



Complexity Theory and Planning - Methodological Insights

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ABSTRACT

The main research question that the thesis addresses is ‘what is the relevance of complexity theory for planning?’ Having set out to examine a theoretical question, the thesis is guided by the nature of theory development. The realm of generalised discourse, theory contextualisation and empirical examination are thus addressed. The argument starts from an understanding of the nature of complexity theory as it emerges from within the natural sciences. The philosophical grounds of the theory and the way in which complexity theory might relate to the social realm are then discussed. Planning is conceptualised in specific ways and the relevance for second order planning is advanced. The use of complexity theory in the non-quantitative stream within planning is discussed leading to the formulation of a methodology for theory transfer derived from the theory of metaphors.

Two concepts for theory transfer and contextualisation are chosen on methodological grounds –fractals and autopoiesis. The chapter on fractals uses the methodology derived and advances a causal claim for use in the second level of planning defined and argued for earlier empirically demonstrated by re-conceptualising a case-study-the People’s Planning Campaign of Kerala, India. The chapters on autopoiesis focus on the use of concepts from autopoiesis to raise separate sets of questions for planning illustrated by discussing secondary case studies. Instances of ways in which answers might be found to these questions in actual planning practice is then discussed through re-interpreting the case study.

In summary, the thesis advances an argument for the relevance of complexity theory for planning and sees this relevance as a contribution to methodological issues that arise from a systemic conception for planning in the second level, foregrounding *society* such that planning as an activity is undertaken by *society* leading to an ordering emerging out of local specificity and detail.

PREFACE

MY EXCURSION INTO THE TOPIC

Many people have asked me how I came to select this topic often described to me as 'unusual'. In this preface I provide the story of my excursion into this topic as it serves to contextualise the research and the thesis from the motivational aspect of a researcher - different from the de-personalised account provided in the introduction of the thesis. This motivational aspect though not overtly visible, remain significant and identifiable as it is embedded within the choices made in the research and the writing of the thesis. Within this section, I also provide a brief account of some of the main influences - people and incidents that have in many direct and indirect ways shaped the thesis and kept it on its track.

Without having a clue of what a 'usual' PhD topic in planning is or how a 'usual' PhD research in planning is, I must confess, that the formulation of the research question that this thesis addresses – an examination of the relevance of complexity theory for planning - was essentially a sort of blind evolution from my vaguely recognised primary research interests. Prior to commencing my PhD in September 2002, I was closely associated with a programme known as the People's Planning Campaign (PPC) in the state of Kerala, India. The PPC, if it is to be described very shortly (more descriptive accounts of this programme follow in the body of the thesis), is a bottom-up planning process operationalised in the state. It involved massive changes in institutional structures, administrative procedures, laws, finance and personnel. I was associated with the programme for 4 years and 5 months primarily involved in capacity building activities for elected representatives and local government functionaries, focussing on the urban local bodies of the state. The institution where I worked – the Kerala Institute of Local Administration (KILA) - is an autonomous body under the State government designated as the nodal agency for capacity building in local administration for the state. The institution was a key player in the operationalisation of the PPC. In my work in KILA, I was very close to practice though not usually directly engaged in it, (except in the case of formal consultancy, action research projects and while imparting advice to local government functionaries). Training and capacity building work was heavy, leaving little time for

reflection or theorising. My desire to do a PhD was to a large extent a reaction to this busy training load that left no time for any serious engagement at an abstracted level (there was opportunity for engagement at the local level in specific contexts) with what I was seeing happening around me, though in many ways I could feel the need for it in the course of my work.

When I came to Cardiff wanting to research something quite as complicated as the PPC, though there was much that I was unsure about, there was one thing that I was sure about. I wanted to understand the PPC holistically - in terms that would allow a refinement of the various stages and procedures within the PPC. The micro-questions did not 'move' me, not that I did not realise that they were important, but I felt I wanted to conceptualise the PPC in holistic *planning terms* first, without borrowing (though not discarding) from political or administrative theories. For instance what were the core features of the PPC that characterised it which were immaterial of its local variations and hence had to be retained if the 'objectives' of the PPC were to be materialised; could one have a theoretical backing to decide if a local undesirable outcome was in fact an outcome of a possible flaw in the PPC or a manifestation of local inadequate contextualisation?, how could this then inform different evaluative criteria?. The problems or questions in my mind were then more to do with 'understanding' PPC rather than finding an answer to one specific 'question' or 'problem' or 'issue'. I was simply looking for a holistic conceptualisation of the PPC in planning terms.

In the first couple of months I did not come across anything that drew my attention. Since it was theories rather than solutions that I was searching for, my search generally centred on theory. I was interested in all that I read in a way, but wanted something larger to relate all the detail to, something that accommodated what I saw and experienced 'on the ground', while at the same time providing me with more insightful perceptions. Eventually, my search led to David Byrne's '*Complexity Theory and the Social Sciences*'. At that time I was fascinated by the book (especially the first few chapters), and felt that it was describing the type of theory I was searching for. It had an holistic approach, was in a sense 'fundamental', and the concepts that it described seemed valuable to the PPC. Yet, there was a certain 'vagueness' and generality about it, that made me wonder how the theory could be *used*. After all, I wanted the theory for informing practice and providing insights for practice. Intuitively, I decided I wanted to know more.

Nobody in the Department whom I was in contact with at that time, seemed to know much more about the theory. My supervisor Huw Thomas, it seemed to me, was quite amused by my choice of theory. He said he could not help me with the theory itself, but I was encouraged to follow my inclination. So, I started concentrating on finding what I could through literature surveys for the next few months. In a sense, the result was quite discouraging. First, there is limited work in the non-quantitative stream in planning dealing with complexity theory (I did not feel totally up to doing a fully quantitative work, though I could understand, conceptualise and relate to it); second, reviewing the work there is, I could not agree to the way in which the theory was being used within the non-quantitative stream; third, I found that I had entered into a multi-disciplinary world, some of the domains of which I knew nothing about. I discussed what I was finding with my supervisor - my disagreements, yet, my continued interest in the theory - who then suggested if I wanted to make the study of the relevance of complexity theory my research topic. The idea that I could do so, was immensely attractive to me. I was warned that it might be unconventional and 'risky' as a PhD topic in planning, though still valid as a thesis topic. I was also warned that there might not be many on the staff who knew about the theory to help me in a conventional way. But for me at that time, all that mattered was whether it could be a valid research topic. If it could be a valid topic, I wanted to do it. Also I reckoned that this might be the only opportunity I would have to pursue a largely theoretical interest. If I could lay the foundations for the theory within the thesis then the development and refinement of concepts formed could in fact shape my research career to a large extent as I reasoned empirical investigations stood more chances of finding a funder.

Throughout the conduct of the research, contrary to expectations I was however helped in many ways, not only by my supervisor, but also by many others in the School who were not otherwise obliged to do so in any way. I must mention Prof Chris Webster and Prof Jon Murdoch in this context. From my supervisor, in terms of feedback and critique, I was assured of a 'different' viewpoint sometimes pulling me back to basics, yet honest, sensitive and encouraging. Equally important and invaluable was the freedom that I enjoyed in a sort of 'protected space' - a space so very essential in the initial stages of development of a theory, be it theory transfer or contextualisation, when concepts and ideas are not yet fully developed to withstand criticism. For me this was the single most important help that I received in this thesis.

The help I received from the other staff members mentioned came as feedback, comments, challenges, discussions and more importantly encouragement based on written work that I had produced. This re-assured me of the path I was following, helped me think and reflect upon why I was making the choices I have made, and also further refined my thinking and more importantly writing. Other instances such as winning the ODPM prize paper competition in 2004 for a section of this thesis, comments received in conference presentations and also referee comments that I received for three journal articles produced from this thesis encouraged me, while correcting me.

In its present form the thesis is a comma, rather than a full stop. It is bounded by the time and space limits of the PhD, which are rather imposed upon it. However it has given me what I think is a rather fundamental understanding of research and the role of theory in the same. It has also helped me not only to see, but also systematically reason, clarify and argue for concepts that lend new light on familiar processes and incidents. I am also glad that some of those in the school who have helped me have found it interesting enough to do further work on their own accord. To that extent I feel that the thesis though necessarily having to be an incomplete statement, has at least partially fulfilled its intention of providing a serious grounding for the consideration of complexity theory within planning.

INTRODUCTION TO THE THESIS

This thesis makes a systematic enquiry into the nature of complexity science¹ enquiring if it is relevant for planning seen as an activity constituted within the social realm. The main research question addressed is – ‘What is the relevance of complexity theory for planning?’ In this chapter, I first dwell at some length on the contextual relevance of this question presented in terms of how science has influenced social science thought, and planning in particular. I then present the nature of the thesis including its scope, sub-research questions that follow from the main research question and the overall research strategy.

1.1 The Contextual Relevance of the Research Question

The short historic perspective presented below provides a framework, within which developments in the science of complex systems can be seen as important. It serves also to position complexity theory within science while preparing the ground for a fuller examination of the theory within social science and planning. In this chapter, the word ‘science’ when used alone shall refer to the natural sciences including mathematics, the physical and biological sciences.

1.1.1 The Nature of Science

The relationship of science to society is now generally acknowledged as being circular, with dense feedback loops from society influencing the kind of science carried out. Details of scientific practice which include choice of problems studied and methodologies used to substantiate a theory have been shown to be shaped by forces operating outside the laboratory - forces ranging from the mental make-up and experience of the scientist, to more institutionalised formal influences of funding, to chance and happenstance (Kuhn, 1996, pg 4). The general cultural receptivity to an idea has also been shown to play an important part in shaping the kind of science carried out, both in terms of the observations deemed acceptable for follow-up and also in terms of anticipation of support and recognition that society bestows upon the scientist (Toffler, 1984, pg xii, xii).

^{1 1} In this thesis the words complexity theory and complexity science are used interchangeably as no clear definition yet exists in the literature distinguishing the one from the other. So both terms refer to a body of work that deals with complex systems.

The relationship is however reciprocal. Science also influences society (Toffler, 1984, pg xiv). It gives rise to metaphors, and shapes mental models that influence the socio-cultural realm, impacting on the manner in which we conceive of ourselves and the way we look upon the world (Outhwaite, 1994, pgs 20-37). The dialectic development gets entrenched first in academic and professional discourses and with time, it gets embedded more permanently in the formal, informal and symbolic interactions of society. This then has almost unconscious consequences on the ways in which we view the future, deem fit to deal with it and organize ourselves to carry on with our daily activities.

The philosopher and historian Thomas Kuhn (1996, pg 11) argued that scientists build their theories and concepts within certain 'paradigms', conceived as a framework of thought – a conceptual scheme – around which the data of experiment and observation are organized. Kuhn argues that from time to time in the history of science, a shift in the dominant paradigms occur, resulting in new scientific theories and fresh explanations to fundamental questions. Using examples of the emergence of Copernican astronomy, Lavoisier's oxygen theory of combustion and the emergence of relativity theory, Kuhn further argues that these paradigm shifts are always accompanied by enormous controversy as they demand a shift in the mental models given rise to by the dominant paradigms of the time (Kuhn, 1996, pgs 67-74).

Given this changing nature of scientific paradigms and the influence of social factors on science, deep questions arise about the nature of reality and how we can come to know it. To some extent, these issues are discussed later in this thesis. It suffices to say now that this if anything, alerts us to the limitations of science. Science clearly captures a lot of reality through various explanations of phenomena around us. However equally true is the fact that science contains contradictions and still has no final answers to some fundamental questions (of life and consciousness for instance). The need therefore is for a pragmatic stand that retains a modesty about scientific claims. This is not to be taken as a call for scepticism towards scientific explanation. It is on the other hand, a call for recognition of the still unfulfilled role of science, an openness to accept the gaps that remain, leading to a willingness to continue the search for explanations. In other words it is a need to remain open to the narratives of perhaps different stories.

1.1.2 Newtonian Science and the Age of Determinism

In the words of Prigogine and Stengers (1984, pg 1) “It is hardly an exaggeration to state that one of the greatest dates in the history of mankind was April 28,1686, when Newton presented his ‘*Principia*’ to the Royal Society of London”. In this book, Newton expounded the basic laws of motion and the universal law of gravitation, which laid the foundations of science, as we have known it thereafter. The uncertain mystic notions of the cosmos suddenly gave way to a precise account of what constituted the universe and the laws that governed matter. A clear cause and effect relationship was established, and deterministic laws of movement combined with the laws of gravity could explain the motions of planets in the heavens, objects on the earth and the invisible motions of atoms in one sweep. This was the triumph of Newtonian science.

Prigogine and Stengers (1984, pg 57-62) also give us a vivid account of Newton’s Laws. The central problem that Newton was addressing was an explanation for acceleration – the change from rest to motion and motion to rest. For this he empirically studied all forces acting on a system in an instant and then proceeded to deduce from these instantaneous forces, with the help of general laws, the series of states the system passes through as time progresses. Thus once the forces are known any single state would be sufficient to determine not only the future but also the past of the system. At each instant everything would be given. In other words, time was no different in the future, the present or the past. It was ‘scalar’ without direction. This treatment of time came to be known as ‘reversible’ denoting that the future, the present and the past were all qualitatively the same.

Avoiding an elaborate exposition of Newton’s laws, I shall move straight on to examine the type of mental models that the Newtonian paradigm gave rise to and its impacts on society at large. At the time of publication of the *Principia*, the clock was the most sophisticated machine of the time and Newton’s image of the workings of nature as an elaborate clockwork (Davies & Gribbin, 1992, pg 6) ruled by simple deterministic laws, provided the metaphor for ages to come. Just as a machine can be taken apart and assembled again, problems and issues could be split up and ‘dealt with’ and then put together again to yield the whole picture. The whole is fully composed of parts that ‘add up’. Also just as a machine is fully self-contained, so also a problem can be isolated from the environment using the device of ‘*ceteris paribus*’ – all other things being equal - and analysed (Toffler, 1984, pg xi). Just as the final outcome from a machine is fully known, given the laws governing the

machine and the inputs, so also given the inputs and the laws governing a situation, the final outcome is fully deterministic and inevitable unless interrupted. Thus there can be no place for uncertainty or chance in the affairs of the world and any such observations could only be mere aberrations that needed to be ignored or managed.

Matter and force in this general scheme of things become important and attain primacy. The ideal state for being had to be the equilibrium state, since here all forces balance each other. The mission of science is then clear - to pave the way towards the attainment of this equilibrium. In fact the Newtonian paradigm so influenced science and society that it gave rise to the famous claim of Laplace, an eighteenth century philosopher mathematician. Speaking about the possibility of defining a given situation fully, he wrote if only that was possible “ Such an intelligence would embrace in the same formula the movements of the greatest bodies of the universe and those of the lightest atoms; for it, nothing would be uncertain and the future, as the past, would be present to its eyes” (Laplace, 1951 quoted in Gleick, 1987, pg 14).

In conclusion the world view that the imagery of the clockwork gave rise to was a worldview defined by dissection, reductionism, determinism, a reversible conception of time and a quest for equilibrium. It came “at a time when feudalism in Western Europe was crumbling. and an emergent industrial societyprovided a particularly receptive environment for it” (Toffler, 1984, pg xxv). Toffler attributes the spread of Newtonian science not only to its rightness or scientific power as demonstrated convincingly through experiments (Kuhn, 1996, pg 78), but also to the receptiveness of the society of the time to the imagery and metaphors it provided.

Besides the question of mental models and metaphors that science gives rise to, is also the question of the type of feelings or the type of psychosis that science induces. In the pre-Newtonian age, the dominant feelings were mysticism and fear (Prigogine & Stengers, 1984, pg 3). With classical Newtonian science, the unknown was no longer unknown. Knowledge of the laws of cause and effect inevitably glorified the position of man as the being that could control the universe. Nature came to be something that could be ‘conquered’ - subjugated to the service of man, unwittingly resulting in its ultimate divorce from mankind. A feeling of alienation from the world scheme of things began to be expressed, in what Lenoble calls the ‘anxiety of modern man’ (Lenoble, 1969 quoted in Prigogine & Stengers, 1984, pg 3). Questions like - “How can we recognize ourselves in the random world of the atoms? Must

science be defined in terms of rupture between man and nature?" (Prigogine & Stengers, 1984, pg 3) became concerns expressed through art, prose and poetry. It led to a backlash in the formation of anti-science movements glorifying ideas of life, destiny, freedom and spontaneity seen to be denied by science (pg 6).

1.1.3 Newtonian Science and the Social Sciences

Debates about the relationship of science and social sciences (politics, sociology, economics and so on) have been examined in depth by many philosophers, most of whom equate science and technology to the Newtonian worldview. Thus 'scientism' as discussed in the works of Habermas, Freyer, Schelsky and Marcuse, (Outhwaite, 1994, pg 21) though advancing different views of its interlinkages with society, do share a common understanding of 'science'. Habermas for instance, claims that technology and 'science' in the form of 'positivist thinking', become ideological (Habermas, 1992, pg 114,115). In his view "scientism means science's belief in itself - the conviction that we can no longer understand science as one form of possible knowledge, but rather must identify knowledge with science" (Habermas, 1987a, pg 4).

The process of domination of 'technocratic consciousness' in society, is described as a process of scientization of politics which results in a transformation of moral-political questions into technical ones. The theme of domination of 'science' is attributed to a pre-occupation of science with prediction and control of objectified processes (Habermas, 1974, pgs 253-282). The orientation towards technical control, it is deemed, "establishes the specific viewpoint from which we can apprehend reality as such" (Habermas, 1987a, pg 311). Linked to this is the concern of Habermas (pg 63) of "the elimination of epistemology in favour of unchained universal scientific knowledge".

It is clear from the above that the worldview advocated by 'science' of the time had indeed disturbed philosophers and social scientists. The main cause of concern being the equation of science to knowledge, power and domination. The over arching all pervading influence of science, which eliminated any space for subjectivity, values and more practical ways of knowledge, thereby effectively distorting reality as experienced, was also a cause of equal concern.

1.1.4 Governance and Planning within a Newtonian World View

The formation of a world-view is bound to encompass all aspects of society including the way it organises itself to anticipate the future to deal with the present. Toffler points out

that Newtonian science influenced the framers of the American Constitution to create a machine for governing, “its checks and balances clicking like parts of a clock”. He also points out that Matternich, when he rode forth to create his balance of power in Europe, “carried a copy of Laplace’s writing in his baggage” (Toffler, 1984, pg xiii).

The genesis of the idea of society or the city as a machine to be ‘worked’ by a parallel notion of scientists or technologists has been traced by Friedmann to Jeremy Bentham, whose work appeared in 1789. According to Friedmann, the ethics of society until then had been a ‘moralistic science’ concerned with proper conduct and right intentions (Friedmann, 1987, pg 51), in keeping with the worldviews shaped by theological discourses that dominated the realm of science and knowledge of the time. Friedmann regards Saint-Simon, in the early 19th century, with his conception of ‘social physiology’ - the planner as a physicist, curing the disease of society - as the ‘father of scientific planning’ (Friedmann, 1987, pgs 51,52). “In Saint-Simon’s world, planning and administration would be based squarely on a science of observation and measurement, a new ‘social physics’ that would discover the basic laws of historic movement” (Friedmann, 1987, pg 67). Familiar with society’s ‘organic laws’ the scientists of the ‘body social’ would consciously set out society’s future course according to a ‘comprehensive plan’. It was the ability of science to predict future outcomes out of present actions that would enable society to control its destiny (Friedmann, 1987, pg 52).

Auguste Comte who started his career with Saint-Simon, in his vision of a unified science placed ‘social physics’ modelled on Newton’s *Principia* right at the apex of his pyramid (Friedmann, 1987, pg 69). ‘True history’, Comte wrote in 1822, is ‘conceived in the scientific spirit’ and lies in ‘the discovery of those laws that regulate the social development of the human race’ (Lenzer, 1975, pg 66 quoted in Friedmann, 1987, pg 70). Comte firmly believed that human freedom lay in submission to ‘natural, scientifically established laws’ just as free-falling bodies obey the law of gravity and the planners task was then to guide social progress in accordance with these laws. (Friedmann, 1987, pg 70,71). Also as per Mannheim, it is imperative that human beings submit inner motives, sudden feelings and beliefs to the commands and needs of a new technical rationality and when this happens, a pre-technological set of values and norms would lose its meaning (Flyvbjerg and Petersen, 1982, pg 26). Friedmann reflects that “a case can be made for the idea that the methods of engineering (derived from Newtonian science) informs major sectors of the planning theory tradition” (Friedmann, 1987, pg 59).

Thus the dominant traditions of planning thought during the immediate post Newtonian period was based on a future, thought to be clearly foreseeable, predictable and controllable towards a desirable goal. Given adequate data it was possible and in fact essential to steer society towards a clearly defined objective. The machinery for implementing the process of change was to be set in place within the governance framework. The 'scientists' that worked the machine were the planners who acquired their expertise through their familiarity with the tools and techniques of 'science'. The paradigm of what is now defined as 'instrumental rationalism' was born within planning.

Instrumental rationalism quite simply places a premium on the techniques of planning. The vocabulary is specialised and today is derived from fields of operations research, systems analysis and neo-classical economics using mathematical analytic techniques like modelling, linear and non linear programming, simulation and so on. The use of these models are to arrive at determinate outcomes which may include either maximisation or optimisation or even choice of satisfactory solutions (satisficing). They largely operate in an equilibrium-seeking model of the world where forces are thought to be 'balanced'.

In its treatment of politics, planning within the Newtonian paradigm is conceived more like an alternative to the vagaries and power struggles of society. This view is perhaps best illustrated in the following quote from Tugwell (1940, pg 97-98). "The arrival of agreed standards and procedures, of close measurement, of specification, furnish the opportunity for excluding, in wider and wider areas, both business and political appeals, and for admitting technical standards in administration as well as a more sophisticated sense of time than is now in use" (quoted in Friedmann, 1987, pg 109).

More lastingly and subtly, it gave rise to attitudes for dealing with unexpectancies, diversities, differences and contingencies, most of which are inconveniences that do not fit the Newtonian paradigm and the associated worldview. This lack of fit implicitly encourages and justifies the tendency to ignore, override or apply quick fix solutions in order to get on with the more important 'scientific work'. (Though more recent trends within this paradigm have sought to address the backlash that arose out of the former trend, using increasingly sophisticated models that include either an error term, or incorporate the notion of probability through stochastic analysis they still remain largely within the overall paradigm of instrumental rationality). The attitudes of the time then slowly find its way into the symbolic

cultural milieu and acquire relative permanence as a default value system which unless questioned becomes the rallying point of ready reference.

Treatment of time in planning acquired a bouncing leap with horizons of 20 and 30 years being effortlessly contemplated. This was possible as there was no inherent unpredictability in the universe as per the Newtonian worldview and hence there was merit in contemplating longer time spans. Forecasting, predictability and control became major pre-occupations. Time scales across regions aggregated into figures, losing its meaning in terms of 'use' at any local scale. Time became another casualty of homogeneity. Similarly space scales were limited more by the technical, financial and administrative compulsions of the period. In some of the utopias that were free from these constraints, space scales swelled to encompass literally the whole horizon of the planner. The space scales contemplated in the 'Radiant City' of Corbusier and 'Broadacre' of Wright illustrates this. More important than the scale of space was the de-emphasising of human associations and engagement with space. In the Corbusian utopia, thus space came to be treated as just another input in the clockwork of the universe – a resource, a variable, or another commodity to be organised towards an equilibrium seeking optimum solution. An aesthetics of space grounded in concepts of homogeneity and conformity followed - the planning of the City of Chandigarh, India being illustrative. Attitudes towards space also lost its symbiotic linkages to larger frameworks of natural systems as these were all manageable under the laws of the universe.

The self image of the planner as a professional, comes to be defined by the premises under which the profession establishes itself in society and by the techniques and tools that it uses to consolidate and guard this position. The planner being the expert in possession of the 'deterministic laws of society' at best assumes the role of the knowledgeable 'technocrat', who can work with the tools and techniques at his/her disposal and achieve prescribed results. At worst, the planner assumes an almost 'god-like' role, of the 'know-all', albeit a benevolent god, who determines the future, charting the course for mankind through the plans that are produced.

1.1.5 Challenges to Newtonian Science

The Newtonian worldview with its doctrine of the clockwork universe in spite of its critique has undoubtedly contributed substantially to our understanding of the universe. The 'success' of this science is an historical fact. However this model has come under withering attack ever since it first arose (Toffler, 1984, pg xiii), as a result of which its power to explain

all of observable phenomena has been relentlessly questioned. Kuhn (1996, pgs 84,85) discussing the practice of science, describes the emergence of anomalies in any science as an inevitable part of its normal practice. The anomalies are closed either by a resolution of it within the existing paradigm or by an acceptance of the anomaly for the present as an anomaly, or further, it may end with the emergence of a new paradigm that requires the reconstruction of the field from new fundamentals which changes the field's theoretical generalizations, methods and applications. Kuhn (pg 77) also points out that a paradigm change occurs only when a new paradigm is ready to take the place of the old one. The timing of breakdown, the ease with which it is recognised and the area in which it occurs are determined not only by internal factors in the development of science, but also by external factors (Kuhn, 1996, pg 69). The socio-cultural context of science is emphasised by Prigogine and Stengers as an 'external history' of science, besides the 'internal history' (1984, pg 309). The overriding grip of the Newtonian model in spite of the attacks against it can only be explained in socio-economic terms. The model came at a time when society was ready to exploit its significance through the industrial revolution and the concomitant spread of colonialism.

One of the early lines of intellectual attack came from thermodynamics and evolutionary biology. It was the treatment of the question of time that was contested. The Second Law of Thermodynamics maintains that left to itself, there is an irreversible tendency towards cooling, decay and molecular scale disorder - known as entropy - in the universe (Waldrop, 1992, pg 286). This then introduces an arrow to the scalar time conception of Newtonian science. If there was a continuous decay in the universe then time past is not time present, which in turn is not time future as there is an inherent change in the system with the passage of time (Toffler, 1984, pg xix). It cannot then be a scalar quantity. Similarly the chemists maintained that if you bring two things together – water and alcohol, you cannot unmix it. Time here is 'irreversible' and matter here is 'active' in an abstract sense. The second line of attack came from the biologists who maintained that time had an arrow, but it was not negative, it was positive as with time came greater organisation and structure. Both these disciplines were challenging the 'scalar' concept of time, but both were contradicting each other – 'a contradiction within a contradiction' (Toffler, 1984, pg xx). They were important because by defining an impossibility they were pointing to a different intrinsic conception of reality.

The theory of relativity of Einstein in the early twentieth century came as another challenge to the Newtonian worldview. There are no ‘universal constants’ in Newtonian physics. These are absolute values that set a ceiling to what can happen within the universe. The velocity of light in vacuum discovered by the theory of relativity, is the limiting velocity for propagation of all signals, which then establishes a point of reference for all velocities. In the Newtonian paradigm, there is no observer as a physical being and hence consequently objective description was defined as the ‘absence of any reference point’. In the words of Prigogine and Stengers (1984, pg 218), “The fact that relativity is based on a constraint that applies only to physically localized observers, to beings who can be in only one place at a time and not everywhere at once, gives this physics (relativity) a ‘human quality. It is a physics that presupposes an observer situated within an observed world”. Similarly relativity also brought in a coupled conception of time and space expressed in four dimensions - three of space and the fourth being time.

The next major blow to Newtonian physics, came with the discovery of quantum mechanics. This challenged the ambition of Newtonian physics to ‘completely’ describe nature. A description of the world of quantum mechanics is not necessary for this thesis. It will suffice to quote from the concise description and evaluation of the implications of the development of the field provided by Prigogine and Stengers (1984, pgs 218-232). “Firstly it led to the realisation that the microscopic world is governed by laws having a new structure, putting an end to the hope of discovering a single conceptual scheme common to all levels of description” (pg 222). Secondly, “all descriptionimplies a choice of the measurement device, a choice of the question asked. In this sense, the answer, the result of the measurement, does not give us access to a given reality. We have to decide which measurement we are going to perform and which questions our experiments will ask the system. Thus there is an irreducible multiplicity of representations for a system, each connected with a determined set of operators” (pg 224-225). “The irreducible plurality of perspectives on the same reality expresses the impossibility of a divine point of view from which the whole of reality is visible” (pg 225) and “on all levels reality implies an essential element of conceptualization” (pg 226). Thirdly quantum mechanics tells us that in the sub-microscopic level “only probabilities can be predicted, not single events” (pg 227) and finally “the co-existence in quantum mechanics of reversibility and irreversibility shows that the classical idealization that describes the dynamic world as self-contained is impossible at the

microscopic level” (pg 229). Quantum mechanics thus brought in concepts of multiple realities depending on multiple conceptualizations, subjectivities, probabilities, and co-existence of differences into the scientific arena.

The developments above were forcing a ‘crises’ in classical Newtonian physics, which called for major revisions not only in science itself, but also to the worldview induced by the ‘power’ of science. The confidence of the scientist and the belief in ‘laws’ that would describe the universe were shaken. Fundamental concepts were being challenged, and the search was on not only for a new science, but also for a new worldview. We shall see later how this has come about through chaos and complexity theories.

1.1.6 Challenges to the Newtonian worldview within the Social Sciences

Challenges to scientism and the associated positivist mode of thinking embodied in ‘modernism’ came through many labels prominent among which were the labels of constructivism, post-structuralism and post-modernism associated mainly with the French thinker Jean-Francois Lyotard. Lyotard combined a scepticism of science, with a rejection of ideologies and philosophies of history, and the grand narratives of progress, emancipation and so on (Outhwaite, 1994, pg 121). More anarchist and subversive accounts of post-modernity aim at transcending the instrumental rationality or technical rationality associated with modernity (Outhwaite, 1994, pg 122).

According to Habermas by the 1970s objectifying approaches no longer dominated the field in the human sciences. They were competing instead with phenomenological, linguistic, hermeneutical and critical approaches (Habermas, 1987b, pg 272). Habermas maintains “the approach of the empirical-analytic sciences incorporates a technical cognitive interest; that of the historical-hermeneutic sciences incorporates a practical one; and the approach of critically oriented sciences incorporates the emancipatory cognitive interest” (pg 308). In response to a survey by a newspaper in 1984, Habermas however maintains that the new theoretical pluralism and openness is also giving rise to a new obscurity which he identifies with three inter related trends. First, a tolerance of diversity and historical variation accompanied by a tolerance of the ‘soft sciences’ and methods. Second, the overcoming of what he calls the ‘philosophy of consciousness’ i.e. the increased importance for the ‘unconscious’. Thirdly a total critique of ‘reason’ which itself rests on a narrowed down version of the same (reason) as applied to ontological, epistemological and semantic realms,

as opposed to a desirable expanded application of 'reason' in the realms of pragmatism or related movements (Outhwaite, 1994, pg 135).

Debates on the role of knowledge, reason, rationality, communication, pragmatism, embodied experiences, perception, cognition and so on dominate the philosophical realm of the social sciences. Parallel to these are the ontological claims on reality and its nature, and debates about the ways of knowing reality. These issues as much as it is relevant to the thesis will be taken up for discussion in more detail in Chapters-3 and 4. The point that is to be made here, is that challenges to scientism and the worldview that it advocates, have been happening in the social sciences just as in the natural sciences.

1.1.7 Challenges to Scientism in Governance and Planning

Challenges to scientism in planning broke out with a continuous disillusionment of the practice of planning. Increasingly various aspects of the paradigm were being questioned. This has ultimately resulted in what can be described as a plurality in planning theories, reflecting diverse positions on all aspects of planning practice. Questions in relation to the glorified 'scientist' or 'technologist' role of the planner has been questioned leading to views of the planner as an advocate within advocacy planning (Davidoff, 1996), a facilitator within communicative planning (Friedmann, 1994, Healey, 1996) or an activist within emancipatory planning traditions (Sandercock, 2000, Friedmann, 1998). Questions with respect to the technical tools inaccessible to the common man within the 'scientific' tradition, has led to an array of planning tools and techniques including participatory tools and techniques (Chambers, 1995) and communicative or discursive forms of planning (Booher and Innes, 2002), each of which contains finer divisions within itself (Harris, 2001). Questions with respect to the 'equilibrium' seeking, 'comprehensive' pretensions of the scientific tradition has led to planning practices based on pragmatism (Verma, 1996, Harrison, 2001), incrementalism (Lindblom, 1996) and radicalism (Sandercock, 2000). The silence of 'scientific planning' with regard to power and its de facto maintenance of existing power relations is challenged by an increased concern for democracy, direct participation, emancipation and equality (Sandercock, 2000, Friedmann, 1993). The authoritative, exploitative and insensitive relationship of planning with nature is challenged by an increasing concern for a harmonious and equitable relationship with nature (Owens and Cowell, 2001). Thus planning theory has branched out, encompassing newer and newer

concerns that exist along with or sometimes challenge various versions of the Newtonian scientific planning paradigm.

1.1.8 The Place of Complexity

I have so far argued for the linkage of science to social science and planning (understood as being activity constituted within the social realm). The argument has been advanced around the nature of Newtonian science and post Newtonian science. The following points have been brought out:

- a) A reductive, deterministic, essentially predictable world view, with scalar conceptions of time and universal laws is propounded by Newtonian science.
- b) The influence of this science in social science can be seen in the positivist tradition that took root.
- c) Conceptions of planning were also based upon a belief that searched for universal laws and technocratic solutions that catered to a predictability that was believed to be achievable.
- d) Newtonian science was challenged first by the theory of relativity and then by quantum mechanics, which introduced universal constants, irreversible time, notions of subjectivity, multiple realities dependent on the observer, and unpredictability.
- e) A parallel trend in the social sciences was also discernible in the move to non-totalising discourses including constructivism, post-structuralism and post-modernism.
- f) Notions of the nature of planning has also diversified with many competing notions including those of advocacy planning, incremental planning, communicative planning and so on taking root. Also conceptions of the role of the planner have diversified.

Given the relationship of science, social science and planning, it is important to examine the discoveries recently made in the sciences, popularly referred to as 'the new science' to see whether they are relevant for planning and if yes, in what way. Complexity science is concerned with a class of phenomena that share essential qualities including non-linearity, recursiveness, unpredictability and so on. A detailed exposition of this science as it appears in the natural sciences is the subject matter in Chapter-2, hence it is not discussed here in any more detail. Numerous writings have already appeared both within social science generally (see for instance Urry, 2000, Byrne, 1997, 1998, 2001, Cilliers, 2000, Reed and Harvey, 1992, Jessop, 2001a, 2001b, Kiel and Elliot, 1996, Rasch and Wolfe, 2000, Thrift, 1999, Eve, *et al*, 1997, Abbott, 2001, Luhman, 1995) and planning and planning allied

disciplines in particular (see for instance Allen, 1997, Batty and Xie, 1999, Batty and Longley, 1987, Byrne, 2003, Innes and Booher, 1999, 2000, 2001, Rhodes and Mac Kechnie, 2003, Dunsire, 1996, Kickert, 1993, Kooiman and Vliet, 2000, Kay , 2001, Strand, 2002). Critiques and sceptics of the 'new science' also abound creating quite some confusion both on the worth of the theory and the worth of its applications (see for instance Stewart, 2001, Horgan, 1995, Sardar and Revetz, 1994, Sardar, 1994, Lo Presti, 1996). This thesis makes a systematic enquiry to find out the nature of complexity science, and to examine if it is of relevance to planning, itself seen as an activity within the social realm.

1.2 The Nature of the Research, its Scope and the Concerns it Addresses

Having argued for the relevance of the main research question from a historic viewpoint in this section, I proceed to analytically break down the main research question presented earlier – what is the relevance of complexity theory for planning? - and thereby argue for the nature of the research. I also explain the research strategy and scoping that flow out of the nature of the thesis.

1.2.1 The Nature of the Research

As mentioned above, the prime central concern of this thesis is to investigate the relevance of complexity theory for planning focussing particularly on the non-quantitative stream. This central concern can be seen to be constituted of two secondary domains – first, the domain of non-linear dynamics in general including chaos theory and complexity theory and second, the domain of the discipline of planning. The first domain (as we shall see in more detail in Chapter-2), is a body of loosely strung together contributions from many disciplines - mostly the natural sciences - which nevertheless have certain properties and characteristics that justify their being gathered under the umbrella of 'complexity theory' or complexity science. The nature of this domain then has to be investigated fully if one is to advance any argument for the relevance of complexity theory in planning¹. This calls for 1) a description of what constitutes the theory; 2) a discussion of the implications of the descriptions; 3) an explication of the nature of the theory based on its implications; 4) an investigation of the ontological basis of the theory which might enable or prohibit it being relevant to the domain of social sciences in general - especially since most of it originates in

¹ Again this becomes necessary to a large extent due to the way in which the theory has been used hitherto in the non-quantitative domain within planning particularly. A more detail discussion and analysis of this use is provided in Chapter-5 of this thesis.

the natural sciences; 5) an explication of the way in which the theory might relate to existing broad theoretical traditions present in the domain of social sciences in general. The part of the thesis that deals with these issues must then necessarily be theoretical in nature.

The second domain of planning is a discipline with specific concerns and interests that are both theoretical as well as practical. If one is to probe for the relevance of any particular theory within this domain, the nature of the domain must first be understood or conceptualised in a certain way, as is done in Chapter- 5. This conceptualisation will in a sense then 'frame' the manner in which subsequent arguments are constructed. The arguments for relevance or non-relevance of the theory for this domain must then be argued for on criteria that will justify or not justify a transfer or contextualisation. If the theory is found to be not relevant, the thesis can then argue for the irrelevance and present its conclusions here. The arguments so far then, will continue to remain theoretical.

If the theory is found relevant however, as I do in this thesis, the relevance for planning (taking off from the nature in which planning is conceptualised) must be substantiated by way of arguments that while remaining theoretical, must also be empirically illustrated. The argument will have to demonstrate both the *added* contribution of the theory to planning as well as the way in which it *relates* to other theories within planning. This part of the argument is then a mixture of theoretical and empirical work, the one reflecting the other while advancing the overall argument for the relevance of complexity theory in planning. In adopting this twin pronged approach, I proceed in two ways. In the first case of theory transfer in this thesis- in chapter-6, I present the theoretical arguments first, and then demonstrate how it plays out empirically, in the second case of theory transfer – in chapters 7 & 8, I present empirical situations first and then re-interpret them theoretically to show how the theory gives certain other insights.

I have above, outlined the overall nature of the thesis that flows from the main research question. It can now be seen that the thesis is largely theoretical, with empirical arguments provided towards the end in support of the theoretical arguments advanced throughout the thesis. The thesis then contains theoretical work and empirical work as in any other thesis, but differs on the relative weightage it assigns to these two domains.

1.2.2 The Scope of the Research

It is argued more extensively in Chapter-4, that theory development proceeds by way of generalised discourse, theory contextualisation and empirical validation. Being concerned

with theory development by way of contextualisation within planning, this thesis then must devote space for the generalised discourse i.e., the metaphysical argument, theory contextualisation and empirical validation.

The theoretical domain described above – that of generalised discourse and theory contextualisation - is however vast and diverse. The range of concerns addressed also range from the ontological (the metaphysical domain) - to the empirical domain. This range is reflective of the needs of theory construction and contextualisation in general. If this is conceived of as the ‘depth’ dimension of the thesis, then the ‘breadth’ cannot be compromised either, as the theory has to be shown to connect to existing theories and position itself in relation to the same. Given the time limits of a PhD and the space limits of a PhD thesis, delimiting the scope of enquiry and presentation is critical. The nature of the thesis makes it difficult to avoid the depth dimension. I have hence retained it, while limiting scope in the breadth dimension.

In limiting scope in the ‘breadth’ dimension, I provide a logical argument for the claims and relations that I advance. This is consistent with the level of the discussion, without taking up the range or variety of concerns that this level might contain. For instance, when I argue for the relevance of the theory for the social sciences, I do not argue for its relevance in economics, politics or law (each of which can be considered as a sub-domain within the social sciences). Similarly from the domain of social sciences, when I move on to planning, besides a discussion in general terms, I choose to deal only with some concepts of complexity theory (the reasons for the choice being provided in the relevant section). Thus there are concepts from complexity theory left out. Also in providing illustrations of how these concepts contribute to planning, I have raised research agendas, which are undoubtedly interesting, but cannot be covered within the space of this PhD. There are also many lines of arguments that can be developed further given time and space. In fact provoking these research agendas is the intention of this thesis as it then demonstrates that a plausible case has been made for the relevance of complexity theory in planning. It is thus a first stepping-stone towards what for me is a rich and interesting domain for planning.

Some issues that interest me at present, those that I would like to take on for immediate further work has been indicated in the concluding chapter. The rest, as I argue within the thesis, is left to the larger planning research community to adopt or discard. The

thesis does not in itself claim to be exhaustive in any sense, though I hope it will be judged as robust in so far as it bounds its arguments.

1.2.3 The Overall Research Strategy and the Research Questions

Within this heading, I describe the overall research strategy and indicate what the sub research questions that reflect this overall research strategy are. The sub-research questions are a series of concerns that can be seen sequentially, the one taking off and building on the other. These sub-research questions are further broken down into finer research questions. These are listed below each sub-research question, so that together they provide an indication of how the sub-research questions are attempted to be answered. I provide below an overall summarised list of the sub-research questions and the subsidiary research questions indicating also where I think the originality of the argument of the thesis lies.

a) What constitutes chaos theory and complexity theory and what is the nature of the theory as it appears in the domains of its origin (in the majority of cases the natural sciences)?

- i. What are the terminologies and properties associated with the general category of non-linear systems that encompass both chaos theory and complexity theory
- ii. What are the properties associated with chaos theory?
- iii. What are the properties associated with complexity theory?
- iv. What is the nature of these theories as revealed in their domain of origin?

These research questions primarily aim at understanding. However drawing out the nature of the theory (again for comprehension) and addressing the last question in the above group of questions, are original arguments to some extent (given that there are other ways - not inconsistent with what I claim in this thesis - emphasizing other aspects)

b) What is the ontological position of complexity theory and how can it relate to the domain of social sciences?

- i. What is the nature of systems theory and what is its ontological position?
- ii. What is the nature of social science and how does this nature relate to systems science?
- iii. What is the nature of complexity theory and how does that relate to systems theory and social science?

The research questions under this sub-research question, demand theoretical analysis and synthesis. Here an argument is to be advanced that aims at explanation through analysis, and

comprehension through synthesis. Creating this argument is thus fully (limited by the fact that it builds on other arguments) an original contribution of the thesis.

c) *What is the nature of planning theory and how can complexity theory relate to it?*

- i. What is the nature of planning theory?
- ii. How has complexity theory been hitherto related to planning thought?
- iii. How might the theory be related to planning thought?
- iv. How can a methodology for theory transfer be derived?
- v. What concepts can be chosen for demonstration?

The research questions demand conceptual clarification, theoretical explication as well as methodological formulation. Conceptual frameworks are to be derived and argued for and a methodology for theory transfer is to be articulated. The arguments for all of these are areas of original contributions of the thesis.

d) *How can 'fractals' in complexity theory be demonstrated as being transferable or capable of relevant contextualisation within planning?*

- i. What is the essence of the fractal concept?
- ii. How can fractals as a concept for planning be theoretically justified?
- iii. How can fractals as a concept for planning be empirically verified?
- iv. How does the concept relate to existing knowledge in planning?
- v. What is the ontological and epistemological claim involved?

The research questions demand conceptual abstraction, application of methodology, conduct of fieldwork and analysis of the same in order to advance an argument for the relevance of fractals in planning. The answers to the research questions as a whole are then an original contribution of the thesis.

e) *How can 'autopoiesis' in complexity theory be demonstrated as being transferable and capable of relevant contextualisation within planning?*

- i. What is the essence of the concept of 'autopoiesis'?
- ii. How has it been contextualised within the social sciences?
- iii. What insights for planning does the contextualisation within social science provide?
- iv. How might these insights be empirically observed in planning?
- v. What is the added contribution of the theory for planning and how does it relate to existing knowledge?

vi. What are the ontological and epistemological claims involved?

Again here as in the case of fractals, conceptual abstraction and explication is demanded, conduct of fieldwork and analysis as well as synthesis with existing knowledge is also demanded. Again, the answers to the research questions as a whole are an original contribution of the thesis.

In the above sub research questions, a, belongs to the domain of generalised discourse, b belong to the domain of generalised discourse as well as theory contextualisation, c to the domain of theory contextualisation and d and e to the domain of empirical validation, though it contains elements of generalised discourse and theory contextualisation also in more specific terms (with reference to the concept being discussed). The claim to the relative emphasis of the thesis being different is also apparent here as it can be seen that although the thesis covers the domain of theory and empirical work, there is more theoretical emphasis required here which includes the *construction of an argument* for the theory which is then part of the original contribution of the thesis. This has implications for both the research strategy and output of the thesis. In terms of research strategy, the argument rests heavily on the construction of argument through a discussion of literature and in terms of outputs, the originality lies in the construction of this argument, rather than a solution to a problem. The originality of the thesis being constitutive of its argument, there are thus numerous points of originality that can be claimed for the thesis, which can all be reduced to a single term - the argument. The original contributions of the thesis are thus distributed over theory, methodology, empirical fieldwork and analysis. In strategic terms the actions relating to the research approach and research questions can be pictorially depicted as in Figure: 1 overleaf. I move on now to describe the structure of this thesis.

1.2.4 1.2.4 The Structure of the Thesis

The structure of the thesis reflects the research strategy. In general each chapter addresses a sub-research question. Chapter-2 addresses sub-research question (a), Chapter-3 and Chapter-4 both together address sub-research question (b), Chapter- 5 address sub-research question (c), Chapter-6 addresses sub-research question (d) and chapter-7 and chapter-8 together address sub-research question (e). Besides the overall introduction and conclusion, there are thus seven chapters in all. Sections within chapters take up the subsidiary research questions.

