics cannot be accounted for by employing strict reductionist strategies as proposed by the principles that underlie a Newtonian paradigm. It was argued that strategies that favour the study of relationships and the dynamic organisation of the connections between components are better suited than methods that rely solely on studying the parts of systems in isolation. It was also stated that the study of complexity demands a revision of how we generate knowledge about complex phenomena.

The traditional view that our theories represent the world in a mirrored correlation is challenged by the fact that complexity exposes an opening or gap between the reality of the world as such and our descriptions of the world. It was argued that all knowledge of complex phenomena is a reduction of complexity and in principle our models of complexity can only guarantee partial or limited knowledge of complexity. Consequently, it can be argued that the recognition of complexity questions the conditions of our traditional knowledge claims and it exposes the limits of what we can know. These insights prepared the ground for putting forward the

argument that the problem(s) of complexity reveals the fact that in our pursuit to understand complex phenomena we are faced with more questions than answers.

Hence, **Part II** proceeded with a reflection on the philosophical implications of studying complexity. It was argued that the study of complex phenomena coincides with poststructural and postmetaphysical philosophical positions that challenge the legitimacy of the grounding norms from where a critique of traditional positions can be launched effectively. Similar to how poststructuralist positions question the traditional modernist metaphysical assumptions, the study of complexity calls us to be critical of inherited theories and models for explaining the world. Moreover, it demands from us a re-examination of the limitations of our meaning-making strategies. Consequently, it was demonstrated that not only is the process of constructing postmetaphysical forms of critique challenged by a questioning of the legitimacy of grounding positions, but moreover, the concept of critique as such is also put under scrutiny. Current postmetaphysical theories of critique suffer under this 'crisis of critique'. This dissertation aimed to expose why current theories of critique have been disempowered to be critical and suggested that by re-inventing the notion of critique as originally conceptualised by Kant, some possibility arises whereby the notion of critique can be revived and strengthened to act from some grounded space again.

Hence, the dissertation focussed on Kant's understanding of the concept of critique in pursuit of the development of a renewed and expanded postmetaphysical understanding of critique in order to address the problem of legitimisation that robbed the notion of critique of its ability to be taken seriously. By means of a deconstructive reading of Kant's notion of judiciary critique, a new displaced meaning of the notion of critique emerged that could best be captured by the Derridean concept of *stricture* which is inter-changeable with his notion of *différance*. Re-conceived as stricture and guided by the movement of the double bind, the role of critique changed from being a measurement or yardstick that is grounded in some firm normative framework, to a generative, reflexive movement that informs a certain kind of thinking. Critique as stricture was described as being simultaneously a structure and a place of movement in which oppositional groundings could be accommodated and transgressed simultaneously. Critique as *movement* (characterised by stricture) constitutes a conceptual shift with which the problem of legitimisation can be negotiated. Through this move, critique becomes a dynamic process of constant cutting and bringing together of seemingly opposing paradigms and it unsettles the strict distinctions that are assumed by each opposing paradigm without falling into the trap of being grounded in some fixed ideology.

Critique as stricture tests and provokes the limits of each paradigm and resists the total reduction of one to the other or the total reconciliation between them simultaneously. As such, critique cannot be grounded in any one of the opposing paradigms, but is constituted and legitimised by belonging to neither wholly, yet partaking in both at once. In its liminal character, critique can answer the question 'in the name of what' by addressing the limits of each paradigm. In doing so it finds its legitimisation of claims in the inadequacy and limits exposed in each paradigm. As a result, critique as stricture operates in the name of the limit and the dilemma of finding a (provisional, yet not impossible) legitimate grounding (as discussed in Chapter 3) from where it can operate is addressed.

The study proceeded to examine what kind of thought strategy could cope with such a dynamic nature as embodied in the notion of critique as stricture. It was argued that the notion of *general economy* as interpreted by Derrida, provided the best fit for such a new conceptualisation of critique. The logic of the general economy offers us the conceptual means with which to overcome the restrictions and reductions of thinking about oppositions in a binary juxtaposition. The study also demonstrated how critique as stricture sides within the logic of the general economy and consequently takes on the role of being at once a *mode of questioning* (of the limitations of inherited thought structures), and of *being a strategy of thinking* that is critically *underway*. Furthermore, the notion of complex thinking was explained to represent a mode of thinking that exemplifies the generative logic of the general economy.