Aim of the Research: To Examine the Relevance of the Complexity Theory for Planning

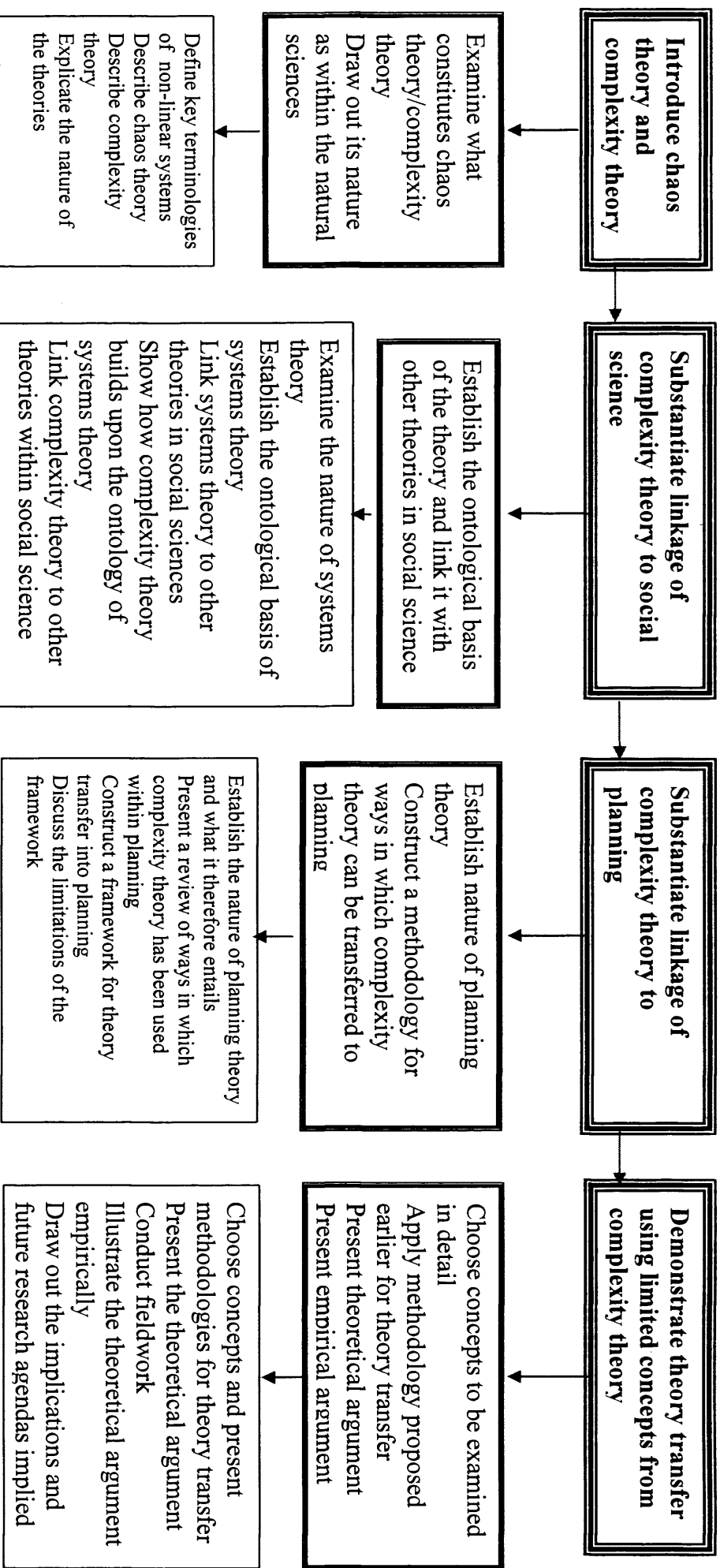


Figure-1.1: The Overall Research Strategy

Besides the formulation of the research strategy, the framing of research questions and the scoping of the thesis, conceptualisation of the writing strategy and the writing itself have also been of considerable challenge. As regards conceptualisation, some of the concepts that this thesis deals with are expressed in abstract terms in their domain of origin or in the domain of social science into which they have been imported. Wherever possible, these terms have been rephrased and explained in simple terms using aids such as tables, diagrams, flow charts, examples and short secondary case studies. However there are portions in which it has been very difficult to do this. In these portions I have had to resort to an abstract argument, expressed in what I hope is a simple yet appropriate vocabulary. It is also hoped that these abstractions are better clarified, when they are discussed empirically within the re-description and analysis of the field work. Overall in the writing, the image of the type of audience has varied, (more on this is given in the concluding chapter), yet it can be generally stated as being those dealing in and reflecting on planning practice to achieve an abstraction that contributes to the development of planning theory consistent with knowledge of planning as a social act.

CHAOS AND COMPLEX SYSTEMS – KEY CONCEPTS, TERMINOLOGIES AND NATURE AS IN FIELD OF ORIGIN

Introduction

This chapter aims to clarify the nature of chaotic systems and complex systems as observed in their field of origin. It hence contributes to an understanding of the theory. The chapter is organised under six sub-headings. The first part explains three types of systems – non-linear, deterministic yet unpredictable systems and dissipative systems. These help to orient oneself to the nature of non-linearity, unpredictability and complex ordering. The second part covers key terminologies associated with the above type of systems (with which complexity theory deals) in general. This forms the ‘vocabulary’ for understanding chaos and complex systems. The third part covers concepts associated with chaos theory, (the properties of which are shared by complex systems). The fourth part covers concepts from complexity theory itself. The fifth part draws together key concepts presented in this chapter and reflects upon the logic of inter-disciplinarity that runs through the discovery of these varied concepts. Through this reflection, it advances an argument for the nature of chaos systems and complex systems as revealed through (mainly) the natural sciences. The argument is then carried further to establish the level of theories that chaos theory and complex theory aspires to within natural science. The chapter concludes with a summary, which is the sixth part.

To a large extent a narrative account is used to accomplish this task. Thus short vignettes, within the text carry the story of how key concepts came to be recognised and identified in different fields. These, it is hoped, while providing a more interesting read to the discovery of the concepts, will also provide information of the significance of the concepts for the particular discipline in which it was discovered. Diagrams and figures are provided wherever possible and needed to further clarify the concepts.

The terminologies and concepts chosen here for explication, are by no means exhaustive of those associated with chaos or complexity theory. Some of the concepts

discussed are used further in the thesis, but not all. The concepts are used in two different ways. Directly they are used as concepts that are examined for theory transfer. But more subtly, the implications of the concepts contribute to the ontological and epistemological arguments presented later. Also the nature of the theory is brought out through the description of the concepts associated with it. The concepts are thus chosen not only for their later relevance, which might be in direct and indirect ways, but also for their heuristic value consistent with the aim of this chapter.

2.1 Types of Systems

Non-linearity, unpredictability, irregularity and complex ordering have been observed and acknowledged in the sciences for quite some time. However the emphasis of the sciences by and large has been traditionally on the study of linear systems and regularity (Gleick, 1987, pg 41, 42). Linear systems lend themselves more readily to analysis and prediction, and therefore they have understandably been deemed as more useful. The study of systems that do not obey linear laws, as a consequence, has never been accorded much significance historically. Also these systems are notoriously difficult to compute and analyse and the tools for studying them being limited, again, caused them to be generally avoided (Gleick, 1987, pg 162). Moreover, the field of the more promising linear science was still waiting to be explored. Computers and the immense potential for computing that it has allowed, has been largely instrumental for the renewed interest and development of this field. Below, I describe briefly systems that give rise to non-linearity, unpredictability and complex ordering.

2.1.1 Non-linear Systems

Much of science as mentioned earlier is built on the idea that a natural system when subjected to well-defined external conditions will follow a predicted course and that any change in the external conditions will produce a *proportionate* change in the systems response (Nicolis, 1995, pg 1). This idea of science is simple, linear and gives rise to reproducibility and predictability and therefore is culturally reassuring and appealing, besides being attractive from a technological point of view. Linear equations are equations that are solvable. They can be taken apart and put together again. The pieces add up (Gleick, 1987, pg 23), referred to as the property of superposition, whereby the combined action of two different causes is merely the superposition of the effects of each cause taken individually (Nicolis, 1995, pg 1).

The linear worldview is now shown to provide at best a limited partial view of the natural world. In most instances it is now acknowledged, ‘a radical qualitative deviation from the regime of proportionality’ (Nicolis, 1995, pg 1) is what is witnessed. Non-linear systems are systems which cannot be reduced to their component parts. Adding two elementary actions produce ‘cooperativity’ between the elements giving rise to unexpected structures/events, which are quite different from those of the underlying laws. (pgs 1,2) These can be abrupt transitions as in phase changes from solid to liquid for example, formation of a multiplicity of states, pattern formation or an irregular markedly unpredictable evolution (pg2). Moreover small changes in the underlying actions can cause this very large change in outcome (Briggs and Peat, 1990, pg 24). The quality of ‘proportionality’ is lost here.

Equations that describe linear systems – linear equations – tend also to differ from equations that describe non-linear systems – non-linear equations. Linear equations allow the solution of one equation to be generalized to other solutions. Non-linear equations on the other hand, though they share some universal characteristics, are essentially individual and stubbornly peculiar (Briggs and Peat, 1990, pg 24). With respect to ‘solubility’ also they present problems. This can be best understood with respect to friction. The force needed to cause a certain acceleration in any moving object can be easily determined using Newton’s laws of motion if friction is not taken into account. However when friction is taken into account, the amount of friction to be assigned will depend on the speed the object is moving at, which in turn follows from the friction. In other words, “the act of playing the game has a way of changing the rules” (Gleick, 1987, pg 24). This *reciprocity* in the equation cause the non-linearity and the “twisted changeability” (pg 24) makes non-linearity hard to calculate. It makes the system insolvable by conventional means, as the *values are never quite precisely known* at any instant.

2.1.2 Deterministic systems

A deterministic equation is one that does not contain any ambiguity with regard to the terms contained therein. All the terms going into the equation can be determined (Briggs and Peat, 1990, pg 73). The laws governing such equations are exact and precise. Chance does not have a role here. It is hence solvable and the results are predictable through dynamic (in other words Newtonian) laws from preceding states (Davies and Gribbin, 1992, pg 30). These types of equations can be

contrasted against 'stochastic' equations, where the equations are governed by randomness and chance (Stewart, 1990, pg 17).

A famous example of non-linearity, instability and predictability is the 'three body problem' of Henri Poincare, a French mathematician largely credited to have produced the first evidence of what is known as 'chaos' (Stewart, 1993, pg 44). Poincare showed that calculating the dynamics of motions of two bodies in space (the earth rotating around the sun) was easily solved (friction is absent in space). However when one more body was added, (the moon rotating around the earth which in turn rotates around the sun) the problem becomes very difficult. This is due to the iterative effects induced by the third body. The calculations requires a number of approximations to close in on the answer using a method known as the 'perturbation theory' which adds up small additional effects of the third body, in a series of successive approximations, each smaller than the one before and applies the effects as a corrective term on the original two body solution (Briggs and Peat, 1990, pg 27).

This was in a sense surprising, because the equations that describe the motions of the planets are with no ambiguity. They are derived from 'deterministic' Newtonian laws of motion and are simple by themselves. Yet it gives rise to an unsolvable situation. Poincare was actually showing that it was possible to associate deterministic equations with non-linearity and unpredictability. Instability could arise from seemingly deterministic equations when *iteration* is involved.

2.1.3 Dissipative Systems

This is a term coined by Prigogine and Stengers (1984, pg 12). Dissipative systems are open systems that are in interaction with the environment (Toffler, 1984, pg xii). They take in food/energy from the environment and dissipate energy/waste out to the environment (Briggs and Peat, 1990, pg 138-139). This process contributes to the development of internal structuration within the system. Negentropy is the most important property of dissipative systems – the capacity for negative entropy or negentropy. This is the opposite of positive entropy, which is the tendency of thermodynamic systems to move irreversibly into a state of random disorder.

The above three types of systems denote ways in which systems can 'deviate' from the commonly known linear predictable models in science. We have thus i) non-linear systems with qualities that are specific to the system, not reducible to their component parts, with parameters that are difficult to measure or compute due to reciprocal relationships embedded in the system, ii) deterministic systems that are

governed completely by deterministic laws that still produce indeterminacy due to iterative effects and finally iii) dissipative systems that give rise to structured order in defiance of the second law of thermodynamics that predicts increasing disorder. All these three systems belong to the class of chaotic systems with the last being the class of complex systems.

2.2 Key Concepts and Terminologies

In this section, I introduce key concepts and terminologies that are discussed in the course of the rest of the chapter. I present them separately so that the discussion on chaotic systems and complex systems can then proceed separately, independent of the need to explain what the concepts are at every point.

2.2.1 Stability and Robustness

Stability in the world of classical Newtonian physics is behaviour that does not disappear if some parameters change by a tiny amount (Gleick, 1987, p 47). Stable states of rest are commonly visible in nature, but unstable states of rest are not, as the ‘instability’ brings it back to the stable state.

A linear process given a slight nudge tends to remain slightly off-track, while as a non-linear system given a slight nudge can either be stabilized or destabilised (Gleick, 1987, pg 193) by the use of repeated feedback. This gives rise to the concept of robustness which indicates how well a system can withstand small jolts. Linked is also the concept of flexibility which indicates how well a system can function over a range of frequencies (pg 293). These notions are referred to again in chapter-8 in discussing causality in autopoiesis.

2.2.2 Iterations and Feedback

Iterations describe a series of operations where the output feeds into the input for the next step. The new output again feeds into the input for the next step and so on, over and over again through time. An example is the simple equation $x_{(next)} = x^2 + 1$, where some value of x is first assigned and then, the next value of x takes on from the result of the equation. There is no ambiguity as the value of ‘ x ’ solely depends on the previous value of ‘ x ’ alone. The system can be said to have a feedback loop as it repeats itself over and over again. It has time built into it and remains historic tracing a path over time.

Two types of feedback loops can be traced. The first of these are negative feedback loops, which seek to dampen a system. Examples of these would be the thermostats used for temperature control. The second type of feedback loop is positive

and they serve to reinforce existing trends. Repeated amplification of a sound by feeding in the output from the speaker back into the microphone is an example. Thus 'negative' feedback regulates or dampens, while 'positive' feedback loops amplify (Briggs and Peat, 1990, pgs 25, 26). They are ubiquitous and can be found in mechanical, economic, social or psychological systems around us.

2.2.3 Phase Space

The concept of phase space is central to the understanding of chaotic systems. By definition, phase space is a mathematical space in which the possible states of a system are plotted, such that each point coincides with one possible state. To explain the concept, one must imagine a situation that is dependent on some variables, say the movement of a ball across a snooker table. The movement of the ball can be described at any point by its velocity and its position. If these variables are plotted on the X-axis and Y-axis of a graph, we get a curve that abstractly describes the movement of the ball. This is a two-dimensional phase space describing the movement of the ball. It is not the actual physical movement of the ball. If the movement of the ball were thought to be dependent on one more variable, say friction, then this third variable could be plotted on the z axis forming a three dimensional phase space describing the movement. Thus any point on the curve in this phase space describes a position of the ball and the variables at that position can be read of the co-ordinate axis.

Things get complicated however when we start assigning more than three variables like say the spin, direction of spin etc of the ball. Phase spaces can have as many co-ordinate axes as the number of variables that define the system. It is thus an abstract imaginary space that helps visualise the overall behaviour of a system and the possible states that it can have. The point in phase space is the system at that point of time. In other words it "turns numbers into pictures" (Gleick, 1987, pg 134) and one of the advantages of phase space is that "it makes change easier to watch" (pg135). A phase space of a simple pendulum suspended at one end coming to rest is shown in Figure-2.1. The velocity of the pendulum is plotted on the y-axis and the position of the pendulum is plotted on the x-axis. Each point on the curve in this phase-space describes a possible position of the pendulum and the phase space describes all the possible positions.

2.2.4 Attractors

Attractors are formed in 'phase space'. The term characterises the long-term behaviour of a system. Thus in the example of the simple pendulum which comes to

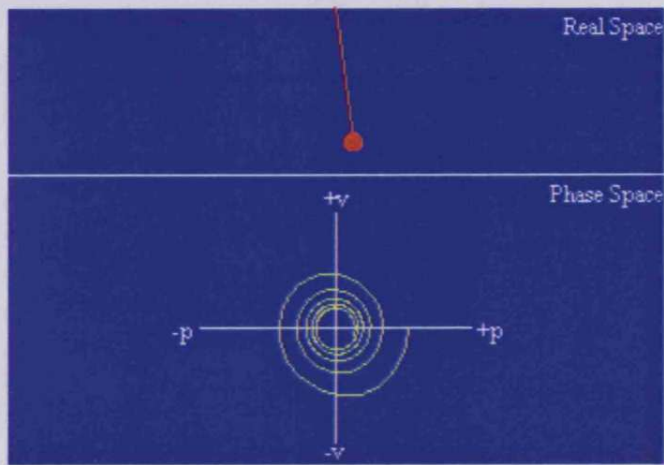


Figure -2.1: Phase space of a simple pendulum coming to rest
 Source: <http://mcasco.com/pend1.html> Accessed : 10-12-2003

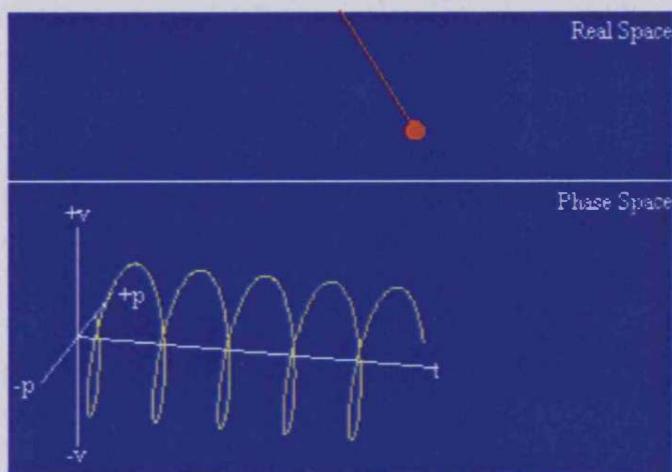


Figure-2.2: The phase space of an un-damped simple pendulum.
 Source: <http://mcasco.com/pend1.html> Accessed : 10-12-2003

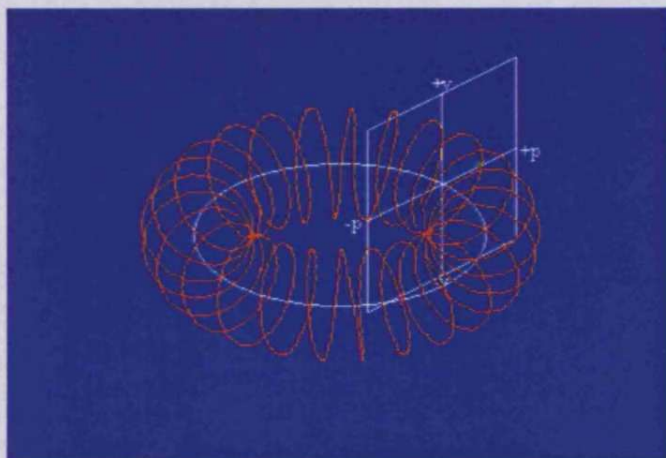


Figure-2.3: The quasi periodic attractor
 Source: <http://mcasco.com/pend1.html>
 Accessed : 10 - 12 - 2003

rest (damped) described above, the attractor is a point. If the pendulum is to be kept moving, by a mechanical device, the phase space would then be as given in Figure-2.2. This is a limit cycle/periodic attractor. Whatever the starting velocity or position, the phase space of the pendulum eventually gets trapped into this cycle. A modified version of the periodic attractor – the quasi-periodic attractor - the torus, can also be observed very rarely. Here two or more distinct periodic oscillations are combined – like the moon going round the earth, which in turn goes round the sun. The phase diagram of this type of motion is given in Figure-2.3.

Many calculations were tried out in classical mathematics to see if there were any other type of attractors, besides the point attractor, the periodic attractor and the quasi-periodic attractor. None were observed. From the qualitative viewpoint, the basic forms of attractors into which all systems studied in science channelled were thus the three types of attractors described above. (Stewart, 1993, pg 50, 51).

2.2.5 Fractals

This concept is one of the two concepts taken up later in this thesis for theory transfer into planning. Fractal geometry is generally posited against classical Euclidean geometry, dealing with circles, triangles, squares and the like (Briggs and Peat, 1990, pg 91). The phenomenon was first studied and the term first coined (in an internal paper to IBM in 1964; <http://fractals.iut.u-bordeaux1.fr/jpl/history.html>), by Benoit Mandelbrot, a mathematician (Gleick, 1987, pg 98), who was studying patterns and searching for symmetry not limited to one scale, but across scales (pg 86). A fractal curve when viewed on many different scales from macroscopic to microscopic, reveals the same intricate pattern of convolutions that constitute the whole. This is unlike a circle, which if magnified sufficiently becomes just a line (Series, 1993, pg 136). Thus fractals define systems that exhibit self-similarity – a symmetry across scales.

The idea of dimensions is central to fractals. This can be best explained, by considering the case of a ball of twine as explained by Mandelbrot. The dimension of a ball of twine from a distance is no more than a point, with zero dimensions. However, if one approaches closer, the ball fills a spherical space and hence has three dimensions. If one approaches closer still the twine assumes importance and then it effectively has one dimension. From still closer up in micro dimensions, the one dimension again becomes a three dimensional column and then one-dimensional fibres and finally again zero dimensional points (Gleick, 1987, pg 97). Thus we find

that the numerical result describing the dimension is actually dependent on the relation of the observer to the object.

By another example Mandelbrot illustrates the importance of the scale of measurement – the question of the length of the British coastline. If the coastline is measured from any particular map, it gives a corresponding length. However if a more detailed map is used, which includes more details of bays and inlets, the length of the British coastline increases. If a still more detailed map is used, then the distance measured becomes very great, as the measuring stick now has to follow a lot more bends and crevices. If that is true then it is possible to conceive of a measuring stick equal to the size of say one grain of sand - now the length has become infinite. In other words, this is a way of seeing infinity (Gleick, 1987, pg 98). Besides the length of the coastline of Manhattan or America has become the same as that of Britain – ie. infinity (Briggs and Peat, 1990, pgs 93,94). Fractals, are a way of seeing the world not quantitatively but qualitatively and there is a way of measuring this qualitative dimension using ‘fractal dimensions’ (Briggs and Peat, 1990, pg 95). Fractal dimensions are fractional, and they measure qualities such as the degree of roughness, brokenness or irregularity in an object. Mandelbrot specified ways of calculating the fractal dimensions of objects. He also showed that the degree of irregularity for fractals remained the same across all scales (Gleick, 1987, pg-98; Mandelbrot, 1982, pg 124). Self-similarity in fractals implies recursion – pattern inside pattern. It is built into the technique of constructing the curves as the same transformations are repeated at smaller and smaller scales

Though the complicated behaviour visible through fractals may seem to be produced by complicated equations, they are actually not so (Series, 1993, pg 138). Fractal branching visible in lightning, leaf veins, arterial structure etc are also described by just a few bits of information (Gleick, 1987, pg 110). The images given in Figure-2.4, illustrate the formation of clouds and mountains from simple equations. Yet, fractals can be said to be highly complex by virtue of their infinite detail and unique mathematical properties.

The degree of irregularity in fact corresponds to the efficiency of an object in taking up space. A Koch curve as in Fig: 2.5 illustrates this. To construct a Koch curve begin with a triangle with a side of length one. In the middle of each side, a new triangle one-third the size must be added and the process repeated. The length of the boundary is now $3 \times \frac{4}{3} \times \frac{4}{3} \times \frac{4}{3} \dots$ - infinity. Though the length of the side

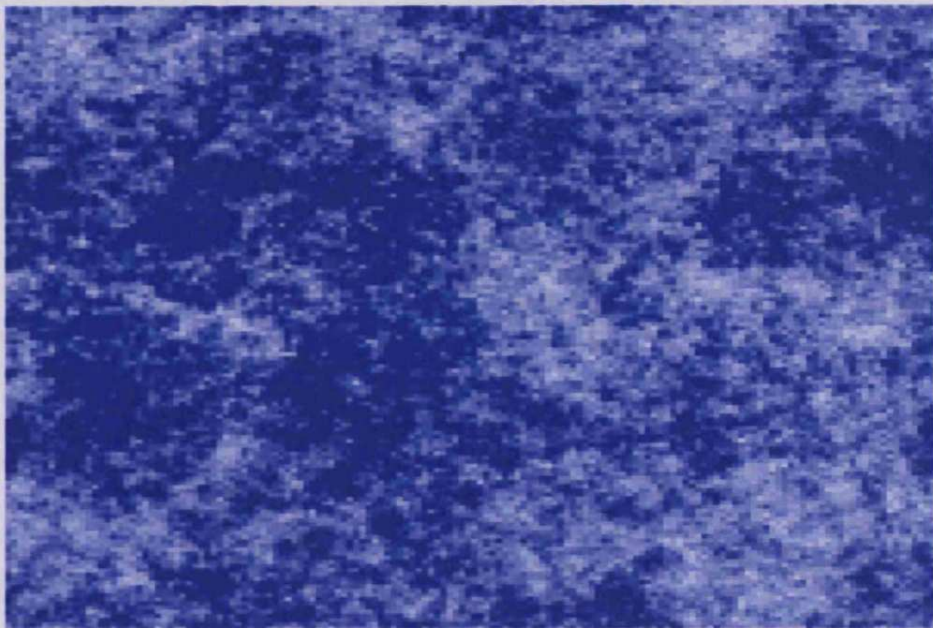


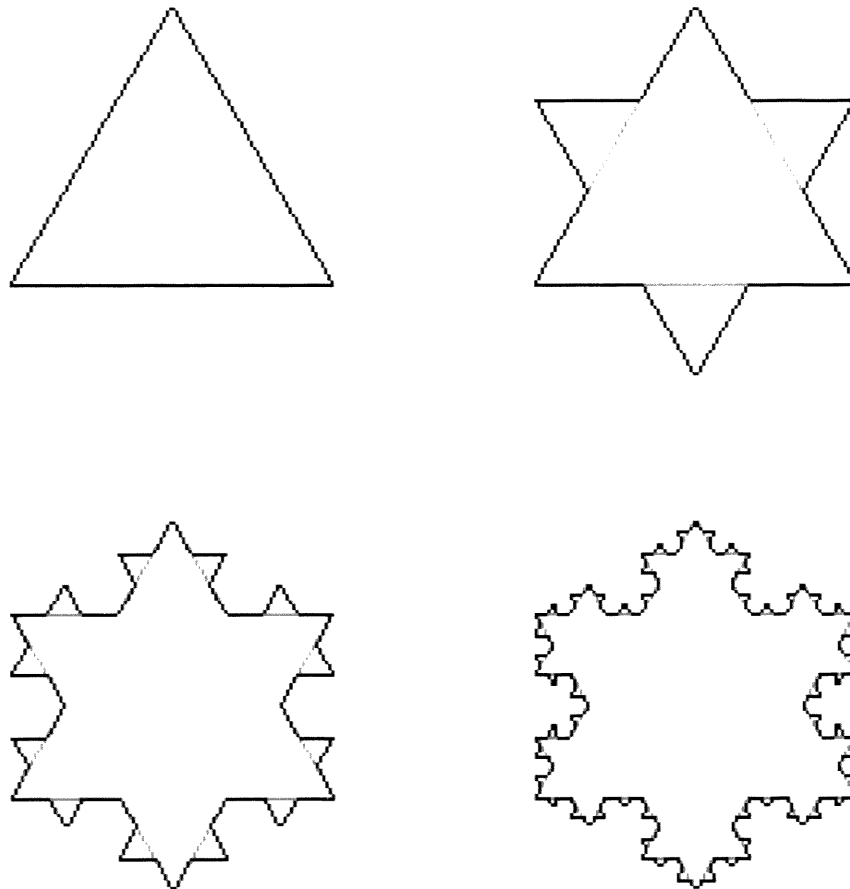
Figure-2.4: Mountains and clouds - Fractal images created from equations on a computer screen

Source:

http://www.lactamme.polytechnique.fr/Mosaic/descripteurs/Galerie_NonDeterministicFractalGeometryNaturalPhenomenonSynthesis.FV.html

http://visearth.ucsd.edu/VisE_teach/SpaceMath/fractalclouds.html

Accessed: 10-12-2003



The first four iterations of the Koch snowflake

Figure-2.5: The Koch curve

Source: http://en2.wikipedia.org/wiki/Koch_snowflake

Accessed 11-12-2003

tends to infinity, the area remains less than the area of a circle drawn around the original triangle. In other words, an infinitely long line surrounds a finite area (Gleick,1987, pg 99).

In general then, fractals are characterized by infinite detail, infinite length, no slope or derivative (proportional change in dimension along one axis for a small change in the other), fractional dimensions, self- similarity and they can be generated by iteration (Briggs and Peat, 1990, pg 95).

2.2.6 Autopoietic Systems

This is the second concept taken up later in this thesis for detailed examination and contextualisation in planning. The term 'autopoiesis' was first coined by two Chilean Biologists, Humberto Maturana and Francisco Varela in the 1970s who were attempting to distil out the real meaning of life in the biological world, choosing as their unit of study a living cell. The authors were interested in an explanation that did not need to be reduced to lower level phenomena, yet held explanatory power.

The term 'autopoiesis' translated from Greek approximates in meaning as 'self-producing' (autos = self, poiein= to make (Brans and Rossbach, 1997, pg 425)). The term relates to Maturana and Varela's key finding that what distinguishes a living organism is 'the system's specific organization of production relationships' (van Twist & Schaap, 1991, pg 32. The outputs of the systems are its own inputs. This is in contrast to an 'allopoietic' system, where the outputs would be very different from the inputs, as say in a chemical factory (Mingers, 1995, pg 11, 12). The concept of autopoiesis for Maturana and Varela is precise. They argue that the capacity to reproduce a particular organisation of parts self-referentially solely from the parts themselves gives rise to a unity which they term as autopoietic. Their definition of an autopoietic system is then 'a network of productions of components which (i) participate recursively in the same network which produced them and (ii) realize the network of productions as a unity' (Varela *et al*, 1974, quoted in Kickert, 1993). More about this concept is said in chapter-7 dealing with ways in which the theory relates to other theories in planning.

2.2.7 Entropy and Entropy Barrier

The concept of entropy comes from the field of thermodynamics. Prigogine and Stengers (1984, pgs 103-129) give an excellent explanation of entropy. In 1811, Baron Jean-Joseph Fourier mathematically described the propagation of heat in solids. The law was simple - heat flow is proportional to the gradient of temperature. The law

however triggered two developments, the first being the formulation of a concept of ‘thermal equilibrium’, which was akin to mechanical equilibrium. The second more interesting development was the systematic study of irreversible processes (Prigogine and Stengers, 1984, pgs 104,105).

In 1847, Joule linked the network of effects that heat was known to have on electricity, chemistry, magnetism and biology, using the concept of ‘conversion’. The idea of conversion postulates that something is conserved, even while it may be qualitatively transformed – the law of conservation of energy. In 1820, Sadi Carnot had come up with a four phase model that described the processes and changes taking place in a heat engine. In 1850, Clausius, using the perspective provided by the law of conservation of energy, linked the processes of heat conversion to mechanical energy, through an equivalence relationship that made the reverse action that is conversion of mechanical energy to heat also possible. However the systems were still describing ideal conditions where heat loss or energy loss were not accounted for (Prigogine and Stengers, 1984).

In 1852, William Thomson first formulated the second law of thermodynamics – the existence in nature of a universal tendency towards degradation of mechanical energy. The world is described as an engine, in which heat is converted into motion only at the price of some irreversible waste and useless dissipation. Effects producing differences in nature progressively diminish and the tendency towards thermal equilibrium ultimately brings in ‘heat death’. This introduced for the first time an arrow for time. In 1865 Clausius introduced the new concept known as ‘entropy’ to express the distinction between useful exchanges of energy, and dissipated energy that is irreversibly wasted. Prigogine and Stengers postulate that there is a gradual increase in entropy for all isolated systems such as the earth and that the state of maximum entropy is the state of thermodynamic equilibrium. Further all non-equilibrium situations produce evolution towards the same kind of equilibrium state, so that by the time equilibrium has been reached, the system ‘forgets’ its initial conditions. This in other words means an inability to go backward in time, which is termed as the ‘entropy barrier’ (Briggs and Peat, 1990, pg 150).

2.2.8 Far from Equilibrium Systems

Prigogine and Stengers (1984, pgs 137-145) divide thermodynamics into three stages. A stage wherein entropy production, and all fluxes and forces, are zero. This is the equilibrium stage. To visualize this we can imagine two boxes connected by an

opening, each carrying two different gases. Eventually the two gases will mix so thoroughly that there is no difference in concentrations between the two boxes. This is the equilibrium stage, exhibiting a sort of ‘passive’ chaos. However if the boxes are heated differentially, that is one more than the other, the mixing will not be so even and one gas will be more in each box. The flow of heat will have produced some order but this is not the same as that in equilibrium (Briggs and Peat, 1990, pg 136). It is in a state of minimum entropy production that the boundary conditions permit. This is the ‘near to equilibrium stage’. In this stage, and in the previous stage, systems tend to be drawn to an ‘attractor’ – either point or limit cycle, losing sense of their history, and linear thermodynamic equations tend to apply.

In systems that are far-from-equilibrium, that is systems that undergo a great deal of energy input from the outside, new behaviour can be seen. There is no longer any universal law from which the system behaviour can be deduced. Each is a separate case exhibiting qualitatively different behaviour. This is the region for the onset of ‘active turbulent chaos’, distinct from the ‘passive inert chaos’ found at equilibrium (Briggs and Peat, 1990, pg 136).

To summarise the narrative so far, this section has introduced key terminologies associated with the science of ‘chaos’ and ‘complexity’. The descriptions of the terminologies foreshadow a description of a ‘new world’ discovered, or rather, systematically being studied by science at present. The contributions to the understanding of this ‘new science’ are not limited in any way to one or two disciplines – it is not a ‘disciplinary problem’ though each concept might have originated as one. The question that remains is how science weaves these concepts together to initiate explanations of nature, society and our position within it? Also what additional insights can such a science give us for our understanding of the world and thereby our actions within it? The rest of this chapter examines the science of chaos and complexity to address these questions.

2.3 Chaotic Systems

It is said that three developments within science have helped to make chaos and complexity almost a household word today. First, cheap computing power, second, growth of scientific interest in irregular phenomena and third, the advances of a new style of mathematics that allowed the exploration of shapes and geometrical imaginations (Stewart, 1993, pg 44, 45). Computers have played so much an integral part in the development of the science of chaos, that chaos science has been described

as a 'science of the computer age' (Percival, 1993, pg-16). Besides the all important computing power of computers, which perform thousands of iterations in the blink of an eye (Vivaldi, 1993, pg 37), is the ability of computers to make visible the abstractions of mathematics through images of phase space, fractals and so on. This capability in particular has added a new dimension to what is now called experimental mathematics (pg 41).

Mathematical analysis in science has generally been through the solution of differential equations (equations that determine the rate of change of a quantity by referring to its values for two small consecutive time intervals). However the problems that can be solved by these processes are limited to those that can be expressed by deterministic equations (Stewart, 1990, pg 10). We have seen earlier in the account of different types of non-linear systems that though equations that described a phenomena can be set up, the solution of it is not so easy. Euler, the mathematician of the mid 18th century, who developed calculus aptly expressed this limitation "If it is not permitted to us to penetrate to a complete knowledge concerning the motions of fluids, it is not to mechanics, or to the insufficiency of known principles of motion, that we must attribute the cause. It is analysis itself which abandons us here" (quoted in Stewart, 1990, pg 38).

Deterministic equations do not include chance or randomness. However, the study of the micro world of molecules and atoms cannot possibly proceed without accepting chance and randomness, as it was quite impossible to know the motions of all the molecules acting in the ever so minute measure of a substance. To this problem scientists came up with the understanding that complexity in detail notwithstanding, behaviour at the macro level was by and large regular and hence was accessible to analysis by course grained laws of averages (Stewart, 1990, pg 44). Thus the science of probabilities and its practical application, statistics, found its way into science through another class of equations - the stochastic equations. Together with differential equations, stochastic equations described the universe we live in, but it was an essentially different description relating to entirely different fundamental concepts not in any way related with one another (pg 54). This co-existence was by and large accepted as "simple phenomena need simple laws and complicated phenomena need complicated laws' and 'between simplicity and complexity there could be no common ground" (pg 55).

These fundamental notions that guided science have however come across difficulties, some of which have been historically important in paving the way for the new science of chaos and complexity. Some of the theorems and concepts associated with chaos have in fact either been known to science earlier or have been suspected to exist. The tools to take them up for investigation, not only in terms of computers, but also in terms of new developments in mathematics itself - the birth of topology – have only now become available. Topology is a branch of mathematics - the study of properties that remain unchanged when shapes are deformed by twisting or stretching or squeezing (Gleick, 1987, pg 46), because of which it has been characterized as “rubber sheet geometry” (Stewart, 1990, pg 63). It is essentially a science of continuity as opposed to that of studying phenomena in discrete time intervals and then integrating them together – the method, in solutions based on differential equations.

Though the history of chaotic dynamics goes back to the late 19th century (Abraham and Shaw, 1984, pg2), the rediscovery of chaos, with a systematic unravelling of its nature, together with an elaboration of key concepts, have however been recent. This chapter concentrates on these recent articulations of chaos theory. A narrative through examples and short vignettes serve to communicate this development. The key concepts and characteristics that define the theory, and bring out its distinctiveness, justifying and qualifying it for the title of a ‘new science’ are described. The section is organised under separate headings of these key characteristics in order to highlight them, even though at times a narrative might run across headings. Towards the end of the section, building upon the short narratives presented, I illustrate how chaos leads to a new understanding.

2.3.1 Sensitive Dependence on Initial Conditions

The re-discovery of chaos in recent times starts with an attempt around the 1960s by Edward Lorenz, to model weather systems in computers in order to study weather forecasting. Series of equations representing relationships between influencing factors were fed into the computer to model future certainties. Philosophically, computer modelling for forecasting as was used by Lorenz, is a tool used within the classical Newtonian tradition in science because it asserts the universality of laws and the possibility of determinacy. It relies on three basic assumptions. The first is a belief in the causal laws that describe the system. The second concerns the distilling of what is known to be central causative factors from

'noise' in order to enable a modelling. The third concerns a reliance on the adequacy of data that describe the constituent elements in the laws. Small errors in the data was generally believed to have small effects, and large or complex effects was believed to be produced only by large and complex causes. So, small errors were believed to be irrelevant making it possible to predict events precisely without bothering too much about the accuracy of data (Gleick, 1987, pg15). With robust laws and approximate measurements weather forecasting was deemed to be a legitimate goal.

In Lorenz's model the laws were those relating known and accepted influencing factors, like temperature and pressure of air and water, wind speed, radiation and so on to weather. Computer outputs gave rise to familiar weather patterns, as the input factors varied. Wanting to rerun the computer through a particular sequence in order to examine it in detail, Lorenz inputted numbers that were mid-way through the process for the re run, in order to avoid a long wait. While entering he rounded the 6 decimal point number to a three decimal point number to save space (0.506 instead of 0.506127). The resulting graphed weather pattern instead of duplicating the old pattern, was found to diverge, so much so that over a period of time, it ceased to bear any resemblance to the earlier pattern. The *difference* was scaled up as it evolved over time. (Gleick, 1987, pg 16). In other words the system was sensitively dependent on initial conditions to the extent of even the 6th decimal. Lorenz saw the larger significance of this as the futility of any long-term attempts in weather forecasting. Hypothetically, however closely data could be gathered there would still be gaps for which data would have to be interpolated. If there was such sensitive dependence on initial conditions there could be no way that weather could be forecasted accurately in the long run. One of the fundamental assumptions in science of large effects only arising from large causes was being challenged. But what was it that characterised Lorenz's model so as to give rise to this phenomenon?

Putting weather aside, Lorenz then experimented with simpler ways of producing this effect. He found that a system described by just three *non linear* equations (initially he had 12) repeatedly *iterated*, could produce this effect (Gleick, 1987, pg 23). He then went on to experiment with real physical/mechanical systems abandoning the abstraction of mathematics. Irregularities that could not be accounted for with conventional physics were detected and identified in water wheels and in the setting up of convection currents (pgs 23-30). Traditionally physics either ignored unexplained irregularity as insignificant or exceptions to the rule, or looked for

explanations outside the system. Lorenz when conducting his experiments however had made sure there were no external influences to account for the irregularity detected. So the system had to be creating its own irregularity.

2.3.2 Strange Attractors

The features that Lorenz saw are associated with a few key characteristics of the system studied - *non-periodicity, repeated iterations and non-linearity* of equations. A non-periodic system, does not repeat itself in precisely the same way. Thus weather does not and in practice cannot ever take on the same exact values of all its parameters of wind speed, direction, pressure temperature etc. It is an aperiodic system.

Attempting to look further into the *nature of the irregularity*, Lorenz then tried to make the effects he was observing more visual by using computer print outs. He tried to plot the path defined by the system over time using the concept of phase space, What he found was that the pattern described always stayed within limits yet, never traced the same path at all. *There was disorderliness in the sense that the same path was never repeated, yet there was orderliness in the sense that the system stayed within limits.* The system had an attractor, which was quite unlike any attractor known to science. It came to be later known as the Lorenz attractor (Figure-2.6) and was the first discovery of a series of what are known as 'strange attractors'. Very simply, it is the set of all possible weather (Palmer, 1993, pg72). Examples of other type of attractors, discovered later are given in Figure-2.7 and Figure-2.8.

2.3.3 Globally Predictable, but Locally Unpredictable

Topology is the science of studying phenomena through shapes, rather than quantitative aspects as it tries to come to grasp with the overall structure, even when detail measurements are not known (Gleick, 1987, pg 46, 47). By visualising system characteristics, the attempt is towards understanding the system globally, in other words, understanding the entire realm of possibilities all at once (Gleick, 1987, pg 47). Work within the conjecture of stable systems by Stephen Smale, a mathematician with a special interest in topology, was questioned by a colleague of his who showed that it was possible for systems to be both erratic and stable. Citing an example of an oscillating electronic circuit, he showed that systems could be stable if its particular type of irregularity remained, in spite of small disturbances (pg 48). It was thus possible for a system to be locally unpredictable but at the system level stable.

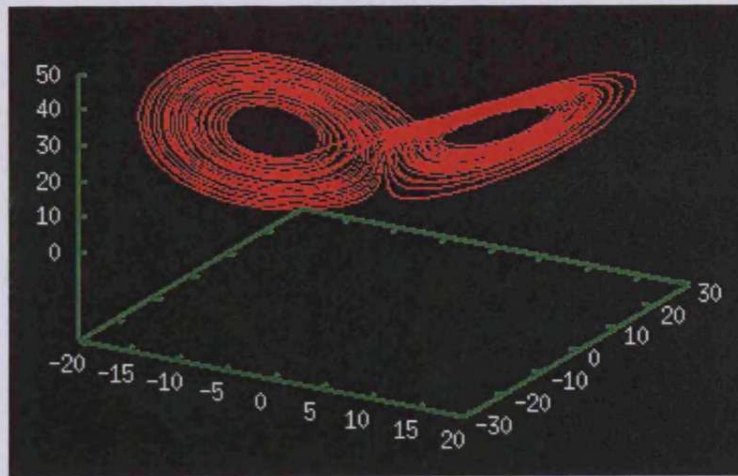


Figure -2.6: The Lorenz Attractor

Source: <http://www.sekine-lab.ei.tuat.ac.jp/~kanamaru/Chaos/e/lorenz.html>

Accessed: 17-02-2004

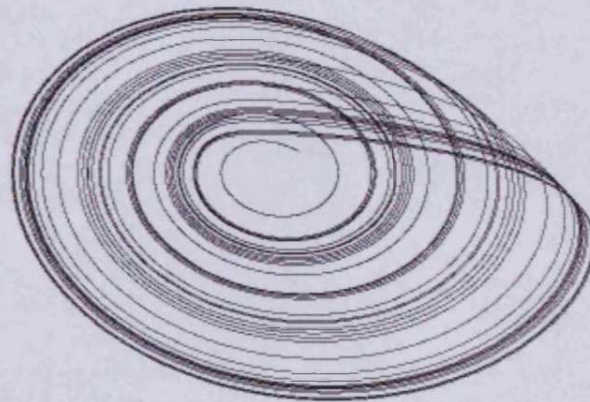


Figure-2.7: The Rossler Attractor

Source: <http://www.pha.ihu.edu/~ldb/seminar/attractors.html>

Accessed : 17-02-2004

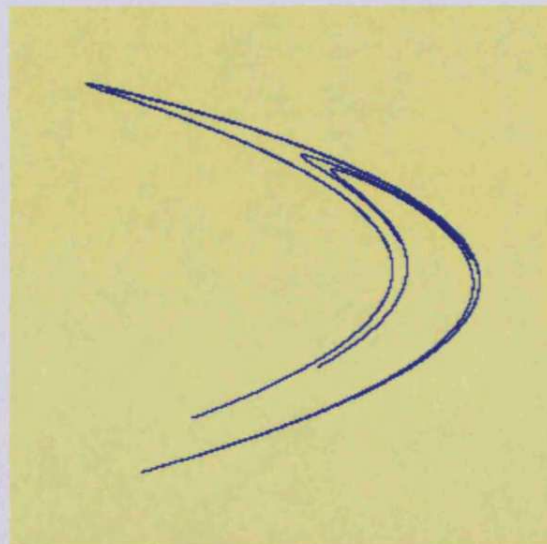


Figure-2.8: The Henon Attractor

Source: <http://keck2.umd.edu/dynamics/H-t1.htm>

Accessed : 17-02-2004

2.3.4 Chaos and Order Together

The red spot of Jupiter- a vast and swirling oval that remained at the same spot and never moved, was a puzzle for astronomers for quite some time. Many theories were advanced to explain the phenomenon, but none were entirely convincing. The Voyager space craft in 1978, revealed the surface of Jupiter to be virtually all fluid in motion with powerful winds and hurricane like swirls (Gleick, 1987, pg 54). Within this chaotic environment, the red spot itself remained unmoved. Pictures of the red spot showed small scale eddies appearing and disappearing, with rapid disorganisation (pg 54). Philip Marcus, an astronomer studied the pictures of the Voyager, and programmed a computer with a system of fluid equations instead of assuming a solid planet. Colour images were used which were then animated to a movie. The result was the formation of the red spot in an animated film. The spot was a self-organising system, created and regulated by the same non-linear forces that created the chaos around it (pg 55). It was an indication of the formation of order and chaos together at once as a result of the same set of processes.

2.3.5 Bifurcations - Order from Chaos and Chaos from Order

Robert May, a biologist, became interested in the behaviour of single populations over time. He used a simple equation to model the behaviour, $x_{next} = rx(1-x)$, where 'x' is the population at a particular moment, and 'r' is a parameter standing for the population's rate of growth. He found that when the parameter value is low, the population becomes extinct (Gleick, 1987, pg 71). As the parameter rises, the equilibrium level of the population also rises. When the parameter value passes 3, the equilibrium value begins to oscillate between two values in alternate years – a near-to-equilibrium state. For still higher values, it begins to oscillate between four values, each value returning every fourth year. The bifurcations, then start faster and faster at 8, 16, 32 and eventually the system turns chaotic, i.e. the population visits infinitely many values – a far-from-equilibrium state. This is depicted in Figure-2.10.

May then increased the parameter values still further. What he observed was that the stable cycles suddenly return. A 'window' would appear with a regular period – an odd period like 3 or 7. Then the period doubling bifurcations begin all over again to renewed chaos. (Gleick, 1987, pgs 72,73). The system when viewed as a whole, was revealing an underlying order. Chaos, in other words behaved in an orderly manner, could result from within systems governed by totally determinate equations

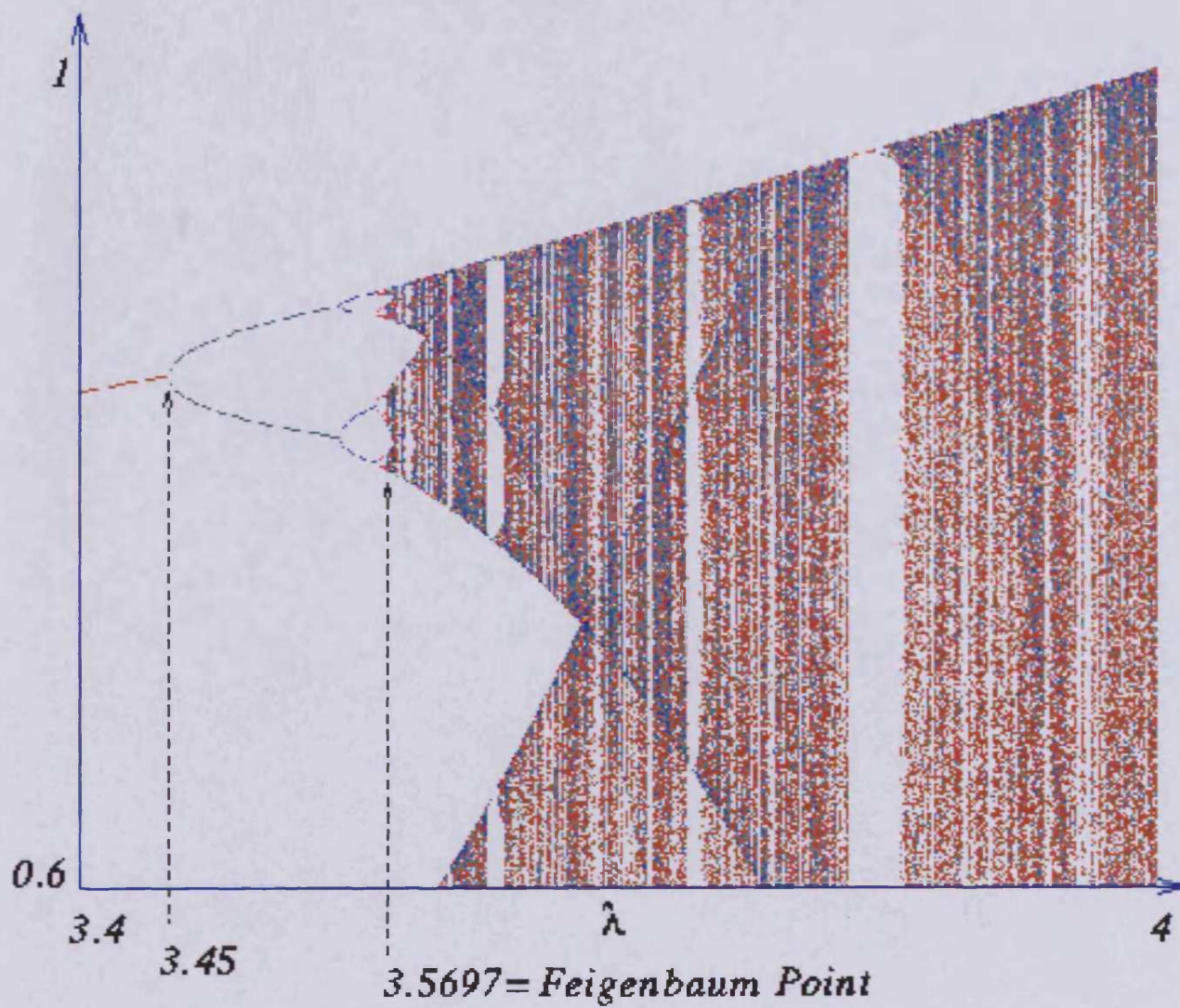


Figure-2.10: The Bifurcation Diagram

Source: <http://www.math.okstate.edu/mathdept/dynamics/lecnotes/node54.html>

Accessed: 17-02-2004

and was in that sense, a product of order itself. Thus we have chaos emerging from order, even while order emerges from chaos.

2.3.6 Fractals and Chaos

The patterns produced by the boundaries between orderly and chaotic behaviour described by May in the early 1970s, it was found, were also interesting. When portions within the bifurcation diagram were enlarged, it resembled the whole diagram. In other words it had a fractal structure which made it in a way infinitely deep. (Gleick 1987, pg 74).

Similar was the structure of the strange attractor. As we have seen earlier fractals give us a way of containing infinitely long line lines within a finite area. Paths described by the system state within the attractor needed to be drawn within a limited space, in ways that would never repeat or cross itself, for if the system came to the same point then it would have to repeat the same path. Thus an infinitely long line had to be contained within a finite space. In other words, the strange attractor proved to be 'fractal' (pg 139). The structures that provided the key to non-linear dynamics were fast proving to be fractal. This geometry was then an organising structure that lay hidden under the complication of shapes (pg 114).

2.3.7 Feigenbaum Numbers and Universality

Mitchell Feigenbaum, a physicist, decided to look into the exact parameter values for which the bifurcations in the equations used by May, were happening. Quite unexpectedly he found that there was another regularity hidden within the system. Not only were the bifurcations happening faster, but also they were doing so at a constant rate. This constant rate suggested that there was something, somewhere that was being preserved, while other parameters changed – a regularity that was giving rise to the scaling, which had not been noticed before. Feigenbaum then tried repeating his observations for other types of equations – trigonometric equations. He found that not only was the same pattern recurring, but also it had the same values – 4.66920.... In other words, the regularity had nothing to do with the type of equation, or the function – it was a 'universal' – an unexpected order, which came to be later known as the Feigenbaum number (Gleick, 1987, pgs 171-180).

Feigenbaum's number let him predict when period – doublings would occur in a system described by non-linear laws. He also discovered that he could predict the exact values of each point on the attractor. These numbers too, it was found, followed a geometric convergence, obeying a law of scaling (Gleick, 1987, pg 175). More

importantly, it led to a definite way of recognising chaos. As it was known that beyond period doubling, chaos would come, observation of the period doubling pattern and the Feigenbaum number indicated that a system was on its way to chaos (Ruelle, 1991, pg 69). Along with the discovery of this universality came also the introduction of quantitative aspects into this largely qualitatively described science – a backing of numbers for the patterns.

2.3.8 Lyapunov Numbers

Lyapunov numbers, named after the Russian mathematician Aleksander.M. Lyapunov, provides a qualitative measure for measuring unpredictability. It is a measure of how fast neighbouring points in a dynamical system separate from each other. It is thus also a measure of how quickly correlations in a system are broken down or also how rapidly small perturbations in a system can spread (Briggs and Peat, 1990, pg 87).

Basically, Lyapunov divided the size of a perturbation at one instant in time by its size a moment before. He then performed the same computation at various intervals and averaged the results. The number, thus obtained, the Lyapunov multiplier, describes how fast the system changes. If the multiplier is less than one, the perturbations just die out and the system is essentially stable. If the system has a multiplier greater than one, the system is unstable and chaotic (Ditto and Pecora, 1993, pgs 79, 80). The Lyapunov number is also now used as a method for detecting the presence of chaos (Stewart, 1990, pg 106).

2.3.9 A Science of Synthesis?

Chaos has been called the ‘new’ science of non-linear systems embodying ‘new hopes, styles and ways of seeing the world’, amounting to a ‘paradigm shift’, within science (Sardar, 1994, pg 676, Gleick, 1987, pgs 36-39). This claim for the science of chaos, is attributed largely to challenges posed to classical science, by discoveries in this area. Once recognised and named, scientists began seeing chaos everywhere. It is now largely agreed that non-linearity is the norm rather than the exception in our universe (Flake, 1998, pg 141). Stewart (1990, pg 84) rather ironically points out that to call general differential equations non-linear is to call zoology non-pachydermology as indeed zoology is not the study of only elephants! It is now largely acknowledged within natural science, that the processes studied within the disciplines of economics and social sciences are in fact non-linear, chaotic or complex phenomena (Ruelle, 1991, pgs 78-85).

Ubiquity of a phenomenon does not however say anything for the uniqueness claimed for it. If anything, it calls for a clearer substantiation for the claim of being 'new'. The nature of the challenges that chaos is said to put forward then needs to be examined closely. I discuss the contributions of chaos, under a broad qualification for the science, that sums it up as a 'science of synthesis'. This brings about questions as to - What are the notions that chaos science synthesises and how exactly is this 'synthesis' achieved? To answer these, I take a series of dichotomous notions that chaos science links together and review very briefly the ways in which the resolution has been achieved.

From the account in this chapter, one of the most striking contributions that the study of chaos has given science can be said to be the experimental and mathematical proof of 'sensitive dependence on initial conditions'. This put an end to one of the fundamental assumptions within 'clockwork' science that allowed predictability and errors of measurement to be ignored – small changes or errors in measurement, lead only to small effects or deviations in the output or solution and it is only large changes or large errors that produce large deviations in the output. Chaos showed that this is not only not so, but also largely not so, if one looked at the non-linear systems that make up our universe. Along with this it must also be borne in mind that chaos talks about 'strange attractors' – a term that by its very name tells us that there is no sensitive dependence on initial conditions for how else can it be an 'attractor'? So the term 'sensitive dependence on initial conditions' applies only for the evolution of points on the attractor (Stewart, 1990, pg 288) and for external points outside the attractor space; there is in fact a tendency for the initial conditions to be 'forgotten' as it gets into the phase space of the attractor - a portrait of dependence and independence on initial conditions at the same time.

Second, are notions of determinacy and indeterminacy. Chaotic systems show that determinacy of input equations (when the equations themselves are linear with all values known) need not necessarily lead to determinacy in outcomes, and indeterminacy can equally well be expected from totally deterministic equations. Further it has told us that this occurs in systems characterised by non-periodicity, non-linearity and repeated iterations, i.e. wherever system inputs and outputs are not linearly connected, wherever the system cannot exactly repeat itself in all its previous values and finally wherever the output of the system, feeds on itself and is an input for the next step. Yet again, the existence of an attractor is by itself deterministic, which

seems to indicate that the formation of an attractor state can be anticipated, though the future state of any point within it cannot be precisely predicted.

Third, are notions of randomness and order. Chaos shows us that randomness and order need not be mutually exclusive. A chaotic output, which appears random, does in fact have underlying order that is stable. Thus the apparent randomness can be just a function of the multitude of states without indicating any absence of order whatsoever. This property of chaos is recognised by science as a capacity for flexibility, as the system can as a whole remain stable, even when individual points in it change, since a multitude of states, none of which really dominates, are possible within the attractor (Ditto and Pecora, 1993, pg 78).

Fourth, are notions of stability and instability. Chaotic systems have been shown to be extremely sensitive to small perturbations, within the system. This property of chaos has in fact attracted technological interest as with small perturbations large changes can be anticipated (Ditto and Pecora, 1993, pg 78, Flake; 1998, pg 204). The downside of it though maybe that what exactly the change will be and how exactly it will develop is unpredictable in the long run, though it can be predicted for the short and medium term. Yet the instabilities of the points within the system give rise to an overall stability which has again become of interest to technology (Ditto and Pecora, 1993, pgs 78) and it implies flexibility over a range of conditions without threatening the stability of the system as a whole.

Fifth, are traditional dichotomies of finiteness and infiniteness. The phase space of the chaotic system while remaining clearly finite, identifiable and measurable, yields a situation in which the number of points inside it is however infinite - due to the fractal nature of the strange attractor. So we see infinity within finiteness.

Sixth, is the union of particularity and universality. Particularity in chaotic systems is asserted by the unpredictability of the trajectories of the system for any long length of time. The system locally seems to exert an independence of its own. Yet we know that universal laws, which are detectable only at global levels, by tracing the history of the system as a whole, do in fact govern the system. What is more they are even measurable – Lyapunov constants, Feigenbaum numbers etc.

The seventh merger is that of a union of the qualitative and the quantitative. Local points within chaotic systems are essentially unique qualitatively, being specific with particular trajectories which never ever coincide, each possessing a unique

dependence on its own history of development. Yet through all of this, the system as a whole adheres to quantitative measures of increased rates of period doubling measured by Feigenbaum numbers and constant measures of rates of divergence, measured by the Lyapunov numbers.

The eighth and final linkage is between the simple and the complex. The 'simplicity' of deterministic equations give way to complex chaotic behaviour, difficult to assign intuitively to the underlying laws. Yet again chaotic regions within the bifurcation diagrams give way to 'windows' for the emergence of 'simplicity'. Simple systems do not behave in simple ways and complex behaviours do not necessarily arise from complicated systems. Also important is the way notions of simplicity and complexity vary with scales. At the local scale, when system behaviour at the larger scale is not known, the behaviour appears enormously complex, with long-term predictability disappearing altogether. At the global system level on the other hand the individual behaviour is describable by 'simple' system rules though not solvable. Again the message seems to be that notions of simplicity and complexity are not mutually exclusive, but can in fact be results of perceptions that depend on one's viewpoint (Flake, 1998, pg 197).

If chaos has indeed produced this synthesis, in the natural sciences, has it had any reflection on the choice of the methodological aspects of enquiry? An examination of the epistemology of the science in fact reflects this synthesis. Stewart (1990, pg 299) puts forward an explanation of chance events that effect a trajectory as being hypothetically fully deterministic, if enough information could be obtained, which is of course practically impossible. Thus if ever Lorenz could get the fully continuous measurements of all his weather variables at infinitely small scales (because of sensitive dependence) for the whole of the earth's surface, then perhaps he could predict weather for infinitely long periods. This view postulates chance as not being inherently opposed to determinism, but rather as a function of inadequate information. This then is an acceptance of an overall structural determinism which however in effect gives rise to what we perceive as chance. Methodologically this makes the co-existence of solutions based on highly precise deterministic equations compatible with chance acknowledging stochastic equations *together within the same system*. This is in fact what quantum mechanics also tells us – a co-existence of a probably or statistically determined sub-micro world with a largely predictable macro physical world (Davies and Gribbin, 1992, pgs 206-228).

As for tools of analysis, we have seen the employment of topology, the qualitative branch of mathematics, which deals with explanations and solutions not quantitatively through figures but qualitatively through visualisation of shapes. Many a theoretical proof for the experimental work has come from this branch of mathematics. Also important without doubt, has been the enormous advance in computers and computing which has allowed not only ever-faster computations involving large quantities of data, but also visualisation of the results, that widened the scope of further investigations.

Even while the contributions of chaos science are acknowledged, there has been a certain amount of trepidation advanced, especially from those at the theoretical level, about its potential. The main disillusionment comes from the perception that chaos theory has said what it can say and that there is nothing further to be done in the field. Chaos is a dead science, one dimensional as it cannot explain the mechanisms of change. (Bak,1997, pg30, Farmer quoted in Waldrop, 1992, pg 287; Inayatullah, 1994, pg 684). Though technological investigations for exploiting the applications side of chaos continues, theoretical focus has now shifted to a sub-region within the study of chaos sciences - the complexity theory – dealing with evolution, emergence, adaptation etc. The next section sketches the broad outlines of this theory within the natural sciences.

2.4 Complex Systems

Chaos science alerted us to a universe that does not work quite like clockwork, or a machine. It gives us insights such as a synthesis of perceived dichotomies in the sense that they can co-exist together within the same system and the primacy of positioning one's viewpoint in understanding phenomena. As such its contributions have been unique within the natural sciences. Yet chaos, by itself, does not explain the 'how' of formation of structure, coherence and self-organisation, found so much in natural and social systems (Waldrop, 1992, pg 12). We know that the second law of thermodynamics has introduced the notion of 'entropy', a natural development of systems towards decay and disorder, challenging the scalar notion of time in classical physics. But we also know that the evolutionary history of biological and social systems do not tell the same story. The experience here is that of increasing order, organisation and complexity (Toffler, 1984, pg xx). How is this cosmic compulsion for disorder then matched by equally powerful compulsions for order and organisation? How can both these forces be going on at once? (Waldrop,1992, pg

10,11). Why is there order in the world and where does it come from? In other words how does the universe transcend the second law of thermodynamics? The study of complex systems tries to explain the processes of spontaneous self-organisation – how groups of agents (animate or inanimate) can transcend themselves to acquire collective properties.

Complex systems besides being spontaneous and self-organising are also actively engaged with the environment and they are thus termed ‘adaptive’. The process of adaptation is also affective in that they try to convert situations and contexts to their advantage, which in turn impacts upon further adaptation. How does this process of co-evolution take place? What rules govern it? The study of complex systems shares with the study of chaos a concern for understanding system dynamics at a ‘global’ level. Yet its emphasis is more on order and organisation rather than chaos, randomness or chance, though the presence of these as integral components of the system under study is acknowledged. In this section key characteristics associated with complex systems are sketched out. As before the description is based within the host discipline through which it emerged, in order to provide the context for the concept and also to bring out the inter-disciplinary interest awoken by complexity.

2.4.1 The Concept of Self-organisation

The notion of ‘self-organisation’, as used in the context of complex systems, refers to the *spontaneous formation of order within systems*, be they physical, biological or social, without the presence or help of external forces. These systems however need to have non-linear components that allow iteration. They also need to be dissipative and in a far-from-equilibrium state. The notion of self-organisation may be best illustrated with the use of examples.

First, if we are to consider the simple example of a pan of water that sits all by itself at room temperature. Nothing happens. It is in an equilibrium state. If the pan is placed on the hob and heated on a very low flame, the system is no longer in equilibrium. The top surface is cooler, while the bottom is hotter. Heat gradually rises up from the bottom, through conduction, but it is not yet strong enough to disturb anything. The system is in a near-to-equilibrium state. If the flame is further turned up, moving the system still further away from equilibrium, the water inside the pan suddenly starts becoming unstable. Random motions appear and some of them grow. Hexagonal patterns of convection cells, known as the Bernard cells form, and the water acquires order and structure (Waldrop, 1992, pg 33). The system by now has

crossed a critical bifurcation point when it can no longer disperse the heat fast enough without formation of large-scale convection currents. The order comes from the very small non-linearity induced by the difference of gravity between the top and bottom layer which folds in upon itself, causing iteration and scaling up of the effect. It is produced by millions of molecules suddenly moving coherently together. If the heat is further turned up, the cells break up into total chaos or randomness (Briggs and Peat, 1990, pg 137).

Chemical clocks further illustrate this point. Toffler (1984, pg xvi) asks us to imagine a million white ping-pong balls mixed at random with a million black ones, bouncing around chaotically in a tank with a glass window in it. Most of the time the mass in it would seem to be grey, with streaks of black or white. Now let us see what would happen if we were to convert the ping pong balls to chemical molecules and see what happens in the case of it being a chemical clock. In a chemical clock situation, the concentrations of the reacting chemicals are linked together by 'cross catalyses' - where the presence of one chemical catalyses a reaction, the output of which catalyses the formation of the first chemical. Thus non-linearity and iteration is introduced. Here the concentration of any one chemical becomes the parameter that drives the system into a far-from-equilibrium state. When the system is thus driven into a far-from-equilibrium state, suddenly the ping pong balls (molecules) in the system turn fully black near the glass window and then fully white - recurrently, regularly - a coherent process, keeping time like a chemical clock. Prigogine and Stengers (1984, pg 148) speculate that to change colour all at once, the system must act as a whole and the molecules must have a way to 'communicate' in an abstract sense.

Third, if we were to look at a biological system - the case of slime moulds. When coming out of their spores, the amoeba grows and multiplies as unicellular organisms. This situation continues until food is scarce. When deprived of food, they send out a chemical signal to other amoeba (Briggs and Peat, 1990, pg 138). A 'spatial symmetry breaking' then happens and the amoeba aggregates around an attracting centre - any amoeba that is the first to emit the signal. A 'temporal symmetry breaking' then occurs when the fluctuations of the amoeba reach a critical point (Prigogine and Stengers, 1984, pg 157). At this point, the amoeba cohere to form a single entity, capable of moving across the forest floor. Finally, in a new location, they together develop a stalk and fruiting body from which shoots out spores

which in turn gives rise to new spores to carry on the cycle (Briggs and Peat, 1990, pg 138). The chemical processes behind the aggregation has been studied and it has been showed to be produced by an auto catalytic reaction (a chemical process that catalyses the formation of its own inputs) that introduces the non-linearity and iteration (Prigogine and Stengers, 1984, pg 157-159).

2.4.2 Bottom-up Self Organisation

Craig Reynold, in the late 1980s, demonstrated the organisation of 'boids' (bird like agents formed in the computer) into self-organised structures by way of flocks. In his program each boid was governed by a set of three simple rules which were:

1. It tried to maintain a minimum distance from other objects in the environment, including other boids,
2. It tried to match velocities with other boids in its neighbourhood
3. It tried to move towards the perceived centre of mass of boids in its neighbourhood.

The emergent effect was the formation of a flock, though none of the rules said 'form a flock'. The rules were local, in the sense they related to only what individual boids would perceive and do (Flake, 1998, pgs 270-271). Yet there was an emergent recognisable effect that was manifested at the collective level. The flock would effortlessly avoid obstacles and reform into flocks, no matter where the boids were scattered initially (Waldrop, 1992, pgs241-242). Also they could split apart and reconvene very easily when faced with obstacles (Waldrop, 1992 pg 279). This implied that the 'flock' characteristic was more of a tendency than a rigid rule that governed the collective behaviour. In other words *the bottom-up organisation showed a tendency for emergent behaviour, while remaining flexible to negotiate local factors*. Designing the flock behaviour from a top down approach through a program that specified rules at the collective level would remain well near impossible, as defining the number of situations that had to be foreseen would itself be an impossible task. Besides, if a situation were not defined, the system would very easily run into difficulties not knowing what to do (Waldrop, 1992, pg 279).

Thus instead of being designed by a 'top-down' process, *complex systems emerge from the bottom-up*, from a population of simpler systems. Simply stated by Langton, complex behaviour need not have complex roots (Waldrop, 1992, pg279). The analogue of the genotype and phenotype in biology comes in useful here. The

genotype of an organism is the genetic blueprint that is encoded in the DNA of an organism. And the phenotype is the structure that unfolds from those instructions interacting with the environment during development. A computer language equivalent of this, coined by Langton in artificial life, is the generalized genotype or GTYPE which refers to a collection of lower level rules and the generalized phenotype or PTYPE which refers to the structure and/or behaviour that results when those rules are activated in a specific environment. In a conventional program, the GTYPE would be the computer code itself and the PTYPE would be what the program does when fed with a set of inputs. In the case of the flocking of birds experiment above, the GTYPE would be the three rules fed in and the PTYPE would be the flocking behaviour exhibited. This then suggests that the process of emergence from GTYPE to PTYPE involves a process of computation at the agent level (Waldrop, 1992, pg 281).

Another implication of this would be that the undecidability theorem in computation would apply. The theorem very simply states that unless the program is very trivial, the fastest way to find out what it can do, is to run it and see. There is no general purpose procedure that can scan the code and the input and tell us what to expect. In other words, one never knows what can happen until it is tried out. That is why as far as non-linear dynamics is concerned, it is both true and irrelevant to say that computers do only what the programmers tell them to do. The GTYPE which is utterly under the control of the programmer can still give rise to surprising behaviour in the PTYPE (Waldrop, 1992, pg 282).

Other theorems also from computer science shed light on the organisation of bottom-up processes. For a given specific PTYPE, there is no iron clad process except through trial and error that can show us the type of GTYPE needed (Waldrop, 1992, pg 282). In well-defined environments, the chances of surprise are reduced significantly, which is why computer programmers can write programs for the solution of specific problems. However in environments that are changing, or are poorly defined or in other words contain non-linearity, there is no way to work backward from the PTYPE (Waldrop, 1992, pg 282).

2.4.3 Patterns, Increasing Returns and Lock-in

The concept of increasing returns and lock-in to explain pattern formation within complex systems was advocated by Brian Arthur, an economist. In defiance of neo-classical economics and its central propositions of market equilibrium, rational

agents and predictable self-interest, Brian Arthur was interested in pattern formation, change, flux, and a place for individuality and accidents of history (Waldrop, 1992, pg17). A theory that took into account the messiness and irrationality of the human world (pg23) and acknowledged the intertwining with politics and culture (pg 27).

Neo-classical economics built its structure of logic on the theory of 'diminishing returns', ie the more you have, the less satisfaction will it bring. Arthur began by questioning this fundamental assumption, proposing that 'increasing returns' were just as fundamental as 'diminishing returns' in understanding the real world. Thus infinitesimally small effects can get magnified by positive feedback into major differences in outcome (Arthur, 1999, pg 108). To prove his point, he used historical studies of the way technology developed and locked 'into' standardised products that are commonly accepted today, even though they may not and are not the best solutions to the problem they set out to solve or functions they set out to perform. Arthur made his point using examples of the QWERTY keyboard for type writing, the standard design and movement of clocks, the development of the gasoline engine, etc (Waldrop, 1992, pgs 40-42). He explained pattern formation as emanating from the tension between 'negative' and 'positive' feedback, the magnification of small events which then have immense historical consequences, and the stabilisation of results through a lock-in process. The mathematical proof to the proposition of chance events selecting one equilibrium out of many possible ones was published in 1983, when Brian Arthur, working in collaboration with probability theorists Yuri Ermoliev and Yuri Kaniovski, published the first of their series of articles in the Soviet journal *Kibernetika* (Waldrop, 1992, pg 46). In Arthur's view, the concept of 'increasing returns' rather than displacing old theories added more information, helping complete the picture (Arthur, 1999, pg 108). It focussed on the 'how' of equilibriums being selected. The added insights from complexity on which the 'new economics' is based according to Brian Arthur is sketched out in Appendix-1:

2.4.4 Bifurcations and Symmetry Breaking

In Prigogine and Stenger's explanation for the emergence of self-organisation from chaos, bifurcations are a central theme. Bifurcations are produced when small differences or forces are magnified by iteration to eventually form a fork. Beyond the fork, there are actually two stable states for the system and both are symmetrical about the previous point. They are thus the mirror image of each other. At the point of bifurcation, the system thus has a choice and chance events determine which among

the choices, the system moves into (Prigogine and Stengers, 1984, pgs 160-162). There is thus a symmetry breaking at this point. Once this happens, the system may resist any further change if the distance between the two forks is large enough. The lost branch of the bifurcation can now only be recovered by a finite perturbation which seeks to bridge the divergence between the two forks. The system then travels along the path chosen by chance until another bifurcation occurs. But by now since the original symmetry has been broken, the system shows an affinity for one particular choice (pg 165). If the parameter value increases further the system moves into large number of bifurcations separated very closely, causing the appearance of chaos and instability (pgs 167 -170).

What keeps a system stable within a particular parameter value is feedback from the environment. The weaving of feedback loops is referred to as 'communication' by Prigogine and Stengers. Bifurcation points become the milestones in the system's evolution and they crystallize the systems history. At each bifurcation point the flux that guided the 'choice' of the system embodied within itself the many futures of the system (in the sense that many possible bifurcations are embedded within it). Through iteration, feedback and amplification, one future comes to be chosen and the others disappear forever.

2.4.5 Attractors and Cell Differentiation

Stuart Kauffmann, trained as a medical doctor, but interested primarily in cell differentiation was intrigued by questions about the evolution of life. He came across the work of Jacob and Monod who showed that any cell contained a number of regulatory genes that acted as switches turning one another off and on. (It was the work for which they won the Nobel Prize.) This created the possibility of genetic circuits and it became possible to think that it might be the computing behaviour of the entire system that was leading to cell differentiation (Waldrop, 1992, pg 106). In a real cell, a great many regulatory genes could be active at the same time. Hence it was possible to think of a great many genetic instructions being executed at the same time - unlike a traditional computer, which goes by a step-by-step process. If that was the case, Kauffmann reasoned, the key question would be not the precise sequence of activation, but rather whether it was possible for the genome as a whole to settle down into a stable consistent pattern of active genes (pg 107).

The conventional search for the answers to the evolution of life centred around natural selection. Though important, it essentially relied on chance alone to explain

the fine tuned, exquisite perfection of the genome. Kauffmann, set about examining if there might be something more as an explanation to this (Lewin, 1993, pg 24). In a rudimentary manner he started of drawing out diagrams in notebooks. He quickly convinced himself that if the network was densely tangled, i.e. every gene was controlled by lots of other genes, then the system would just thrash about chaotically, never falling into any order. Similarly if the system was controlled by just one gene then its behaviour tended to be too simple. Experimenting with two-input genes, Kauffmann found that as long as the two different patterns of gene activation were not too different, they would tend to converge (Lewin, 1993, pgs 45, 46; Flake, 1998, pgs 330,331). In other words, an order would emerge. More experiments were done on 100 genes (using genetic algorithms on computers), with two input simulated networks known as Boolean networks, with the same result. Stable patterns would emerge quickly, though the possible states were one million trillion trillion. Instead of wandering through the whole space of possibilities, the system just moved into a corner of that space and stayed there (Waldrop, 1992, pgs 109-112).

Trying to discern the generic behaviour of complex networks, Kauffmann began running bigger and bigger simulations, keeping track of how many state cycles occurred as the size of the model increased. He concluded that the number of cycles scaled roughly as the square root of the number of genes in the network (Lewin, 1993, pg 30; Flake, 1998, pg 253; Waldrop, 1992, pg 112). Yet, there was no explanation of how this was happening. Gradually Kaufmann came to be exposed to the work of physicists in non-linear dynamics and his genetic regulatory networks actually turned out to be a special case in the field. In the space of all possible network behaviours, the stable patterns were like basins – in mathematical terms, they were the ‘attractors’.

2.4.6 The Edge of Chaos

Cellular automata were first invented by John von Neumann in the 1940s as a frame of reference in which to study reproduction. He was interested in the essence of reproduction, which he sought to analyse using a mathematical framework that would allow information to be reproduced (Flake, 1998, pg 232). Cellular automata can be described essentially as a programmable ‘universe’ within the computer. At each tick of a clock, each cell in the automata can occupy only a finite number of states (say red, blue or green) depending upon its own state and the states of its neighbours. The laws for this are encoded in a state transition table, which tells the automata which

state to change into for each combination of states (Waldrop, 1992, pgs 219,220). Thus the dynamical system is discrete in both space and time (Flake, 1998, pg 232).

Stephen Wolfram, a physicist, contended in 1984 that cellular automata not only had a rich mathematical structure but also had deep similarities to non-linear dynamical systems. He classified all automata as falling into one of four universality classes. With Class I category rules, no matter what pattern you started out with, the grid on the computer would quickly converge to a homogeneous arrangement. In the language of dynamical systems, this was similar to a point attractor. In Class II category rules, the system was bit more lively, but it would quickly coalesce into a set of blobs that would endlessly cycle through a fixed number of states. This was again similar to a periodic attractor. In Class III category rules, the system became aperiodic, generating random patterns. There was a lot of activity, the equivalent of chaos. Nothing was stable and nothing was predictable. With Class IV category rules, there were no frozen blobs, nor any chaos. They produced coherent structures that propagated, grew and split apart and recombined in complex ways never settling down (Flake, 1998, pg 237). There was no explanation for this behaviour and nobody knew how to classify a rule into its appropriate Class. The only way to find out seemed to be to try it out (Waldrop, 1992, pg 226).

Chris Langton, identified more with artificial life, was working on this problem trying to discern what exactly was causing this behaviour. He was working with the premise that there is normally a numerical 'parameter' that the systems behaviour depended on (Lewis, 1993, pg 49). In the case of flowing water through a tap it was the rate of flow. In the case of population statistics, it was a ratio between birth rates and death rates. He finally zeroed in on a value, which he called lambda (λ). This was a simple value denoting the probability of any cell being alive or dead in the next generation. Thus when λ was 0.0, the system was in Class I rules. When it was increased a bit more, it followed Class II rules. And when it was increased to 0.5, it showed Class III rules. But what was surprising was he found the more interesting Class IV rules within a critical range between Class II and Class III. Thus the transition was

Class I \longrightarrow Class II \longrightarrow Class IV \longrightarrow Class III
(Flake, 1998, pgs 242-245; Waldrop, 1992, pg 226-228)

Going into theories of computation Langton found that an equivalent classification could be made about programs. In terms of dynamical systems it implied that the realm of Complexity lay between Order and Chaos (Waldrop, 1992, pgs 225-235). In other words, Complexity was to be found 'at the edge of Chaos' – a term coined by Norman Packard, who was researching the same phenomena (Lewin, 1993, pg 53). Similar results had been noted in the genetic networks and autocatalytic models. In the genetic model if the connections were too sparse nothing would happen and if it was too dense, the system just froze. In the case of the autocatalytic model, it was set to a number of parameters. Again it was only if the parameter values were within a range that autocatalytic sets formed and developed.

2.4.7 Complex Adaptive Systems

Complex adaptive systems is a more sophisticated concept than that of complex systems, which takes into account a system's interaction with the environment, addressing the basic question of : what do emergent structures actually do (Waldrop,1992, pg 149)? First advocated by John. H. Holland, complex adaptive systems have certain crucial properties. These are described below.

First, each of these systems is a network of tiny agents, acting simultaneously. Thus it can comprise of nerve cells that form a brain or species that form an ecology. Each agent is in an environment produced by its interactions with other agents in the system, because of which nothing in its environment is fixed. The control of the system is highly dispersed. There is no 'master' neuron in the brain for example. All coherent behaviour arises from competition or co-operation among the agents themselves.

The second key characteristic is that complex adaptive systems have many levels of organization, with agents at any one level serving as building blocks for agents at a higher level. A group of proteins, lipids and nucleic acids form a cell, a group of cells will form a tissue, a collection of tissues will form an organ, an association of organs will form an organisation, and so on. Complex adaptive systems are also constantly revising and rearranging their building blocks as they gain experience.

Third, all complex adaptive systems 'anticipate' the future (like in choices made for survival). This business of 'anticipation' and 'prediction' is at an abstracted level, beyond human foresight or consciousness. From bacteria onwards every living organism has then an implicit prediction based on an 'internal model' (as manifested

in survival instincts) of the world encoded in its genes. Moreover these models are not passive blueprints, but are active in the sense that they come to life in a given situation and produce 'behaviour'. Thus the internal models can be conceived to be building blocks of behaviour, which can be tested, refined and rearranged as the system gains experience.

Finally complex adaptive systems have many niches, each one of which can be exploited by an agent adapted to fill that niche. The very act of filling a niche also opens up many more niches. So new opportunities are always being created by the system, making it meaningless to talk about a complex adaptive system being in equilibrium. If the system ever does get into equilibrium, it can only mean that the system is dead. Also no agent can practically 'optimize' its behaviour. All that it can do is to either change or improve itself relative to what others are doing. In short these systems are characterised by perpetual change, novelty and creativity (Waldrop, 1992, pgs 145-147).

Work on computer simulations aims at discerning the basic nature of adaptation, learning and evolution. Adaptation implies a series of steps predicted by the internal implicit model of the world – a prediction about the environment, reinforced or modified through a process of feedback. According to Holland, the process of prediction runs far deeper than conscious thought, and hence is not a property of humans alone (Waldrop, 1992, pg 177). Anything that we call skill or expertise is an implicit model, a set of standard rules inscribed on the nervous system, refined by experience. Similarly culture can be thought of as an implicit model of myths and symbols that define people's beliefs about the world, with rules of correct behaviour (pg 178,179). The key question then is : where does this internal implicit model come from? It cannot be predicated on consciousness, as then the answer just begs the question, where does consciousness come from? The question remains, shifted but unsolved. Evolutionary biology tells us that an agent can do this by trial and error without any paranormal guidance. Thus "in biology,..... the agents are individual organisms, the feedback is provided by natural selection and the steady improvement of the model is called evolution. But in cognition, the process is the same: the agents are individual minds, the feedback comes from teachers and direct experience, and the improvement is called learning". (Waldrop,1992, Pg 179)

But how can an agent explore the whole realm of possibilities through trial and error? For Holland the answer lies in coherent clusters, which serve as hierarchical

building blocks. These building blocks can transform a system's capacity to learn, evolve and adapt, as instead of moving through a whole system step by step, it can shuffle its building blocks and try out various combinations very soon. (Waldrop, 1992, pg 169). The advantage of this process, according to Holland, is that the most useful parts of existing units can be extracted and recombined in novel ways (Holland *et al*, 1989, pg 82). The process is illustrated by an analogue - the way police artists used to work to make a drawing of a suspect that matched the witness description. "The idea was to divide the face up into say 10 building blocks: hairline, forehead, eyes, nose and so on down to the chin. Then the artist would have strips of paper with a variety of options for each, say 10 different noses, 10 different hairlines and so forth. That would make a total of 100 pieces of paper. Armed with that the artist could talk to the witness, assemble the appropriate pieces and produce a sketch of the suspect very quickly" (Holland quoted in Waldrop, 1992, pg 170). So instead of moving through the immense space of possibilities, step by step, a system can reshuffle its building blocks for creativity. Holland proposed reproduction, mutation and cross-over as the mechanisms for building blocks of genes to emerge and evolve together (pg 174).

In their book, Holland *et al* (1989, pgs 343,344) flesh out a theory of cognition that is founded on three basic principles – knowledge can be expressed in terms of mental structures that behave very much like rules; these rules are in competition, so that experience causes useful rules to grow stronger and unhelpful rules to grow weaker; plausible new rules are generated from combination of old rules. In particular their argument is that these three basic principles together by themselves can cause the emergence of rule hierarchies as a basic organising structure of knowledge. Thus weak general rules form a default basic layer (pgs 18, 19), with stronger rules for exceptions. These stronger rules can then kick the weak general rules off the implicit model in exceptional circumstances. The possibility for this spontaneous organisation to take place was demonstrated through computer simulations that started with a random set of rules, but ended up with a hierarchical structure of rules (Holland *et al*, 1989, pgs 145-150).

2.4.8 Cooperation and Competition

Darwin's theory of evolution as popularly known has emphasized competition among species in the notion of 'survival of the fittest'. The balance of nature thus is a result of intense competition among organisms. However along with competition-

based relationships, cooperation-based relationships are also extremely common in nature. In their book *Microcosmos*, Lynn Margulis and Dorian Sagan, say – “Competition in which the strong wins has been given a good deal more press, than cooperation. But certain superficially weak organisms have survived in the long run by being part of collectives, while the so-called strong ones, never learning the trick of cooperation, have been dumped onto the scrap heap of evolutionary extinction” (Margulis and Sagan, 1986 quoted in Briggs and Peat, 1990, pg 155). Darwin’s theory of evolution is at a loss to explain this mutual cooperation (Flake, 1998, pg 382).

Work by Axelrod, a political scientist who used game theory to study how cooperation emerged among selfish agents, showed that the key to cooperation being a winning strategy is iteration. If there is no chance that two parties will ever meet again, then defection is a better action from a game theorist’s point of view (Flake, 1998, pg 303). This was illustrated in the game of the Iterated Prisoner’s Dilemma. This was a tournament conducted by Axelrod. Anybody who liked could enter a program that would take the role of one of the prisoners. The programs would then be paired in various combinations and they would play the Prisoner’s Dilemma against one another by choosing whether to cooperate or defect. Instead of playing just once, however the game would be played for 200 moves, allowing the programs to ‘remember’ what other programs had done in previous moves. This arguably was a more realistic way of representing the kind of extended relations we usually get into with each other. The result of the game was that if the programs met only once, then defection was the most rational choice. However when they met many times, the programs developed a history – a reputation. The program that eventually did win out was a simple program called TIT FOR TAT. It was simple in the sense that only two rules governed it. The program was ‘nice’ in the sense that it would always cooperate in the first move. But after that it would do exactly what the other program had done in the move before (Waldrop, 1992, pgs 263, 264). In a sense this was pointing to the conclusion, that some forms of ethical behaviour were not only morally correct, but pragmatic as well (Flake, 1998, pg 282).

2.4.9 Connectionism

This model was identified by Doyne Farmer as a common theme that ran through much of the computer simulation research done in modelling complex systems (Waldrop, 1992, pg 289). *In this model emergence is a property of the type of*

connections established within the system rather than the entities themselves. The neural network movement, classifiers of Holland and genetic algorithms and autocatalytic models of Kauffman, all have this characteristic. Thus if connections are properly arranged, the network will soon settle down into a self-consistent pattern. Farmer also went beyond just identifying the common themes; he worked out the actual translation machinery from one model to another. This led to the conclusion that to modify a system's PTYPE behaviour, the GTYPE encoded in the connections is what has to be changed. There are two main sources of change here, the first termed 'exploitation learning'. Here improvements are made on what already exists, by leaving the connections intact but modifying their strengths. The second, termed 'exploration learning', is a more radical way of change. It includes a complete re-wiring of the connections. This while posing a risk opens up new 'spaces' for exploration (Waldrop,1992, pg 291).

2.4.10 Self Organised Criticality

The phenomenon of 'self-organised criticality' was discovered by Per Bak, Chao Tang and Kurt Wiesenfeld back in 1986 as they were studying the condensed matter phenomenon (Bak, 1997, pgs 33-34). The best way to explain this phenomenon is by using the metaphor of the sand pile. If a steady drizzle of sand was to fall on to a table in a constant rate, the sand would organise itself into a pile that would continue growing until it comes to a stage when any more sand that is added will only fall off the edge of the pile. The same pile can also be arrived at by loading the table with excess sand, which would then fall off the edges until a pile just covering the table would be formed. The pile is then at the point of self-organised criticality. There is no way of knowing what will happen if a grain of sand was to fall on this pile. It could result in an avalanche removing a face of the pile or it could cause just a few grains of sand to displace itself or it could even result in no effect at all (pgs 49-51).

In the critical state, the sand pile is the functional unit, not the single grain of sand. Parts of the critical system cannot be understood in isolation and the dynamics observed locally reflects that it is part of the entire sand pile. For a forecaster situated locally in the sand pile, any local precaution taken to avoid an avalanche will be at best of no use overall, as it will just shift the avalanche to another area. In other words, here global behaviour does not depend on local detail. Also, a historic account does not provide much insight to what is going on, despite the fact that each step

follows logically from the previous step. This is because of two main reasons. First the amount of information needed would be that of everything, everywhere with absolute accuracy, which is an impossibility. Secondly, the evolution to a critical state takes place in a much longer time scale, and as such it is difficult to discern all the logical steps that have led to the behaviour (Bak, 1997, pgs 60, 61).

Bak, with his model of self-organised criticality, basically illustrates that many complex systems can naturally evolve towards the critical state. The significant aspect here is that while the current stability of the pile determines how much a newly added grain of sand can alter it, the grain of sand can potentially have either no effect or a tremendous effect. The amount of influence is determined by the present state but the next state is determined by the grain of sand (Flake, 1998, pgs 328,335).

2.4.11 A Science of Synergy?

The notion of complexity, and the subject matter that it deals with, is an accumulation of knowledge from various branches of the natural sciences. As such the concept is diffuse and awaits an articulation in terms of a clear unified definition. Yet scientists working within complexity research have no difficulty in recognising their domain or negotiating the boundaries of their enquiry. What then is the default definition that guides them in the recognition of this domain?

The science of complexity is an effort to understand nature and life by synthesis. Instead of relying on a dissection into constituent parts or concepts which are then aggregated to make sense of what constitutes the whole, Complexity concentrates on processes and concepts that explain how the 'whole' can evolve from more simpler constituents. Its main argument is then that emergent phenomena observable at system level (like life, learning etc) are actually not a property of the matter per se, but are a property of the *organisation* of the matter. Its operating principles concentrate not on the details of the constituents but on the *type of connections* formed by the constituents. The abstraction is at the level of connections between phenomena or concepts. In this way it stresses a particular perspective to view the evolution of emergent phenomena.

This begs more clarification of the question of abstraction. When a system is modelled at the 'global' level, how does one decide what to abstract? A model can be modelled faithfully to reality or it can be made simpler and easier to handle. As every artist or scientist knows, a model depicting reality in all honesty, defeats the purpose of art and science. Such a model would have the same drawbacks as a map as large

and detailed as the city it represents. (Gleick, 1987). Thus whatever be their purpose, art, maps and models must simplify as much as they mimic the world. In complex systems, the abstraction is at the level of rules, relations and connections of individual agents - be they genes, species, neurons, programs, buyers and sellers, individuals or nations - and factors that influence these rules and connections. Moreover the abstraction is at local level, modelling rules that operate at the local level but which are *integral to the emergent system considered holistically*. The system level emergent phenomena become the object of study.

If chaos is a science of synthesis, then complexity is a science of synergy and creativity. Being embedded within chaos theory, it not only carries forward the synthesis of chaos, but also develops it further to articulate fresh notions and concepts about the everyday world around us, hitherto, very often, relegated to the domain of metaphysics. In doing this, complexity theory adds its own nuances to what is familiar, thereby forcing a re-conceptualisation demanding that science look again at accepted meanings.

First among these is the concept of time. The scalar time of classical science is challenged by a directional time that points in two directions simultaneously. For isolated systems not in interaction with the environment, it points to increasing entropy or randomness and for dissipative systems it points to increasing order and organisation. This in turn has introduced the concept of 'entropy barrier' which simply says 'you can't unscramble an egg'. Second, is the concept of change. A universe that is guided by unchanging laws that remain the same for eternity according to classical science has been shown to be continuously changing and evolving irreversibly. In place of permanence being the norm, change and evolution is shown to be the norm. Third the security of predictability fostered by the universal laws of Newtonian science has given way to an acknowledgement of the larger role of chance and inherent unpredictability. The acknowledgement of uncertainty in itself gives rise to an attitudinal change in the way science relates to its environment. Fourth is the way science encapsulates man's relationship with nature. The feeling of alienation or mastery over nature induced by the universality and predictability of classical science now gives way to a reverence for nature as co-evolving partners, towards an uncertain future. Last is the inclusion of qualitative dimensions, hitherto thought to be out of bounds for natural science. Matters of 'freedom', 'contingency', and so on acquire a 'space' within natural science qualifying for 'acceptable serious'

investigation within the natural sciences. Along with this comes a scope for examining the relevance of notions like ‘multiplicity’, ‘specificity’, ‘parallelism’, ‘tolerance’, ‘cooperation’, ‘competition’, etc – concepts that were not really part of the mainstream in the natural sciences.

Epistemologically, complexity theory demands an investigation of the evolution of systems. Hence we see the re-incorporation of time in the form of an increased emphasis on historical studies, especially with respect to natural systems. Thus complexity has spawned studies in biological evolution, geological evolution, archaeology, anthropology, etc. An alternate response to the time scale demand, is an attempt to compress time by a reduction of system essentials to what is deemed to be important for the studying of particular system dynamics. We have thus the incredible spur in simulation techniques using the capacities of a computer. Though not amounting to be a proof in itself, the computer has become a virtual lab for testing out feasibilities and pointing to possible results that may be anticipated - a new site for experimentation albeit within limitations, yet offering potentially useful hypotheses. Mathematics still exerts its influence, but now also through the use of stochastic processes that take into account chance and probability in tandem with deterministic equations. Mathematics also finds an ally in the computer by way of experimental mathematics that relies on feeding in analytically insolvable equations and watching for the visual displays that otherwise would have been difficult to compute or visualize. Thus epistemologically we have a return to history and the development of computer related techniques, both a response to the larger time dimension involved in the study of evolutionary dynamics of complex systems.

The study of system interactions and its effects on larger scale processes are also studied in lesser time scales. Here however the breadth of the data required to form a coherent picture leads the scientist back to the computer for simulative studies. Large scale data involving considerable breadth has been undertaken for studying stock market performance, the arms race, political processes (Gurian *et al*, 1996) etc, again falling back on the computer but this time for its data handling capabilities. Thus we see the rapid development of an epistemology that basically serves to extend human capabilities and carries with it the methods and tools that make it possible.

Still lesser timescale studies have been done especially in the social sciences to study the effects of system dynamics within small scales - for instance using the notion of path dependency (Cox, 2004, Alexander, 2001, McFaul, 1999, Kay, 2003);

investigating and searching for general characteristics of complex systems within social systems (Ortegon-Monroy, 2003, White, 2001, Corning,P,A, 2002) - effects of system dynamics seen from the viewpoint of complexity. These involve qualitative studies of themes falling within the realm of research defined by complexity using what can be called ‘conventional’ tools and methods.

2.5 The Place of Complexity

In this section I summarise the arguments made for complexity in this chapter so as to contribute to the main research question. Key arguments of chaos theory and complexity theory within the broader trends of scientific pursuit in the natural sciences are summarised, and in doing so the metaphysical and epistemological level of the theory is suggested. I then also comment on the level of acceptance of these theories within circles of scientific discourse. The summary also prepares the ground for the next chapter.