Finally, **Part III** introduced the notion of critical complexity in Chapter 5 and contended that this 'brand' of complexity presents a radically critical and normative turn in the field of studying complex phenomena. It was argued, that based on an encounter with lived experiences, the problem of complexity cannot be solved. It is more realistic to reframe the problem as a *condition* that needs to be negotiated afresh every day. Moreover, Chapter 5 aimed to provide some substantive content to the notion of critical complexity so as to delineate it from other poststructural forms of critique. Drawing on the Kantian notion of the categorical imperative, this delineation took on the form of marking itself by posing three self-undermining but non-arbitrary normative imperatives, namely 1) the Provisional Imperative, 2) the Critical Reflexive Imperative and 3) the World-Disclosing Imperative. These imperatives highlighted the fact that a radical engagement with the antagonistic forces underlying the condition of complexity calls for a perpetual and radical form of self-critique.

Chapter 5 concluded with the argument that based on the reflective disclosure found in the World-disclosing Imperative, critical complexity is a call to proceed differently in the world. Our conceptual and theoretical engagements with complexity cannot be divorced from our lived experiences of being in the world. It was contended that the significance of critical complexity can be found in remaining sensitive to how the self, the other and society as a whole is co-constituted relationally. The condition of complexity calls us to perpetually reconsider what it means to be human in a world that remains ruled by an instrumental form of enlightenment rationality.

2. Critical implications

A radical critical position informed by the lived experiences of complexity has implications for how we engage with and design research programmes that are concerned with the condition of complexity. Building on the idea that a critical complexity approach does not offer unambiguous solutions to complex problems, but might expose more questions and problems along the way, it is evident that any intervention that may emerge from such an approach can only be provisional and temporary in nature. Furthermore it should be taken into account that such interventions do not happen as the result of following an *a priori* set of rules or regulations in a programmatic way, but instead, are the result of the dynamic interactions of the components of the system as a whole. Thus, one should be open to re-invent strategies as the process of implementation develops and heuristic approaches might be more productive strategies to follow.

In the absence of a best-practice manual that contains rule-based formulas for dealing with complexity, our encounter with complex phenomena leaves us in a space where we have to face the quagmire of the infinite play of contingencies, contradictions and challenges of what it means to be human. In other words, it means that complexity cannot be seen to be a foolproof method or strategy that can be utilised blindly in the search for answers to difficult questions. Instead it proposes that we adopt an attitude of radical self-reflexivity that becomes the means by which we are to face the messiness of the world. This includes being perpetually sceptical and distrustful of grand ideas and powerful institutions that reduce what it means to be human with their straitjacket agendas, obedience to mechanistic rules and pathological dogmatism. At the same time it also challenges us not to give in to a general kind of resignation (or in-action), but to take a stand and resist injustice whilst acknowledging that we do not have all the answers to the questions at hand.

As Morin (2008) argues, complex thinking can be described as the *art* of thinking that enables us to recalibrate our perspectives concerning the nature of knowledge and politics. Thus, we should be open to alternative forms of modelling and studying complexity. Moreover, we should be perpetually mindful of thinking about other ways of being in the world. The process of disclosing the complexity in the world calls us to think and reflect artfully about our place in this world and the future that we create for our children and those who come after us. Woermann & Cilliers (2012:408) argue that a radically critical approach provides us with "a strategy for remaining open to complexity at the same time that we reduce complexity through our decisions and actions." Moreover, this implies, as Woermann & Cilliers (408–413) argue, that the critical position has to be 1) a transgressive position (we have to be actively engaged and searching for ways in which to overcome problems that need transformation), 2) an ironic position (an acknowledgement of the self-division that is at work in conjuring up solutions that are based on provisional knowledge of a problem) and 3) a position in which the role of the imagination is indispensable (we cannot calculate what will or should happen, we have to make a creative leap in order to imagine what things could be like).

Lastly, faced with the limits of our modes of inquiry, the implications of a radically critical position should not leave us in a state of resignation and is no reason for gloom (see Spivak's quote in the beginning). We are challenged to explore new avenues for studying complexity. The gap that remains between our models of the world and the world as it is (undisclosed), should inspire us to become more creative in our problem solving endeavours. A spark of encouragement is given to us by Donella Meadows (2008:169–170) who suggests the following 'systems wisdom' in which the word 'system' can be replaced with 'complexity':

> The future can't be predicted, but it can be envisioned and brought lovingly into being. Systems can't be controlled, but they can be designed and redesigned. We can't surge forward with certainty into a world of no surprises, but we can expect surprises and learn from them and even profit from them.