2.5.1 Dichotomies and Dualisms

Kuhn (1996) shows us, through the history of science, that paradigm shifts in science are possible and also repeatedly observed. The paradigm shift nevertheless occurs only when there is a new paradigm ready to replace the older one.

The development of the theories of chaos and complexity has been the almost sudden consolidation of anomalies popping up ever since classical science put forth its particular world view, dominated by determinism, universality and time reversibility. Chaos and complexity theories, by articulating the existence of systems not governed by classical laws have assimilated a large part of the anomalies that remained stubbornly inexplicable by Newtonian science. In doing so it defines different expectations and makes it possible to look at different sets of problems. Epistemologically it demands different methods of enquiry made necessary by the existence of the type of systems that it lays claim to. Thus the realm of science and the types of problems that chaos and complexity defines is different and separate from that of classical Newtonian science.

2.5.2 The Fundamental Level of the Theories

Chaos and complexity are not the only challenges to classical Newtonian science. The theory of relativity demands a worldview that denies universality by accommodating a space for the position of the observer. Quantum mechanics demands forfeiture of certainty and predictability in favour of uncertainty and chance. Both these theories however accommodate classical Newtonian science as being

pertinent to a special class of phenomena defined with respect to the attributes each deals with. Thus relativity tells us that as long as the relative velocities of particles considered are small with respect to light, Newtonian dynamics apply. Similarly quantum mechanics restricts its ambit to the sub-micro world, making allowances for the larger macro world of everyday observance. Both these theories are known to be major paradigm shifts or revolutions within the natural sciences (Gleick, 1987, pg 6).

Chaos and complexity by way of its ambit advocates a worldview that complements these challenges. It too makes provisions for the success of Newtonian science by portraying the laws of classical science as being that of a special category of systems also to be found in nature. Thus systems governed by linear dynamics, with no iteration, close to equilibrium, conform to the laws of classical science. In this respect, chaos and complexity science pitch in with the paradigm shift claimed for the theory of relativity and quantum mechanics and as such they lay claim to a similar fundamental shift.

What makes chaos and complexity sciences very different from the theories of relativity and quantum mechanics though, is that they deal with the everyday visible world that we familiarly engage in (Gleick, 1987, pg 6). In the words of Phil Anderson "...the more the elementary particle physicists tell us about the nature of the fundamental laws, the less relevance they seem to have to the very real problems of the rest of science, much less society" (quoted in Waldrop, 1992, pg 81). The challenges posed by complexity theory and the changed worldview that it advocates are not just abstract notions interesting only to the scientists engaged in them. They concern our daily life, and by opening up new possibilities they make it possible to look anew at things around us. Chaos and complexity also articulate and describe a universe governed by mechanisms that accommodate anomalies from different disciplines. The wide varieties of phenomena, that have been observed in various disciplines though articulating problems within the discipline itself, are explained by the existence of chaotic and complex systems with *rules that transcend disciplinary boundaries*. The theories that describe these systems thus necessarily need to be placed at a *higher* level than the disciplinary situations that they explain. This is the claim of chaos and complexity to a fundamental level of explanation. Questions in relation to level of theories, the level of abstraction they address and the nature of phenomena they seek to explain are taken up again for more detailed discussion in chapter-3.

Viewed as a theory that can include the classical paradigm within it, the insights of chaos and complexity theories at first sight may seem to be a further contribution - more of an addition rather than a replacement of the knowledge provided by classical science. Yet the contribution effectually produces a total replacement in the worldview of science, by opening up possibilities and new phenomena for investigation that were hitherto deemed as not worthy of scientific investigation. By defining a more inclusive frame of reference, chaos and complexity theories, even while framing universal laws, in effect articulate a revised worldview – a point missed by the argument that complexity is really ‘science as usual’ as it is searching for universal laws.

2.5.3 An Afterword- Acceptability of Chaos and Complexity Theories within Natural Sciences

Chaos and complexity sciences, I have suggested, herald a major paradigm shift in the natural sciences. The very premises to which the success of science is attributed is challenged by these theories. It is thus no wonder that chaos and complexity have given rise to considerable discomfort in the conventional circles of practice of science (Ruelle, 1991, pg 70; Gleick, 1987, pg 180). The history of the development of chaos and complexity science is thus strewn with stories and accounts of rejected articles from bewildered editors; delayed and discouraged doctoral theses falling in a no man’s land in between sciences; isolated pioneers; and defiant and radical groups like the Dynamical Systems Collective at Santa Cruz, University of California (Gleick, 1987, Waldrop, 1992, Ruelle, 1991).

This science later attracted the attention of the media, mainly through the high profile of the scientists – several of them Nobel prize winners like Murray Gell-Mann, Phil Anderson, Ilya Prigogine etc engaging with it. Newspaper articles and popular science books (see for instance Gleick, 1987, Waldrop, 1992, Stewart, 1990, Prigogine and Stengers, 1994) and journal articles came to be released, heralding the advent of a ‘new science’. In fact the situation in the early 1990s went to the other extreme. This again caused considerable scepticism and wariness, discouraging a lot of serious scientists from entering the field (Ruelle, 1991, pg 72).

The situation at present is however stabilising, with serious work being done within the framework of chaos and more so within the framework of complexity. Whole institutions like the Santa Fe Institute, and dedicated centres have been established in prestigious universities. Exclusive international conferences are

organised and dedicated journals (for instance *Complexity*, *Emergence*, *Journal of Complexity*) now circulate in the field of Complex systems study (Ruelle, 1991, pg 71). The science however still remains young, though fast spreading into other disciplines, especially the social sciences.

In this chapter then, the overall nature of chaos and complexity science has been discussed with respect to varied fields in the natural sciences through which the concepts have originated. The level of insight that these theories contribute to and thereby the fundamental nature of this theory has also been argued for. In the next chapter these arguments are carried forward and substantiated with respect to the domain of social sciences, within which planning is conceived, it being a social activity.

COMPLEXITY THEORY-AN ONTOLOGICAL INVESTIGATION**Introduction**

This chapter contributes to the realm of generalised discourse for theory development or contextualisation. In terms of the thesis i) it provides theoretical and philosophical grounds for constructing an argument for using complexity science (which we have seen has largely originated in the natural sciences) in the realm of social science; ii) by building up an ontological argument for the systems science, it advances a claim to 'reality', which in turn provides the philosophical base for a serious consideration of complexity theory, for what is claimed as real, then has causal properties. It also lays the grounds for a fuller and closer examination of the usefulness of complexity theory for planning. The domain of social science however remains a general encompassing framework only, with detailed substantive issues within social sciences, like the explanation of the formation or maintenance of society, or social systems, not the focus of discussion. Thus, by providing a framework for subsequent discussions of the relevance of the theory for planning, this section focuses on clarifying the metaphysical, ontological, epistemological and methodological questions that might arise in the more specific discussions that follow.

Any discussion on the use of a theory for social systems must start with a clarification of the suitability of such a proposition. Complexity science as hitherto discussed essentially talks about properties of complex systems developed from within the natural sciences - both physical and biological - dealing with entities vastly different from human beings the subject matter of the social sciences. The basis for considering an import into the social realm is therefore to be established. In the last chapter, it has been argued that concepts in complexity hinge on connectionism, holism, relations and so on. There is a parallel stream within social science that deals with these concepts - the stream of systems theory. In this chapter I show how underlying concepts from systems theory parallel those of complexity theory. I then proceed to argue for the ontological foundations of both systems theory and

complexity theory establishing thereby the logic by which the physical, biological and social come to be bridged.

This chapter is organised in two sections. Fundamental ideas of systems sciences¹ are introduced in the first section wherein systems characteristics and systems thinking are discussed, thereby establishing the general nature of systems science. The second section dwells more in detail on the scientific and metaphysical base of the systems science. This is discussed primarily with respect to transcendental realism/naturalism. The main arguments in transcendental realism are examined with respect to the natural/physical sciences. The ontological base for a grounding of the systems science in a realist framework within the physical/natural sciences is then argued. The realist argument with respect to social science is finally examined and critiqued. An argument parallel to that constructed for the systems sciences in the realm of the natural/physical sciences is then presented for the social sciences as well. This section thus defends a philosophical position that grounds systems sciences in general.

3.1 Systems Sciences

Here I clarify the meaning of the term ‘system’ first, together with meanings of features or concepts that thereby get defined. Key characteristics of a system and the consequence that it has had for the development of what is now known as ‘systems thinking’ are then drawn out. The nature of systems science is then established in broad and general terms.

3.1.1 What is a system?

According to Kuhn and Beam (1982, pg 27), any two or more interacting components constitute a system. The term ‘components’ and ‘interacting’ is crucial here. This is so because if not constituted of ‘components’ it is just a ‘lump’ and if not interacting it is just a ‘heap’. This then qualifies any living organism as a system since life cannot happen unless there are components and the components are interacting. An agglomeration of living organisms however need not constitute a system if they are not interacting. Thus, a category like ‘all mothers’ or ‘all teachers’ will not form a system unless they are interacting. The requirement of interaction alone cannot help one define the system though. A system is recognised as such only with respect to a

¹As in the case of complexity, I use the terms systems science and systems theory interchangeably as there does not seem to be a very rigid distinction made between the two in the literature

larger whole. This is what constitutes its 'environment', the differentiation of which is achieved by a 'boundary'. Boundaries can be 'closed' or 'open', a distinction which is credited to Ludwig von Bertalanffy (Dubin, 1978, pg 245), generally regarded as the founder of General System Theory (Boulding, 1956 pg 197, Rapaport, 2001, pg 3, Flood *et al*, 1988) and the consequent systems movement in mid 20th century. In a closed system, the boundary is absolute and a relationship of consequence does not exist between elements of a system and the environment. However in an open system, exchanges of material, energy or information can happen between the system and the environment (Flood *et al*, 1988).

Kuhn and Beam (1982, pg 28) introduces a further requirement – that of the observer. Thus they point out “whether something is or is not a system often depends on the observer’s focus of interest”. Thus “the ocean is simply a heap of water for the casual visitor but a complex system to someone interested in its currents or marine life” (pg 28).

Further to the above system features, it must be kept in mind that systems need not be only material. Thus according to Bunge, (2004, pg 372) “systems can be material like schools, conceptual like theories, or semiotic like texts.”

3.1.2 Systems Characteristics and Systems Thinking

Though thinking in system terms, for getting on with the practicalities of life, must have existed from time immemorial, as when man first tried to plan his food (Churchman, 1979), systems thought in formal academic or scientific discourse, has been traced back to Plato and far eastern cultures (Churchman, 1979, Hammond 2002). However systems principles were formally laid out as a separate mode of thinking with a separate subject focus by Ludwig von Bertalanffy under the name of General Systems Theory (GST) (Bertalanffy, 1951, 1968). Since the time of Bertalanffy, systems theory has developed immensely to yield different strands, so much so that there are now multiple versions of GST (Churchman, 1979, Zwick, 2001) each studying different aspects of system dynamics, thus differing in content (Warfield, 2003) and also following different philosophical underpinnings and consequently different research traditions.

Bausch (2002b, pg 417) points out that “ with the coming of Descartes and the rise of modern science, the medieval hierarchical metaphor relating to society and the heavens was replaced with a mechanical metaphor.” This is borne out by the second rule advocated by Descartes for the ‘proper conduct of research’ – “The second to

divide each of the difficulties that I was examining into as many parts as might be possible and necessary in order best to solve it” (Descartes, 1637, quoted in Checkland, 1981a, pg 46). A rule of analytic reduction is advocated here – a process whereby the whole can be explained by a summation of the working of the parts. Checkland (1981a, pg 52) points out, “we can do this if biological phenomena... can be wholly explained in terms of physics and chemistry...” i.e. if the whole process of say humour can be fully explained by physico-chemical changes in the brain. This form of reductionism whereby a whole entity is sought to be solely explained away (Checkland, 1981a, pg 65) by reduction into parts is a key concern for systems thinking and it originally developed as a reaction against this form of reductionism.

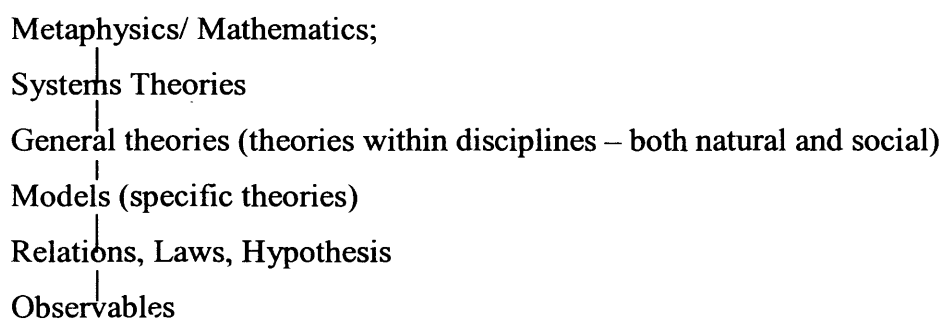
The second concern for systems thinking was the proliferation of ever more disciplines in the pursuit of knowledge. Thus in the course of accumulation of knowledge, increasing specialisation was noted as a concern. In their book dealing with the logic of organisations, Kuhn and Beam (1982, pg 8) point out that while each branch within the social science has *functional* (sociology, economics, politics) categories which are understood within the disciplines, there is no “basic general science within the social science”. They therefore call for the development of basic *analytical* categories, as opposed to functional categories. Systems theory then can serve a *skeletal* function “on which a vast variety of other kinds of taxonomy and analysis can be hung” (pg 9). A concern for communication across disciplinary boundaries that gets to core analytical principles, which themselves may be founded on synthetic criteria, grounded on scientific principles is the concern – the second concern that prompted system thinking.

Both the above concerns are succinctly discussed by Kenneth Boulding (1956) in his often quoted and influential article *General Systems Theory*. Thus according to Boulding, systems theory describes a level of modelling that is somewhere below highly generalised concerns like mathematics, yet above those of the disciplinary sciences. He describes mathematics as a system with no connection to the real world in the sense that it is so much abstracted from the real world that it loses content. Thus “because mathematics contains all theories it contains none” (pg 197). From this placement of the systems theory, Boulding goes on to sketch a role for GST. Accordingly at a low level of ambition, GST just points out similarities in theoretical constructions of different disciplines where they exist and tries to develop models that can be applied to at least two disciplines. At a high level of ambition however, GST

aims to construct a ‘spectrum of theories – a system of systems’ which will serve as a ‘gestalt’. Boulding proceeds to identify two ways in which this might be done. These are described in Appendix-2 and can be seen to be broadly linked to the key concerns described in the above two paragraphs, that GST had in its inception.

3.1.3 Systems Science

Emanating from the overall schema of the purpose of systems science and what it intends to achieve, Bunge (1973) proceeds to create an epistemological hierarchy within which he positions systems sciences. Thus according to him systems theory falls in between two levels. The first being the realm of mathematics which he characterises as being an exact science and metaphysics characterised as a philosophical endeavour. Both of these are abstract and thus devoid of content. They may thus be qualified as meta-disciplinary. There is then the level of the disciplinary sciences with theories of relevance to particular disciplines. These are less abstract but richer in substantive content. Systems theory is positioned as being less abstract than mathematics or metaphysics, but more abstract than the theories within disciplines (Boulding, 1956). Content wise also they hover between the metaphysical realm and the disciplinary realm. Bunge, in his “epistemological hierarchy” extends this further down wards. His hierarchy has been re-interpreted and modified by Zwick, (2001). This re-interpreted hierarchy has the following structure:



According to the above structure, just as models can be derived deductively downwards from general theories or built up inductively from relations or laws, so also systems theories can be built up inductively from theories within disciplines by identifying isomorphisms between different theories or deduced deductively from mathematical formalisms or metaphysical positions by adding interpretations (Zwick, 2001). It thus qualifies as a meta-theory and stakes a claim towards being more fundamental than disciplinary theories.

Following from this it has been postulated that there can be two ways in which systems sciences can develop. First, by a development of different aspects of the theory in itself, focussing on cross-disciplinary work and secondly by work within disciplinary sciences, which adopt system theories and examine the added insight that they provide within the discipline (Checkland, 1981a, pg 94). The former then will be more a question of identification of isomorphisms and an abstraction of theoretical essence from the disciplinary theories, which can have relevance across a broader range of disciplines. Work at this level is likely to be informed by metaphysical stands and/or mathematical formalisms. An example of this type of work in this thesis can be seen in Chapter-6 which discusses the concept of 'fractals'. In the latter case, system theories must be combined with other disciplinary theories. An example of this type of use in this thesis can be seen in Chapters 7 & 8, which discusses autopoiesis. System theories being abstract cannot yield knowledge or testable hypotheses on their own. They can however suggest ways of re-interpreting knowledge and suggest research agendas in combination with disciplinary theories to form testable propositions. The contributions of systems theory in terms of insights will therefore necessarily contain both disciplinary issues and systemic concerns, the one co-existing with the other. Having reviewed the literature that positions the systems sciences with respect to a hierarchical schema of knowledge abstraction and acquisition, I now examine the broad ways in which systems sciences as a whole have developed over time. The discussion here is limited to sketching an overall picture of the development of philosophical debate within systems science, the content of the science itself is not the subject of discussion.

Simms (2001, pg 7) states that the basic areas of scientific study of systems are 1) the static component, which deals with the structure and organization of systems and 2) the dynamic component, which deals with the investigation of systems behaviour when subjected to various influences. Concern with these two strands can be said to have led to the development of two related streams within systems science - systems theory and systems practice. Although different strands can be said to exist within systems theory and systems practice, leading to what is now a multiplicity of theories (Zwick, 2001, pg 87), (the information theory stream, the control theory stream, the game theory stream etc), a general development pattern can be discerned suggesting an evolution within systems thinking. I would like to suggest that this development can be more or less seen to be a response to an awareness of increasing

system complexity. In other words systems science has been climbing the levels of systems within Boulding's hierarchical ordering outlined in Appendix-2.

Jackson (2001, pg 240), in tracing the evolution of systems sciences in relation to the social sciences, comments that in philosophy, though aspects of holistic thought can be seen in the works of Aristotle and Plato and later in the work of Kant, Hegel, Spinoza and also Marx, the mechanistic analogy of looking at society as a system in equilibrium developed from the work of Pareto. In these early versions, the emphasis was on establishing agreed goals and developing systems of control that would optimise the system towards achieving that goal. Thus analysts would typically start by naming the system, its objectives etc and place it within a hierarchy of systems. The system would be designed by quantitative modelling and simulation. This model would then be optimized using defined performance criteria and then the result would be implemented (Checkland, 1981a, pg 190). The system is seen and modelled here as tending towards a predetermined goal, be it equilibrium or optimisation of some parameter, and system dynamics are modelled on inductive empirical data. Functional relationships follow a mechanistic though experimental model. An innate positivism is implied here and 'structural-functional' analysis relying heavily on quantitative methods became the principal methodological trend within the systems sciences (Blauberg *et al*, 1977, pg 28). Blauberg *et al* (1977, pg 28) identifies two fundamental postulates of structural-functional analysis: identification of the structure of the system as an invariant and identification of the functional description of the structure. This practice of system science came to be characterised as 'hard-systems' science.

The tradition soon met with problems characterised by Jackson as horizontal – dealing with differences in values, beliefs, etc - because of which desired end-result could not be defined precisely; and vertical – dealing with increased complexity by which all system parameters were difficult to define and build in (Jackson, 2001, pg 242). As a consequence of the above problems it gave way to what is known as 'soft-system' science. This is characterised by a shift away from modelling the world to systemically learning about what kind of change may be possible in the world (Jackson, 2001, pg 242). Acknowledging the difficulties of problem definition, this development in systems sciences is characterised by an interest in 'structure' and 'process' and their mutual relationships (Checkland, 1981a, pg 190). A clarification by Bunge (2004, pg 373) is relevant here. According to Bunge, systems have both 'structure' and 'mechanism'. A structure denotes the set of internal (endo structure) or

external (exo structure) relations that a system might have, while a mechanism denotes a process in the system (Bunge, 2004, pg 373). One can be changed keeping the other unchanged. For example, when a teacher ‘imparts knowledge’ (mechanism) of systems to a class either through a formal lecture (structure-1) or through a form of informal discussion (structure-2). We see here a concern with structure that gives rise to effects as opposed to variables of a system that can produce results - a shift from positivism to structuralism characterised by a concern with structure, mechanism and process. This shift was also simultaneously accompanied by a turn towards ‘phenomenalism’ (Mingers, 2000, pg 1260). It was accompanied by a grounding in practice and the ‘real world’ leading towards action research as a research method in place of system modelling.

Following from the development of soft systems science, came still more refinement within system science referred to currently as the critical systems stream. The emphasis here is on a systematic appraisal for values and emancipatory goals (Jackson, 2001, pg 244). Ulrich (1983) is generally credited with the development of this concern in systems science (Georgiou, 2000, pg 392). Engaging with practice directly, critical systems science emphasises multi-methodology, thereby promoting a methodological pluralism in the use of systems approaches and systems ideas (Midgley, 1997).

In the account above I have sketched general characteristics, of systems, systems thinking and system science. I have introduced the fundamental concerns of systems sciences and the frameworks that guide scientific endeavours in dealing with these concerns. I have also shown how systems thinking has evolved through time, starting from mechanical, control concerns to more humanistic, non-goal based concerns right through to critical and emancipatory concerns. I now turn to a more in depth investigation of the *nature* of systems thinking. An examination of the metaphysical, ontological and epistemological roots is called for. A clarification of these will help us relate to the systems science on a more ‘scientific’ basis. This is then the subject matter of the following section.

3.2 The Metaphysics, Ontology and Epistemology of the Systems Sciences

This section focuses on investigating the philosophical underpinnings of systems theory. According to Harre (1972, pg 100), “metaphysics is the study of the most general categories with which we think’. Lowe (2002, pg 2, 3) opines “its (metaphysics) central concern is with *the fundamental structure of reality as a whole*

(original italics)". This chapter seeks a clarification of systems concepts at the metaphysical level enabling us to ontologically and epistemologically ground subsequent discussions with respect to complexity theory.

If one were to agree with the position of systems science within the epistemological hierarchy proposed by Bunge, (discussed in section 3.1.3), ontological aspects of the system science can only be discussed either at a metaphysical or mathematical level. Deriving from this hierarchy again, ontological aspects can likewise be discerned from the innumerable ways in which system science has developed across disciplines. Surveying the literature of system sciences for a metaphysical grounding is not very encouraging. Thus Blauberg *et al* (1977, pg 97) remark that 'ontological problems are not as a rule treated specially in systems studies but are included in the majority of works as most general preliminary remarks.' Checkland (1981a, pg 264, 265) attempts to do this with respect to soft systems methodologies asking the question, "What model of social reality is implied by the methodology?". He goes on to remark that relating the experience of systems research to the context of social science is something that the systems movement has been markedly reluctant to do (pg 265). He also cites Bryer and Kistuck (1976) who remark that they did not find a single attempt by a systems theorist to justify his approach in sociological terms. However, the case is not completely hopeless. There can be found in the literature reflections and discussions on the philosophical aspects of systems sciences. What is lacking is a systematic argument to ground the philosophy in its metaphysical aspects with respect to other positions in the social sciences. The task in this section, then, is to address this gap to some extent and to propose a metaphysical position that relates to other positions in the social sciences while serving the primary task of grounding the discipline ontologically and epistemologically.

The domain of substantive content in the systems sciences, as we have seen, covers not only a range of disciplines, but also a range of methods. In the words of Blauberg *et al* (1977, pg 84) it is now "a chequered pattern of various concepts, methods of analysis, theoretical constructions and practical R & D". According to them, scientists in the course of their day-to-day work within the systems tradition single out only one specific feature from the systems approach and make that feature the dominant theme. Thus choosing what type of questions to ground at a metaphysical level becomes problematic. In order to avoid the risk of understanding

the systems science from just one among the numerous perspectives and approaches, I opt to first understand it at a very general level relying on the most general yet fundamental concerns that describe its scientific domain. Boulding's systems ontology and Bunge's epistemological hierarchy are particularly of importance and are drawn upon extensively. My question then is : what sort of metaphysical position is implicit in systems ontology? In other words to use a transcendental argument resonating with the one put forward by Bhaskar in his argument for a realist theory of science, how does systems science picture the world in order for the practice of such a science to be possible? Following from this, I specifically seek metaphysical clarifications for 1) the systems perspective on the nature of reality, 2) hierarchy, atomism and reductive explanations of reality, 3) notions of causality and modes of explanation, and 4) the epistemological basis of isomorphisms across disciplines.

In searching for the ontological dimension of the systems sciences, I proceed from the metaphysical level downwards. This decision is informed by Bunge's epistemological hierarchy. I start by examining the metaphysical argument for realism presented by Roy Bhaskar in the natural/physical sciences. Thereafter I proceed to discuss the way systems theory takes a position with respect to this thesis of realism. I then examine modifications made by the realist claim in the social sciences to enable a possibility for naturalism. From this I argue for an ontological realm implicit in the concerns of systems sciences. The significance of complexity theory for social science is dealt with as a continuation of the general development of system science and is consequently a matter for discussion in the next section.

3.2.1 The Realist Theory of Science

A very influential work within the debate on the existence of an independent 'reality' has been the work of Roy Bhaskar advocating for a realist theory of science (Bhaskar,1997). The key question that Bhaskar posits as a basis for building up his thesis is "what must the world be like for science to be possible" (Bhaskar, 1998a, pg 18)? He builds up the argument for transcendental realism by arguing against two philosophical positions of science – classical empiricism represented by Hume and transcendental idealism represented by Kant. Thus transcendental realism regards objects of knowledge as not a conflation of the observed phenomena with reality, as argued by classical empiricism but as contingent manifestations of structures and mechanisms that generate phenomena in open systems. They are also not just human

constructs imposed on phenomena, as argued by idealism but are real and endure independent of our knowledge or experience of them.

Transcendental realism identifies two domains - the transitive and the intransitive - which fundamentally explains its thesis. The transitive domain depends upon the activity of scientists and contains objects of knowledge, which include antecedently established facts, theories, paradigms, models, methods and techniques. The intransitive domain on the other hand consists of objects that exist independent of human knowledge or activity and they constitute the real structures and mechanisms by which the world is ordered. Knowledge is produced in the transitive domain in the social activity of science wherein open systems as found empirically, are carefully and meticulously crafted into closed systems through which structures and mechanisms that exist in the intransitive domain can be identified. According to realism then, “both knowledge and the world are structured, both are differentiated and changing; the latter exists independently of the former; and experiences and the things and causal laws to which it affords us access are normally out of phase with one another” (Bhaskar, 1998a, pg 19).

Generative causal mechanisms according to realism endure even if they are not acting and remain unrealised, due to intervening mechanisms or countervailing causes. It is the social activity of experimental science that creates closed conditions that allow for the removal of countervailing conditions and its consequent identification. It is this “characteristic pattern of activity or mode of operation that is described in the statement of a causal law” (Bhaskar, 1998a, pg 34). Thus causal laws remain distinct and separate – the domain of the real - from what is realised – the domain of the actual. If the domain of the actual need not always manifest the workings of the domain of the real, then how is one to know of a relation or connection between the two? Bhaskar introduces the concept of necessary connections and accidental connections or sequences. A necessary connection corresponds to the activity of a generative mechanism making it real. It must be noted here that it is the generative mechanism itself that constitutes the basic unit of reality, not the causal law. The causal law however reflects the generative mechanism, but is subject to modification as a result of scientific activity. These generative mechanisms are endowed in things possessing causal powers. But then if ‘things’ possess causal powers how can we account for the necessity of causal powers not being always manifest in open systems? Transcendental realism answers by analysing these powers

as tendencies. Thus Bhaskar (1998a, pg 37) states “whereas powers are potentialities which may or may not be exercised, tendencies are potentialities which may be exercised.....without being realized or manifest in any possible outcome”. Thus phenomena of the world are explained here by reference to both fulfilled, actualised as well as unrealised, unmanifest tendencies, liabilities and powers possessed by complex objects. The essential concern of science then is to uncover the nature of these objects that *explain* what they are and what they tend to do.

Since co-incidence of the ‘actual’ events with the domain of the ‘real’ can only be manifest in closed systems, there remains a domain of active empirical experimental activity, experience and perception. This constitutes the third domain - that of the empirical - requiring among other things triggering of the mechanism to be identified, prevention of contravening forces and the use of special sense extending equipments. Thus according to transcendental realism the world and knowledge about it is both differentiated and structured into overlapping domains of the real, constituting structures and mechanisms, the actual constituting events, and the empirical constituting experiences belonging to the social world of science.

The ontological basis for causal explanation being given, what is the mode of explanation in realism? In other words how does one ascribe natural necessity to an event or mechanism? Bhaskar relies on a concept of the nature of the stratification of the world and the logic of scientific discovery to explain this. By ‘logic of scientific discovery’ Bhaskar means that “there is in science a characteristic kind of dialectic in which a regularity is identified, a plausible explanation for it is invented and the reality of the entities and processes postulated in the explanation is then checked. This is the logic of scientific discovery” (Bhaskar, 1998b, pg 49). Methodologically the initial positing of the existence of a mechanism is established by philosophical argument in transcendental realism, after which it is the nature of the substantive sciences to establish which ones actually exist. Thus Bhaskar writes:

“For transcendental realism that some real things and generative mechanisms *must* (original italics) exist can be established by philosophical argument (their existence, and transfactual activity, is a condition of the philosophy of science). But it is contingent and the job of substantive science to discover which ones actually do. That is, it is the task of science to discover which hypothetical or imagined mechanisms are not imaginary but real; or to put it the other way

round, to discover what the real mechanisms are, i.e. to produce an adequate account of them” (Bhaskar, 1998b, pg 50).

But what is the mode of this discovery? Bhaskar rejects both deductivism based on a higher law and inductivism based on experience alone as possible modes of discovery. This rejection is founded on what he sees as the failure of deductivism to provide the ‘surplus element’ (the element over and above constant conjunction that provides a basis for ascribing necessity). If the search is for this ‘surplus element’ then deductivism actually just shifts the burden of proof to a higher law. The case of inductivism is also not enough as accidental generalisations can easily be inductively confirmed (the problem of induction). As an answer Bhaskar writes:

“the possibility of the latter (truth-functional operations) depends upon some terms of the theory not being explicitly defined in terms of experience and/or some idea of the theory being non-propositional in logical form. These establish the possibilities of intensional relationships between predicates, non-deductive (eg: analogical) relationships between ideas and non-propositional (eg: iconic) ideas respectively as potential sources of necessity” (Bhaskar, 1998b, pg 54).

Harre (1988, pg 139) also calls for the use of “theoretical imagination to create ideas of beings which are often yet to be observed”. He suggests the use of a *source model*. Thus according to him “Great scientific advances are often made by the development and demonstration of the use of a new source-model. It is not unreasonable to see the explaining act in the natural sciences as the invention and use of a suitable source-model to enable the community to conceive of a causal mechanism, generative of phenomena, which is currently unobservable” (Harre, 1988, pg 139). The source model then “not only controls the content of the explanatory concept but also provides it with a measure of initial plausibility, so that it can be taken seriously enough to be the basis of exploratory projects” (pg 141). I discuss this point again, in more detail, in Chapter- 5, wherein I derive the methodology for this thesis used for theory transfer and contextualisation .

Explanations within a realist conception proceed in a stratified manner. Thus explanations at one level are provided by identification of structures and mechanisms at a deeper level, which in turn are further explained by structures and mechanisms at a still deeper level (chemical bonding explained by theory of atomic numbers and valency explained in turn by theory of electrons and atomic structure explained in turn

by competing theories of sub-atomic structure and so on). Bhaskar suggests that “for the transcendental realist the stratification this form of explanation imposes upon our knowledge reflects a real stratification in the world” (Bhaskar, 1998b, pg 67).

Natural mechanisms can be very simply stated as the powers or ways of acting of things. There is then a relationship between what a thing is and what a thing can do and consequently between what a thing is and what it tends to do in appropriate conditions. The deducibility of such a tendency from nature is a criterion for our knowledge of natural necessity. Thus when natural tendencies are realised, events are necessarily connected. Mechanisms identified thus are not only enduring but are also transfactually applicable, with both the endurance and transfactual activity not in need of any further explanation (pg 80). Science thus has *a posteriori* knowledge of necessary connections.

Regarding essences of things in nature, Bhaskar gives a further clarification distinguishing between nominal essences and real essences. Thus “nominal essence of a thing or substance consists of those properties the manifestation of which are necessary for the thing to be correctly identified as one of a certain type. Real essence consists of those structures or constitutions in virtue of which the thing or substance tends to behave the way it does, including manifest the properties that constitute its nominal essence” (pg 85). From a description of the nature of a thing it can then be possible to deduce its behavioural tendencies (pg 89). In connection with this it can be said that classifying a thing and calling it by one name (taxonomical classification) can be a reference to a real essence held in common. It is then a commitment to a certain line of enquiry (pg 86). This argument of Bhaskar’s is built upon again in Chapter-5 dealing with ‘fractals’.

It might be useful here to examine Shoemaker’s arguments regarding real essences on causality. With respect to ways of identification of real essences or properties, Shoemaker (1999, pg 253-267) discusses the relationship of properties to causality in which the main thesis is that properties are distinguished by their causal powers. Thus for Shoemaker (pg 274) “A property is genuine if and only if its acquisition or loss by a thing constitutes a genuine change in that thing”. Likewise he says “the identity of a property is determined by its causal potentialities, the contributions it is capable of making to the causal powers of things that have it. And the causal potentialities that are essential to a property correspond to the conditional powers that make up the cluster with which the property can be identified; for a

property to have a causal potentiality is for it to be such that whatever has it, has a certain conditional power” (pg 256-7). The immutability of causal potentialities of genuine properties is a consequence of the immutability of laws (pg 282). Shoemaker further justifies the view he holds on epistemological grounds. Thus we can recognize a property by its effects, which may be observable directly. It may also be inferred from properties we know it has on other cases to be correlated to the one in question. However this requires prior knowledge and as put by Shoemaker “for unless the instantiation of the property had, under some circumstances, effects from which its existence could be concluded, we could never discover laws or correlations” (pg 257). Thus analogy to known effects and circumstances becomes a methodological tool. Again this point is taken forward both in Chapter-5 in discussions of a methodology for theory transfer and in Chapter-6 when the methodology arrived at is actually applied.

3.2.2 Realism in System Science in Natural Science

I shall in this section now attempt to sketch out the ontological and epistemological status of the systems sciences in the natural/physical sciences. Given the above arguments of a metaphysical position of realism by Bhaskar, I now combine it with the arguments presented in previous sections for a systems ontology by Boulding (section 3.1.2) and an epistemological hierarchy by Bunge (section 3.1.3). In doing so, I argue for a distinct domain for the systems sciences.

Initially it must be stated that system science is not essentially at logger-heads with the fundamental view of the world presented by realism. By believing in a cross-disciplinary science, it *prima facie* makes a claim for a ‘reality’ that must exist across disciplines. But within this domain system science carves out a particular niche for itself, not obviously apparent in – though not refuting - the realist argument. Focus on this niche in turn enriches the picture of the world presented by realism. I shall now sketch the outlines of this picture.

Bhaskar in laying out the above arguments for realism essentially argues for a world seen as stratified, and differentiated. The stratification is evident in the layers of explanation embedded in generative mechanisms that retroductively constitute an explanation for phenomenon visible at any one level. Differentiation is due to the not necessary, contingent, manifestation of generative mechanisms in observable phenomena, which can be explained by the presence of counter-veiling forces. Causation is attributed to deep generative mechanisms of natural necessity, which

emanate from the properties of objects/things. Thus the behaviour of liquids, solids or gases may be explained by reference to the behaviour of molecules and atoms which is in turn explained by the behaviour of electrically charged electrons, protons and neutrons. The process continues until the level of quarks which is the current fundamental level reached. In doing so thus a process of infinite regress is in operation. The nature of explanation and consequently the nature of the world presented can figuratively be expressed as below:

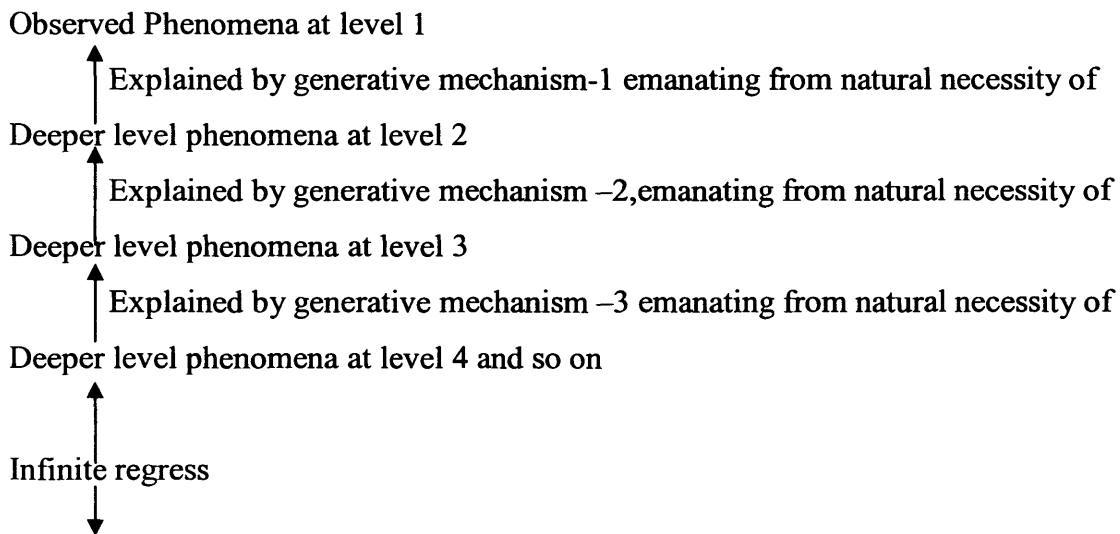


Figure-3.1: Nature of Explanation and the Nature of the World in Realism

We have here what can be said to be an essentially linear nature of explanation where phenomena at one level is ‘reduced’ and explained by phenomena at a deeper level, giving rise to a ‘structure’ for the world and ‘structure’ for explanation. This inevitably calls for an ultimate explanation in terms of molecules and atoms and sub-atomic entities. The possibility of different disciplines developing from this fundamental mode of explanation is explained by there existing distinct types of phenomena generated at higher levels constituting different streams of explanations termed as ‘emergence’. The picture is that of a branching series. Thus Bhaskar (1998b, pg 75) posits “On it, quantum mechanics and chemistry would belong to the same branch. But electromagnetism and mechanics, neurophysiology and psychology and...psychology and sociology would belong to different branches”. Thus “the course of nature is different than it would have been if the more basic stratum alone operated” (Bhaskar, 1998d, pg xiii) and “the higher – order structure is real and worthy of scientific investigation in its own right” (pg xiii).

This view then clearly acknowledges something other than the basic strata operating. If that is the case, then a stratified linear sort of explanation as advocated by realism cannot be sufficient. There is a need for another 'surplus element' here. This mechanism is acknowledged as 'emergence' but is not further dealt with by Bhaskar either in terms of the world-view presented (which is essentially linearly stratified), or by way of modes of explanation possible. Operating parallel to generative mechanisms what then is the causal source of 'emergence', and how can causal explanation grounded in generative mechanisms emanating consistently from lower level reality be reconciled with an examination of higher level structures 'in its own right'? As stated earlier, Bhaskar is not clear on how explanation is then achieved. The non-reductiveness is however acknowledged. Thus "even though one kind of mechanism may be explained or grounded in terms of another, it cannot necessarily be reduced to or explained away in terms of it" (Bhaskar, 1998d pg xiii).

In order to define the gap in more precise terms and introduce the ontology of systems science, I now examine two aspects of the operation of generative mechanisms in more detail. First, the ways in which realism sees combinations of generative mechanisms and second, what constitutes generative mechanisms. We know that for realism, generative mechanisms are hierarchically constituted which in combination produces contingent events manifest as observable phenomena in the domain of the actual. It is the contingent combination of generative mechanisms that produce the observable world. The combination of generative mechanisms are essentially seen here as forces converging at a point. The combination is achieved through a selection of generative mechanisms, selection in the sense that some generative mechanisms may be prevented from being manifested due to other counter-veiling generative mechanisms. It is then, essentially, what can be expressed as a neutralisation or over powering of generative and counter-veiling mechanisms that ultimately result in a particular phenomena being manifest. These generative mechanisms are intrinsic to and proceed from natural powers of objects/things which then require no further explanation as they are basic entities that constitute the world. This is the form of attribution of causality also. Causal powers are powers of generative mechanisms, which are in turn powers of natural necessity, which emanate from real essences of objects. The picture portrayed is then a conceptualisation of individually identifiable innumerable mechanisms attributable independently to

objects/things – an essentially linear picture that achieves variety through combinations.

How does this picture relate to the picture implicit in the practice of the systems sciences? Systems sciences, as we have seen stress relationships and irreducibility. Though not fundamentally or explicitly contradicting the presence of generative powers or natural necessity, this however focuses on another form of 'structure'. This is the *form* of a synthetic whole that does not only emerge from the natural necessity of objects that constitute it, but also emerges from the type of *relations* that constitute it. It thus claims irreducibility to just the natures of the constituents for explanation. This is then a stress on the emergent properties that realism acknowledges – a claim to the recognition of, in the terminology of Lorentz (quoted in Broad, 1999, pg 489) both microscopic and macroscopic properties (which are irreducible to the micro level). Emergent properties are then studied as manifestations of both the *nature* and also the type of *relations* that form between constituents of the whole - both quantitatively as well as qualitatively. In this manner it accommodates both the quantitative and qualitative, the mathematical and normative stream within it (both the nature and relations can be analysed normatively).

But what is the nature of explanation here? Is there another type of causal allocation embedded in the systems approach? We have seen that realism in the natural/physical sciences allocates causal claims to mechanisms on the basis of natural powers of objects/things. However concepts in metaphysics tell us that claims to universality need not always be causal claims. They can in fact be time-space relationships as well. There are thus different criteria for allocation of causal claims (Tooley, 1999 provides some discussion of some of these claims). I contend then that the systems science also takes into account space, understood in an abstract fundamental sense, along with mechanisms. Thus ways in which relations are constituted in space are equally important here. In a regress through stratified levels of explanation as advocated in realism, there is a progressive shrinkage or expansion in space of the entities or phenomena that embody the generative mechanisms. A reductionist explanation is possible only because the entities occupy different volumes of space (larger or smaller).

In systems science, explanation is not only thus vertically embodied in generative mechanisms operating through entities occupying progressively larger or

smaller spaces, but is also horizontally constituted at the same level of explanation. Thus in addition to generative mechanisms, the form and nature in which the whole is constituted also provides a causal explanation, for the same constituents in different combinatorial forms yield different phenomena. There is thus a second line of causation initiated in system science – one that relates to the way components are hinged together. This is a modification to the way that realism explains observed phenomena. We are here talking about not just a ‘combination’ of linearly existing forces but a synthesis of a whole with emergent properties, synergetic in its effects, which are in turn dependent on the type of relations that constitute the whole. This whole exhibits invariant properties, which are not fully determined by the properties of its parts, but which are not independent of them either, making a science of systems possible. This systemic relationship then is ‘real’, in the sense advocated by realism that it is a ‘tendency’ which exists independent of it being exercised or not, manifested in observable phenomena or not.

The possibility for the existence of this type of real entity, composed and defined by the relations that constitute it, is accommodated in the realism advocated by Bhaskar wherein he asserts that

“Now the things posited by science in its investigation may be quite recondite and abstract with respect to our ordinary experience. It is wrong to think of them as necessarily like material objects – they may be powers, forces, fields or just complex structures or *sets of relationships* (added italics). Their metaphysical character, which justifies us labelling them as ‘things’..lies in their persistence and transfactual activity. This entails that they persist even when they do not act, and act in their normal way in the flux of conditions that co-determine the actual outcome of their activity” (Bhaskar, 1998b, pg 97).

Though Bhaskar here sees relations and complex structures as valid objects for the pursuance of science and recognises emergent properties and irreducibility, forms of explanation advocated by realism do not really focus on this aspect. If these are taken into account, explanation that runs linearly through the stratified picture of the world, takes on also a disjointed mode of explanation that matches the layered stratification, presenting a picture of the world that is disjointedly stratified in one plane but relational and synergetic in another. The more detailed metaphysical debate and argument for attribution of causality to relations is included in Appendix-3.

Scientific theories have a time and the history of scientific knowledge is still not mature in this domain, though research activity in this domain as we have seen earlier is picking up within the natural sciences. History of science has time and again shown that what is shrouded in an aura of mysticism today is but tomorrow's science, that will with time be taken for granted. In the practical sciences however, one cannot ignore the existence of phenomena, known to exist, just because we do not have a fully-fledged explanation of it for the moment. We must instead find a pragmatic intermediate level of scientific explanation which carries the hallmark of science, allowing its practical use. This is essential to the very development of science itself, as, if such intermediate levels are not admitted we would not have a reason for the existence of science itself. This sort of an intermediate position that can claim practical adequacy, while at the same time signaling a definite propositional agenda for enquiry is I argue what can be claimed in terms of the ontological basis of the systems sciences. This agenda for enquiry will also include among other things a clarification of the definitional and descriptive dimensions of systems, for identification is a necessary step for explanation.

If systems science looks into relations and their combinations for an explanation, then what can be the epistemological basis of it? Referring again to Bunge's epistemological hierarchy (section 3.1.3), theories in the substantive disciplines are lower in hierarchy to the systems sciences (in terms of abstraction), indicating that an empirical testing or an explanation of empirically noted phenomena in terms of systems sciences must inevitably combine the knowledge, insight of the systems sciences with that of the substantive disciplines. Together they can lead to a research agenda that clarifies both substantive and systems concerns, provided that they are formulated in a way that takes into account questions raised within the systems sciences. As Sayer (1992, pg 48 - 52) notes, science is practical as well as cognitive and we can have no perception of things without concepts that help identify them. Learning a new theory thus helps us to not only conceptualise things in another way, but also to see different things (pg 54). As mentioned in Chapter-1, the history of science is rich in stories of disregard of anomalies in favour of familiar theoretical positions (Kuhn, 1996). Thus the use of systems science in any discipline must take into account both the nature of the discipline and also the conceptual paradigms that we are working with within the particular discipline. The epistemological question can then only be ultimately answered, if given this context, for they (the nature of the

discipline and the conceptual paradigms) define the limits of a vast possibility of methodological enquiry.

However since systems science claims a higher level in the epistemological hierarchy of science and allows transfer of concepts between disciplines, there must be a level of methodology specific to it. We have seen in section 3.1.3, that methodologically we can construct an argument deductively from metaphysical discussion or inductively by identifying iso-morphisms between disciplines. The deductive argument essentially is a philosophical argument relying on philosophical discourse, that establishes ontology and is subject to verification in the domain of substantive theories. An ontological argument by claiming knowledge of reality that exists independently must necessarily be verifiable across domains (for what is real and enduring cannot be expected to change depending on the subject studied) or provide an explanation for why it is not so verifiable. An argument that explains the inaccessibility of this reality in a subject domain must then relate to either the nature of the discipline or the phenomena under investigation or both. This also then constitutes the basis for the validity of an approach that relies on identification of iso-morphisms as a methodology. For if there is a reality that reveals itself in the practice of one particular discipline, then it must be present in the domains of other disciplines as well. Or to put it the other way around, if there are iso-morphisms found between disciplines, then it must denote the existence of a 'reality' that is independent of the domain of enquiry. This also then allows for the possibility of initiating substantive research agendas using the methodology of metaphors or analogues. Thus Sayer (1992, pg 62 -66) points out that shifts and leakages of meaning through metaphors and analogies give rise to conceptual innovation are an important part in the conceptual development of science, for we must inevitably at least temporally have an anchor point to call into question or propose a line of enquiry in some other domain. What constitutes a limit on validity of this manner of metaphorical theory construction is an unexamined assumption of the identical nature of the source domain and target domain. More on this aspect of theory transfer and theory construction is said in Chapter-5.

3.2.3 Realism in the Social Sciences

Having examined the argument for realism in the natural/physical science domain, let us now examine the nature of the argument put forward by Roy Bhaskar for realism in the domain of social sciences. Just as the realist argument in the natural

sciences was used as an anchor point to demarcate the ontological domain of the systems sciences, I shall here reflect upon the ontological domain in the realm of social sciences using again the realist argument in social sciences.

Bhaskar in his *Possibility for Naturalism* argues for the possibility of a science that holds true for the natural/physical and social domain. Thus he advocates for

“a qualified anti-positivist naturalism, based on an essentially realist view of science. Such a naturalism holds that it is possible to give an account of science under which the proper and more-or-less specific methods of both the natural and social sciences can fall. But it does not deny that there are significant differences in these methods grounded in real differences in theory, subject matters and in the relationships in which their sciences stand to them” (Bhaskar, 1979, Pg 3).

Realism in social sciences then, while advancing a view of the world as ‘real’, is modified to take into account the nature of the entities it deals with. Unlike the natural/physical domain, it argues for the irreducibility of societies to people as society exists only through the active mediation of the individuals that constitute it. However realism in the social domain also argues for the autonomy of society, which makes possible a scientific investigation. Thus Bhaskar (1998c.pg 206) says “I argue that social forms are a necessary condition for any intentional act. That their *pre-existence* establishes their *autonomy* as possible objects of scientific investigation and that their *causal power* establishes their *reality*” (original italics). The argument for autonomy of society is thus built up from the pre-existence of societal structures and the real existence of social structures are argued for on the basis of causal powers of social structures. Just as the argument for transcendental realism in the natural sciences is built up by contrasting it against empirical realism and transcendental idealism, so also the argument for realism in social science is built up by contrasting it against the argument for methodological individualism and collectivism.

In arguing against methodological individualism, Bhaskar (1998c, pg 208-212) essentially argues against the fallacy of explaining social structures solely in terms of individuals that make up society terming this line of explanation ‘social atomism’ (pg 207). Thus for Bhaskar, “it (sociology) is concerned, at least paradigmatically, with the persistent *relations* (original italics) between individuals (and groups), and with the relations between these relations (and between such relations and nature and the products of such relations)”. Arguing against collectivism

Bhaskar says “For it is as futile to attempt to sustain a concept of the social on the basis of the category of the group, as it is to attempt to sustain a concept of necessity on that of experience” (pg 211). According to Bhaskar, in collectivism, ‘enduring relationships, must be reconstructed from collective phenomena; whereas on the realist and relational view collective phenomena are seen primarily as the expressions of enduring relationships’ (pg 211).

The society/individual relationship on which Bhaskar bases his argument for realism is referred to as a ‘transformational model of social activity’ by him. Essentially it proposes, “People do not create society. For it always pre-exists them and is a necessary condition for their activity. Rather, society must be regarded as an ensemble of structures, practices and conventions which individuals reproduce or transform, but which would not exist unless they did so. Society does not exist independently of human activity (the error of reification). But it is not the product of it (the error of voluntarism)” (Bhaskar, 1998c, pg 216). In this way the realist view sustains a concept of change and history in social life. “Purposefulness, intentionality and sometimes self-consciousness characterize human actions but not transformation in the social structure.People in their conscious activity, for the most part unconsciously reproduce (and occasionally transform) the structures. Yet it is nevertheless the unintended consequence of, as it is also a necessary condition for their activity” (pg 215). There is thus a sort of ‘ontological hiatus’ (pg 217), as well as connection proposed between society and people. The realist view thus does not advocate for a total ontological independence of societal structures, practices and conventions from the individuals that constitute it.

This ontological dependence is summed up by Bhaskar as ‘limitations to a possible naturalism’ and explicitly stated as

“1) Social structures, unlike natural structures, do not exist independently of the activities they govern.

2) Social structures, unlike natural structures, do not exist independently of the agent’s conceptions of what they are doing in their activity.

3) Social structures, unlike natural structures, may be only relatively enduring (so that the tendency they ground may not be universal in the sense of space-time invariant)” (pgs 218/219).

With a ‘transient’ conception of societal structures, what then is real? Bhaskar assigns reality to two levels – First is the level of the individual in society. Thus he

states “If,....intentional action is a necessary condition for certain determinate states of the physical world, then the properties and powers that persons possess in virtue of which intentionality is correctly attributed to them are real” (pg 219). Second is the level of society. Thus he continues “If it can be shown that but for society certain physical actions would not be performed, thenone is justified in asserting that it is real” (pg 219). The base for the claim for reality here is not the same as that in the natural world. It essentially rests on a causal criterion. Thus something is claimed to exist (though transient) because it has causal powers; existing in its effects, though irreducible to the same. Given the transformational view of society, these two levels for a claim to reality are not enough, as they do not explain the transformation. The additional dimension that links the two is provided by a claim to reality of what Bhaskar calls the position-practice system. Thus, positions occupied by individuals and practices in which they engage is claimed to be real. Reality here is thus entirely relational as it must always “include or tacitly presuppose reference to some or other social relation” (pg 221). The reality is however not hinged to individuals but to the position-practice slot occupied by them. Since any particular event may be the outcome of multiple position-practice relations, explanation will be in terms of a multiplicity of causes. This opens up possibilities for continuous and possibly new re-descriptions of phenomena.

What is the ontological and epistemological status of generative mechanisms and natural necessity here? Given the transformational model of social life, which can only operate through time, a generative mechanism if operating can only be seen in historic perspective. This historic model will also have to be relational explaining the production of various types of relations. In the physical sciences, we have seen that the reality of generative mechanisms is claimed on the basis of natural powers of materials/things and is claimed independent of its effects, which then means that generative mechanisms can be interpreted as tendencies rather than laws. In the social sciences however, reality of a generative mechanisms is claimed on causal effects. Thus Bhaskar commenting on Durkheim opines, “..in employing a causal criterion to establish the reality of social facts, Durkheim observed perfectly proper scientific practice..” (pg 220). He then uses the same criterion “Although Durkheim used a causal criterion to establish the reality of social facts, on a collectivist conception of sociology, the same criterion can be employed... to establish their reality on a relational one” (pg 220). Bhaskar reflects that this difference in criterion does not

cause any particular ontological difference, for in the social sciences too, generative mechanisms cannot be said to exist as laws, but must be analysed as tendencies that may or may not be empirically identified or present. Only the form of our knowledge of them varies. Thus in his opinion “because the mode of application of laws is the same in open and closed systems alike, there is no reason to suppose that the mode of application of social laws will be any different from natural ones. And although the necessity to rely exclusively on explanatory criteria *may* affect the subjective confidence with which beliefs are held, if a social scientific theory or hypothesis has been *independently* validated (on explanatory grounds) then one is in principle just as warranted in applying it transfactorially as a natural scientific one” (pgs 225,26) (original italics).

The argument for applying the laws to both natural and social sciences essentially stems from a realist view of the world. Thus for realism “the concept of existence is univocal: ‘being’ means the same in the human as the natural world, even though the modes of being may radically differ. The human sciences, then, take intransitive objects as any other” (Bhaskar, 1998c, pg 227). This view is contrasted against the “characteristic error of positivism to ignore (or play down) interdependency” and the “characteristic error of hermeneutics to dissolve intransitivity” (pg 227). An intransitive view of the world, whether natural or social, is thus argued to be fundamental to the possibility of scientific critique. This is summed up as -

“1) The *conditions* for the phenomena (namely social activities as conceptualised in experience) exist *intransitively* and may therefore exist independently of their appropriate conceptualisation, and as such be subject to an unacknowledged possibility of historic transformation.

2) The *phenomena* themselves may be *false* or in an important sense inadequate (for example superficial or systematically misleading)” (original italics) (pg 231).

The concept of causal interdependency in social science is here subtly distinguished from the concept of existential intransitivity. Thus for Bhaskar, “although the processes of production may be interdependent, once some object O exists, if it exists, however it has been produced, it constitutes a possible object of scientific investigation. And its existence (or not), and properties, are quite independent of the act or process of investigation, of which it is the putative object, even though such an investigation, once initiated, may radically modify it” (pg 227).

If ontologically, it is argued that ‘being’ denotes intransitivity what then is the epistemological significance of scientific activity in the social sciences? The transformational model of society implies that qualitatively new developments would forever be forthcoming in social science. This then implies that “for ontological, as distinct from purely epistemological, reasons, social scientific (unlike natural scientific) theory is *necessarily incomplete*” (pg 228) (original italics). Thus developments in the social sciences are forever continuous, with current events dependent on past events. This then makes knowledge in the social sciences not only historic but also in need of continuous revision. The development of knowledge is thus very much linked to the development of the object itself in the social sciences. These historic explanations will also tend to operate in a single level of the social structure, making knowledge essentially incomplete, describable as tendencies only. Thus, “the law-like statements of the social sciences will thus typically designate historically restricted tendencies operating at a *single level of the social structure only* (added italics). Because they are defined, for only one relatively autonomous component of the social structure, and because they act in systems that are always open, they designate tendencies.... which may never be manifested, but which are nevertheless essential to the understanding (and the changing) of the different forms of social life, just because they are really productive of them” (pg 233).

Faced with a mass of empirical data, Bhaskar reflects that the social sciences can be fraught with the problem of how to proceed with theory construction. He proposes that this is partially achieved by the concept-dependent nature of the science. The first step in theory construction is to get at a real definition of an object/a form of social life, independent of people’s definition or theoretical re-description of it. This real definition then guides the next stage of causal hypotheses, which is followed by empirical testing of the explanatory power of the hypothesis. In social science then, “real definitions will in general precede rather than follow successful causal hypotheses” (p 229). Then the first epistemological problem zeroes down on how to fix real definitions. Since reality is attributed as stated earlier on the basis of causal effects, the mode of discourse is similar to that of philosophical knowledge, i.e. by second-order discourse. Since more than one set of conditions will be consistent with the situation being investigated, supplementary considerations will be necessary to establish the validity of the analysis. Thus the process of theory construction, “both 1) isolates real but non-empirical and not necessarily adequately conceptualised

conditions and 2) consists essentially, as critique, in two modes of conceptual criticism and change” (pg 232). A relation of necessity has to be brought out however. This according to Bhaskar entails, being able to present a critique, being able to provide a better explanation and also being able to account for reasons why false or superficial explanations are being held (pg 232).

To sum up then, Bhaskar’s essential argument for realism in social science is “Society is not a mass of separable events and sequences. But neither is it constituted by the concepts that we attach to our physiological states. Rather it is a complex and causally efficacious whole – a totality, which is being continually transformed in practice. As an object of study it can neither be read straight off a given world nor reconstructed from our subjective experiences. But, although empirical realism cannot think it, in this respect at least it is on par with the objects of study in the natural sciences too” (pg 233).

3.2.4 Realism in Systems Science in Social Science

Realism in social sciences is adapted from the realist thesis in the natural/physical sciences. It takes the possibility of a science common to the natural and social, as the fundamental premise for this. However it modifies the philosophical argument for naturalism in the social sciences to accommodate the differences in the nature of the subject matters of the physical and social domain. This philosophical argument then has ontological, epistemological and methodological implications, which are then argued to be both the possibility and limitation of naturalism in the social sciences. In discussing Bhaskar’s realism in the social science then one has to start from the fundamental premise on which the argument is built – the difference between the physical/social science.

We have seen that Bhaskar argues that social structures in the social sciences are not reducible to the constituent individuals, yet do not exist independent of them. In the natural/physical sciences however he argues that a reduction to lower levels is possible through generative mechanisms. I have argued in the earlier section that this may not be the case. In almost all physical phenomena, the properties present in the macro level are not reducible to the properties of the constituents, nor are they independent of it. Thus the properties that water possesses are not the properties of hydrogen or oxygen and cannot be explained in terms of these elements. Yet water cannot exist independent of its constituent elements. This is the phenomenon of emergence discussed earlier and is a phenomenon common to both the

natural/physical as well as the social domain. Given the recognition of the interdependency as well as independence of the social from the individual, as constitutive of the nature of societies, the scientific activity of sociology is then imagined as “Rather it (sociology) is concerned, at least paradigmatically, with the persistent *relations* (original italics) between individuals (and groups) and with the relations between these relations (and between such relations and nature and the products of such relations)” (Bhaskar, 1998c, pg 209). This argument for relations, rather than a reductionist model of explanation which explains society in terms of individuals, arises essentially from a view of society seen as irreducible. It is an argument advanced against the collectivist conception of society and the individualist conception of society.

Comparing the realist argument in the natural/physical sciences and the realist argument in social sciences, one can now draw a parallel between certain lines of thought. Thus it appears that the reductionist argument for generative mechanisms operating at lower levels in the natural/physical sciences can be in fact be compared to the individualist argument in the social sciences, and the actual manifestation of phenomena, explained as a result of generative mechanisms that may or may not be manifest due to counter-vailing forces in the natural/physical sciences, can be compared to the collectivist argument in the social sciences. I have argued against this view under the last heading, advancing the notion that relations must be also considered as they give rise to irreducible properties. This conclusion, it can be seen, is very similar to the one advocated by Bhaskar for the social sciences. I thus argue not against the nature of societies as laid out by Bhaskar, but against the nature of the natural/physical science as laid out by Bhaskar. There is a lot more similarity between the two domains than is acknowledged in the realist thesis advanced by Bhaskar.

The above point is also argued by Ted Benton (1998, pg 304-311). Benton argues for a similarity of the sciences in two directions. First, he argues that the social sciences are not all that radically different from the natural sciences and secondly, he argues that the natural sciences in turn are also not all that radically different from the social sciences. I briefly sum up the core arguments he presents. First, he points out that structures in the social sciences may very well exist independent of ‘activities they govern’. For instance the concept of a power structure enables a researcher to identify it if it is possessed even though not exercised. Thus the existence of the power structure is independent of it being exercised or not. Second, he argues against

the concept-dependence of social structure for structures can exist in spite of agents not having any concept of what they might be doing. Thus if a concept is scientifically established, it need not be an anomaly that the agents concerned do not share the concept. Third, he argues against the claim for transience in social structures as opposed to natural structures, because of which they are said to be not universal. Though the transience may be true, it does not constitute a claim to the non-universal character of social structures, but must instead be seen as a contingent manifestation in space-time, the transience constituting the change in the conditions that make manifest a particular universal structure. This is the same then for natural systems also. Fourth, is the argument for social systems existing only in open systems making experiment, prediction and decisive tests of theory impossible. This according to Benton is also untrue, not only because assumptions for closure must also be made within the natural sciences, but also because a regularity of results is not necessary for prediction. A prediction can also be made by calculation of the combined effects of a number of mechanisms, though the complexity of a system can make prediction probabilistic. Isolation of mechanisms can also be done theoretically. Also there are within the natural sciences a range of disciplines within which experimental closure is impossible, for instance the historical natural sciences like evolutionary biology and geology. Fifth, is the argument for the partial identity of the subject and the object in the social sciences so that it is difficult to keep the subject distinct from the object of study. Benton argues that what is at stake here actually is a causal interdependence of the subject and the object while the existential independence of the object is really not the issue. But this, as he sees it, is very much what happens in an experiment in the natural sciences as well. Sixth, Benton argues that Bhaskar's ontology of a sharp natural/social divide is also reified by a restricted view of the physical sciences, for sciences like evolutionary biology, cosmology, geology, embryology etc all require qualitative information that is difficult to access as in sociology. Benton thus concludes his critique by suggesting that Bhaskar in arguing for a sharp divide between the natural and social sciences is in effect arguing for an anti-naturalism though not anti-scientific. Thus, "the result of Roy Bhaskar's comparison of social and natural objects seems then, to be a series of concessions to anti-naturalism, such that his position would be better described as a form of anti-naturalism, rather than as a naturalism, however qualified. Nevertheless, he remains committed to the

possibility of a *scientific* (original italics) social science, if not a naturalistic one” (pg 309).

Notwithstanding the above arguments of Benton, it must be admitted that there is a transformation in meaning of the transitive and intransitive domain here between the physical and social sciences. For as defined by Bhaskar, the intransitive domain consists of “knowledge *of* (original italics) things which are not produced by men at all.” Thus “none of these objects of knowledge depend upon human activity”. The transitive domain on the other hand are “raw materials of science – the artificial objects fashioned into items of knowledge by the science of the day. They include the antecedently established facts and theories, paradigms and models, methods and techniques of inquiry available to a particular scientific school or worker” (Bhaskar, 1998a, pg 16). Under this definition then, the possibility of naturalism in the social sciences is ruled out immediately as pointed out by Benton. It can only be advanced then, if there is a modification to the definitions of the transitive and intransitive domains. Benton reflects “This revision does allow for the possibility that social and psychological mechanisms, processes etc, at least under some characterisations of them, might be possible intransitive objects of knowledge. This problem of the partial identity of subject and object of knowledge is, indeed a general difficulty for the maintenance of the transitive/intransitive distinction in the human sciences and Roy Bhaskar later proposes a further distinction to take account of it” (Benton, 1998, pg 302). The distinction proposed is one between existential and causal independence. Thus “social relationships are existentially independent of knowledge of, but causally interdependent with it. For the social and human sciences, their intransitive objects are existentially but not causally independent of the processes by which they are known” (pg 302).

This then according to Benton and contrary to the argument by Bhaskar, does not entail any particular epistemological problem. It does entail methodological problems though, which are specific to the social sciences. He thus concludes:

“I remain committed..... to the view that there are significant differences in the methods of the different sciences, which are grounded in real differences in the subject matters of those sciences and the relationships of those sciences to their subject-matters. Where I differ from Roy Bhaskar and other anti-naturalists is that I think these differences to be almost always of a methodological rather than epistemological kind, and that I do not, whereas Roy Bhaskar does, align

the whole range of methodological diversity along a single fault-plain, dividing the natural and the social” (pg 311).

Having understood the realist argument in social science as a modification to the one proposed by Roy Bhaskar, but which nonetheless concedes to the possibility of realism in the social sciences, we must now see how and in what way systems science claims an ontological position in the social realm. In the earlier discussion with respect to the ontological position of the systems sciences in general, I argued that the systems sciences stresses an ontological reality that is not reducible to generative mechanisms alone, but consist also in the way these generative mechanisms hold together to form systemic and synergetic emergent qualities. I argued that this introduced a stress on relations and their relations in turn, which constitute the claim of systems science to being a holistic science.

In the realist argument in social science, we see that the question of relations is acknowledged in the ontology and epistemology of sociology which is then shown to give rise to methodological difficulties unique to the social sciences. Along with the acknowledgement of relations and interactions comes the acknowledgement of emergence and irreducibility ruling out individualistic and collectivistic explanations. Thus the nature of an argument for a distinct ontological realm for the system sciences is slightly different here. Rather than stress relations between generative mechanisms, in the social sciences, the systems sciences stress the relationship between different analytically substantive streams. Again just like systems sciences acknowledges the presence of generative mechanisms, but calls for something more, in the natural/physical sciences, so also in the social sciences, the systems sciences acknowledges the importance of the analytical traditions but calls for more in terms of a synthetic philosophy. It thus tries to build up a realist picture of the world that is not carved up into different analytical traditions, but draws upon these traditions to access a reality that can be termed as cross-disciplinary. Thus as stated by Laszlo (1972, pg 8) it claims that the world is at least in some respects intelligibly ordered and that this ordering exists not only in special domains but also as a whole. This ordered whole is then what constitutes the intransitive domain, a reality that has an existential independence from the ways in which it might be known. As Whitehead, quoted in Laszlo remarks “The point is that every proposition refers to a universe exhibiting some general systemic metaphysical character... Thus every proposition posing a fact must, in its complete analysis, propose the general character of the universe required

for that fact” (Whitehead, 1929, quoted in Laszlo, 1972, pg 9). Systems science then stresses the synthetic aspect of the world that builds up from analytical aspects visible in various disciplinary streams.

In the social sciences then this points to an abstraction that allows for processes that might operate across disciplines, but which also accounts for the substantive phenomena observed in each discipline. It must be noted here though that it is the analytical traditions found in different disciplines that provide the substance for the abstraction of processes that might exist pan-disciplinarily. There is thus a second order abstraction in operation within the systems science. Firstly from empirical data, there is an abstraction along analytical lines which gives rise to substantive analytical theories. From these there is thereafter a second abstraction that gives rise to systems theories, which must remain verifiable empirically across domains. The particular methods that are employed in this process of verification will then inevitably have to follow the nature of the disciplinary domain within which it is tested. Once systems theories are thus established, they can then serve as sources for deductive laws, applied across disciplines provided there is a reflection on the validity of the continuance of core definitions, their meanings and their nature. Also systems sciences, in achieving an abstraction that may not be immediately apparent within the analytical traditions themselves, can also claim to access a reality that may elude the analytical disciplines *per se*. For unless there is a word or a concept describing something, it is generally very difficult to identify it and study it for, as the history of science has time and again told us, scientific practice is a social activity and is as such very much concept –dependent. This then entails that the systems sciences can at least potentially infuse subject disciplines with fresh ideas by transfactual import which are ontologically consistent with a notion of reality, epistemologically consistent with the nature of the reality and methodologically consistent with the nature of the substantive discipline.

Conclusions

In this chapter I have first defined what a system is, in general terms, emphasising the stress on constituent parts and relations. I have then provided an account of the nature of systems thinking, emphasising qualities of holism and emergence. The position of systems theory in the epistemological hierarchy of theories, as being more abstract and fundamental than disciplinary theories, yet not as fully abstract as metaphysics or mathematics, is also discussed.

I have also argued for the ontological foundations of systems theory from a realist point of view, using Roy Bhaskar's transcendental realism. I have sought to construct my argument by carving out the distinct domain of the systems sciences from the transcendental realist argument in both the natural/physical as well as the social sciences. In doing so I show that the systems science in fact builds on and gives a more fundamental access to 'reality' (in terms of its abstraction) both in the natural/physical as well as social domain. In the natural/physical domain it stresses causality grounded in relations, and in the social domain it stresses the synthetic aspects of analytical traditions. This 'fundamental' picture essentially emanates from a view of the world as structured in its entirety, and not just in its disciplines. The differences in disciplines however are real and give rise to what are essentially methodological problems, rather than ontological or epistemological problem. The practice of systems science within any particular discipline therefore requires careful examination of the re-constituted meaning of concepts, which while retaining its ontology, are nevertheless manifested differently in various disciplines requiring subject – specific methodological tools that allows access.

In discussing the above concepts the chapter contributes towards the realm of generalised discourse argued as necessary for theory development and contextualisation in Chapter-4. It specifically serves to 1) ground the possibility of a transfer of concepts between the natural and social sciences and 2) provide an argument for a serious consideration of the systems sciences that is philosophically grounded as the claim is now for 'real' effects.

CHAPTER-4

SYSTEMS THEORY, COMPLEXITY THEORY, AND SOCIAL SCIENCE

Introduction

Having examined the philosophical foundations of systems theory at a general metaphysical level, this chapter now moves down the epistemological hierarchy to comprehend systems theory in conjunction with discipline specific theories – the discipline here being social science. It seeks to first position systems theory within the social sciences in relation to theoretical concerns within the discipline. This positioning serves to further inform the later linkage of the theory to the more restricted domain of practice and planning. Thus in terms of the overall research strategy required for theory development and contextualisation, (argued for in detail in this chapter), the chapter contributes to the realm of theory contextualisation as far as social science is concerned and generalised discourse as far as planning is concerned¹. Second, this chapter also serves to position complexity theory with respect to both systems theory as well as social science theory. This explicitly carves out the position of complexity theory within social science enabling discussions of theory transfer into the more tightly conceived domain of planning - the subject matter of Chapter-5.

4.1 Systems Science and Social Science

In examining the relevance of a particular theory for a disciplinary domain, one needs not only an understanding of broad concepts associated with the theory (introduced in chapter-2) and fundamental metaphysical grounds for argument (constructed in chapter-3), but also guidance for navigating and linking one's way through the domains of theory within the discipline. This being the task, I survey the literature on the nature of social science theory – its peculiarities, limitations, nature of development and the broad ways in which theoretical development within the social science has taken place - in short the meta-theoretical aspects². From this survey, I discuss the ways in which systems theory gets defined (again in meta-

¹ This is because planning is seen as being within the encompassing discipline of social science

² A more fundamental discussion of the nature of social science which informs the nature of social science theory is included in Appendix 4

theoretical terms) within the social realm in relation to theories within the social realm. From this I arrive at broad indications for possible ways in which theoretical development can take place. I have used this review for arriving at the overall research strategy adopted for this thesis. Finally, I move on to examine the use of systems theory within social science – its potential and limitations and the ways in which this use connects to mainstream social science theory.

4.1.1 Nature of Social Science Theory

Different aspects of the nature of social science theory including ways of engaging with theories, concepts about the purpose of theories, ways in which theories are thought to be susceptible to change, and ways in which theory construction activity actually takes place are discussed in this section.

Ritzer and Smart (2001, pg 3) identify change and fluctuation as being the defining elements of social theory today. The reason according to them is the innate nature of the object of enquiry - it being a 'moving target'. Thus, "unavoidably, , the object of social theory is a changing world, a modern world in perpetual motion, a (post)modern world in which it seems the only certainty is that things will be different tomorrow" (pg 4). They see the proliferation of perspectives in the social sciences, the 'diversity of theoretical standpoints' as being a direct consequence of this uncertainty. This development has not been uniformly welcomed within the social scientific community, though. Many, including those engaged in both empirical research as well as theoretical work, see it as reason for disillusionment with social theory (Mouzelis, 1995, pg 54; Knorr-Cetina, 1981, pg 41, Luhmann, 1995, pg 1). However most social scientists see it as a way to avoid the dogmatism associated with a single framework of thought, the general viewpoint being that "the study of human behaviour is necessarily a contested affair; only within a totalitarian society would an unquestioned single framework for the analysis of human social conduct exist" (Giddens and Turner, 1987, pg 3).

The fact of theoretical diversity and change having been acknowledged, the question then arises as to how does theoretical activity in social science then change or progress? Seven processes are identified by Ritzer and Smart. These are 1) innovation – when new theories and synthesis are continuously coming to the forefront, 2) retrieval – when older theories or certain aspects of it are rediscovered or retrieved, 3) translation – when works that have not been translated before are translated giving rise to new modes of interpretation, 4) re-interpretation – when

dominant works of classical authors are re-read and re-interpreted in contemporary terms, 5) changing intellectual priorities – due to fluctuations in the ‘prominence and profile’ of perspectives, 6) changing social conditions – due to changes in the social world, and 7) developments in cognate fields of enquiry. Of these, process 2) retrieval, can be claimed of complexity theory in general and especially so in the theory of autopoiesis and 3) translation can be claimed more specifically of autopoiesis, as I shall show later in my arguments in this chapter and also chapter- 7 & 8 on autopoiesis.

Giddens (1990, pg 16) remarks that sociology does not “develop cumulative knowledge in the same way as the natural sciences”. Alexander and Colomy (1998, pg 25-49) advance what they term as a post positivist notion of knowledge accumulation in the social science. They first put forward four basic assumptions. The first among this concerns the constitution of social knowledge. Alexander and Colomy hold that “sociological work is profitably analysed as falling along a scientific continuum ranging from abstract, general and metaphysical elements on the one end to concrete, empirical and factual elements on the other end. Other elements of scientific discourse, including ideologies, models, concepts, laws, propositions, methodological assumptions and observational statements, fall between these end points” (pg 32). This resonates with Bunge’s epistemological hierarchy presented earlier. Second, in spite of its observer dependent status, sociological work cannot be formulated in an infinite number of ways. This is because though social scientists might accept a particular position without hard and concrete evidence along the nature of the natural sciences, they do not do so without “argument and vigorous efforts at intellectual persuasion” (pg 32). Also they are rational in the sense that they refer to “generalised criteria that themselves must ultimately be justified through open and uncoerced debate” (pg 32). Third, whatever the discursive level, sociological theory actually provides limited options. Thus if one were to take an example of models of society, “the axes of dispute have concerned the relative randomness or coherence of systems, on the one hand, and the relative dynamic versus equilibrating tendencies of systems, on the other” (pgs 32-33). Fourth, although in principle there may not be an intrinsic scientific relationship for different elements in a discipline to hang together, in practice they do. “Thus there are no empirical or logically compelling theoretical reasons for an interpretive methodology to be combined with the commitment to a non rational or normative understanding of action” (pg 33), though they do so in

practice. This 'hanging together' is explained by the concept of 'powerfully stated research traditions', which "stipulate the relationships between theoretical elements in a sharply defined way" (pg 33).

The research traditions form a fundamental organising element in Alexander and Colomy's post positivist theory of knowledge accumulation. These traditions function rather like the paradigms of Kuhn in that they condition the patterns and directions of discourses conducted within the tradition. Thus "social science practice cannot be understood simply as the confrontation between scientist and social reality. Social reality is never confronted in itself. Because perception is mediated by the discursive commitments of traditions, social scientific formulations are channelled within relatively standardized paradigmatic forms" (pg 34). Research traditions, it is argued, are followed mostly because they are inherited from the past. It is not imperative though, that social scientists draw from only one tradition or that a body of work be wholly situated in a single tradition.

Wagner and Berger (1985) make a similar argument at a meta-theoretical level for what they call 'orienting strategies'. These orienting strategies according to them may take one of several forms. These can thus include "the development of ontological and epistemological arguments (often metaphorically stated) concerning the subject matter of sociology, the nature of social reality, and the values and goals of sociological inquiry. It may also involve the articulation of the conceptual foundation employed in the description and analysis of social phenomena. It is also likely to incorporate the formulation of directives for the selection of theoretical problems for investigation and for the construction and evaluation of proposed problem solutions" (pg 700). According to Wagner and Berger, generally orienting strategies are stable and not much of growth is seen at this level, mainly because they are claims about what is valued and are not about 'facts'(pg 701). As such they are untestable which is to be seen not as a shortcoming, but as an indication of their strategic nature. Thus orienting strategies must rely on a priori claims for acceptance or rejection (pg 702). Though orienting strategies may become dormant over time, they are never really displaced totally. Replacements when proposed are also generally strongly resisted (pg 701).

Given this model of development of social science research through traditions/orienting strategies, what interests us next is – given the nature of the main research question of this thesis, how actual growth/change takes place within the

tradition/orienting strategies. An understanding of this also serves to theoretically legitimise the research strategy adopted in this thesis. Research traditions according to Alexander (1998, pg 34) are generally established by classical founders. They get established by definitions of theoretical ‘cores’, which are by themselves resistant to change. The cores are however surrounded by ‘peripheral areas’ that are subject to continuous variation. Changes in these peripheral areas take place along three lines – elaboration, proliferation and revision. Theory elaboration and proliferation assume the consistency and validity of the original theory and therefore proceed by increasing the “scope, rigor, precision or empirical adequacy” (Wagner and Berger, 1985, pg 707) of the theory in the case of theory elaboration; or the “range of applications of ideas about social phenomena” (Wagner and Berger, 1985, pg 708), in the case of theory proliferation. In theory revision, there is ‘a greater sense of the vulnerabilities of the established tradition’ and therefore “an often implicit effort is made to address these strains and to offer formulations that can resolve them” (pg 34). When this effort to address the vulnerability of the core leaves the peripheral realm of activity and gets to the core itself, a reconstruction takes place. Alexander and Colomy (1998, pg 35) assert

“reconstruction differs from elaboration, proliferation, and revision in that differences with the founder of the tradition are clearly acknowledged and openings to other traditions are explicitly made. Reconstruction can revive a theoretical tradition, even while it creates the opportunity for the kind of development out of which new traditions are born”.

A more far-reaching form of scientific change is that of tradition-creation, when new schools are formed. “The essence of tradition-creation is the synthesis of elements drawn from several existing and often competing intellectual paradigms, with the aim of generating the theoretical core of a new school” (Alexander and Colomy, 1998, pg 35). Finally traditions can also be destroyed – tradition-deconstruction. This happens not due to falsification but when core commitments of the tradition are de-legitimised before the scientific community. Even then latency is more likely than a complete disappearance. Alexander and Colomy (1998, pg 36), further opine that shifts in the trajectory of a discipline’s ‘scientific sensibility’ are usually due to social and global developments, which put different questions on the floor.

The growth of social science, both within or without traditions is through a process of competition according to Alexander and Colomy (1998, pgs 36-42,

Wagner and Berger, 1985, pgs 708,709). At the level of *generalised discourse*, disputes are centred around “a tradition’s residual categories, its analytic and empirical breadth, its theoretical acumen in interpreting the classics, its avowed or implied ideological stance, its resonance with the epoch’s reigning issues and social movements, its logical coherence (or lack thereof) as expressed through its conceptual schemes, and its utility for empirical investigation. At the level of research programs, competition is organized around rival attempts to *explain empirical structures* and processes regarded as significant by the discipline. In either case, a tradition advances when it issues statements deemed superior relative to comparable work produced by other schools” (pg 37). The competition view is however contested. Herbert Simon (1977, pg xvi, xvii), for instance opines, “competition among theories occurs only occasionally. Much more often, scientists are faced with a set of phenomena and no theory that explains them in even a minimally acceptable way. In this more typical situation, the scientific task is not to verify or falsify theories or to choose between alternative theories, but to discover candidate theories that might help explain the facts”.

On the question of theory and empirical testing, Alexander and Colomy suggest that even when positivism as a philosophical basis for the social sciences is challenged by contrasting versions influenced by ‘literary and humanistic enterprises’, there remains a ‘broad positivist persuasion’ within the social sciences. As part of the discussion of this positivist persuasion, they reflect upon the relevance of empirical observations and non-empirical statements for knowledge accumulation in the social sciences. Thus they posit that in the positivist persuasion, “questions of a general theoretical nature,...., can be adequately addressed only in relation to empirical observation” (pg 27). Following from this they suggest “with regard to the formulation of social theories, the positivist position argues that the process should be one of induction and generalization from observation, or specification through hypothetico-deduction. Critical empirical tests and falsification are enshrined as the final arbiter in theoretical disputes. it is held that there is no logical basis for generalized, ongoing and structured types of scientific disagreement” (pg 28). Thus the positivist persuasion as argued by Alexander and Colomy links scientific progress indisputably and solely with empirical verification at the expense of what is termed ‘generalized discourse’. Given the nature of social science, this view is contested by the anti-positivists who according to Alexander and Colomy argue that the link

between scientific theories and external observation is much more problematic than the positivist persuasion envisioned. Anti-positivists maintain that theories necessarily involve conjecture and highly contestable interpretations. Herbert Simon (1977, pg 6) also highlights the tentative nature of scientific propositions in relation to observed phenomena. He remarks “the working scientist, even in his most optimistic moods, does not normally regard a scientific theory as embodying final and exact truth about a body of phenomena. Theories, even good theories, contain simplified and approximate descriptions of the phenomena they purport to explain”.

Wagner and Berger (1985, pg 698) point out that all theoretical activities are not the same. They differ with respect to characteristics and intent. Also, theoretical growth as stated earlier is not all empirical. It does not primarily involve a relation between a theory and an increasingly supportive body of observations. Thus, relation between theories - what they term as '*theoretical context*' - is equally relevant. Types of theoretical contexts also vary. Theories, in a theoretical context, can relate to one another in widely different ways making it important that the theoretical context be appropriately conceptualised and distinguished. These remarks, as Alexander and Colomy maintain, “have underscored the independent contributions that non-empirical and generalized elements make to the most respected scientific work” (pg 29).

We have now a reconnaissance of the social science theoretical field, which shows it as diverse and fractured. Theory change is largely associated with theoretical traditions, but can occur in many ways in association with it. Theoretical development does not only entail empirical testing but also involves theoretical development through generalised discourse engaging with the logical and metaphysical foundations of the theory as well as through theory contextualisation, linking a theory to its theoretical context. This position has informed the adoption of the overall research strategy for this thesis. Elements/chapters in it thus contribute as stated earlier to realms of generalised discourse, theory contextualisation and empirical validation, with no claims to exhaustiveness in any of these domains of research activity.

Approaching theory construction within the social sciences, however, entails more than an understanding of how knowledge growth occurs. Diverse grounds for claiming scientific status for social knowledge are actually also based upon conceptions of what count as goals for social science research. Zhao (2001, pgs 390-91) broadly classifies the goals of social science research into three – the nomological,

the interpretive and the normative. For nomological theorists the goal of social sciences and thus social theory is to discover law-like statements that pertain to the social realm. Thus for Zetterberg (1965, pgs 8,9, quoted in Zhao, 2001, pg 390), “the assumption here is that sociology will eventually discover a small number of propositions that are valid in several diverse contexts...This approach represents what we see as the main task of the sociological theorist – that is the discovery of general propositions”. Well within this goal is the mechanism-based approach in sociology, which aims to identify causal social mechanisms that will generate and explain observations and are thereby predictive in the sense that under like circumstances like outcomes can be expected. The interpretive approach opposing the nomological approach argues that the goal of social sciences is not to uncover any form of laws but is concerned with the interpretation of meaning and the understanding of ‘lifeworlds’ of actors. Thus Taylor (1985, pg 91, quoted in Zhao, 2001, pg 390) argues, “social theory is.....concerned with finding a more satisfactory fundamental description of what is happening. The basic question of all social theory is in a sense: what is really going on”? Sociological theories here are then narrative tales. Normative approach sees social theory more as linked to practice and hence asks questions of what ought to be. Theories in this vein seek to articulate and advocate for specific positions that can guide social action. Thus according to Steven Seidman (1991, pg 132, quoted in Zhao, 2001, pg 391), “social theory relates moral tales that have practical significance; they embody the will to shape history”. I come back again to these three view points later in this chapter, while discussing the ambit of complexity theory within the social sciences.

Are these three viewpoints on social science research compatible with a realist metaphysics? A survey of the literature on realism shows that it is. The nomological and normative viewpoints are articulated in works of both Bhaskar (1998d) and Sayer (1992) with the mechanism based approach stressed on nomological lines and the emancipatory potential of realism stressed on normative lines. The interpretive viewpoint can be seen more in views expressed by Harre (Harre and Bhaskar, 2001), where the constructed narrative presented is imagined as having a real referent. What is common to all these different viewpoints within sociology then, if one were to follow a realist metaphysics, is the acknowledgement of the existence of a reality whether or not one researches it. Quoting from Sayer (1992, pg 49), “although social phenomena cannot exist independently of actors or subjects, they usually do exist

independently of the particular individual who is studying them". It is possible for all of them to acknowledge this proposition as given while varying on other details of what actually constitutes reality and how we may access it, given the difference in perceived goals of social science research. Thus, the nomological viewpoint would give primacy to social mechanisms which it would claim exist independent of the researcher, the interpretive viewpoint would give primacy to the social construction of narratives which it would claim has a referent that exists independent of the researcher, and the normative viewpoint would give primacy to the emancipatory potential that underlies the unveiling of real inequalities or injustice.

How does this formulation of the linkage between metaphysics and substantive theories help us in relation to systems theory? Referring back to the level of abstraction that systems theory deals with, it is worthwhile to recall that it is positioned between the level of metaphysics and substantive theories within the disciplines. I have shown in the last chapter how systems theory can subscribe to a realist ontology at a metaphysical level while at the same time emphasising a distinctive domain for itself. It should then now be possible to verify whether the theoretical orientations within social science can be accommodated within systems science itself. The possibilities for these different orientations can be broadly seen if the brief history of development of systems science recounted in section 3.1.3 is recalled. Here the practice of systems science was shown to have started out as a discipline being largely concerned with the formulation of nomological rules that could aid control and management – the hard systems science movement. Later it was shown how the soft systems science movement came to be defined taking into consideration the constructed nature of reported reality more in tune with the interpretive tradition. Finally it was shown how the practice of systems science came to take into account power dynamics and its effects leading to a normative approach - what has been come to be called the critical systems movement.

I now focus on social science theory and analyse its relation to systemic concepts. In the following section, I recount key systemic principles and discuss them within the realm of social science. By way of illustration for the employment of a classical systemic approach to explanation of society, the structuralist-functionalist theory of Talcott Parsons is analysed in Appendix-6, bringing out the systemic elements in it. The brief overview of criticisms raised against the systems theory,

presented in the discussion to follow, form the point of departure for introducing complexity theory and its features.

4.1.2 Systems Principles and Social Science

Checkland (1981b, pg 31) identifies two pairs of ideas as being of core importance to systems theory – those of emergence and hierarchy, and communication and control. The notion of emergence has been discussed in the previous chapter and its relevance to social systems has been argued. All that is highlighted here in connection with this is the importance of the notion of ‘meaning’ in qualifying emergence. Thus Checkland (1981b, pg 32) points out ‘more than the fact that they (emergent properties) ‘do not exist’ at the lower level, emergent properties are *meaningless* (original italics) in the language appropriate at the lower level’. This statement has implications in two directions. First, that the processes at a lower level can result in an outcome that has meaning only at a higher level. Second, the differentiation of a whole into lower level entities yields meanings that are specific to that level not contained in the higher level. The use of the word ‘meaning’ here is worth some examination. It is more targeted towards an objective quality manifested at a particular level of analysis, rather than at any subjective meaning of individual actors engaged in purposeful activity. The referent here is thus a collective or structural attribute to be found at a specific level. The two senses in which the word ‘meaning’ is used, parallel and aid the twin concepts of autonomous societal structures and purposeful agency that constitute a very live debate in the social sciences (Knorr-Cetina & Cicourel, 1981).

Concerning hierarchy theory, Checkland (1981b, pg 33) explains “hierarchy theory is concerned with the fundamental differences between one level of complexity and another. Its ultimate aim must be to provide both an account of the relationships between different levels and an account of how observed hierarchies come to be found; what generates the levels, what separates them, what links them?” Again this is very much a part of debates centring around micro-macro sociologies (Knorr-Cetina & Cicourel, 1981).

The concerns of communication and control, which fall under the general heading of ‘cybernetics’ deals with goal-directed behaviour, feedback, and a host of other related issues. They (especially the stream of ‘hard systems science’) have been of particular interest to the applied stream of social science, which includes the fields of planning, policy studies and management.

Ackoff (1974, pg 12), discussing key modes of thought in systems science, points to 'doctrines of expansionism and teleology'. By expansionism is meant the "doctrine that maintains that all objects, events and experiences of them are part of larger wholes" (pg 12), not to be seen independently. By advocating irreducibility and the doctrine of 'the whole being larger than the part', the systems science can be thought to maintain that the parts undergo a modification of their individual property - either quantitatively in terms of more or less, or qualitatively, in terms of emphasis on particular traits - by virtue of their being part of systems. This quality of modification is inherent to social sciences. Social relations as shown in Appendix 4 are always modified and are inherently causally dependent on the circumstances (both environment and actors), which modify them giving rise to what are variously termed as social patterns or social structures. The term structure is used in sociology in a number of ways, each of which is specific to particular research traditions. Porpora (1998, pg 339- 355) discusses four such conceptions of structure, predominant in sociology. Of these four conceptions, Porpora makes a case for the third conception, which he argues most suits the realist viewpoint. Structure here is simply systems of relationships among social positions, which may constitute a causal mechanism in itself (pg 343/44). Thus a structure is claimed if there is a law-like causal relationship that binds systemically constituted social positions. In broad terms then the notion of expansionism is linked to the notion of structure in sociology.

Teleology introduces notions of purposefulness or goal-directed behaviour. Thus in addition to cause-effect relationships grounded on the operation of mechanisms that emanate from the inherent nature of objects, we have through systems science explanations grounded on time-space relationships, and explanations grounded also on what could be the result of an operation or the intention of an operation. Teleological explanations are strongly contested within the literature. A review and discussion on this debate can be found in Appendix-5. In sociology this mode of explanation is linked to functionalism, which has been very influential. Kast & Rosenzweig (1981, pg 45), claim that the growth of functionalism in social sciences has close links to general systems theory. According to them, "functionalism attempts to look at social systems in terms of structures, processes and functions and attempts to understand the relationship between these components". Its emphasis is on "systems of relationships and the integration of parts and subsystems into a functional

whole” where “each element of a culture or social institution has a function in the broader system”.

The influence of the functionalist school has been quite wide ranging within the social sciences. Thus in anthropology through the work of A.R.Radcliffe Brown and Bronislaw Malinowski, it pioneered the view that social customs, behavioural patterns and institutions do not have an independent existence and must therefore be considered in relation to the totality of culture (Kast & Rosenzweig, 1981, pg 45). In psychology it led to the rise of gestalt psychology, field theory and now social psychology. Thus, purely psychological explanations of personality were thought to be inadequate and socio-cultural factors also came to be stressed (pg 46). In the words of Radcliff-Browne, “the concept of function.....involves the notion of a *structure* consisting of a *set of relations* amongst *unit entities*, the *continuity* of the structure being maintained by a *life-process* made up of the *activities* of the constituent units. If, with these concepts in mind, we set out on a systematic investigation of the nature of human society and of social life, we find presented to us three sets of problems. First, the problems of social morphology – what kinds of social structures are there, what are their similarities and differences, how are they to be classified? Second, the problems of social physiology – how do social structures function? Third, the problems of development – how do new types of social structure come into existence?” (original italics) (Radcliffe-Brown, 1952, pg 180 quoted in Harvey, 1969, pg 440).

A full discussion of the structural-functionalist school advanced by Talcot Parsons is included in Appendix-6. It serves as an example illustrating how systems theory has been used within social science. The analysis provided therein highlights the systemic components and discerns how holistic non-reductive approaches are attempted when dealing with complex entities in social settings.

I have in this section discussed the nature of social science theory - the process of change in social science theory and the way in which theoretical advances occur. This understanding has informed the formulation of the overall research strategy of the thesis. Different conceptions about the purpose of social science theory are also discussed. Finally the main defining features of systems theory in social science are highlighted with particular relevance to concepts of structure and function. These defining features can be said to constitute the theoretical core of the systems tradition within social science. An illustration and discussion of how structural functionalism

plays out in social science theory is provided in Appendix-6. Here the main systemic elements of the theory are brought out and the main criticism against it is recounted. In the next section I discuss the place of complexity theory with respect to systems science within social science.

4.2 Complexity Theory and Social Science

This section examines complexity theory and what it brings to social science. Key concepts within complexity science having been presented in Chapter-1, I now discuss the significance of these concepts for the social sciences. In this section I discuss the modifications complexity theory brings to systems theory in ontological terms. These modifications carry with them epistemological implications. These implications are discussed by linking specific concepts from within complexity theory to questions of knowledge production in the social sciences. The argument relies on a generalised discussion at the meta-theoretical level that builds on features of complexity theory presented in Chapter-2, the arguments presented in Chapter-3 and the purposes of social science theory presented earlier. Also herein I discuss the influence of complexity theory in social science, illustrated by an example, by examining the work of Niklas Luhmann identified with this stream. The discussion and analysis (as an example only) of the use of complexity theory within social science is included in Appendix-7. Overall the intention is to lay in terms of theory contextualisation and generalised discourse, the grounds for examining the relevance of complexity theory for a more restricted realm of planning seen as constituted within the social sphere.