To conclude, critical complexity cannot tell us what to do, but as Meadows (185) also suggests, it can "lead us to the edge of what analysis can do and then point beyond—to what can and must be done by the human spirit."

3. Contributions and relevance of the study

In this section I will list a number of topics so as to provide a brief summary of the most important contributions made in this dissertation. The list does not present the topics in their order of importance. Instead, the list is an attempt to deal with the various issues in a systematic way.

1. This dissertation offers a thoroughgoing problematisation of the study of complexity by means of a *descriptive thematic analysis* of both the concepts and theories that underpin and inform the contemporary study of complex phenomena. In the absence of a unified 'theory' or 'science' of complexity, this study presents a list of common denominators that mark the various different interpretations of complexity. Such a list of common denominators does not exist elsewhere and could be utilised to supplement Cilliers' (1998) list of characteristics of complex systems. The relevance of this list of ten common denominators lies in the fact that it condenses the general overarching themes and assumptions found in a vast collection of literature into a concise 'economy of concepts' that could serve as some point of conceptual orientation for newcomers to the field of study.

2. The study situates the study of complexity as a *post-reductionist* position that manages to negotiate a middle way between strong reductionist interpretations of complexity, namely positivism on the one hand and a constructivism on the other. The main tenet of the post-reductionist position is situated in the recognition that the notion of complexity is marked by a double movement which can be expressed as follows: although the acknowledgement of complexity encompasses a critical stance toward modernist thought strategies, it also at once recognises the fact that we cannot discard the premises of these strategies. A reductionist dilemma is exposed: in order to have knowledge of complex phenomena, we have to embrace reductionist strategies to be able to say anything meaningful about complex systems at all. It is precisely this reductionist dilemma that is utilised to characterise the post-reductionist position that is divided at the core. Out of this inner rupture a self-reflexive kind of reductionism emerges that forms the middle way between binary opposites. Moreover, contrary to a radical understanding of the notion post-modernism, post-reductionism does not partake in the legacy of the so-called "loss of reference" tradition with its dislocation of epistemological security. A certain point of reference remains—namely the relation to a complex reality.

3. An important implication resulting from the preceding point is the admittance that the challenges of dealing with complexity are not just situated at an epistemological level, and that one cannot disregard ontological considerations. This dissertation makes a clear argument in favour of ontological complexity (within the seminal literature that concerns itself with the study of complexity, the acknowledgement of the ontological nature of complexity remains a controversial matter). Moreover, it is also argued that the study of complex phenomena challenges us to undo the strict distinction that is traditionally made between epistemology and ontology. In this study the notion of ontological complexity was explained by means of the notion of 'wicked problems' that remain impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise. These were defined as insolvable problems that are better described as being 'conditions' (Allenby & Sarewitz 2011). As a result, the interwoveness of the epistemological and ontological considerations that characterise the problems of complex phenomena implies that it is better to speak of the insolvable *condition of complexity*. Subsequently, this conceptual shift introduces a corresponding shift in attitude: the problems that constitute our study of complex phenomena are re-defined as not things that need to be solved, but as insoluble conditions that resist the implementation of one-dimensional solutions. Conditions are not states to be cured; they are at best, to be accepted, understood, and wisely managed. This shift in attitude holds productive consequences for the way in which research and intervention strategies are to be tackled when concerned with the condition of complexity. One important consequence lies in the challenge of employing and creating adequate models that reflect the reality of complexity in novel ways that would enable us to configure future social, political and environmental constellations in different and innovative ways.

4. The study ended with the statement that critical complexity calls us to proceed differently. The discussion on this point did not offer many directives or examples that might offer substantive ideas as to how exactly we should proceed differently. However, when looking back on the study, it is noticeable that the way in which the study went about the process of reconfiguring the concepts (or the 'problems') of 'complexity', 'knowledge', 'critique' and 'thinking' represents such a different way of proceeding. In a sense, all these concepts were re-defined in a way that demonstrates how these concepts can be changed and interpreted differently when responding to the call of complexity. As such, this study 'practiced what it preached' and *serves as a demonstration* at large of how one can proceed differently. The notions of 'complexity', 'knowledge', 'critique' and 'thinking' were all redefined in terms of the double bind that can be teased out from their conceptual structures. By inscribing the

movement of the general economy into all of these concepts, it was shown that these concepts took on a dynamic nature that allowed for alternative interpretations of these concepts to emerge. The notion of complexity was changed to 'general complexity', the notion of knowledge was changed to 'difficult' and 'hybrid' knowledge, the notion of critique underwent a displacement to become 'critique as stricture' and the notion of thinking was developed into the notion of 'complex thinking'. All of these concepts worked together to inform and put life into the conceptualisation of 'critical complexity.'