4.2.1 Ontological Modifications to the Systems Theory

Complexity theory has had, and is continuing to have, a significant influence in contemporary theorising in both the social sciences and humanities. Its impacts and influences have been characterised as neo-evolutionism (Knorr-Cetina, 1981, pg 19), second order cybernetics (Rasch and Wolfe, 2000, pg 12), neo-functionalism (Alexander, 1998, pg 6) and so on. Each of these terms emphasises particular aspects of complexity theory and particular ways in which it has been and is being used in social science. I adopt the more generic nomenclature of 'neo-systems' movement, used by Knorr-Cetina (1981, pg 28) in referring to this group of theories. The adoption of the term also signals a conceptual pre-disposition in examining the theory- a predisposition based on ontological grounds. Before venturing into an explanation of the ontological grounds for the claim to the nomenclature, it must be

said here that, though substantial ‘scientific’ work is going on, both in efforts to advance the body of theoretical work itself, and also to make use of the theory in its present form in distinctive though diverse subject domains, it has had its questionable uses, arguably all too often. One of the reasons for this, in my view, is the absence of an ontological foundation. This absence eventually becomes a presence, when the claim is advanced that the theory may not have an ontological reality at all (Le Moigne, 1985, pg 37). In this section then, I address this gap in the literature.

I shall first state my reasons for adoption of the term, ‘neo-systems’ from a social science meta-theoretical position. This is, as mentioned earlier, also indicative of the ontological argument that I put forward. The terrain of theoretical social science is today replete with theoretical reconstructions – neo-Marxism, neo-Kantianism, neo-Institutionalism and so on - and also theoretical departures in a seemingly radical vein – post structuralism, post modernism and so on. In the ‘neo’ stream generally a theoretical *reconstruction* is involved, which emphasises both an element of continuity as well of critique (Alexander, 1998, pg 54). The *core of a theoretical tradition* is targeted, which then inevitably leads to much of this type of theoretical progress being in the lines of *generalised discourse*. In the ‘post’ stream on the other hand, there is much greater impatience with the older stream (Holton, 2001, pg 161) and generally a decisive cut from the earlier drift of theoretical progress is articulated. This is then more in the nature of a tradition creation, possibly drawing from elements across a number of schools (Alexander and Colomy, 1998, pg 35). I suggest in this chapter, that the influences from complexity theory have been more in terms of a theoretical reconstruction of the systems science movement, where some aspects of the core of the systems movement have been targeted and radically changed, yet the newer forms of theoretical advancements build on much that has existed before, never really fully departing from the more general lines of the tradition of systems thinking itself. Thus complexity science shares with systems science the general ontological foundations but adds more to it. I now show how this modification to the ontological foundations comes about.

I have argued in Chapter-2 that systems theory ontologically gives primacy to time-space inter relations that come together to form a synergetic whole, which is larger than the sum of the constituent parts. The discourse here, is one of relationship of the parts among themselves and to the whole. In terms of dynamic change, the system is analysed primarily in terms of an entity striving to retain its identity as a

whole in the presence of external forces and the stress is then inevitably on system maintenance. There is implicit in this ontology then an unspoken claim to stasis as a continued definition of the system is implied even though the parts may be reacting and changing. This identity is then imagined to persist only when changes to the whole of the system fall under a certain range – the concept of homeostasis. Being grounded largely in a social science theoretical model largely derived from natural science (Giddens and Turner, 1987, pg 2) especially physics, which asks for causes and unambiguous origins (Leydesdoff, 2000, pg 278), social science was also imagined as needing a transcendental basis for understanding specificity. The implication of this ontology has been immense in the practice of systems science, especially through the cybernetic movement grounded largely as it were in the positivist tradition of laws of cause and effect and thereby control towards maintenance of homeostasis.

With the development of evolutionary theories in biology, came the concept of evolutionary systems. In its earlier versions that carried the positivist legacy, to some extent, a pathway of steady change is conceived leading to functional competence of the system with respect to its goals. Even when the system as a whole was placed on this evolutionary trajectory that allowed for evolutionary irreversible change, the system components continued to be locked into the maintenance of an equilibrium, albeit a moving one. In explanations of society it has been influential as can be seen in Parson's structural-functional theory of social dynamics, where the tendency of the social system is always 'towards a symmetrical balancing of the four functional exigencies faced by any society, if it is to evolve and be sustainable' (Holton, 2001, Pg 159). The concept of homeostatic equilibrium and the concept of balanced evolutionary development, both came under scathing criticism as normative theorists pointed out pathological imbalances (eg: instances of power imbalances (Holton, 2001, pg 157-159)) and instances of seemingly evolutionary reversals indicated by processes of de-differentiation rather than continued evolutionary differentiation (tendencies towards unification in gender differentiation of labour within the family, Holton, 2001, pg 160). The evolutionary movement however replaced the paradigm of linear cause and effect by one of multiple trajectories grounded in the possibilities of emerging order though focused on the overall goal of system maintenance

What does complexity theory bring to this 'ontological bias' of systems theory? In order to discuss this, we must first acknowledge that complexity theory

does not invalidate any of the earlier ontological claims of systems theory. What it does is to reveal an entirely different range of systems that behave quite differently, but are nevertheless most commonly found. This revelation then leads to a new understanding of systems and the processes that constitute as well as define them. To explain further, classical systems theory looks more into systems constituted by linear processes, that is systems whose components are uniquely defined and whose individual properties are known to be expressible in determined ways, which also as a whole yield results, that though greater than the sum of the parts, are nevertheless determinate. These systems are studied under stable conditions that reveal the structure of the system, and also under dynamic conditions that reveal the determinism of the system. Complexity theory, as we have seen earlier, deals with the study of entities that reveal non-linear dynamics; that is entities that though having determinate properties, yield indeterminate results. It must be pointed out here, however, that there are many classifications of types of complexity (Weaver, 1968; Jensen, 2004, pgs 125, 126; Gregersen, 2004, pgs 136-141). Systems with indeterminate results are actually a particular type of complex system - causally complex systems. Other types of complexities that appear in the literature are computational complexities, which deal more with computational problems and descriptive complexities, which deal with the number of types of descriptions necessary for a system (Gregersen, 2004, pgs 136-141).

The focus here, in constructing the ontological argument, is on causally complex systems, because this is the base from which an ontological argument can be most clearly constructed. We have seen earlier that what gives rise to system indeterminism in complex systems, is the direction of information flow that the system is repeatedly subjected to - the iteration or feedback loop wherein the outputs of the system are repeatedly fed into itself. The system is here then ontologically tied to something other than its structure. Over and above the ontology of classical systems theory, there is here an additional layer of complexity added. As Jantsch (1980, pg 6), comments "The notion of system itself is no longer tied to a specific spatial or spatio-temporal structure nor to a changing configuration of particular components, nor to sets of internal or external relations". What is new here very simply, then, is that there is now created an ontology of not only structure but also process – not only 'being' but 'becoming' in the words of Prigogine and Stengers (1984). According to Jantsch (1980, pg 6), this was in a way preceded philosophically

in the writings of Alfred North Whitehead (1969) and the statesman Jan Smuts (1926).

Complex systems thus occupy a new level of 'ontological depth'. They constitute a realm of systems that undergo a process of feedback closure, be it informational or operational. They are thus not just evolutionary, but are self-organising. Ways of integration of the linear evolutionary trajectory with the circular feedback loop is still not very clear, as debates (Hayles, 2000, pgs 153-157) on the topic show. The science of complexity then deals with different facets of the properties that these types of systems exhibit. Obviously this very broad definition characterises most systems seen around us including, material, biological, human, social and also heterogeneous systems. If this ontology is accepted however, the question of system definition presents itself, for I have argued above that the classical systems theory implied a concept of stasis, which was connected to its identity, stemming essentially from its ontological bias. When systems acquire more ontological depth to yield indeterminate results, how can then the system acquire identity? Questions of identity with respect to systems were first answered by Bertalanffy, when he made the distinction between system and environment. The system here then acquired identity by distinguishing itself from its environment. The significance of this step is that now a system could be defined as long as the entity it constitutes can be said to be distinct from its environment. There is no dependence on any particular structure within the system. This inevitably provides a great deal of 'freedom' to the system, enabling it to maintain its identity in the face of changes that may be structural. With complexity science comes the advent of feedback or self-reference, which produced what has been termed as second order cybernetics – processes whereby structures change or the change of change is discussed. This innate dependence on the ontology of systems theory, while taking off from it quite radically, is what justifies the name of neo-systems movement for the complexity science. The acknowledgement and incorporation of change at a fundamental level has mistakenly given rise to a coupling of complexity theory to postmodernism and given it the nomenclature of 'post modern science' (Turner, 1997, pg xi). In concurrence with others who do not see a correspondence between postmodernism and complexity theory (Price, 1997 pgs 3-14; Lee, 1997, pgs 15-29), I shall later argue that this view is misplaced. For the moment, however, I move on to discuss the epistemological implications of complexity theory.

4.2.2 Complexity Science and Knowledge Production

Having discussed the ontological depth added by complexity theory to systems theory, I now move downward from the ontological realm to a discussion of the implications of some more tangible discoveries within complexity science for social science. Complexity and its implications for knowledge production, particularly with respect to mathematical models, have been discussed to some extent by Warren Weaver in a very influential paper published in the *American Scientist* in 1968. According to Weaver, there are three ranges of complexity - organized simplicity, disorganized complexity and organized complexity. Organized simplicity consists of systems that have few variables, and the variables are dependent on each other in highly deterministic ways, which then allow isolation and experimentation and also the use of deterministic mathematical models. Disorganized complexity is the complete antithesis of organized simplicity. It is characterised by large numbers of variables and a high degree of randomness. The high degree of randomness however allows the use of mathematical approaches based on probability and statistical methods. These two types of systems together can however cover only a small proportion of phenomena encountered in nature. The vast majority of systems fall under the class of organized complexity. These consist of a large number of variables, which cannot be neglected. The variables are not random either, so that statistical methods become unsuitable. Therefore *simplification strategies* are needed here for dealing with these systems.

Complexity theory, as we have seen, focuses on a commonly found, yet rather under-investigated, realm of systems. Focus on this realm has unearthed fundamental characteristics that these systems possess - characteristics that have posed challenges to many concepts that research, generally assumes unquestioningly. The relative importance of these challenges may vary across disciplines depending on their nature, the kind of entities studied and the general assumptions that the discipline has been used to working with. The findings of complexity theory have been quite revolutionary in the natural science, resulting in exalted heralding of a total paradigm shift. This may be true in the case of natural science, but I would argue against it being as true in the biological sciences and even less so in the social sciences. This is because the social science has always had to deal with complex entities, reacting non-linearly through reflexive feedback loops, revealing the unsuitability of the methods of the natural sciences, especially the material/physical sciences, quite early. It is

acknowledged that the social sciences in their initial phase- the modernist period, following the Enlightenment in western history - were modelled along the lines of the natural sciences (Giddens and Turner, 1987, pg2; Wilson, 1987, pg 383-402, Rundell, 2001, pg13-17), but the reaction against this did not wait for the advent of the complexity theory. There is therefore considerable conceptual thought and debate already in the social sciences on issues that are totally new (in terms of scientific attention) to the natural scientists. For example the question of emergence, agency-structure debates and micro-macro linkages in systems are old concerns. Is there anything new then in the complexity theory for the social sciences? I argue the affirmative. This is because the social sciences having identified very many problems and issues in research due to the nature of the entities it studies, have also been methodologically restricted by the very same nature of the entities. In the absence of test conditions and experimental control, the unearthing of fundamental processes – ontological claims - are difficult to unearth and reveal conclusively. As we have seen in the realist argument, mechanisms can always be modified or blocked by counter-vailing forces, and given the myriad number of forces operating in the social world, it is difficult for a mechanism to be visible in undiluted pure form, making results always susceptible to a relativist counter-argument. Thus though it can be argued that there is a real referent for social science discourse, the nature of the referent is forever inconclusive, leading to the very rife debate on the nature of all statements in the social science as constructed narrative, even though they may happen to have a referent that is real (Harre and Bhaskar, 2001). Besides Parsons, little attempt at ‘all encompassing grand theories’ have been made within social science. We have seen how this has eventually given rise to the fragmented nature of social science theory. This is further compounded by the necessarily limited range that research can practically cover, making knowledge claims ultimately susceptible to the charge of limited validity or situated reality. The natural sciences on the other hand, being comparatively less restricted (though by no means insulated) by these inhibitions, have been able to advance ontological claims and identify the possible presence of mechanisms or phenomena more effectively. The mutual interest and dialogue that has come into being, especially at the philosophical level, has thus proved to be fruitful for both sides. This conception of the value of complexity theory for the social sciences later informs the scoping of the thesis in terms of a methodology for theory transfer discussed in Chpater-5.

We have seen earlier that social science theory is differently perceived to address three goals – the nomological, the interpretive and the normative. I shall organise the discussion that follows under these three headings. This approach can be contested in the sense that the systems theory can be argued to entail a holistic approach as a fundamental principle. Thus admittance of different traditions in justifying systems theory can itself be pointed out as paradoxical. However I adopt this metatheoretical approach because it is possible, as I shall demonstrate, to use the insights from complexity theory in ways that are diverse enough to suit different orientations in social science. This is primarily due to its higher level of abstraction by way of it being within the systems tradition, which permits varied combinations at lower levels of theory. Secondly, adopting this metatheoretical approach will also enable the forging of the link with social science in broad terms, which is the level sought to be established for the scope of this thesis, the implications and relevance in more specific terms being discussed within the more narrowed down realm of planning, the subject matter of Chapters 5, 6, 7 and 8.

4.2.3 Complexity Theory – The Nomological Dimension

The aim of social science theory, according to nomological theorists, is to seek to establish general universal laws or mechanisms that explain processes in the social world. What can complexity theory contribute in these terms to sociological theory? The answer using concepts from complexity theory is discussed below.

The nature of entities the social sciences deals with being different from the natural sciences, the most interesting revelations for social science have been at the philosophical or meta-theoretical level. More details of discoveries in the natural sciences having been provided earlier, I highlight only some of the conceptual impacts of these discoveries for the social realm. Prominent among these have been conceptions about certainty/uncertainty, the importance of feedback, concepts about stability and robustness, time, self-organisation, processes embedded in hierarchical structures and so on. I elaborate on some of these concepts below, not exhaustively, but more as an indicator to show that there are nomological research possibilities raised by complexity theory in the social sphere.

The futility of predictions in social science have been quite generally acknowledged within the profession. The stress consequently, even for nomological theorists in the social sciences, has been on explanations that reveal the operations of mechanisms (Zhao, 2001, pg 390). The reasons for this futility of prediction are

grounded on two arguments. First, the possibility of the existence of counter-vailing forces that might obscure the outcome of mechanisms that may be operating; second, the inherent quality of agency of human subjects by which they could change outcomes, making prediction futile. Both these limitations to prediction are thus rooted in factors that are conceivably open to at least partial mitigation in the research process, leading to validation of research processes that are, besides many others, based on the extent of this mitigation achieved. The complexity theory gives us two additional reasons for the futility of prediction. These are first, the very high sensitivity to initial conditions, which makes prediction impossible because the precision of measurement needed is essentially infinite. Thus not the very minute error, but the very minute rounding off of the digits in measurement, could lead to widely divergent outcomes over time, effectively closing off possibilities for long-term prediction in systems characterised by feedback. The second source of unpredictability is the ever present possibility of chance. Chance, when occurring at a sensitive moment in a system posed for bifurcation, will cause it to choose any one of a possible branching of trajectories. At other moments the system might remain largely unaffected by the chance event. As there is by definition no way of knowing chance events both in terms of what they might be and also in terms of when they might occur, the system is inevitably unpredictable. The effects of these revelations on predictability encourages more rigorous thought on the realm of possibilities in the social science. The main question it raises is : what are the conditions, or rather prerequisites, needed for admitting the possibility of any future oriented activity, like say management, policy or planning? I address this question to some extent in Chapter-7 on autopoiesis, the intention here being not to address substantive issues, but rather make a general case highlighting the potential of complexity theory for domains in the social science.

With regard to feedback, complexity science shows that repeated iteration - that is feeding back outputs of a system into the system itself as input - opens up certain possibilities in the system. First, this can create the process of 'positive feedback'. That is, instead of the damping of systems by negative feedback towards an equilibrium, which could be the lowest common denominator. This can reinforce certain traits that lead the system to self-organize into stable patterns. Thus iteration shows up as a potential tool to guide systems towards self-organisation. Second, feedback causes, as shown earlier in mathematical topological terms, numerous

'folds' within the system. Each fold is an iteration. The resulting texture is one of multiple folds giving rise to a 'fractal' structure – that is a structure that is composed of versions of itself, which are in turn composed of still smaller versions of itself. This line of thought, linked with other concepts of system organisations has been carried forward in the work of Niklas Luhmann. The coupling of feedback with self-organisation, then, prompts important questions linked to, for instance, what types of self-organisation are produced by what feedback processes, which then potentially opens up fields of interest for practice and planning. I discuss this aspect to some extent again in Chapter-6 dealing with fractals.

With respect to stability, complex systems show us that the same system can be potentially unstable or stable, depending on how close it is to bifurcation. However as we can never really know in social systems how close we are to a bifurcation point, this is not really telling us much. What is more useful however is the concept of the strange attractor as a stable zone. This indicates that for a set of values there is inevitably a zone or phase space into which the system will enter and stay, even though it may not be apparent or known at a local level. This phase space is defined by system variables. The concept by itself admits the possibility of steering and management in broad terms. Thus it can be thought to indicate that 1) it may not be ever possible to get a complex system to perform to specific pre-specified needs as being a complex system the system is ultimately indeterminate in its final outcome. 2) it is reasonable to expect a system to perform within a broad range of possibilities, the extreme values of which are set by the strange attractor or the parameters of the system. This in turn raises questions about how a self-evolving system sets its parameters or sets its extreme conditions and what are the mechanisms involved in keeping the system phase space within bounds. Some of these issues are addressed in chapter-8 dealing with the empirical dimension of autopoiesis.

Having provided a few examples to make an indicative case for the potential of a nomologically oriented research based in complexity science in the social realm, and more so in planning I shall move now to examine its potential within the interpretive tradition.

4.2.4 Complexity Theory – The Interpretive Dimension

The interpretive tradition within social science, relies on a constructivist perspective, on a micro-sociology, aimed at achieving an understanding of society in terms of thick descriptions that reveal 'what really is going on' (Knorr-Cetina, 1981;

Cicourel, 1981, Collins, 1981). The focus is on the construction of meaning of human action and the 'life world' in which actors live (Zhao, 2001, pg 390). Re-descriptions of known situations that reveal the situated nature of reality 'caused' really by contingency, rather than mechanisms, become an important project in this endeavour. Thus the story line becomes a narrative that reveals contingency and history (Hayles, 2000) rather than an abstraction that reveals mechanisms.

What in complexity theory aids this project or the logic of this project? I argue that complexity theory does largely support the logic of the interpretivist tradition if this tradition is understood as a stress on contingency. It provides us with pictorial 'proofs' (in terms of the bifurcation diagram in Figure-3.1) of progressive branching of historically determined system trajectories caused by chance events. By this progressive branching it also tells us how, though history is instantiated in any

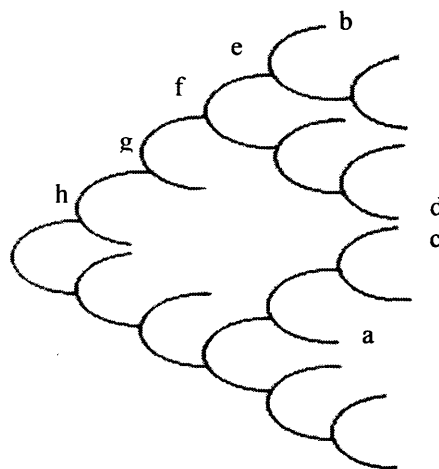


Figure-4.1: Points on the Bifurcation Diagram

contingency (point 'a' incorporates within it all the earlier branchings), the admittance of chance or choice cannot be precluded (all the events that led to each of the branching). It also tells us how chance or choice can bring specific system states, though historically constituted differently, into very near proximity in terms of state attributes - points 'd' and 'c' moving towards each other though having started from and travelled through divergent branches. It thus admits a viewpoint that sees the contingent determined present in terms of a piling up of one contingency on another (Hayles, 2000) - point 'b' being the piling up of contingencies that occurred at 'e', 'f',

'g', 'h' - , rather than the inevitability of mechanisms. This is one side of the coin. By the very same diagram it also shows that any system state is always shaped by its history, whatever be the chance or choices it makes. Thus chance and history become two faces of the same coin that gives rise to the alluring tension of determinism and freedom. This is the perspective that complexity theory brings to the debate of determinism vs agency, a negation of positivism as well as post modernism at one and the same time. Given this insight then, there is abundant room for the interpretivist school to reveal the play of determinacy and contingency through research of social situations.

4.2.5 Complexity Theory – The Normative Dimension

The normative tradition in social sciences has been more concerned with not what is, but what can be or what ought to be (Zhao, 2001, pg 390-91). It is thus essentially concerned with the potential for change. Being so constituted, the normative tradition inherently brings with it a value or ethical dimension alerting us to dynamics of power. The goal is then to bring in change consistent with value dimensions, in spite of constraints of power. We have seen earlier in Chapter-3 that systems theory itself has developed into what is now called the 'critical systems' stream wherein the methods used for research take into account the likely power imbalances that may be present and its consequent influences. Besides allowing for the continuance of this, does complexity theory have anything more to add to research engaged with normative ideals or emancipatory concerns?

The question is best answered by examining possibilities of change admitted by complexity theory. These are of three types. Referring to the bifurcation diagram (Figure-4.1), first, there is the normal incremental change, allowed for in movements along the branched forks of the bifurcation diagram, which is with respect to immediate previous moments, largely historically determined (between points 'e' and 'f' or 'f' and 'g' and 'g' and 'h'). Second, there are critical junctions, where choice is presented (at 'e', 'f', 'g' and 'h'), junctions where small events or chance can nudge the system into a phase state that moves along a totally different trajectory. In both these instances change is within limits set by the system parameters. It does not leave the phase space of the strange attractor that the system proscribes. The acknowledgement of the strange attractor, though, is at once binding as well as liberating. Binding because it shows us that the normal evolution of a complex system is bound by the system parameters (within which there maybe different phase states),

liberating because it shows us that there is always the possibility of changing the system parameters to break out of the strange attractor or more correctly redefine it according to new parameters inscribed on to the system. So is complexity science here, at least in the normative sphere of social theory, then providing us with more of a 'hard science' proof of phenomena we intuitively know of daily life? More of a validation rather than an innovation? If social science theory is perceived to be in competition with common-sense knowledge (Sayer, 1992, pg 8), will it then not seem to lose out here? In order to answer this, I search within conditions of possibilities of change that the theory allows and thereby informs.

Changes within the bifurcation diagram or strange attractor we have seen are largely dependent on internal causes. No external force need be present for a dynamic dissipative complex system to undergo this type of change. Evolutionary change and change revolving around strategically significant decisions can then be normally found in the course of the system's evolution. Drastic change in the sense of a punctuated equilibrium, after which the system reorganises afresh, is also possible but only when the system attains a state of criticality. It can then be produced entirely within the system. For change involving a reconfiguration of the strange attractor though – meaning a change involving a significant change in system parameters that go beyond the normal range admitted by the systems attractor limits - the force will necessarily have to be external : external with reference to the way the system is defined. This is because an internal source is already confined by the system attractor and its evolution, be it in whatever manner, and thus cannot by definition of the term attractor move beyond its confines. Hence change of this sort has to originate without. How might external perturbations originating from without interact with the system? At the level of the total system, these can be engaged in redefining the system parameters in two ways. As almost a mechanical endeavour of changing system parameters which entails a linear causality, or as engaged in a more dynamic interaction with the system whereby the system self-organises by recursive positive feedback from the environment that pushes system parameters – an evolutionary perspective. External perturbations can also be engaged at a more local level, where at opportune moments a system state when perturbed bifurcates and adopts one of two paths, both within the strange attractor though. This has obvious implications for any normative view of social situations – both in situations that need a direct initiation of change or in situations that need to *allow* for the initiation of change, be it normative,

managerial (risk and adaptation) or emancipatory (creation of conditions that allow for freedom).

I have now laid out an argument for the potential relevance of complexity theory for the broad realm of social sciences in metatheoretical terms not entering into details as the detailed realm is set aside for discussions in planning. In doing so I have touched upon some concepts of complexity theory and reflected upon ways in which they could influence the realm of possibilities in social science research, approached with whatever purpose. The arguments for the potential for complexity theory concepts to be influential in social science theorising can be better demonstrated by a discussion of an actual such influence. A discussion of such an influence is included in Appendix-7, wherein I discuss the theory of social systems put forward by Niklas Luhmann. This theory is informed by themes from complexity science - that of autopoiesis, originally from the discipline of biology. The discussion included in Appendix-7 is limited to the purpose of illustration of complexity concepts. A more substantial discussion of this theory is taken up later in Chapters-7 & 8 where I examine the relevance of the concept of autopoiesis for planning.

Conclusions

I have in this section discussed the nature of social science theory emphasising ways in which theoretical advance takes place in social science. It has been highlighted that the activity of theory construction is actually a very varied and diverse activity, involving changes through social and global influences. The process of change is generally through research traditions and orienting strategies. The necessity of and the importance for the linkage of theory to generalised discourse and empirical activity, as well as theoretical contexts have also been discussed. Different conceptions about the purpose of social science theory also exist – the nomological, interpretive and normative. The use of systems theory within social science is then examined, with particular relevance to the concepts of structure and function. An illustration and discussion of how structural functionalism plays out in social science theory is provided in Appendix-6. Here the main systemic elements of the theory and the main criticism against it have been recounted. This laid the ground for the discussion of concepts from complexity theory.

In the discussion of the relation of complexity theory to social science theory, I have proceeded to make a case for the potential relevance of adoption of concepts from complexity science into the social domain by way of a generalised discourse and

a contextualisation of the theory at a level of abstraction that links mainly to the meta-theoretical domain of social science. Thus, I have first presented ways in which theory development takes place in sociology. The case is then made for a conception of complexity science as a reconstruction of the systems sciences, keeping many of the core principles and ambitions of systems science, like abstraction across subject domains, holistic explanations etc, but taking into account contemporary knowledge developed across disciplines in line with the ambitions of systems science. The point of divergence of complexity science from systems science in terms of ontology and the consequent development of new concepts is then argued for, thereby qualifying complexity theory for the title of 'neo-systems' theory. The linkage of complexity theory to social science theory has then been illustrated as possible in all three meta-theoretical terms – the nomological, interpretive and normative - the linkage in broad terms being possible due to the level of abstraction that systems theory and consequently complexity theory engages in. The possibility for adaptation itself keeping intact the systemic tradition, yet building upon it in terms of complexity, is briefly illustrated in Appendix-7, by a discussion of the adaptation of the theory of autopoiesis, from biology to sociology by Niklas Luhmann.

From the discussions presented in this chapter, I have justified the overall nature of the research strategy adopted for this thesis, by way of examining how theory development takes place in social science. I have also carried forward the realm of generalised discourse started in Chapter-3 and built on it further to provide the ontological status of complexity theory. I have also in a limited way contextualised the theory within social science, arguing how it might be relevant to social science research in meta theoretical terms. In conclusion then it can be stated that the arguments presented so far have examined the nature of complexity theory - the first part of the main research question - and have argued for admitting the possibility of its relevance to planning. From Chapter 5 onwards I enter the second domain, of planning. Here I largely leave the level of generalized discourse and engage more in the other activities associated with theory development – theoretical imagination, theory transfer, theory contextualisation and empirical validation.

COMPLEXITY THEORY AND PLANNING**Introduction**

In this chapter, I make the transition from social science to planning, building on an a priori understanding of planning as an applied activity, concerned with application and practice. The aim of the chapter is to first develop and present an understanding of planning theory as this is the target domain into which complexity theory is to be transferred. For this, I investigate the nature of practice as opposed to theory which leads to an argument for the nature of planning theory in the sense of the level of abstraction it addresses and the way it contributes to knowledge while aiming to inform practice. This conception of planning theory influences and informs the objectives that the thesis sets for itself in arguing for and examining the relevance of complexity theory for planning. I also use the argument to delineate and distinguish between two different levels by way of which planning theory might relate to planning practice. The second of these two levels I argue is under researched, though it is becoming increasingly relevant in the world of today. This is the level, I argue that complexity theory contributes to and consequently this is the level that this thesis addresses and contributes to in planning. The initial part of this chapter thus builds up and makes explicit the conceptions of the target domain - i.e. planning theory – that informs the theory transfer attempted in this thesis

The second aim of this chapter is to develop a methodology for theory transfer and contextualisation. Towards this aim, I first present a general overall review of the way in which complexity theory has been used hitherto in social sciences as well as planning. Here I argue that even though there are increasingly numerous instances of the use of the theory, a rigorous and social science based application of the theory, especially in the non-quantitative stream, is rare, resulting in considerable scepticism about the worth of the theory. Second, as a prelude to the development of a methodology for theory transfer, I develop an evaluative framework for theory transfer, based on the theory of metaphors. This evaluative framework is then applied by reviewing two published articles discussing complexity theory and its use for planning. The review also demonstrates how scepticism on the use of complexity

theory in general has formed. Based on the evaluative framework, I further formulate a methodology for transferring complexity theory into planning. I present also the rationale of the scoping of the thesis in terms of the choice of concepts dealt with and the reasons for the same, as well as the reasons for the choice of the case study and the implications of the same. Chapters - 6, 7 & 8 carry out the actual transfer.

5.1 The Scope and Nature of Abstraction in Planning Theory

In this section I move from theory to practice. Planning being an activity very much engaged with the daily lives of people whom planners address, I look now to ways of understanding this realm, - ways of understanding practice, first through the lens of social science and then through planning itself. This is undertaken by reviewing writings and reflections on the difference between theory and practice. Planning theory is seen here as different and distinct from social science theory and the nature of this difference and distinction is clarified in this section.

According to Bertaux, “the truth is that sociologists do not know very much about the societies in which they live” (1979, pg 18, quoted in Maffesoli, 1996, pg 137, 138). The statement demands of planning serious reflection, on how this might come to be so, as this is one luxury that planning as a profession cannot afford. The questions raised and the issues addressed in the review presented below lead eventually to an understanding of what differentiates a practice approach from a theoretical approach. The understanding enables a positioning of planning theory and the level and nature of abstraction that it addresses.

5.1.1 Theory and Practice

The ‘distance’ between theory and practice has been widely discussed within sociology from many viewpoints. Most of these writings highlight the lack of correspondence between theory and practice. Thus Sayer (1992) points to an ‘intellectualist fallacy’ whereby the reporter or the ‘scientist’ engaged in structural analysis, dealing with ‘macro’ issues, when reporting on events or incidents tends to forget that for the actor or participant engaged in the activity, their goals are not clear, and the path taken is not a determined path but rather one prone to vulnerability or ‘diversions’. The *ex post* report produced compresses time, and strategies on the ground become “routine and mechanical execution of well-defined, perhaps reified, ‘actions’ undertaken according to firm ‘rules’ and ‘roles’” (pg 97). Practical knowledge gets codified in propositional form, which then results in a mistrust between ordinary people and ‘intellectuals’. Sayer is resigned to this issue to a certain

extent, but argues that structural analysis must still not be done away with as then that would only admit 'actor accounts'. He instead advocates a realisation of the limits of structural analysis. Thus "the above errors lie not in using structural analysis as a mode of abstraction but in using it as if it could provide *concrete* descriptions on its own; it provides a possible beginning to research but not an end" (original italics) (pg 98). Sayer also points to a tendency which seeks to privilege written or spoken knowledge over 'making and doing'. Practical and tacit knowledge which are often guided by a 'vague and unexamined practical consciousness' is by and large underestimated in academic discourse (pg 15). Sayer's discussion acknowledges a difference between an 'academic account' and a more practice oriented account, with no effort made to bridge it. The focus is on acknowledging the difference by stressing the incompleteness of a structural account to fully describe concrete situations. Concrete situations are however generally the primary concern in planning. So there is then a need to go beyond purely structural accounts for an understanding of concrete situations.

The relationship between academic accounts and practice is discussed at some length by Bourdieu (1998) in his notion of practical reason. Bourdieu differentiates between two fundamental types of logic that governs the two realms of academic discourse and practical discourse. Thus, "practice has a logic which is not that of logic, and thus to apply practical logic to logical logic is to run the risk of destroying the logic one wants to describe with the instruments used to describe it" (pg 82). Bourdieu argues that there is what he calls 'a scholastic point of view' which reflects on the social world, language or any possible object of thought. This view is integral with the conditions that make it possible i.e. the 'institutionalised situation of studious leisure' (pg 127, 128). The situation of studious leisure is explained as a 'socially instituted situation' (pg 128) that assures a person the means and the free time outside the urgency of a practical situation to engage in 'futile stakes' (pg 128) which are generated in the scholastic world. It makes possible "academic exercise as a gratuitous game, as a mental experience that is an end in itself" (pg 128). In conditions where situations of studious leisure are not available, the scholastic point of view cannot exist. Assuming that it does leads to 'epistemocentric fallacy' or 'scholastic fallacy' (pg 130, 132). Bourdieu moves on to discuss the ways in which this fallacy impacts on the instruments and methods used for research. There is a clear note of warning here for the development of planning theory. If theory is a product of

the scholastic point of view that cannot relate to practice, due to the institutional conditions that make it possible then, what might be the realm of concern for planning theory? How might it justify its claim to being 'theory', while also retaining its claim of informing practice? I search further for answers.

Giddens (1993) sees the 'resurrection' of common-sense as both a resource and a topic for study - as a reaction against positivism. He addresses the concern of whether sociologist's accounts of social conduct can be seen as 'unnecessary and pretentious' given that participants already know of their life. Two justifications are advanced for what in addition a study of social life contributes. First, "no specific person can possess detailed knowledge of anything more than the particular sector of society in which he or she participates, so that there still remains the task of making into an explicit and composite body of knowledge that which is only known in a partial way by lay actors themselves" (pg 137). The composite body of knowledge then relates to the idea of 'constructed universals' advanced by Alexander (1990) discussed in Appendix-4. Second, in Giddens's opinion "it is in any case not true that their (sociologists) endeavour can be no more than descriptive in character; their aim is to correct and improve upon notions used by actors themselves in interpreting their own actions and the actions of others" (pg 137). Giddens points out that Winch and Schutz have argued that the social sciences could legitimately use concepts that are unfamiliar to those to whose behaviour the concepts refer to. He points to the distinction made by Schutz between 'rational constructs of models of human action' on the one hand and 'constructs of models of rational human actions' (pg 160). His argument is that though sociological concepts must pick up differentiations of meanings which are relevant to the accomplishment of day to day interaction, they "are in *no way* constrained to embody the same differentiations in their own formulation. ..." (original italics) (pg 160).

We have above a broad picture of some ways in which a theory dealing with practice can define a scope for itself. These are 1) descriptions that provide a much larger picture than what any one person or actor can provide, 2) presentation of insights that the actors may not themselves be aware of, 3) introduction of concepts or models that 'improves' upon frames of reference that actors themselves might otherwise use. Therefore when linkage to practice is considered, theory can be descriptive, cognitive in terms of providing or refining insights, as well as innovative, in terms of constructing new references for practice. If this is the case then what

defines a theory that aims to inform practice as distinct from say a mere suggestion? I again search further for answers.

Schatzi (2001) argues for a practice turn in sociology which occurs within and are aspects or components of the field of practices. The field of practice is defined as “the total nexus of interconnected human practices” (pg 2) and the practice approach is defined as “all analyses that (1) develop an account of practices, either the field of practices or some sub domain thereof (e.g. science), or (2) treat the field of practices as the place to study the nature and transformation of their subject matter” (pg 2). Schatzi points out that the practice approach is actually not a unified approach but is rather what can be conceived of as ‘arrays of activity’ (pg 2). Conceptions of activities and what connects activities that constitute practice vary. The notion of a ‘theory’ when talking about practice is however explicated. For Schatzi “‘theory’ means, simply, general and abstract account” and “a theory is of the practice variety, consequently, when it either (1) proffers a general and abstract account of practices, either the field of practices or some sub domain thereof, or (2) refers whatever it offers a general and abstract account of to the field of practices” (pgs 3,4). This conception of theory is contrasted against the more commonly known understanding of theory as linked to explanation or prediction. Thus “systems of generalizations (or universal statements) that back explanations, predictions, and research strategies are theories. But so, too, for example, are typologies of social phenomena; models of social affairs; accounts of what social things (e.g, practices, institutions) are; conceptual frameworks developed expressly for depicting sociality; and descriptions of social life – so long as they are couched in general, abstract terms” (pg 4). From this overview of practice, I attempt now to understand the position of planning theory.

5.1.2 The Position of Planning Theory

Taking off from the above notion of theory by Schatzi, practice theory requires 1) an abstraction and 2) generality. What is not mandated - though not precluded - is explanation or prediction. This class of theories, i.e. practice theories, are also however depicted as ‘generalizations that back explanation or prediction’. This calls for something beyond abstraction and generality - a need for a linkage to higher levels of explanation or prediction, though they need not specifically be concerned with either explanation or prediction. This is typically the requirement of a lower level theory, if the epistemological hierarchy of theories provided earlier in section 3.1.3 by Bunge (1973) is referred to. Bunge therein suggests that lower level

theories can be arrived at from ‘observables’. Hence lower level theories can be and are, derived from actual practice through induction. As Maffesoli (1996, pg 136) suggests “we find here the theoretical justification for the recent interest in the humdrum, the normal and the everyday; what is rejected often, like a subterranean centrality, provides a solid basis for the whole of sociology”. However for its validity to be established concretely, it must forge a link to higher level theories. This I suggest is the position of planning theory – between day to day practice which seeks descriptive, cognitive and innovative aids that might help inform action¹ (for example communication theory, theories that argue for a particular role for the planner-theories of advocacy, insurgent action etc) and higher levels of theory that are concerned primarily with explanation and prediction, resulting in abstraction at levels that enable this function. As in practice, explanation or prediction is not however precluded in planning theory too. But they are *not* the only function of theory at this level. Planning theory can also then by virtue of its position contribute inductively to higher level more abstract explanations and predictions. As Bunge argues lower level theories can be deductively arrived at from higher level theories and higher level theories can be inductively arrived at from lower level theories. Hence planning theory contributes to practice as well as knowledge accumulation in its own right. The argument I have presented above can be argued to be a systematic and parallel elaboration of Friedmann’s (1987) assertion of planning being a linkage between knowledge and action. The parallel assertion here is ‘planning theory’ is a linkage between ‘knowledge claims’ embedded in higher level theories of society per se and ‘practice’ as realised in specific situations and contexts.

This level of theory, as we know, is not occupied by planning alone. All sciences including the social sciences and more functionally defined domains of social science such as economics, politics, or law have theories that occupy this domain. As long as the theories in these domains take off from a common conception of society, there is considerable overlap between the domains. What planning lays exclusive claim to I suggest is *systematic procedural* (understood in the broad sense of systems of actions needed) planning with regard to the *future*, be it in terms of social reform, policy analysis, social learning or social mobilization (Friedmann, 1987), what Camhis (1979) terms as theories *of* planning as opposed to theories *in*

¹ The requirement for planning theory to contribute to practice has been widely discussed in the literature – see for instance Forester, 1993, 1999, Sandercock, 2000

planning. Theories *in* planning may come about through different streams with which planning engages, but theories *of* planning deal more with what can be termed as 'content less' entities such as 'objectives', 'goals', 'actions', 'decisions' etc which as Camhis argues, assume a substance of their own, and thereby become objects about which theories can be built (pg 3). The focus in this thesis is on this group of theories - theories *of* planning - as they form a central core that identifies planning theory as an 'academic' discipline, in its own right, with its own contributions to make to knowledge claims.

5.1.3 Methodological Implications of the Positioning of Planning Theory

I now examine the implications of the above epistemological positioning of planning theory for methodology. Since this thesis aims to examine the relevance of complexity theory for planning, and since planning theory must be general and abstract as pointed out by Schartzzi, I first search for sources of abstraction for planning theory. This along with arguments presented in Chapter 3 and 4 contributes towards an understanding of how theoretical development might take place in planning. This understanding in turn as we shall see later legitimises the primary research question of the thesis.

Due to the position of planning theory as being close to practice, planning theorists cannot afford to be as Maffesoli (1996, pg 135) comments (in relation to interpretive social research) , "intellectual workers' who are all too often so obsessed with their concepts and critiques that they forget that the social flow often obeys a logic which is not logical. If we try too hard to keep our distance, we tend to forget what gives intellectual work its legitimacy". Planning theorists need to engage with the day to day problems that 'planning in real' throws up. This in turn asks questions of the nature of the relationship between planning theory and planning practice. If 'theory' is considered generally to be something that 'informs' practice and provides 'direction' to practice, then the question of how planning theory itself first comes to take shape crops up. Also it is far from unambiguous if planning practice is indeed 'led' by planning theory for if planning theory is engaged with abstraction - which Schatzi argues it has to be if it is to lay claim to a 'theory' - then abstraction in itself by definition can only happen post event. Thus it appears and it can be argued that abstraction in planning theory must necessarily follow from practice. However what we as a community of planning theorists, 'see' in practice post event, - as Kuhn (1996) has so well brought out, in relation to the natural sciences - is also framed by

the ‘discourses’, ‘concepts’ ‘models’ ‘frames of reference’ that we gain from the academic community we relate to. Thus ‘advances’ that happen in fields of enquiry different from planning practice can also help us ‘see’ different things, enabling the infusion of ‘new’ abstractions into planning thought. The sources for abstraction can therefore be from both within and without and it is the infusion from without, together with experience from within and the resulting adaptations that occur within planning theory that enable it to retain legitimacy on its own grounds, for the result is always potentially more than just a direct borrowing or just a recounting or description of experience. In this sense the field of planning theory is an exciting realm where in realist terms, the ‘actual’ meets the ‘real’ and in more interpretive terms, new frames of reference mutate and transform influencing both practice and knowledge while getting influenced in the process. What gains prominence in this ‘play’ of knowledge is conditioned, as Kuhn (1996) argues, by the social factors that make the production of knowledge a social activity.

The second implication I discuss is the question of generality that is required of theory. It also links into the manner in which variations and specificity might be dealt with. Being linked to situated practice, planning theory cannot afford to ignore the variations that come up from practice. Again I concur with Maffesoli (1996) who states “talk of an epistemological ‘break’, or even of ‘critical distance’ is therefore pointless. I am suggesting that we should interpret the popular view of the presentby looking at intellectual *variations* which prove nothing and say a lot” (original italics, pg 140). This (relativist) view is inevitable for planning if it is to address specific people in specific situations in specific times with specific concerns. The extrapolation of the specific to the general can be only through an act of abstraction, that distinguishes between the specific form that a general entity exhibits and its general form. If this *act* of abstraction is not made, the extrapolation from specific to general becomes nothing but conflation. Only the general realm can yield a general statement. The answers that this general realm yields may however be relevant only to a certain extent, as the specific aspects of a situation takes over in ‘real life’. How then will planning theory reconcile this dichotomous requirement of having to be general and abstract, as Schartzzi demands, yet remain specific and situated?

I suggest that the dichotomy actually says a lot, because it demands a split in levels of concern and thereby a split in ways of conceiving how planning can be done. I shall explain further. Planning as we know it now is typically (not always) engaged

with direct experiences of planning practice in the first order. By that I mean, situations where the planner is directly involved in all aspects of planning. The focus here is on the substantial, technical and methodological side of planning as an activity and the skill, attitude, competence side of the planner as a professional. It typically asks of planning theory answers regarding the substantive, technical and methodological problems faced by planners in the daily execution of their work. Planning theory comes up with explanations, models, mechanisms, techniques and tool-kits that can help planners understand and perform better in their job. Planning theory also observes planning practice and points out the personal and inter-personal skills that must be embedded in a planner for 'successful' or 'good' planning (Schon, 1991). This is the level which most accounts of planning practice and planning theory address. However the legitimacy of the planner as a person who 'leads', 'decides' or 'facilitates' is increasingly being questioned within practice and theory leading to quite a lot of confusion as to where planning as a profession is headed (Thomas, 2004). Also forms of professional and technical knowledge are being increasingly challenged by other forms of knowledge, including experiential knowledge, perceptive knowledge and tacit knowledge. As Maffesoli (1996, pg 146) argues "ultimately, an approximate truth is potentially more 'scientific' than an apparently exhaustive approach, because the latter tends to view other approaches in terms of either affinity or conflict. As a result an approximate truth will..... construct an architectonic that is much closer to reality than one produced by the haughty isolation of a perfect system that leaves nothing undefined". By and large, prescriptions within planning to address this increasing 'illegitimacy' of planning have centred around prescribing a multi- dimensional perspective or analysis (Harvey, 1996b, Shields, 1995) that effectively casts the planner as a person able to respond to and incorporate all these various forms of knowledge. In other words I argue we have a planner-centred and planning-centred view in this first level of engagement.

Even while retaining the first level of planning in some of its aspects, it is increasingly becoming evident that it is time now to enter into a second level, where the planner is not in the forefront directly, but is engaged in a sort of indirect planning. The planning of planning. Here the first order process is opened up and incorporates many actors including the planner who are involved in the shaping of lives – citizens themselves, different types of 'experts', politicians, bureaucrats and so on. The first order process is direct, specific and contextualised in the local milieu.

Planning in the 'second order' (ordering of ordering) is concerned with how inputs from first order planning can be channelled into the overall concerns of the discipline of planning. The concerns for planning theory at this level are different from the concerns of first order planning. We are now dealing with a complex *system* of planning and more theories *of* planning are needed here that help understand the nature of activities conducted in planning in an abstract sense. In the above level of second order planning there is a sense of holism involved in that the system as a whole is under consideration and parts of the system is considered in relation to planning system objectives. Thus whatever be the substantive content of planning proposals, and whatever be the local variation, the level at which it is analysed for second order planning is in a sense general and abstract. Though abstract, there is in this realm of second order planning a concept of holism that resonates with Maffesoli's (1996, pg 137) statement "Holism is a specific methodology designed to bring us into intimate contact with the meanders of social existence". It must be stressed that the concept of holism here, if it is to address this intimate contact with social reality cannot be left to the discernment of patterns or repetitions alone, but is much more. It is concerned with how entities within it are related to each other to produce an evolving order that is not predetermined in its specificities, yet determined in its general objectives; how a self-evolving system through structural parameters might legitimise the act of planning while moving away from prescription. This in turn poses questions of what types of 'causality' are involved, what types of dynamics get activated under what circumstances, how parts within a system which can have an independent existence come to be constituted as parts of the system, and so on. It is this detailing of holism that brings it into intimate contact with social existence and reality, and for planning it addresses questions of 'how to' which might guide planning interventions that remain specific to time and place.