5. A highlight of this study is the process of the conceptual development and deepening of the notion of *critical complexity*. As discussed in Chapter 5, it was the intention of Paul Cilliers to develop a substantial theoretical framework that could inform a critical understanding of complexity. As a starting point he developed the ideas concerning the Provisional Imperative, but his untimely death came in the way of finishing what he set out to do. With this in mind, this study set itself the goal of continuing with the structural and conceptual development of critical complexity which resulted in the invention of two additional imperatives, namely the Critical Reflexive Imperative and the World-disclosing Imperative. All these imperatives are also examples of how the call of complexity challenges us to come up with responses (in theoretical and practical terms) that are more cognisant of the implications of dealing with the condition of complexity. In turn, the three imperatives also offer suggestions as to how to proceed differently. The imperatives form non-foundational (or self-undermining) groundings that offer provisional and open-ended strategies with which one can respond to the condition of complexity.

6. The uniqueness of critical complexity is situated in the first place, in terms of how this understanding of complexity marks a *difference to other interpretations of complexity*. It signals the convergence of critique and complexity as expressed in the general economy of the double bind and institutes the conjunction of *complexity and/as critique*. This conjunction inscribes a critical-emancipatory impetus into the complexity approach which is missing in other theories of complexity. From this impetus a conceptual opening is allowed whereby critical complexity can build a bridge to the field of critical theory which in turn allows the complexity approach to engage with societal problems and might even be productively taken up by current theories in the field of social and critical philosophy.

In the second place, critical complexity can be said to be a unique intervention in terms of the position that it takes up in the range of critical responses within the broader field of

poststructural philosophy. Even though critical complexity employs deconstructive strategies to inform its critical practice, it does not lay claim to being a strategy that is better than deconstruction. In fact, the dissemination of deconstructive terms and strategies underlines the fact that critical complexity does not claim to radically shift the parameters of the post-metaphysical or post-foundational condition. If anything, it proposes a *deepening of our understanding of that condition*. Furthermore it proposes how we can respond to this condition differently whilst simultaneously acknowledging that there is no prescriptive devise available that would allow us to determine or measure how the responses of critical complexity could be rated as being better than any other response.

7. The invention of critical complexity opens up a space in which the notion of complexity can be situated and developed more rigorously within the humanities and social sciences. As discussed in Chapter 1, an overview of the development of the theories of complexity took place overwhelmingly in the field of the natural sciences. This could lead to the creation of productive links between the complexity approach and other similar arguments in the mainstream philosophical tradition. In turn the invention of critical complexity *could serve as a conceptual transversal meeting* place in which a liminal space is opened up where constructive and transformative cooperation can occur between the humanities and the natural sciences. Critical complexity has the potential to equip the humanities with sustainable critical practices with which it can enrich the knowledge generating methodologies of the natural sciences. Critical complexity has the possibility of forming a network of connectivity where the research-policy divide can be addressed in a novel way, and where different approaches to the problems of, for example, governance and regulation, processes of social change and socio-ecological problems can be negotiated. Moreover, the notion of critical complexity can inform current emerging research themes in the humanities (markedly in the field of Critical Theory) by developing some conceptual tools with which we can imagine and articulate meaningful and sustainable alternatives to contemporary social and political conditions (for example, by recasting problems in ways that demonstrate their interconnectedness to many levels of complexity) so as to regenerate hope and confidence in the future. The value of a project like this is not necessarily that it takes us further than, say, other poststructural positions, but that it illuminates wicked problems differently and that it deepens our understanding of what post-foundational modes of critique could amount to.

8. Finally, this study *serves as an example* of how such a transversal process that weaves together ideas from various fields of study can be implemented. A unique contribution can be

recognised in the methodological process of reading and writing together the various themes, strategies and theorists that are concerned with the study of complex phenomena.