The above level of engagement for planning practice is a relatively new area for planning theory – an area that given the social nature of production of any 'scientific' knowledge may well gain prominence in the world of relativity and difference, yet efficiency and order. Being new, this realm for planning is also under researched. There are important contributions made in the area of meta governance and management. Most of this work is concerned with case-study based inferences, which lead to mechanism based understanding or a normative understanding of how certain changes are more desirable or effective (see for instance Kickert, 1993,

Kooiman, 1993, Kooiman and Vliet van 2000). These are valuable, no doubt, but they need to be positioned within a much broader understanding of where all these changes are headed to – not only in normative terms, but also in theoretical and philosophical terms, as only then can we appreciate the significance of the contribution - not only normatively, but also theoretically and philosophically - to both practice as well as knowledge itself. Also most of this literature is related to governance, in terms of management rooted in the present. Almost nothing exists in terms of planning that deals with problems associated with an orientation to the future, from the present, with an understanding of the past.

This picture of the nature of planning corresponds also with the disjointed picture of the world presented in the realist ontology – layered stratification in one plane but relational and synergetic in another (section 3.2.2). It also resonates with the concept of supervenience discussed earlier (section 3.2.2), wherein following Kim (1999) it was pointed out that each stage supervenes on the one before - relations supervene on relata.

The planning part of this thesis contributes to the above area and level of planning research. It 1) addresses issues of second level planning using insights from complexity theory, 2) provides the philosophical and theoretical links in terms of explanation for theories at a lower level that already exist in planning, 3) develops new concepts for planning from other domains through complexity theory, 4) links these concepts to existing theories and practices in planning, 5) elaborates and illustrates how these concepts can come into play in ‘real life’ planning. By carrying out the above objectives, the thesis addresses the twin requirement for planning theory to both contribute to planning practice as well as advance knowledge claims of its own.

Having positioned the remit of the contribution of this thesis for planning theory and practice, I now move on to examine ways in which complexity theory has been used in planning.

5.2 Complexity Theory and Planning – Towards a Methodology for Theory

Transfer

In this section, I evaluate the present use of complexity theory in planning. Following a general survey of ways in which concepts from complexity theory have been used in planning and social science, I search for ways in which theory transfer might more rigorously be done, focussing on the theory of metaphors. Based on this

theory, I construct a framework for evaluation, which I use to evaluate two published articles dealing with complexity theory and planning. Building upon the insights from this evaluation, I proceed to develop the evaluative framework to arrive at a methodology of theory transfer which I later employ in Chapters- 6, 7 & 8.

5.2.1 Complexity Theory in Social Science and Planning

Complexity theory, since publication of some of its concepts in popular science books written by popular science writers (Gleick, 1987; Waldrop, 1992; Gribbin, 2004) as well as by and large accessible books written by scientists (Progogine and Stengers, 1984; Ruelle, 1991; Stewart, 1990), has found many adherents in various disciplines including the discipline of social science. Discussions of the theory within social science include philosophical discussions (King, 2000; Cilliers, 2000), discussions of applications (Kiel and Elliot, 1996; Byrne, 1998), discussion of general implications of the theory (Eve *et al*, 1997; Byrne, 1998; Urry, 2003, Sullivan, 2004) and engagement with certain concepts or ideas (Rasch *et al*, 2000; Abbott, 2001). It has also, as is shown in Appendix-5, given rise to profoundly innovative and far-reaching work within sociology such as Luhmann's (1995) voluminous and now classical work on social autopoiesis, building on work done originally in biology. Besides these explicitly stated engagements, some concepts that complexity theory has adopted and focussed upon have been around for a long time within sociology and its sub disciplines. Thus we have theories that investigate the rise of spontaneous order as in Hayek (1996), theories that investigate emergence as in Giddens (1984), theories that concentrate on holism as in Smuts (1926), theories that concentrate on the whole impacting on the part, such as in Kim (1999).

Complexity theory in the last few years has also made a transition into planning. Discussions at a broad level relating to complexity theory in general have taken place in planning as well as planning related disciplines like urban studies, policy science or governance (for instance Byrne, 2001, 2003; Kooiman, 1993; Allen, 1997; Rhodes and Mac Kechnie, 2003; Strand, 2002). Specific applications using particular concepts have also been attempted (for instance Dunsire 1996; Jessop 2001a, 2001b; Batty and Longley, 1987, Batty and Xie, 1999). Work that has taken place can be broadly seen as being within two streams – the quantitative stream concerned with modelling related issues and the non-quantitative stream concerned more with qualitative aspects. Both deal with sometimes similar concerns and concepts related to complexity theory including the emergence of spontaneous order,

robustness, fractals, etc. The range of issues that complexity theory is called upon to explicate, together with the rather admittedly 'vague' manner in which it has been employed, in some instances, have however resulted in a considerable amount of confusion and scepticism about the worth of the theory itself.

Writings for and against the theory have hitherto tended to be based upon either intuitive empathy giving rise to benevolent optimism (Byrne, 2003; Thrift, 1999), or intuitive rejection (Stewart, 2001; Horgan, 1995) giving rise to cynical pessimism. Substantive content of the arguments are based upon all or some of the following factors. Firstly, condemnation of the theory as a whole based on what can at best be termed limited reviews of the use of complexity theory (reactions to one or few authors). The second factor is more commonly seen and I shall term it 'informed speculation' on what constitutes the theory, its nature and features. This is to a certain extent inevitable as the theory has its source in many subject domains all of which no single person can be said to have an authoritative knowledge in. Finally, arguments are also explicitly and implicitly based upon the reviewer's concept of the nature of social science/planning per se. The result is that we have diverse viewpoints that do not easily aid any understanding of the theory or its worth for the advancement or understanding of planning thought. I argue that for the potential usefulness of the theory to be accepted, or rejected, arguments for or against must be based upon more robust grounds. In the coming paragraphs I attempt to construct these grounds.

The problems highlighted above, it can be argued, are inevitable, as they are to a certain extent inherent to the subject matters involved. How then can one evaluate an application of the theory and conclude whether it is a one off case of unconvincing translation (robust applications will inevitably speak for themselves) from the original domain or a more fundamental problem of theoretical incompatibility (for planning)? What is required here is a framework that can accommodate the above limitations, yet provide a yardstick rigorous enough to be accepted by those engaged in planning theory and thought. Since the concepts from complexity theory originate from a diverse range of disciplines, a theory of theory transfer and theory construction would address the issue best. I propose the use of the 'theory of metaphors' as a lens for evaluating the use of complexity theory in planning.

Two reasons justify my choice. Firstly, metaphors are particularly known as vehicles for the transfer of concepts, ideas and notions from one domain to the other, though their efficacy remains contested. Why then choose a 'vague' vehicle to clarify

a vague area of enquiry? The answer I argue is because this vagueness of metaphors serves to illuminate partly the reason for the mysticism of complexity and its subsequent significantly unconvincing employment within planning. The second reason for the use of metaphors is that in spite of its vagueness there is developed within the theory of metaphors, a fairly robust notion of how theory transfer and theory construction takes place, which I shall employ to argue my case.

5.2.2 'Theoretical' Metaphors, their Nature and their Use

Etymologically metaphors mean 'to carry over' or 'to transfer' (Hunt and Menon, 1995). The theory of metaphors introduces us to two basic types of metaphors different in fundamental ways from each other. These are the 'literary metaphors' and the 'theory-constructive', 'theoretical' or 'scientific' metaphors. Literary metaphors and the mechanisms by which they operate on the reader or hearer form a well-discussed area within studies of language (Goatly, 1997; Ortony, 1993). Basic terminologies for the systematic study of metaphors is laid out within this domain. Very briefly, there is a 'source' domain and a 'target' domain, with the metaphor itself being the 'vehicle' (Goatly, 1997). The operation of the metaphor is through a tension between congruence and incongruence, expressed by Hunt and Menon (1995, pg 82) as being 'denotatively false and connotatively true'. In other words, there are always features of the source domain that the metaphor denotes, which are not necessarily possessed by features in the target domain. However the metaphor carries with it associative connotative meanings from the source domain, which resonate with the target domain and it is these connotative meanings that lend richness to a metaphor (Noveck *et al*, 2001).

The use of metaphors is very much a part of our everyday language used to say exactly what we mean (Glucksberg and Keysar, 1993). There are many theories that account for the way metaphors work. Prominent among these are three, the substitution theory, the comparison theory and the interaction theory (Ortony, 1993, Ricoeur, 1978). Substitution theory advances the notion that metaphors work by substituting a literal sentence or term by a figurative one (Olsen, 1982). Comparison theory advances the notion that metaphors act by making comparisons of attributes or beliefs between domains involved (Tourangeau, 1982; Xu, 2000). Interaction theory is the more recent and generally accepted, (though details are contested) notion. Here metaphors act by interaction between two domains, whereby the hearer is incited to select properties from the source domain and construct a parallel in the target domain,

which in turn may induce parallel changes in the source domain (Black, 1993). Theory-construction metaphors basically build on this view (Black, 1962 discussed in Boyd, 1993).

Focussing more on theory construction metaphors *per se*, the answers that I search for relate to specific questions 1) what is distinctive about theory construction metaphors? 2) what is their role in facilitating and contributing to theory transfer and construction? and 3) what is the process of transfer? Reviewing the literature on theory construction metaphors, I draw out what emerges as answers to these questions.

Lakoff (1993, pg 203) emphasizes that ‘the locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another’. It is thus ‘the ontological mappings across conceptual domains’, making it a matter of ‘thought and reason’, where ‘language is secondary’ (pg 208). The notion of ‘structure-mapping’ informs us here. It advocates that an analogy works by mapping knowledge from one domain to another in a way that holds together systems of relations (Gentner, 1982; Gentner and Jeziorski, 1993). Thus features in the target and source domain need not resemble each other, yet correspondences can be mapped by virtue of their ‘like roles in relational structures’ (Gentner and Jeziorski, 1993). Eg: structure of the solar system and the atom. It is again this feature of metaphors that form the basis of theory construction metaphors.

Opposed to this concept of an ontological mapping is the argument that metaphors are essentially sensuous or intuitive, especially in the domain of poetics (Hester, 1967) and that their primary purpose is in invoking images that aid cognition. Alvesson and Skoldberg (2000) argue that

“which image we choose depends on the angle of view, the perspective, and is thus subjectively conditioned (pg 89)”.

They point out however, that there are limits to the choice of images and the ‘objective’ degrees of freedom for the choice will depend upon the properties of the two phenomena that are compared. It follows that if the properties are not known or if the limits of choice are transgressed a ‘bad metaphor’ is the result.

The properties must not only be known, but must also resemble. This provides the reason for metaphoric transfer. As Ricoeur (1978) argues:

“between the figurative sense of the borrowed word and the proper meaning of the absent word, there exists a relationship that can be called the ‘reason’ (in the

sense of rationale or basis) for the transposition. This reason constitutes a paradigm for the substitution of terms. In the case of metaphor, the paradigmatic structure is that of resemblance (pg 46)”.

There are two fundamentally different ways in which theory construction metaphors act. This is dependent on the relative state of advancement of the particular area constituting the target domain. Thus there is a role for metaphors in 1) the pre-theoretical stages as well as in 2) the more mature stages. In pre-theoretical stages, a creative metaphor induces emotive and cognitive tensions by bringing together two disparate domains. Efforts are then made to ease out tensions by further work, which in turn results in further comprehension (Hunt and Menon, 1995). Thus conceptually viewing one domain in terms of another by itself induces a research agenda for further investigation. This is clearly illustrated by Boyd (1993), wherein he uses the example of the domain of computer science and the manner in which it has informed the setting of research agendas in cognitive psychology - suggestions that motoric processes are ‘pre-programmed’, suggestions that certain information is ‘encoded’ or ‘indexed’ in ‘memory store’ by ‘labelling’ and so on. The dominant function here is then one of *generating ‘scientific’ or theoretical ideas*.

Metaphors discussed above, have certain characteristics. Firstly, users of these metaphors may not be able to initially specify *exhaustively* the relevant aspects of similarity. In fact it is this open-endedness that allows theoretical transfer and later theory-construction in a new domain. However, this does not mean that there is no responsibility on the user of the metaphor. As stated by Boyd (1993, pg 488):

“it is part of the task of scientific theory construction involving metaphors to offer the best possible explication of the terminology employed,”

And

“it is certainly the routine responsibility of scientists’ as ‘the sciences in general...are self-reflective disciplines, and the explication of theoretical concepts – metaphorical or not – is an essential part of the task of scientific enquiry.”

The reference role of metaphors here, then, is a sort of ‘non-definitional’ reference and the entities they refer to can be viewed ontologically, if from a realist point of view as causal structural relations (Boyd, 1993), or from an instrumentalist or pragmatic view, as substantive or cognitive (Kuhn, 1993). They provide the

terminology to conceptualise features of the world in one domain, whose existence or usefulness may seem plausible, through work in another domain. By metaphoric transfer, the features not only get contextualised in the target domain, but may also interactively inform in turn the source domain. One important conclusion that follows is that for usage of metaphors in theory transfer and theory construction, a good understanding of both the source domain and the target domain is essential, as only then can the structural relations be abstracted.

Theory-construction metaphors used in the above manner also undergo a different developmental history from that of literary metaphors. Literary metaphors when used over time lose their dramatic quality and tend to get ‘stale’ or ‘dead’ (becoming incorporated into literal usage). Theory-construction metaphors on the other hand if successful, will be used by many researchers (Hunt and Menon, 1995, Boyd, 1993), heuristically informing new research agendas within disciplines, and thereby undergoing a change or evolution of exact meanings within disciplines over time. This will continue until the research community finally establishes and defines the metaphor (Knudsen, 2003) within the discipline itself in relation to theories and knowledge within the discipline. Thus, even though one can imagine them as losing their productive quality over time, they never become trite.

In mature disciplines, metaphors perform yet another important role, that of ‘catachresis’ – the introduction of theoretical terminology where none existed earlier (Ricoeur, 1978). According to Boyd (1993, pg 483), catachresis is a process of

“accommodation of language to the causal structure of the world,... making possible socially coordinated *epistemic access* (original emphasis) to a particular sort of thing or natural phenomenon.”

Thus metaphors again perform a social role in providing, by means of an accepted usage, heuristic and conceptual access to theoretical concepts, hitherto remaining unnamed.

The case for the relevance of metaphors as a vehicle for theoretical transfer and consequent theory construction in a new domain has been stated above. But this endorsement of metaphors in a theory-transfer and theory-construction context must be qualified by evidence of 1) reasonable knowledge about the source as well as target domains, enough to enable a pertinent abstraction of key relational characteristics, within each domain; 2) an effort to draw out and explicate key similarities and analogies 3) an effort to abstract and elucidate essential relational features and 4) an

attempt to explore the abstractions with relation to other theoretical work in the target domain. In the absence of the above, the use of metaphors may fall short of being 'theoretical', even though they may still be employed in 'scientific' work, either as a descriptive medium for pedagogical or persuasive purposes, or as a gap-filling device for inadequacies of language. In both cases the author might then have to ensure that the hearer or reader understands the source domain and also what features of the source domain the author wants to convey, as it might otherwise result in 'asymmetrical understanding', whereby the meaning meant by the author is not grasped by the reader or hearer (Goatly, 1997), causing considerable confusion.

An endorsement of this mode of theory transfer can be seen in philosophical writings as well. Thus, dwelling on the analogical mode of reasoning, Bhaskar discusses Campbell's (1957) theory of models. According to this model, a theory must contain correlation not only with empirical 'facts', but also with a 'model' by means of which "its hypothetical subject matter may be imagined to be like in some, but not all, respects the real empirical subject matter of some field which is already known. On this view the surplus element is the model" (Bhaskar, 1998b, pg 55). Bhaskar concedes that such a model may be necessary for "a theory's growth and development, and in particular.... for the generation of facts empirically relevant for the theory but which would not have been forthcoming without it" (Bhaskar, 1998b, pg 57). However he points out that this view cannot prompt questions about the reality of the entities and processes postulated in the theory. "Models function then not as knowledge-extending but as essentially pragmatic devices, servicing the needs of the understanding" (Bhaskar, 1998b, pg 57). The choice of any particular model out of a range of possible ones may remain questionable, for Bhaskar further points out that the model form of reasoning essentially places the surplus-element in the imagination of men, while for realism this has to be placed in the concept of a generative mechanism. Thus as a further improvement on Campbell's model, Bhaskar suggests "for the transcendental realist then a model has a relationship with its subject as well as its source. And it is within the nexus formed by this double articulation that new knowledge is produced. For new knowledge is doubly articulated in two dimensions (transitive and intransitive): it is a socially produced knowledge of a natural (man-independent) thing. It is this bi-polarity that a model expresses in standing in two sorts of relationship: a relationship of *analogy* (original italics) with its source; and a relationship of *adequacy* (original italics) (when it is) with its subject

matter” (Bhaskar, 1998b, pg 65). Further, “the existence of the first type of relationship (in the transitive domain) is important in establishing both a constraint on the number of possible explanations and an indispensable means of their production” (Bhaskar, 1998b, pg 65). The identification of a protolaw normally depends upon the prior existence of a conjecture or a hypothesis of a mechanism intended to function as a possible explanation for the presumed protolaw (pg 71). According to Bhaskar (1998b, pg 65) there are however no philosophical criteria for judgements of adequacy as they are necessarily intrinsic to the particular science concerned. This argument of Bhaskar’s then, provide the philosophical underpinnings for the theory of metaphors to be used as a methodology for theory transfer.

Having laid a broad framework for evaluation of theory transfer between two domains, using the theory of metaphors, I now examine the use of complexity theory within planning thought in more detail in the next section.

5.2.3 Complexity theory within planning

The purpose of this discussion is to test the efficacy of using the theory of metaphors to see how far it can contribute to the formation of a methodology for carrying out theory transfer in the context of this thesis. I restrict my discussion to a review of two articles. Both these articles engage with what the authors see as insights of complexity theory in a general sense. The articles have been chosen for 1) the general level of engagement which yields a potential of examining how various ideas or concepts have been discussed, 2) the explicit, sustained serious engagement with complexity theory of the authors, demonstrated by the number of publications they have, dealing with complexity theory and planning (Innes and Booher, 1999, 2000, 2001; Byrne, 1997, 1998, 2001, 2003) and 3) the difference in scope it presents to demonstrate how the framework could be used to yield different types of insights. It must be emphasised here that my discussion of the writings are limited to a critique of the use of complexity theory viewed through the lens of the theory of metaphors, the intention being to observe the type of insights it yields, so as to more fully examine its potential for the development of a methodology for theory transfer. Discussions of the content are thus ancillary to this purpose.

5.2.3.1 *Article -1*

Innes, J.E and Booher, D.E (1999) 'Consensus Building and Complex Adaptive Systems – A Framework for Evaluating Collaborative Planning'. In *Journal of the American Planning Association* Vol 65, No 4, 412 – 423.

Innes and Booher, in this article use complexity science along with other sources – their own research findings and the Habermasian concept of communicative rationality - to evolve a framework for evaluating consensus-building processes. Their use of complexity science is as a metaphor. They claim

“Complexity science provides a powerful metaphor to help understand why and in what ways consensus building can work more effectively in today’s complex, fragmented policy context (pg 413).”

I start the review from their conclusive frameworks expressed in terms of a ‘process criteria’ and an ‘outcome criteria’ for evaluation (pg 419), and work backwards. Features listed in the outcome criteria, are almost exclusively based on their own research, except for the use of the term ‘co-evolution’ and ‘adaptation’ in the third order effects listed (pg 419). ‘Adaptation’ has a literal use, the identification with complexity theory being due to the fact that the adapting process is introduced as part of processes associated with complexity theory. The word ‘co-evolution’ per se is not introduced but within the context the reader can make an informed guess as to what might be the authors meaning. In the process criteria, the authors specify that the process of consensus building must be ‘self-organising’, the meaning of which has been briefly introduced earlier. Thus in terms of meanings conveyed by the metaphoric use the authors do communicate successfully with the reader.

Moving backwards from here to the ‘Principles of Evaluation’ (pg 418), the authors advance normative principles, two of which are based on complexity. They maintain

“a complexity perspective suggests that a high quality consensus building process in an uncertain and changing society should be self-organising and evolving, good at gathering information from the environment and effective at making connections among participants (pg 418).”

And,

“a complex adaptive system depends on each individual being empowered to act autonomously and in an informed way, so that manipulation of any

participant or suppression of their own views can only make a system less intelligent (pg 418).”

These are normative inferences not only using the terminology of complexity science, but also explicitly grounding themselves on it. How do Innes and Booher get to these normative conclusions? They base it on 1) a perspective that sees consensus-building process as a complex adaptive system and 2) a reading of the features of a complex adaptive system. We shall discuss these groundings in detail.

Before venturing into a discussion of grounding of concepts, let us digress a little and address the question of whether this is a metaphoric theory transfer at all. We have seen that the notion of complex adaptive systems within complexity theory has evolved to an ontological claim based upon experiments conducted across disciplines ranging from physics to biology to computer science. Any talk of the features of a complex adaptive system is thus based upon an already abstracted set of features and characteristics, which constitute what is known as the complexity theory. Thus, a source domain here does not exist in the true sense. What is at issue then is whether it is possible to extend the ontological claim of complex adaptive systems to inform the target domain of consensus building processes or whether alternately it is possible to use the concepts metaphorically to inform consensus building processes. In the case of an extension of ontological claim, the ‘vehicles’ (as per the theory of metaphorical transfer) used for extension are inevitably the terminology, which denote ontological relationships in the source theory. However they remain a metaphor in the target domain until validated, potentially signifying either useful cognitive concepts or causal relationships depending on one’s philosophical viewpoint. The process here is that of structure mapping, introduced earlier – the mapping of relational attributes. This leads to the question of ascertaining the validity of a structure mapping. How does one contest the validity of any theoretical application to any domain? I maintain that in the case of metaphoric theory transfer this must be done by a description of the target domain that establishes its position as one at least equivalent to the source domain, within which the structural correspondence makes some possible sense. In this case then an unavoidable task for establishing the validity of mapping would be to draw out the correspondence of consensus-building process with that of a complex adaptive system. Taking off from the earlier concern of grounding, we must now examine how far this has been done.

Features of complex adaptive systems are sketched out in the text. Features of the consensus building process based upon findings from their own previous research are sketched out separately. I shall quote from the text and underline the words/phrases that establish congruence with complex adaptive systems, as has been later sketched in the text (pg 417). The authors maintain

- i. “learning and change can be the most far-reaching effects of consensus building (pg 415).”
- ii. “they (participants in a consensus building process) may learn how all participants interests are interconnected (pg 415).”
- iii. “consensus building is not grounded in the authority of law and tradition (pg 415).”
- iv. “typically it (consensus building) is adaptive and evolving often with spin-off working groups and other self-organizing activities (pg 416).”
- v. “consensus building is mutually interactive with its environment (pg 416).”

Though not specifically stated, one can infer that it is because these features of consensus building are in common with features of complex adaptive systems, that there is validity in applying the insights of complexity theory to consensus building.

But what are the insights? From their own research, Innes and Booher claim that

“much of what consensus building accomplishes, such as new levels of trust, shared knowledge, alliances, personal networks and working relationships, depends on collaboration and a mutually respectful process (pg 416).”

From a Habermasian perspectives, they draw out

“for dialogue to produce emancipatory knowledge, the stakeholders must be equally informed, listened to and respected, and none can be accorded more power than others to speak or make decisions (pg 418).”

I shall now re-quote from their principles of evaluations once more –

“a complexity perspective suggests that a high quality consensus building process in an uncertain and changing society should be self-organising and evolving, good at gathering information from the environment and effective at making connections among participants (pg 418).”

“a complex adaptive system depends on each individual being empowered to act autonomously and in an informed way, so that manipulation of any

participant or suppression of their own views can only make a system less intelligent (pg 418).”

The authors end up recounting the features of consensus building arrived at through other means as insights from a complexity theory perspective.

What does complexity theory contribute then? At best it can be said to couch and repackage their findings in terms enabling the authors to make a circular normative argument. This can have a social role in promoting and favouring certain values that may otherwise be difficult given the scattered nature of the findings. Thus it can serve a gap-filling linguistic and possibly conceptual function, consolidating findings into a unified theory, which though known individually is otherwise dispersed through the target domain.

One last point worthy of notice is the value dimension of metaphors. The authors opine

“at the edge of chaos- a good analogy to the current period of social transformation – innovation and dramatic shifts in activity patterns can occur, and systems can move to higher levels of performance (pg 417).”

This statement without a proper qualification of what an ‘edge of chaos system’ is (which in complexity theory means a system with certain properties including the presence of a certain order), has the potential of being interpreted rather arbitrarily and arguably dangerously, given the literal meaning of the word ‘chaos’. As Hunt and Menon state (1995, pg 88)

“what an adopting discipline borrows in a metaphoric transfer is not just a positive collection of concepts and theories, but either explicitly or implicitly, a set of norms as well.”

In terms of theory construction then has the complexity theory served any function? I would say that the authors have been able to show that reasonable grounds exist for a re-conceptualisation of consensus building as a complex adaptive system - a useful first step no doubt. This will however remain a redundant exercise if it yields no insights. The re-conceptualisation if it is to yield anything to the target domain, must be taken further to 1) explore the connotative meanings associated with complexity theory, as revealed in different source domains from which the theory originates. This is an area where metaphoric theory transfer has its utmost potential, 2) undertake a fuller and more detailed exploration of the abstracted features so as to yield the relational structure within the abstraction in finer detail, and 3) undertake

empirical work to detail out how the imported structural mapping plays out in the new target domain, thereby yielding new insights relevant to this domain, while changing and contextualising the received concepts. This is the final benefit of innovativeness triggered by a re-conceptualisation. I now move on to explore the second article.

5.1.6.2 Article-2

Byrne,D (1997) ‘ Chaotic Places or Complex Places – Cities in a Post Industrial Era’.
In Westwood,S and Williams,J (eds) *Imagining Cities*. London: Routledge.

Byrne in this essay attempts to use chaos/complexity theory insights to comment on and argue for a viewpoint on internal processes that he sees as happening in post-industrial cities in the UK. He uses this viewpoint to reflect - again with the aid of chaos/complexity theory - on the larger issue of the role of structure and agency in urban transformation. An explicit ontological claim for the theory runs through the essay as the author attempts to empirically test a hypothesis based not upon the contextualisation of a transfer based upon structural mapping, but rather a hypothesis derived directly from the theory itself.

Byrne introduces the notion of ‘chaos’ as in chaos theory early (pg 51). Sensitivity to initial conditions and the possibility of order emerging from chaos are highlighted as insights gained from chaos theory. Specific terminology is introduced namely ‘strange attractor’, ‘torus attractor’ and ‘phase states’, all of which are not explicitly expounded, though one might vaguely guess that these have something to do with stability (pg 52,53). The author proceeds to use these terms to argue for a qualified determinacy, which he contrasts with ‘linear determinacy’. This is a central theme of the essay, for as far as has been made explicit in the essay, the justification for the use of chaos theory essentially starts with this felt correspondence – that of non-linearity in chaotic systems and also in the real world.

The word ‘torus’ again comes up later in describing Graham’s account of possibilities of urban transformation. Byrne uses the word in a substitutive sense for the literal meaning ‘reconstitution within limits’ (pg 54). Though torus can be said to possess this property it is not *the* defining property of a torus, for all attractors excluding the point attractor has this property. Similarly later in the text the author defines a ‘torus’ as ‘characterised by self-similarity’ (pg 56). This however is not a property of ‘torus’, as self-similarity is a feature of strange attractors of which torus is not one (see sections 2.2.3, 2.2.4, and 2.3.2 for a description of phase spaces, different types of attractors and strange attractor). The torus is technically a quasi-periodic

attractor (discussed in section pg 2.2.4, pg 35 and illustrated in Figure 2.3) discussed earlier in this thesis. So one must conclude that the choice of the word is a case of a wrong metaphor, though here it makes no difference, as the metaphor is not really understood or introduced to the reader and thus conveys no additional insight to one not well versed in the terminology of complex systems.

Further on Byrne, introduces defining features of complex systems quoting from Reed and Harvey (1992, pg 55). In the quote they are said to be 'governed by an evolutionary dynamic that is of a far from equilibrium state', are 'inherently historical and intensely innovative', have capacities for 'spontaneous change and long range tendencies towards evolutionary behaviour'. Their 'internal dynamic is said to be ontologically unique' as is predicated on 'self-replicating, non-linear feedback'. Though literal meanings of terms 'far-from-equilibrium', 'non-linear feedback', and 'long range tendencies towards evolutionary behaviour' are known, their connotative meanings cannot be expected to be known to a planning or social science based audience, at least not yet. Hence a serious reader is left with a sense that the writer means something more and important which has its base in complexity theory but cannot guess what. This invariably leaves him/her with a sense of mysticism about the theory as such. Essentially the same response results when the author quoting Nicolis and Prigogine (1989) in Reed and Harvey (1992) uses the terminologies to make the claim 'perturbations of far-from-equilibrium conditions can originate in the values and actions of human themselves' (pg 55). How is one to agree or disagree when the full meaning of the terminologies is obscure? As stated earlier it is the task of the author when using concepts in one domain in another domain to explain the meanings he/she attributes. (In the original work of Reed and Harvey, this is done and the sentence reads in context with ideas and concepts introduced earlier in the body of the text).

Byrne in introducing the property of 'sensitivity to initial conditions' makes good of the earlier omission and expounds the meanings/properties he attaches to the phrase. However the same form of obscuring of meaning happens again when 'dissipative systems' is used. As per the definition provided – 'all dissipative systems have to be understood as being characterised by a dominance of information over energy with information representing both order and the origins of disorder' (pg 55). One never can decide if social systems can be dissipative as the meanings of 'energy' and the phrase 'information representing both order and the origins of disorder' are

obscure. Thus claims made for social systems based on it being classified as a dissipative system remain at best again unconvincing.

The employment of the concept of 'fractals' takes another turn. From Casti (1994) the author quotes referring to the concept of fractals -

“Moreover they have exactly the same degree of irregularity at all scales of measurement. If you start looking from a distance (i.e., with a long ruler) then as you get closer and closer (with smaller rulers) small pieces of the curve that looked like formless blobs earlier turn into recognizable objects, the shapes of which are the same as that of the overall itself (pg 56).”

Following from this Byrne wants to argue that expressions of global restructuring can be primarily seen in intra-urban analysis and not in inter-urban analysis. He maintains that

“studies which emphasise the distinctiveness of localities, and especially whole city regions, have been using too long a ruler, ...we need to look within cities, at intra-not inter-urban differentiation, if we are to find the expressed consequences of what is certainly a phase state change (pg 56).”

Three immediate questions arise : 1) why should we consider cities to be fractals? What makes it so?; 2) If fractals exhibit self-similarity across all scales and conceding that cities are fractals then how exactly does scale matter for bringing out consequences of global restructuring? Should not the effects the author is searching for be visible across all scales as it exhibits properties of self-similarity across scales? The use of the term fractals here then seems to be actually counterproductive to the argument that Byrne wants to make 3) What is the significance of the metaphor 'phase change' here since it is explicitly asserted? How does it add to the argument for detecting what the author is searching for? What comes out is thus a deficiency in terms of

- 1) joining of two domains through an unconvincing metaphor, primarily because the nature of compatibility is not clearly stated,
- 2) improper explication of the meaning of the metaphor, with which the information available seems to be incommensurate and counter productive to the argument for which it is used,
- 3) introduction of unfamiliar redundant metaphors that serve to distract rather than expound the argument.

The text actually is packed with usage of unfamiliar metaphors not clarified by the author. Thus we have terms and phrases like ‘autopoetic’, ‘change from torus form to a butterfly form’ and whole sentences like - ‘the conception of a butterfly attractor as descriptive of household/individual possible phase states is profoundly pessimistic for simple talent/energy-based models of individual or household social mobility’ (pg 56) - can only be ignored by a reader not well-versed in complexity theory. It is also puzzling for one who is reasonably acquainted with the theory, as the sense in which the author uses it is not explicitly made clear. As Goatly (1997, pg 127) states

“though misunderstanding, infelicitous uptake can occur with all speech acts, utterances like metaphors which are highly dependent on pragmatic inferencing are particularly risky.”

The empirical part of the essay is based upon a hypothesis of the urban process as a complex system. From a study of selected industrial cities, the hypothesis that Byrne seems to advance is that

they (industrial cities) have indeed changed from toruses into butterflies. Complex models suggest that we should look for changes in key variables which have increased by about a factor of 3 (pg 62).

Following from this the tasks laid out become 1) to show that cities have changed from toruses into butterflies, 2) that there is an increase by a factor of 3 in key variables. A reader of this article remains confused as to why cities should be considered as ‘toruses’ in the first place and secondly, how they can be considered as ‘butterflies’. Both usages are not systematically presented or argued in the text. Here also the problem of comprehension extends to those reasonably familiar with complexity theory, as which properties of toruses or butterflies the author is referring to and wants to emphasize is not known.

I contend that the need of linking the empirical work to complex system dynamics and the need for describing it in terms of ‘chaotic’ or ‘complex’ places itself remains unclear. First, because as we have seen in section, 2.3.2, a butterfly attractor is not the only strange attractor that a complex system can possess. It is just one among many. Second, as I understand it, Byrne is looking for bifurcations and an increase in a key parameter by factor 3. In doing this he is assigning the key parameter as equivalent to the ‘Feigenbaum’ numbers in complexity theory (see section 2.3.7, in this thesis). He states:

“I don’t want to reify Feigenbaum numbers but here we have one and we have the phase form which it suggests would occur (pg 63).”

Both Feigenbaum numbers and the relevance of the number 3, especially for social systems, are not introduced. One must assume that Byrne’s intention, in claiming a Feigenbaum number in his analysis, is to prove that the system is a complex system (Again as stated in section 2.3.6, one must remember that in the natural sciences, this is a method used for proving that a system is a complex). However, it is nowhere stated or proved as yet at least, that this is an accepted or even necessary proof for complex *social* systems. The argument for complexity in social systems normally adopts a line of argument starting from what systems are, what an open system is and what complexity in social systems mean (in Luhmann, 1995, for instance).

Byrne further on in his paper, discusses how policy must respond to the empirical analysis presented. First, he argues that two sorts of policy have created the butterfly form. This argument is separate from complexity theory or the empirical work. It builds on the author’s understanding of urban processes. He then reviews the potential for ‘complex founded policies’ (pg 65). The review is again separate, using general properties of complex systems. Byrne presents three forms in which the policy comes, leading to an argument for a

“creative engagement with complex urban realities, based on a clear Gouldian understanding of the historical process by which we got to where we are now (pg 67).”

This for Byrne,

“can be illuminated precisely by a consideration of how the present butterfly form of industrial cities has developed, and of the role of housing and planning policies in its creation (pg 67).”

If the object of the empirical analysis is to prove that cities have come to a butterfly form, it is again not clear what contribution this makes to better comprehension, as the connotative significance of the term in the sense of what it means in complexity theory is not introduced. Arguments in a similar vein are thus quite lost on the reader

“It could be argued, using the vocabulary of complexity, that policy sought to create an attractor state which did not exist in the range of possible attractors (pg, 68).”

The use of complexity theory here thus remains unconvincing both for those who are curious about the theory as such and for those whom the author targets when he states

“The point of this chapter is to try to present a framework for understanding the situation to be dealt with and to assert that the task is actually a do-able one (pg 69).”

To summarise the discussion of this chapter, it remains unconvincing overall due to 1) it not being based on a careful mapping of concepts with their meaning and relations from one domain to another, 2) the author takes off from a hypothesis derived directly from complexity theory itself (as developed in the natural sciences), without attempting to contextualise or without giving reasons why the concepts might hold promise for the target domain discussed, 3) the empirical work highlights results that are *described* using terminology from complexity theory. The empirical work as such does not use the theory, nor are any new insights gained from the reconceptualisation of the result highlighted. The use of complexity theory thus loses its legitimacy and strength, 4) the numbers chosen for verification in the empirical work and the significance attached to them are not explained clearly, causing the claims made to remain again unconvincing.

Summarising from the above two case studies we can conclude that there is some ground for scepticism in the use of complexity theory in planning. This has primarily been due to three factors. First, as we have seen earlier, there are ontological and epistemological claims that complexity theory makes which needs to be mapped into the social domain and contextualised. A realist view would advocate a structural mapping that retains relational features, while a pragmatist or constructivist view would emphasize the cognitive function of the mapping as demonstrated by Morgan (1998). Second, there needs to be greater appreciation for the conditions of metaphoric theory transfer. If these are not met, the result is quite counterproductive rather than innovative or original. Third, metaphoric theory transfer can only be effective if appreciated as Rorty (1991) says by ‘us’ meaning the community with which the writer is communicating. This is because theory construction metaphors demand that they be explored and contextualised within the target domain. Only then will it give rise to other research agendas, the articulation and exploration of which is best advanced by the effort of a research community.

5.2.4 Implications for a Methodology

In this chapter, hitherto, I have laid out a framework for evaluation and then discussed the use of complexity theory in planning through a critique of two articles. I now reflect on how far the framework can be adapted to formulate a methodology for theory transfer. First, the framework stipulates adequate knowledge of the target domain and source domain. If there is not enough evidence for this, either because the terms are not explained to the reader or because they are inappropriately used, an unconvincing argument can easily be the result. Second, the framework calls for an explicit explication of key similarities and analogies across domains that justify the transfer. This applies if the theory is directly used (because in the target domain where it has not been stabilised and accepted, it still acts as a metaphor) or if concepts or properties are used. An *a priori* analogical likening can be drawn stressing parallel concepts ideas or processes, which urge the reader to proceed further as there could be something in the likening waiting to be drawn out. Third, the framework calls for an attempt to abstract and elucidate essential relational features from the source domain that contribute to establishing a causal claim or a cognitive claim. This is a key step for theory transfer as it is through this process that a reader gets to know the worth of the metaphor, its denotative and connotative meanings. The final point in the framework requires that there must be an attempt to relate the imported abstraction to other theories - theory contextualisation (as discussed in section 4.1.3,) and empirical results in the target domain for only then will the metaphor attain full meaning in the target domain and thus get stabilised.

In examining the use of complexity theory in planning by employing the theory of metaphors, I have also shown how it helps us to understand to a large extent, the mysticism or scepticism accorded to complexity theory and its utility. The theory of metaphors helps us appreciate that there may yet be possibilities to explore the application of complexity theory in planning through a more rigorous methodology and equally rigorous articulation. The path that such a research agenda might adopt is sketched out, in the framework of evaluation itself, with an illustration of pitfalls that one needs to be careful about. It must be stressed that there is no claim made here for the exclusiveness of the theory of metaphor as a method for theory transfer. It might equally well be possible by 'reach of reason' or inference (Green, 1993), or by substantiation of an ontological claim such as transcendental realism (Martin and Harre, 1982) or by means of generalisation and re-specification (Luhmann, 1995). A

full theory transfer, contextualisation and construction may ultimately be a mix of all these methods attaining importance at various stages of theory transfer and development. Also unearthing of disanalogies need not be seen as totally detrimental. It is rather intrinsic to a process of refinement of the theory in the target domain, especially in the initial stages. Transfer of complexity theory into social science or planning is still in its infancy especially in the non-quantitative stream and hence there is a case for the metaphorical method of transfer at this stage and especially so for this thesis.

5.2.5 The Scoping of Theory Transfer and Contextualisation in Planning

Having presented the argument for the use of theory of metaphors as a methodology for carrying out theory transfer, it now becomes necessary to limit and define the scope of the thesis for the actual execution of theory transfer. This section is concerned with this delimitation and scoping.

Theories from complexity - as has been stated at the start of this chapter - can be generally categorised under theories that deal with complex systems expounding properties of complex systems in general (spontaneous order, robustness, importance of chance, indeterminacy, dependence on initial conditions etc) and theories that deal with specific concepts (strange attractors, fractals, autopoiesis etc) expounding these concepts. In the case of general properties, (as I have argued both in section 4.2.2, and in section 5.2.1) many concepts have been around in the social sciences for quite a long time before the discovery of these phenomena in the natural sciences. They have thus a history of their own within social science. New properties discovered of complex systems in the natural sciences and their consequent adaptation must follow a research agenda grounded in tracing the history of these concepts in the social sciences. This clearly not being the research strategy adopted so far in this thesis, I refrain from pursuing this line of enquiry. I move then to the second line of enquiry that remains open – new concepts that have specific properties.

As argued in section 4.2.2, the discovery of new concepts and its isolation is difficult in the social sciences due to the nature of the discipline and the nature of the objects that are dealt with in social science. The new concepts discovered in natural science therefore present new areas for social science to investigate and engage in. The opportunity presented by the discovery of these concepts, thus provide a second rationale for engaging with complexity theory. In this thesis then, in continuation with the research strategy adopted so far, given the inevitable need for scoping, I choose to

concentrate on the transfer and contextualisation of specific concepts, rather than general concepts.

Two concepts for theory transfer and contextualisation have been chosen – fractals and autopoiesis. Essentially the choice rests on methodological potential. ‘Fractals’ is a concept that is little investigated within the qualitative stream of social science (though work has been done on the quantitative stream involving modelling-essentially looking into physical urban forms as being fractal). An import of this concept into planning, would then involve a case of theory transfer amenable to the methodology derived in this chapter. In the case of autopoiesis however, as we have glimpsed in Appendix-5, serious (and sustained) work has been done within social sciences transferring the concept into the social domain involving a ‘generalization and re-specification’ (Luhmann, 1995, pg 14) in line with the epistemology of systems theory. This concept then, when examined for relevance within planning primarily calls for theory contextualisation rather than theory transfer and thus raises different questions which consequently must be approached differently. It is also, in terms of theory development, a step further advanced, when compared to what is required in the case of theory transfer. Thus by choosing fractals and autopoiesis, I am in fact addressing two types of methodological questions that are relevant in different stages of theory development. The rest of the thesis carries out the theory transfer and contextualisation within the discipline of planning.

5.2.6 The Choice of the Case Study

Here I provide a brief justification for the choice of the case study and the implications of the reasons for the choice. The case-study discussed for illustrating the relevance of the theory is the People’s Planning Campaign (PPC) of Kerala, India. In the preface of this thesis I have mentioned how the thesis started off from a need to understand the PPC in holistic terms. Thus partly my readings of complexity theory and the ways in which it might be relevant to planning has been inevitably shaped by my experiences within the PPC. Many concepts in abstract made sense to me only when I imagined it in terms of the PPC. Hence one strong reason for the choice of the case study is my relative familiarity with it and the fact that it was in fact the initial impetus for the thesis.

Though the personal factor remains, the choice was also possible because the PPC in fact has characteristics that are in line with the argument of this thesis. Thus it embodies a set of reforms in planning practice that does not centre the planner, even

while centering planning as a societal activity. Planning as a profession in the case study is encased more in ways in which societal dynamics can be channelled to produce a certain ordering of society that recursively feeds on itself. The strong presence of this type of dynamics within planning, (almost to the exclusion or relative neglect of the first type of planning engagement) – what I have called planning in the second order - also makes the PPC an apt case (perhaps the only one for a variety of concepts, though not the only possible one) for illustrating and discussing the ambit of complexity theory in planning.

In short then, the choice of the case study rests both on its substantial and heuristic potential. Heuristically, it provides the matter and content for contextualising the abstraction of theory and substantially, it argues and demonstrates the contribution of the theory. The implications of the ground of the choice of the case study are then that it is used primarily for the process of theory development within planning – to illustrate and to ground the theory - rather it being used to illustrate a problem that the theory might solve. The latter use is important no doubt but can be done only after the first, and as such is at present out of scope of this thesis. The ambit of discussion of the case study here is then limited to a re-conceptualisation.

Conclusions

This chapter makes the transition from social science theory to planning. The argument primarily rests on a conception of planning as being closely related to practice. The difference between theory and practice was first reviewed. Based on this I positioned the level of abstraction and generality that planning theory engages in as being between knowledge claims and practice. I then examined the methodological implications of this conception of planning theory, arguing for a need for a second level of engagement – that of planning of planning, which then allows for specificity as well as generality. I then positioned the contribution of this thesis as being towards this second level of engagement.

Second, in this chapter, I have presented a general overview of the various ways in which complexity theory has come to be used in planning and social science. From a general critique of the use, I argued the need of a more rigorous framework for theory evaluation. I proposed the theory of metaphors as a theory of theory transfer and then proceeded to build an evaluative framework based on this theory. Two published articles were then reviewed using the framework. Taking into account,

the insights that this yielded, I arrived at a methodology for carrying out theory transfer from one domain to another.

Third, I presented the scoping of the thesis in relation to the actual transfer of concepts into planning. Two choices for working with complexity theory were presented and discussed. Of these two choices, the group of concepts that deal with properties of complex systems was set-aside as dealing with these concepts would necessitate a different research strategy from that pursued so far in this thesis. The second group of concepts which are specific and new have been argued as more suitable for this thesis in its present form. Next, I presented the arguments for the choice of two concepts – fractals and autopoiesis - based on methodological grounds which potentially provide an opportunity to exercise two different types of approaches, one requiring theory transfer and the other requiring theory contextualisation. Finally I discussed the grounds for the choice of the case study highlighting that it is used primarily to aid theory development rather than to describe a situation which the theory ‘solves’. The discussion of the case-study is thus limited to a re-conceptualisation.

This chapter then contributes to the overall research strategy in terms of making explicit the understanding of planning theory (this being the target domain) that informs the theory transfer attempted in this thesis and the domain of planning activity towards which the insights from complexity theory is claimed to contribute. In terms of the process of theory transfer the chapter develops a methodology for theory transfer and delimits the scope of the thesis in carrying out this transfer.

FRACTALS IN PLANNING AND GOVERNANCE**Introduction**

Hitherto in this thesis I have examined the philosophical and theoretical base for complexity theory in the social realm. I have then argued for the need for theory to link into practice especially for a practice based discipline such as planning. From this argument, I suggest a level of abstraction and purpose for planning theory. Next, I moved on to construct a general framework for ways in which a theory might be imported into another discipline. I examined two instances of the use of complexity theory in planning, arguing that the employment of the theory was wanting in many ways. From the evaluative framework and the examination, I then proceeded to define a methodology for theory transfer and contextualisation. The scoping of actual theory transfer carried out in this thesis has also been discussed. In the chapters to follow I now carry out the task of theory transfer and contextualisation.

This chapter focuses on the concept of 'fractals'. In examining its relevance for planning, the process involved here is one of theory transfer. Therefore, first, in this chapter, I re-examine the concept of 'fractals'. The re-examination aims to define the concepts more clearly by way of abstraction of key definitional features and effects, in terms of causality. These definitional features in turn highlight the distinctiveness or uniqueness of the concepts themselves. A parallel line of argument is then drawn within planning highlighting the potential for fractals to exist within planning. An *a priori* argument is thus advanced for the possibility for fractals in planning. From the second part of this chapter onwards, I examine an empirical situation for the claim of fractals. The definitional abstraction and the manner in which it might take shape in planning, is first illustrated. The causal effects are then probed for empirically following a discussion of mechanism and causality. Finally, the abstracted features are linked to the causal effects noted and the theory of fractals is discussed in relation to other notions of institutional design presently seen in the literature. Fractals being essentially a spatial concept, the way in which it fills a gap in concepts of space currently in use in planning are also discussed extensively in Appendix-8. Methodologically then, this chapter follows the methods derived from the theory of metaphors and strategically it addresses the level of theory transfer, empirical investigation and theory contextualisation needed for theory development. The chapter thus, besides constructing a substantive argument

within planning for the claims of complexity theory, also becomes a methodological illustration for both the process of theory transfer and the epistemological claims of complexity theory.