3. Limitations of the study

1. In its pursuit to reconceptualise the study of complexity as a form of critical inquiry, the focus on the notion of critique was done by only considering it from its interpretation thereof in Kant's *Critique of Pure Reason*. By engaging rather single-mindedly with the Kantian notion of critique, the study failed to engage with the larger context of critical philosophy as found in the field of neo-Pragmatism, the work of Foucault or other critical trends in for example the fields of Feminist theory or Social Theories of Justice. Although there was no direct engagement with or elaboration of the notion of critique in terms of its relevance in the field of Critical Theory, however, some aspects and insights were taken from the work of Horkheimer and Adorno (2001) and their critique of Enlightenment rationality. By evoking Habermas' critique of postmodernism the study did manage to establish a link, albeit vaguely, with the field of critical theory.

2. The study did not engage with the ethical aspects of complexity in a very thoroughgoing way. The reason for it being that such a study was done recently by Woermann (2011) in which the notion of an 'ethics of complexity' was explained in great detail. I did some previous work in uncovering the consequences of complexity in a Business ethics context (cf. Preiser & Cilliers 2010) and did not want to repeat the findings here, seeing that it would have changed the direction of the study too much. Instead, I explored the idea of establishing normative imperatives that could give some more practical and substantive content to the discourse of ethical complexity which often remains abstract and theoretical.

3. An argument can be put forward that the study does not provide an in-depth clarification concerning the epistemological status of the three imperatives that inform the structure of critical complexity. It could be argued that these imperatives present themselves to be mere ethical formalisms rather than being prescriptive or normative guidelines and that they are incapable of generating moral directives itself. More work will be needed in future explorations of this possible critique of the three imperatives and it surely proves to provide for interesting analitical and conceptual development of these imperatives.

4. True to the definition of complexity as meaning *complexus* (Morin 2008) which means 'a weaving together,' this study is the result of a weaving together of the ideas of a number of philosophers. The spectres of Kant, Derrida, Morin, Cilliers, Adorno, Heidegger and even Ricoeur hover over this study in a very much woven-together way. And in a sense their presence is felt rather lightly on these pages. No deep excavations of their ideas were made here. As a result, the act of weaving together took place in the spirit of resembling the work of the *bricoleur* (as mentioned in the work of Benjamin (1999)) that collects things on her way and then employs them as she sees fit. The study comprised a thematic analysis of the relationship between complexity and critique and as a result had to collect what it deemed fitting from other theoretical positions. Each chapter glanced over the main arguments that were related to the underlying philosophical problems, but in reality each chapter could be developed into five different theses themselves, seeing that there remains so much ground to be covered in each of the themes. Thus, the arguments for example that involved the work of Kant and Heidegger or Ricoeur could have been given more space. Instead, the main points of their ideas were taken and incorporated in this study in order to bring across the relevance of the arguments used only in terms of the problem statement.

5. The study failed to provide a concise 'Theory of Complexity' with solid answers for how to apply its concepts and implications to other fields of study. No application was made in this respect. Readers who approached this study with that expectation will be disappointed.

4. Themes for future research

The following themes suggest interesting and important avenues to explore for future research endeavours:

1. In Chapter 1 it was mentioned that complex phenomena are marked by characteristics such as non-linear causality, emergence and self-organisation. These characteristics have been studied in-depth by the analytic tradition (notably in the field of Philosophy of Science). Very little has been written on these notions from the continental tradition of philosophy. The notions of 'emergence' and 'complex causality' deserve much more research and in-depth analysis from a variety of philosophical perspectives.

2. In Chapter 5 the section on the World-disclosing Imperative engaged with the work of Niklas Kompridis in terms of his re-appropriation of Heidegger's understanding of 'world-disclosure.'

Exploring the idea of how critical complexity can be aligned to this position in more detail will prove to be a very interesting endeavour. The work of Kompridis represents a new generation of Critical Theory scholarship and I think an exploration of this new strain of theory could be a very productive undertaking for underpinning the notion of critical complexity even more profoundly.

3. The practical relevance of critical complexity for other fields of study such as the neo-institutional theories of global culture, or global legal pluralism and theories of global civil society could be very informative, seeing that these theories all acknowledge the importance of difference and are based on norms that are informed by moral pluralism.

4. Linked to the notion of difference is the concept of excess variety. As was argued in this study, a general economy of thought is kept open and alive by the presence of excess that refuses to be incorporated into the calculating structures of the restricted economy. A more in-depth study of a 'theory of excess' could provide valuable insights in the formulation and deepening of the understanding of the general economy.

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