In Chapter-4 of this thesis, I have argued that complexity science accommodates the causal mechanism based explanations, as well as more meaning laden interpretive explanations and morally laden normative streams. In this chapter, the mode of explanation is causal, based on relations (in line with systems theories) as well as recursivity (in line with complex systems). It is pitched at the level of second order planning argued for in Chapter-5 and thus in turn accommodates different forms of causalities including mechanism based causality within itself, at the level of first order planning. There is thus no claim advanced for any exclusiveness in second-order planning. It operates concurrently with first order planning but at a different level. These are brought out in the discussions that follow. As I have argued earlier, theory development is an ongoing process and as an initial step, there is also no claim of exhaustivity here. On the contrary, the focus is on providing an argument robust enough to provoke a number of research agendas.

In approaching the task of providing a substantive argument as well as a methodological illustration simultaneously, I follow an ordering that I hope will serve to highlight both. The emphasis is unambiguously on the logic of the concepts and their relevance for planning. The case study is therefore introduced in a piece-meal manner highlighting aspects that are of relevance for the argument being constructed. The storyline for the case study is thus discontinuous, but eventually adds up to form a complete picture that might possibly be of interest in numerous other ways. These are not discussed as they move away from the scope of the thesis. However some effort is made to connect the findings to different streams of knowledge within planning, besides those discussed initially. A reflexive part that discusses the methodologically illustrative intention is included towards the end of the arguments.

6.1 The Appeal of Fractals

In this sub-section, I underline features in fractals that make it appealing to a field like planning. I then use examples from planning to explore ways in which fractals could potentially exist within planning. Tentative links between fractals and planning are thus created here, which are explored through later in more detail.

6.1.1 Fractals through the Natural Sciences

I have introduced the notion of fractals in some detail earlier in this thesis (section 2.2.5). The emphasis is now on an identification of key defining elements, for a first step in

theory construction, according to Bhaskar (1998c, pg 229), is to get at a real definition of an object/ or a form.

Fractals as we have seen earlier are structures that give rise to symmetry not limited to one scale, but across scales. They define systems that exhibit self-similarity across scales. Depending upon the type of situation under study, there are different ways in which self-similarity can be conceived, and these correspond to different ways in which a fractal can be identified or generated. It can be thus, either through a geometric rule that is recursively applied, a relation rule that is recursively applied, or a stochastic process again recursively applied. The resulting fractals might be exactly similar, quasi-similar or statistically similar, corresponding to the type of rule applied, leading to either self-similarity or self-affinity (<http://www.absoluteastronomy.com/encyclopedia/F/Fr/Fractal.htm>).

In stressing self-similarity or self-affinity, fractals essentially imply recursive scaling – a pattern inside a pattern. Building up on the different ways in which fractals can be formed, essentially two ways in which fractals can be conceived and consequently identified can be suggested. The geometric rule and the relational rule essentially stress self-similarity of *form*. One way to look at fractals is therefore to look for structures that are self-similar structures in *form*. The self-similarity in form then suggests the presence of qualities (could be either morphological or generative) that are present across scales and are thus invariant. The presence of invariant qualities in turn suggests the possibility of iteration taking place across scales as processes that enter the system get modified with respect to the same features. In its dynamic form, the system can then get hinged together and recursively feed upon higher and lower levels.

If one were to follow the stochastic rule on the other hand, another way of looking at fractals is suggested. This is to look at dynamic iterative *processes* that could result in potentially different manifestations across scales. Here the iterative process *a priori* hinges the system across scales. The actual manifestation of the form of the invariance that the scaling preserves can vary across scales, even when the invariance is retained, because the system takes into account other emergent factors that may be pertinent to that particular scale. The observed manifestation here is then a result of invariance as well as specific scale level emergent factors. Thus qualitatively different manifestations are possible even when constancy is implied – the presence of regularity within irregularity.

Both these ways of looking at fractals, potentially give rise to the possibility of achieving infinite reach or detail within finite space (see description of Koch curve provided earlier on page 39). It then suggests the possibility of two different *methods* to achieve reach

or detail – the one starting with a form that gives rise to a *process* due to the iteration that takes place, the other starting from a process that gives rise to a self-similar *form* due to some aspects or qualities remaining invariant by the specification of the process. Overall in systemic terms it suggests a way of seeing systems through scales, pointing to the *methodological* importance of scale in both form and process.

There is a vast amount of mathematically based literature describing fractal equations of various kinds that generate fascinating patterns exhibiting essential qualities of self-similarity, scale dependence, recursivity and capabilities for dissolution into infinite detail. There are also many good popular science books that introduce one to qualities that flow from a fractal structure (for instance Gleick, 1987, Briggs and Peat, 1990). There is however very much less descriptive literature on fractals that systematically enumerates its definitional relations non-quantitatively. Earlier in the epistemological hierarchy of Bunge, we saw that mathematics is placed at a higher level of abstraction than systems theories. So if the concept of fractals is to be brought down into the domain of practice, what is now required is an interpretation of fractals that preserves its essential mathematical qualities yet adds a level of epistemological contextualisation that will facilitate a further contextualisation in disciplinary domains. A non-quantitative interpretation is required. Hayles (1990) does this to some extent. But here too, a step-by-step logically built up argument is not presented. I attempt to do this below.

6.1.2 A Conceptual Abstraction of Fractals

There are two key types of quantitative abstractions associated with fractals – the fractal dimension and the formula (algorithm) that gives rise to fractals. I examine both below to see what is entailed in both.

The quantitative way in which irregularity of fractals is measured involves what is known as the fractal dimension. Essentially it is an indicator of the amount of irregularity accommodated within an encompassing object/system. Thus roughly it can be conceptualised as the “capacity of a set of points to partly fill a line without achieving it completely” or the “capacity of a line to partly fill a plane without achieving it completely”, or again the “capacity of a surface to partly fill a volume without achieving it completely” (http://pro.wanadoo.fr/quatuor/english/fractal_21.htm). This then is essentially a quantitative *indicator* of what can be (restrictively) thought of as a non-quantitative quality – an indicator that allows one to assess the amount of reach that is achieved by the *form* of any particular fractal system. In methodological terms it has then implications for the *design* and *correction* of fractal systems. The process that arrives at the indicator nevertheless involves a

mathematical calculation. It can be thought of thus as a quantitative expression of a qualitative parameter.

With respect to formulas that give rise to fractals, I examine here the Mandelbrot equation (which is a case of a relation rule giving rise to quasi- similar situations) to arrive at an interpretation of the essential components of relational fractals. I will not go into too much details of what these numbers signify or what the Mandelbrot set is here. This is because in this exercise, I am essentially concerned with the interpretation of key relational features, which can then potentially lead to an identification of fractals.

The Mandelbrot equation is given as $Z_{(next)} = Z^2 + C$. The term C here indicates a constant that is kept the same through repeated iterations. The equation then essentially contains the following i) a constant term that is invariant across repeated iterations (here the term C), ii) a formula (here a squaring and an addition of a constant term) that specifies and thus guides the next output, iii) numerical terms that effect the distance that separates two consequent iterations in a constant way (here the number 2 that indicates squaring of the term 'Z' and the constant C), iv) re-entry of the output into the input which then actually gives rise to an 'axis' through time (since the output will always share partly the features of the input).

The above statements of key relational characteristics now allow the formulation of a *general descriptive statement* of what is involved in a relational fractal. First, self-similarity can be seen as a critical property. This is the first definitional feature. (In the above equation it can be seen that $Z_{(next)}$ will always contain the previous terms within it.) As we have seen by another argument presented earlier, it is only when systems are self-similar that they can be coupled and consequently aligned and correlated across different scales. Different levels of time-space spreads have different characteristics though they may be self-similar (due to the variation caused by the formula that specifies the next output). This points to the uniqueness of scale manifestation. Hence a question asked of a manifestation of a fractal system will have a unique answer that is scale dependent. Also in a fractal system, levels do not operate in isolation but are hinged to different time-space levels, each of which is uniquely defined. Thus change in one level results in a change through-out the system (if for instance the value of C changes for one iteration in the formula). If the levels co-exist in time then the results of the outputs will feed recursively to scales below and scales above, thus constituting an important mechanism for co-evolution. The local here will constitute the global and the global will reach the local by means of this mechanism of correlation, which hinges them together. In a fractal configuration of complex systems then, movement between scales become "highly non-trivial" (Hayles, 1990, pg 212).

The second factor of importance is the length of the scale (specified by the formula and values that changes the input to the output). This becomes critical. Detail (in the sense of many scale dependent solutions for intermediate scales) can be lost if too large a measure is used, while it would just be replicated if too small a ruler is used. In other words sensitivity of the system to scale dependent detail – the resolution of the system, will be a function of the ruler (both in terms of the calibration as well as the overall length) used to define different time-scales. So specifying the calibration and length of the scale demands attention.

Third, we have seen that fractals can achieve global characteristics in a way uniquely sensitive to the fine-grained local. There is an axis of correlation, which allows fractals to do this (formed by the iterative process involved in the formula). The coupling potentially provides not only the axis for transmission across scales, but in fractals that are self similar in form, it also allows the scope for magnification, complementariness, or substitution by higher order solutions. The nature of the coupling is thus crucial. It needs to be decided both quantitatively and qualitatively. The quantitative dimension - that is how much variety of points of coupling are needed and the qualitative dimension - that is which features need to be coupled, will define the way the system performs. The quantitative dimension will define the system complexity, while the qualitative dimension will define the system sensitivity to detail in variety, not detail in numbers. The encoding of this information then becomes the third point that demands attention.

Fourth, in a fractal systems, the global cannot subsume the local, not only because the “locality intrudes itself as a necessary descriptive feature, defeating totalization” (Hayles, 1990, pg 210), but also because the global itself is an emergent property from the detail of the local. In other words the local at particular scale will always be distinctive due to the unique factors that modify the invariance at that particular scale. The encoded mechanism, along the vertical axis referred to above, allows the deconstruction of macro-level phenomena. However there is a mechanism also needed for allowing the deconstruction to be specific to the increasingly fine-grained texture of the locality - a mechanism for the system to acquire ‘roughness’, while still remaining orderly in the vertical dimension. This mechanism will also have to relate in the reverse direction to simultaneously assimilate contextual phenomena unique to that scale. This is the horizontal dimension of the system as it operates within a scale as opposed to the earlier mechanism, which operates across scales. This then is the fourth point that demands attention. The figure below conceptually presents the case.

The above four simple parameters then, can generate a number of solutions in different subject domains- solutions that suit different situations and different purposes.

Whatever the detail of the parameters, these systems can be said to have certain essential properties. The global and the local gets defined simultaneously – the local, which is historically specific and scale specific defining the nature of the global, while the global in turn reflexively acting upon the local to allow for creativity and emergent properties. The onward progression along the coupled multiple levels can thus allow for variety and order to co-exist at the same time constituting an operative goal that planning as a profession can identify with.

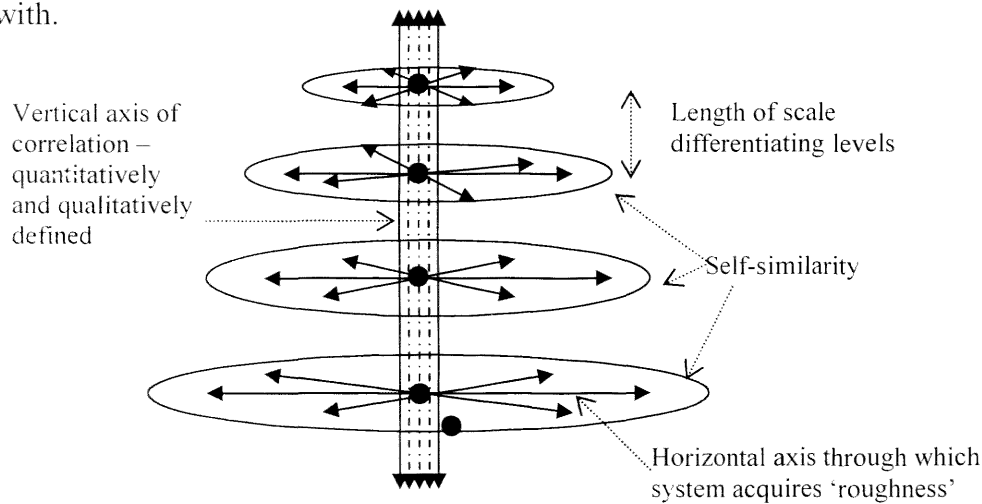


Figure-6.1: The Four Guiding Parameters of a Fractal System

As Hayles (1990) points out, in the fractal paradigm, what counts as a temporal (and spatial) explanation is fundamentally different from what counts as an explanation in the Euclidean paradigm. There is discernable an unmistakable logico-scientific argument that lays claim to an universality. The claim follows a systems ontology in that it is time-space relations of constituent parts, rather than mechanisms identified at a lower level of reality that are attributed causality. It is also distinct in another sense. In older paradigms, a cause-effect explanation places events along a temporal or spatial straight line. In fractals, by contrast, an explanation means understanding the structural principles that relate different sites together by self-similarity or interaction, along with the rules that govern their evolution over time. Thus “the system is no longer conceived as a mass of points moving along a predictable path, but is seen as the evolution of the internal structural principles that describe the propagation of self-similar symmetries” (Hayles, 1990, pg 218).

Having interpreted the abstracted qualities and definitional and attributional features of fractals from a systems ontological viewpoint, I now argue for its relevance to the field of planning. For as argued by Bhaskar (1998b, pg 50), in transcendental realism the possibility

for some things or mechanisms to exist can be established by philosophical argument, but it is the job of the substantive disciplines to establish which ones do. In the following section, I present varied types of empirical examples, that alerts us to the possible existence of ‘fractals’ as an abstracted, but empirically operating concept within planning. This lays the ground for hypothesizing the plausibility of fractals in planning

6.1.3 Fractal Effects in Planning

Scales in governance have been traditionally organised along service delivery logic or an administrative logic of distributing responsibilities. In discussing the significance of fractals for planning, I contend that this is a limited logic that excludes a meaningful understanding of scale and its role. I ground my argument on three empirically noted phenomena, which I shall call the distributive phenomenon, the amplification phenomenon and the emergent phenomenon. I shall describe what I mean by these with recourse to concrete examples.

The ‘distributive’ phenomenon is a rather commonly known organising principle for delivery. Very simply this relies on a branching logic, very like the fractal branching of trees or the blood vessels in our body. The principle is commonly used in infrastructure provision, when main roads branch into secondary roads, which in turn branch into tertiary roads and so on. The logic of branching is the same and each branch reflects the larger and smaller on a functional logic appropriate to that level. However in the institutionalisation of this fractal logic, the system is conceived as being part of a single time-space logic and is consequently organised under the ‘global’ time-space logic of sectoral control which distances the local and alienates the particular. An organisation under a fractal time-space logic would bring different institutional practices that recognise the local time-space through which the ‘global’ system traverses. I shall illustrate the actual operation of this type of logic more explicitly through the case study discussed later.

The amplification phenomenon points to an importance of agency or local time-spaces as small as that of an individual. Through simple scalar amplification, it is possible for an agent to connect to global processes. This is very different from being networked into an externally controlled process. Here the agent is not a cog (with manoeuvring space) in a wheel, but rather has the potential to contribute to global processes through scale magnification and conversely tap and utilise global resources that would otherwise have been unavailable. The cause-effect relationship is no longer linear, but is scale magnified acquiring significance as it moves up the scale. To illustrate this point I shall use the example of micro-credit, a phenomenon known to contribute substantially to poverty reduction. The need for

micro-credit organisation arose due to the practical difficulty of extending credit facilities or savings facilities for the poor, who cannot operate conventional bank accounts due to the extremely small amounts that are involved. The solution to reach this group followed a fractal concept in that it relied on a self-similar constitution across scales. Thus in the micro-credit system run by the National Bank for Agriculture and Rural Development (NABARD), India, 15-20 persons form a Self Help Group (SHG) which operate an individual pass-book for every member. The SHG's now in command of pooled resources, scale magnified, bank with a conventional bank, accessing savings and credit benefits for its members (<http://www.nabard.org/roles/mcid/introduction.htm>). The SHG's are sometimes federated into area-based groups, which are in turn further federated into a city level single group, which can then bank with a conventional bank. If scale economies are attained at the level of the SHG's or area societies they can then bank at that level. Sometimes an NGO operates the account for SHGs. Here the micro time-spaces of local entrepreneurship are connected to the macro time-space of banking systems by an amplification through scale.

Finally, the emergent phenomenon claims that the solution to an issue or problem is really scale dependent. This can operate in two ways. In the first instance, one can get different answers to the same question or problem, dependent on the observer's viewpoint or the scale within which the problem is manifested. Thus the problem of inadequate infrastructure, say water supply, could yield different solutions dependent on the scale. It could be a well on an individual scale, a community supported and managed small-scale purification and distribution network on a community scale, a larger level 'water works' on a city level, and a hydroelectric project at a national scale. So the solution to any problem has not one answer, but contains numerous possibilities dependent on the scale of time-space within which it is manifested and hence fruitfully and meaningfully addressed. The choice of going local or global depends then on a recognition of the appropriate time-space scale. In the second instance is the fact that each solution in one particular scale might need reinforcements or complementary schemes at a larger wider time-space scale. Thus, if there is going to be a neighbourhood composting plant set-up, the marketing may need to be organised on a larger time-space scale. The global in this case becomes emergent from the interplay of local action, which in turn recursively feeds back into the local. The local has a say in the global, making it localised. The local-global interplay continues in co-evolution, leading to continuously creative solutions, and new issues/problems that emerge out of them.

Having defined key areas of concern that one must pay attention to in a conceptual abstraction of fractals, and the ways in which one might observe fractal effects in planning,

the next question is how these observations might be translated into concrete systematic planning practice. I suggest that the answer is highly context specific and hinges on considerations of what is the purpose to be achieved, as well as what are the value systems that inform choice. Through a re-conceptualisation, I describe below, one instance of how a concept of fractals can be identified and operationalised within planning. I describe the design of the institutional structures for the People's Planning Campaign (PPC) of Kerala, India. The claim for fractals here rests on, first, an empirical identification of the abstracted structural interpretation of a 'fractal' derived from the fractal equation – in other words by providing substance to the systemic abstraction arrived at earlier in this chapter, itself being derived from the more abstracted realm of mathematics. The structural mapping follows the arguments suggested by the epistemological hierarchy of Bunge (1973) presented in chapter-3. The need for the abstraction itself follows the methodology suggested by the theory of metaphors arrived at in chapter-5.

The claim to fractals also rests on the identification of effects associated with fractals. In other words by an attribution of causality based on effects that are observed of fractals in the natural sciences (the validity of which is described and argued in the discussion of realism in social science in chapter-3). Thus the possibility of the same effects in the social realm exists according to the realist thesis – a possibility that must be searched for taking into consideration the nature of the domain and the nature of entities it deals with in that domain for as Bhaskar, (1998b pg 89) points out, “a real essence consists of structures or constitutions in virtue of which the thing or substance will behave the way it does” and “when natural tendencies are realised, events are necessarily connected” (pg 80).

6.2 Empirical Illustration of Fractals in Planning

To retain the focus of the argument, I confine myself to describing the PPC, in terms of key parameters laid out in the previous section. Though the case study is in itself quite an exemplar for other normative concepts in planning, I discuss it here restrictively, the intention, being illustrative and demonstrative of ways in which institutional transformations of the concepts put forward may be possible. The details of the process thus are not discussed at any great length as this would be out of scope of the purpose for which the case study is recounted here. Other aspects and description of the PPC however appear in chapter-8 while discussing the concept of autopoiesis.

6.2.1 The General Background

The State of Kerala, (location provided in Figure 5.3 and 5.4 overleaf) is situated in the southern tip of the Indian sub-continent, wedged in between the Western Ghats on the



Figure 6.2: Position of India in World Map

Source: <http://www.worldatlas.com/webimage/countrys/asia/in.htm>

Accessed 09-07-2005



Figure-6.3: Location of Kerala within India

Source: http://encarta.msn.com/map_701513696/Kerala.html

Accessed: 17-02-2005

East and the Arabian Sea on the West. The population of the State is 31,838,619 (2001 census) persons over a total area of 38,863 sq kms. The division of powers between the Centre at New Delhi and the State is through the seventh schedule of the Indian Constitution. Jurisdiction over subjects are listed under three headings. Ninety seven subjects like defence, foreign affairs, currency, income tax, excise duty, railways, shipping, posts and telegraphs etc are in the Union List, and only the Union Government at the centre can legislate over these subjects. The State List has 66 subjects like local government, police, public health, communications, agriculture, lotteries, sales tax, taxes on entertainment and wealth, etc and the state has exclusive legislative powers over them. A further 47 subjects like electricity, newspapers, criminal law, marriage and divorce, stamp duties, trade unions, price controls, etc are listed in the Concurrent List over which the State and the Centre may legislate. If there is a contention the Centre is pre-eminent (Manorama Yearbook, 2003).

The State of Kerala, building on the amendments made to the Constitution of India in 1994, to ensure decentralization of governance, has been experimenting with an innovative programme known as the People's Planning Campaign (PPC) launched in 1996. This is implemented both in the urban areas and the rural areas. It aims to identify local needs and establish local development options and priorities through a process of consultation and participation with local people. In a bold step forward in decentralization, the State devolved 35-40% of the plan funds to the Local Self Government Institutions (LSGIs), redeployed more than 12,000 state departmental officials and devolved additional powers to the LSGIs (Economic Review, 2001). All this was accompanied by massive efforts at capacity building in which both administrative and subject/sector related trainings were provided, to meet the changed planning context needs. The Local Government Acts have been amended twice – once in 1994 and then in 1999. More than 35 allied Acts have also been amended to fully empower the LSGIs (Economic Review, 2001). Besides the Acts, a host of specific Government Orders have been issued to aid day to day administration and help planning.

Prior to devolution, power to plan and govern was limited largely to the state, along with the centre. Local government institutions existed more in name, with hardly any worthwhile powers or finance devolved (Isaac and Franke, 2000). Thus the length of the scale difference separating the state government from the local government was great. At the district levels, there were no planning functions with the governance function restricted to administrative powers decentralised from the State. The self-similarity criteria, the criteria for similarity across scales, necessary for a fractal formation, in terms of process and form for both the plans drawn and the institutional form that was involved in the making of the plans,

were thus not met here. How is the present system then different and how does it justify a claim to being a fractal? Herein I concentrate now on the mapping of key structural qualities arrived at earlier.

6.2.2 The Horizontal Axis

Following devolution, planning was recast into a bottom-up process. It is initiated at the bottom most level of wards in a LSGI. Each ward in a Village area consists of around 5000 families, and every person is a member of the grama sabha (the deliberating forum for direct participatory planning). In cities, below 100,000, ward sabhas are constituted and the same rules apply (Kerala Municipality Act, 1994). For larger cities with larger populations, ward committees are constituted, the composition of which is specified so as to make sure that every interest group is included. These primary bodies must meet at least four times a year. The manner of conduct of meetings and roles of facilitators as well as the formats for recording deliberations are specified (more about the conduct of the meetings in chapter -8 dealing with autopoiesis). The mechanism for horizontal co-ordination is direct participation and negotiation.

The next level consists of the representative level of village elected representatives – the village panchayats. In cities it consists of the municipal council for small cities and city corporations for larger cities. There are at present 991 village panchayats, 53 municipalities, and 5 corporations (Economic Review, 2001). Though the names are different, to denote the sizes of the constituencies they represent, the functions and responsibilities are essentially the same with the urban areas allowed more finely designated institutional structures in order to deal with urban phenomena. These bodies must look into the deliberations that have come from below, broadly consolidated through a vertical mechanism, described later. The forum for deliberation on the consolidated results is the debating chamber of the LSGI. It is self-similar to the ward sabhas/committees below in terms of principles that guide the constitution of the organisation. The horizontal mechanism of debate and deliberation is preserved in this forum and the participants in the deliberation process are the elected representatives of the people. This is unlike it being an administrative arm of a higher up government.

It must also be noted that the LSGIs are also strengthened and protected by 1) law that safe-guards their autonomy from the state and 2) by the political action of removing of ancillary structures like urban development corporations that might be a threat to the autonomy of the LSGI. All sectoral officers operating at this scale are also brought under the purview of the LSGI. Thus more than 12,000 state officials have been re-deployed to the LSGIs with the re-deployment process still going on (Lelithabhai, *et al*, 1997). Also

considerable funds have been devolved with broadly specified areas/scales of jurisdiction. It amounts to a massive 35-40% of the State budget, distributed according to an agreed formula (Isaac and Franke, 2000).

The next level is the block level in the case of villages. There are 152 block panchayats at present. The block panchayats must look into the draft project proposals of the grama panchayats and then form their own projects at a higher scale. Thus they may substitute higher level solutions for smaller level problems that are multiple. For instance proposals for a number of street level transformers to solve a voltage problem if manifested across panchayats may be substituted by a sub-station proposal at the block panchayat level. They could also be complementary projects for forward and backward linkages. Thus if a number of village panchayats have decided to encourage poultry farms, they could be complemented by either a fodder project or maybe a marketing project that takes up the distribution of the eggs. They could also be just cross panchayat projects linking up mutually beneficial projects to yield synergetic outcomes. Detailed government orders (GOs) and circulars exist specifying the appropriate scale, sector wise that the blocks can take up, the institutions that they consequently can manage, the officers that they have control over etc (GO(P)No. 189/95/LAD dated 18th Sep 1995, ,GO(Rt)No.82/97/SC-ST. dated 13th Feb, 1997, GO(A) No.161/97/LAD dated 7-7-1997, GO(P) No 113/98/LAD dated 02-06-1998, GO(P) No 113/98/LAD dated 2-6-1998, GO(P) No 114/98/LAD dated 2-6-1998, etc). Here again, core horizontal mechanisms of debate and deliberation, through elected representatives, chosen to the block panchayats, (and nominated elected representatives from the village panchayats) are preserved, while vertical mechanism through which scale transformation is achieved is also institutionally specified.

The next level is the district level. There are 14 district panchayats. The functions are similar to that of the block panchayats except for them operating at a larger scale. Again, the mechanism that gives it self-similarity is preserved. Thus the debating chamber consists of councillors elected to the district panchayat (and representatives from the block panchayats). Beyond the district panchayat is the district planning committee (DPC), which is the layer within which the urban and the rural get together. The DPC consists entirely of elected representatives nominated by the constituent panchayats and municipalities. The only non-elected member is the district collector who serves as ex-officio secretary to the committee. The DPC is envisaged both as a planning authority and a sanctioning authority. It gives final administrative sanction for plans to be executed emanating from the village, block and municipal level. For plans to be executed at the district and corporation level the state is the

sanctioning authority. We thus have a six tier layered structure of time-spaces covering the largely rural population of the state and a four tiered layering structure covering the urban areas, inclusive of the wards.

The bottom-up planning process is also complemented by a parallel division of responsibilities, within the planning system. Thus institutions and personnel operating at a particular level are devolved and redeployed to the corresponding level of local governance, for all sectors devolved. (The process is still going on and is not fully complete, though most functions are devolved). Similarly branching infrastructure like roads, electricity distribution systems etc are also devolved to the appropriate level. Thus roads within a LSGI come within its jurisdiction and the wards deliberate upon the design and maintenance. Roads linking LSGI's come within the jurisdiction of the higher level and so on. Thus effectively globally planned and executed infrastructure is mediated and contextualised by the appropriate level.

In the above account, I have presented a picture of self-similar *form* brought about by 'independent' design, in the sense that it is not processes within the PPC that has by itself *generated* the form. However the self-similarity in the design gives rise to certain characteristics in the *process*, due to iterative modification, arising from the character that is retained as invariant in all the levels. This in turn causally modifies the process as we shall see later in more detail in the discussion on self-similarity.

6.2.3 The Vertical Axis

The vertical mechanism of coordination is institutionalised through various stages in the planning process (Isaac and Franke, 2000). The first stage is that of the conduct of grama/ward sabha meetings (G.O. (MS) No 10/96/Plg, Dated 30th July 1996) that involve citizen mobilisation for identification of felt needs of the people. This is done in the grama/ward sabhas through the technique of small group discussion. The members of the grama/ward sabhas split up into groups dealing with a developmental issue and discuss the problems that concern them in that sector. The discussions are aided by group facilitators and the results of the deliberations are presented in plenary for consolidation. Members to represent the grama/ward sabha in the next stage of the planning process (development seminars) are also decided here (Isaac and Franke, 2000). The outcome of the grama/ward sabhas in planning terms are thus a sectorwise list of problems in a particular ward area, a consolidation of tacit knowledge expressed through consultations and deliberations and a list of possible solutions to the problems expressed. It thus expresses the *felt needs* of people.

The second stage of the planning process is the stage of development seminars (G.O. (MS) No 10/96/Plg, Dated 30th July 1996) that systematically appraise the felt needs put up

from below in view of resource constraints and local government level dynamics, so as to yield a comprehensive area plan that is at once democratic as well as scientific. The first steps are the collection of secondary data from different government departments operating in the area. Primary data collection was not adopted in this stage as it was felt that resources and time would not permit it. Transect walks were conducted in most rural LSGI and some urban LSGIs to mark eco-zones on which to plan the agricultural and other primary developments for the villages. Based on all the above information gathered, development reports for each LSGI are prepared. These developmental reports together with the grama/ward sabha suggestions are discussed in development seminars conducted at LSGI level, including representatives from each grama sabha/ward sabha (Isaac and Franke, 2000). A sectorwise recommendation for action that *reflects the felt needs* expressed from below emerges from these discussions.

The third stage is that of projectisation (G.O. (MS) No 10/96/P1g, Dated 30th July 1996), the preparation of a shelf of projects that converts the recommendations of the development seminar into a shelf of projects that again are *in tune with the felt needs* expressed. A common project format is provided, so that consolidation and aggregation at higher tier levels become less problematic. Sector wise task forces (now renamed as working groups) (G.O.(MS) No. 40/2004/P1ng; Dated 31st March, 2004) are constituted in every LSGI, for carrying out the work (Isaac and Franke, 2000).

The fourth stage is that of preparation of the draft annual plan document (G.O. (MS) No 10/96/P1g, Dated 30th July 1996). The shelf of projects are debated upon and prioritised by the LSGI. The decisions taken are organised in a particular format that prompts serious reflection, while allowing cross LSGI comparisons by higher tiers for discerning trends and potentials. The plan document that emerges is the draft plan for the annual expenditure of the LSGI (Isaac and Franke, 2000) which is *reflective of the felt needs* expressed from below, though not wholly determined by it alone.

The fifth stage in the process, the plan preparation for the higher tiers starts only after the plan documents of the lower tiers are well under way. They are required by government order (G.O.(MS) No. 40/2004/P1ng; Dated 31st March, 2004), to both convene a meeting of all the panchayat presidents of village LSGI in their jurisdiction for consultation, and also to mandatorily consult the plans of the LSGIs in their jurisdiction. The plans of the higher tiers thus, can reflect the local priorities agreed upon at the scale below. Plans can be complemented or substituted by higher order solutions for scale economies by the higher tiers. Also forward and backward linkages for the projects can be taken up. A plan document listing

the projects adopted by the higher tiers is the outcome (Isaac and Franke, 2000). This again has the *felt needs expressed by people at the bottom tier embedded and reflected* within it.

The sixth stage is essentially one of giving formal approval to plans put forward by the LSGIs. Since the number of projects that come up for approval are so large so as to make it impossible to manage, a system that can cope with the load had to be designed and in place. The voluntary technical corps were formed initially as a response to this. This body was constituted essentially drawing upon retired but active professionals. An expert committee was constituted at block, district and urban local body level, to scrutinize the plan documents prepared, checking them for technical feasibility. The VTCs were not expected to just return the project documents as rejected, but rather were expected to work with the LSGIs to make the projects technically feasible. The expert committees would then recommend to the district planning committees (DPC) that a particular project could be approved. The ambit of these committees have since been restricted to certain sectors like that of engineering, public works etc and the names of these expert committees have been changed now to 'technical advisory committees' (G. O(MS) No. 40/2004/Plng; Dated 31st March, 2004).

The final stage is that of formal approval for projects of the village, block and municipal levels. These are granted by the district planning committee. Projects of the corporations and districts go to the state for formal approval. The process as a whole is diagrammatically represented in Figures-: 6.4 and 6.5 overleaf.

The *process* of plan making specified here retains an invariant at every scale level, in the form of the felt needs expressed from below. This invariant gives rise to different plans, at different scales which are not self-similar in terms of *form* or content. Yet they are self-affine, in that they retain the felt needs of the people as an invariant. The plans here are thus self-similar in another sense. The repeated iterations in this case are the institutional norms by way of government orders that specify that the plans at every level must look into plans from below. Here then we have another methodological approach to self-similarity – different forms arising as output from a process that specifies iteration.

In this brief re-description of the PPC in fractal terms, I have highlighted the criteria of self-similarity, and picked up the horizontal and vertical axis of co-ordination as it might be manifested in plan making, planning practice and planning institutions. In describing the self-similar horizontal layers that remain separate but hinged together, by the planning process, I have argued that the specification of the self-similar *form* subjugates the plan to similar types of processes at every level thereby in effect resulting in an iteration that reinforces certain characteristics. I have also described the vertical process that by specification involves

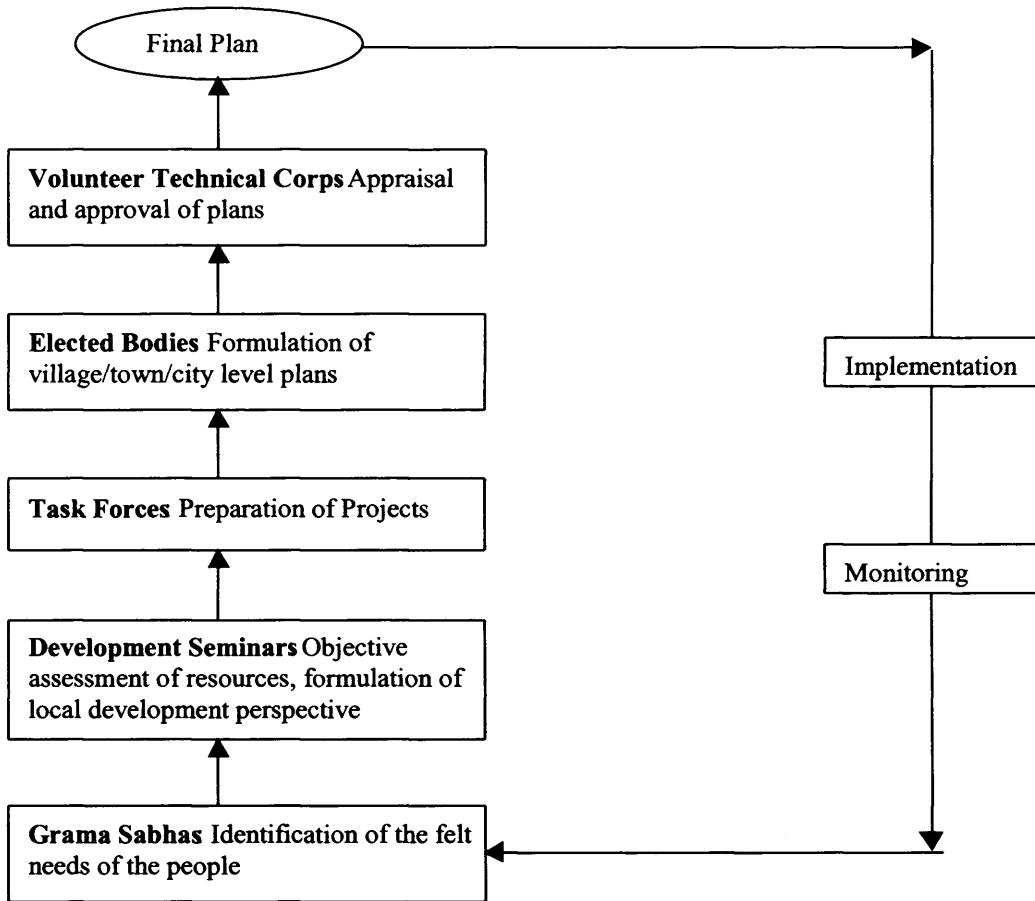


Figure-6.4: The Planning Process of the People's Planning Campaign

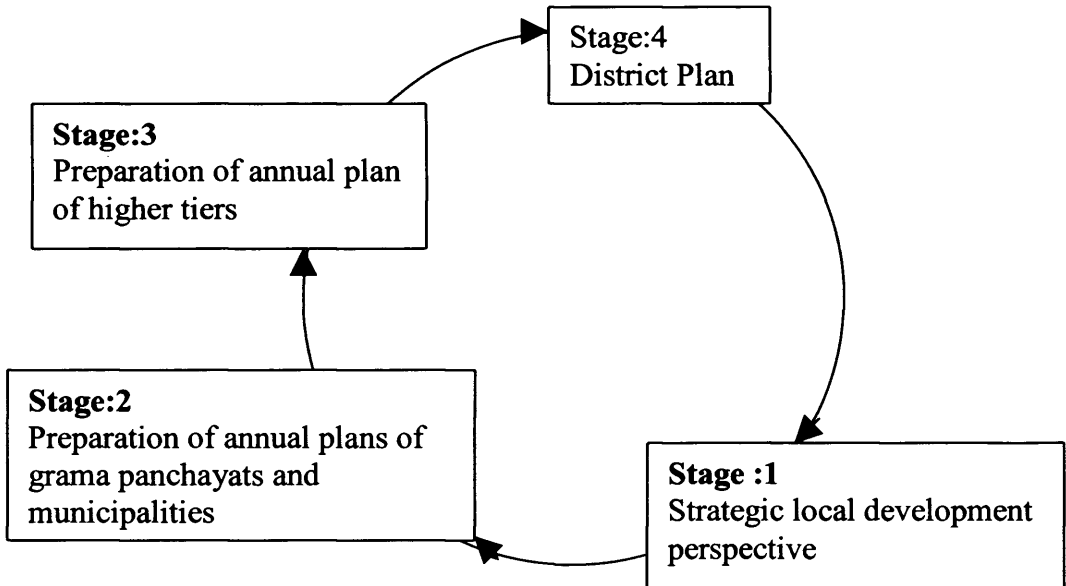


Figure-6.5: Cycle of Decentralised Planning`

another iteration, as the plans at every level must look at the plans/felt needs expressed from below. This iteration in the specification of the process gives rise to difference in form even while retaining the felt needs as an invariant. Thus we have two methodologically different but parallel fractal systems working in the PPC.

A fundamental question that the description of the PPC in terms of fractals evokes is that granting the possibility of a conceptual re-description in planning in fractal terms, what significance might this 'sensitising' have for planning? I argue for the significance in both the generalised sphere of knowledge and practice within the discipline of planning and also the more restricted sphere of the PPC. I take up the generalised sphere first for detailed discussion and shall return to the second later. In the generalised realm, what is entailed is that if fractals are identified in planning, then this must give rise to qualities and features that planning as a discipline can identify with normatively. This then requires a substantiation of the causal claim of fractals within planning. I attempt to do this below.

6.3 Explanation, Mechanisms, Causality and Fractals

Probing for the causal claim of fractals first demands an understanding of causality itself. Building up on ideas and notions described earlier, I discuss here notions of causality, explanation and mechanisms in some detail. This digression becomes necessary in order to understand the type of causality embodied in the concept of fractals.

6.3.1 Explanations and Mechanisms

There are a number of ways in which explanation has been understood. The first is the 'covering law model'. For Hempel (1959), one of the proponents of this model, a satisfactory explanation must specify the general covering law and the conditions which make the law work in a specific case (Hedstrom and Swedberg, 1996). This view is however resisted by Hedstrom and Swedberg (1996, pg 287) as they believe that "covering-law explanations in the social sciences...normally are black-box explanations and they do not attempt to reveal any mechanisms that might have generated the observed relationships". They point out that a black-box covering law explanation need only link input and output without saying anything about the mechanism that causes the transformation or effect (pg 288). They advocate in its place the relevance for following a mechanism based explanation which for them is a "*deeper, more direct and more fine-grained*" (pg 287) (original italics) form of explanation.

If one were to accede to this demand for a mechanism based explanation to understand causality, the need then is to understand what might be meant by the term 'mechanism'. For Hedstrom and Swedberg, "all proper explanations explain the particular by the general" (pg 282) and "it is this generality that gives them (mechanisms) their explanatory power" (pg

189). However since mechanisms are understood to be distinct from covering laws, it is necessary to be clear here about what level of generality is involved. Taking off from Robert Merton's (1967) discussions, Hedstrom and Swedberg argue for Merton's conception of mechanisms constituting a middle-range between social laws and descriptions, thus forming "elementary building blocks for middle-range theories" (1996, pg 283). Merton defined social mechanisms as "social processes having designated consequences for designated parts of the social structure". For him the primary task of sociology is to 'identify' these mechanisms and to establish under which conditions they 'come into being', 'fail to operate' and so on (Merton, 1967, pg 43-44, quoted in Hedstrom and Swedberg, 1996, pg 283). Mechanisms here then are understood as being specific to a situation which under certain specified conditions, produce, or fail to produce, certain outcomes. The specificity or contingency of the situation to which it applies prevents it from being a 'law' and the generality that characterises it prevents it from being just a 'description'. Mechanisms are also further understood as being fundamentally inter-disciplinary given the conditions of occurrence (Hedstrom and Swedberg, 1996, pg 282,284).

What sort of entities may then be referred to as mechanisms? Again for Hedstrom and Swedberg "in sociology,, the elementary 'causal agents' are always individual actors, and intelligible social mechanisms, should, always include explicit references to the causes and consequences of their actions" (1996, pg 290). Thus for them, "there exist no macro-level mechanisms" (pg 299). This view grounded in methodological individualism, takes off from what Mayntz calls a 'macro-micro-macro' (Mayntz, 2004, pg 248 - macro-level phenomena explained by micro-level dynamics that result in macro-level phenomena) view of sociological explanation. First developed by Coleman (1986), the model states that explanation of macro-level phenomena always entails going down to a lower level. This view we have seen earlier in chapter-3 is also present in the realist thesis within natural science, which places a stress on 'generative mechanisms'.

For Mayntz (2004, pg 239), "the term 'mechanism' is used to designate a certain class of real phenomena (mechanisms *are* such and such, they *do* such and such) and to designate a class of (causal) propositions referring to such phenomena" (original italics). They are also "causal generalizations about recurrent processes" (pg 241). Here Mayntz clarifies that "the notion of a recurrent process presupposes epistemologically that generalizable properties can be abstracted from concrete (historical) processes; it pre-supposes ontologically that (some) observable sequences of real events have similar properties" (footnote, pg 241). The generalizable properties are then an abstraction made by the researcher from a real situation.

Constructs and generalizations are both by definition unobservable (Mayntz, 2004, pg 243). The identification of a generalizable property is possible, just as an abstraction of a mechanism from a real situation is possible - through its effects, even if it is not observable directly.

Mayntz here is not strictly advocating a view of mechanisms that have meaning only at lower levels of reality. In the realist thesis within social sciences, we have seen how social phenomena need not have an explanation restricted to the individual level. While not refuting the importance of this form of explanation, there are other forms of causality. Sawyer (2004, pg 261) for instance argues “once social properties emerge, they have an ontological status distinct from their realizing mechanisms and may participate in causal relations”. He therefore argues for a combination of ‘bottom-up and top-down explanatory mechanisms’ (Sawyer, 2004, pg 263) with some emergent social properties having autonomous causal powers at the same level. Mayntz (2004) advances the same view by advocating that there may be different types of mechanisms, some of which need not be at a lower level.

6.3.2 Causality and Fractals

What other types of causal explanations in social science are then possible? First, is the initial situational descriptions (specification of initial conditions) also termed as downward causation (Sawyer, 2004, pg 269). Thus the very state that a macro-level situation is in may in fact have causal powers. Mayntz points out “causal structure of mechanisms can... be linear as well as nonlinear”. Second, “mechanisms may consist of a sequence of actions involving different social elements, as in a diffusion process. But they can also involve repeated actions of the same elements, as in an escalation process’ (Mayntz, 2004, pg 242). Here the mechanism of change is not purely reducible to the individual level, but is rather a function of the type of structure and the type of feedback or process occurring through time which may be a property of the system as a whole rather than one that has meaning only at the individual level. Third, Mayntz, also acknowledging the role of elements external to the immediate circle of concern, remarks “we must admit that mechanisms can also operate outside of a systemic context” (pg 243) which again need not be necessarily reducible to the micro-level of the entity under study.

In arguing for a different form of causality earlier, I have stressed the importance of time-space relations - the ways in which entities in a system may be connected to one another. The relational aspect is also stressed by Mayntz who points out “relational constellations that may, but need not, be institutionally based are integral parts of the processes generating social macro-phenomena” (Mayntz, 2004, pg 250). Mayntz thereafter moves on to argue for

recognition of institutional structures and relations as causal factors along with motivational factors that maybe found at the individual level. Thus “specific structural (or institutional) features are decisive for the generation of aggregate macro effects by the motivated actions of individuals” (pg 251) and “structures exert their effect through the actions of individuals, but assuming a general action orientation of individuals,...it is the nature of the structural arrangements within which they act that determines the effect” (pg 252).

In consistence with this overall position, I argue for fractals as embodying a particular type of time-space relationship, which can be identified in empirical situations. From the natural sciences we have indications of fractals being a particular type of relation by which local scales can be connected to global scales. If mechanisms are inter-disciplinary by nature (Hedstrom and Swedberg, 1996, pgs 282, 284) and if a realist position entails the possibility of admitting a reality that could potentially hold true for both the natural sciences and social sciences, then it should also be possible to potentially admit the causal claim of fractals.

The consequence of having a causality that is based on time-space relations is that it can be coupled with causality based on mechanisms or other forms of causality to produce different forms of empirical impacts. The value dimension of this form of causality is then neutral as it can very well have negative as well as positive impacts based on the value dimension of the mechanisms that ‘work’ the structure. Whatever is fed in is thus constrained to have certain impacts due to the causality arising from the particular fractal structure. In this vein, fractals embody a claim to connecting the local to global in a way that does not subsume the local and does not ignore the global allowing for the impact of scale to manifest itself through scale dependent emergence. Just as Bunge with regard to mechanisms, observes “generic mechanisms can explain no facts” (Bunge, 1997, pg 451) and Mayntz further warns us “it is not possible to build a substantive theory out of context-free, general mechanisms” (Mayntz, 2004, pg 253), so also with fractals, *a substantive theory cannot arise from it alone. Fractals when combined with mechanisms that work at lower levels can however give rise to substantive theories.*

I have hitherto shown how it might be possible to observe in planning the key definitional features of fractals. I have also shown through short illustrative empirical discussions the possibility of admitting the feasibility of the claim in planning. I now intend to discuss in more detail the case-study presented with respect to the causal claim of fractals. In the following paragraphs, I intend to illustrate how different mechanisms ‘work’ the structure, to substantiate the causal claim of fractals. There is here thus a rejection of any claim to exclusivity in terms of causality. The causality embedded in fractals is essentially facilitative

of mechanisms embodied in lower levels. The illustrations are theoretically argued, drawing upon planning and governance literature as well as empirically identified in the contingent settings of the PPC.

6.4 Probing Empirically for Causality in Fractals

If the PPC can indeed be seen as a fractal structure as I have argued, then it should be possible to empirically search for and discuss the causal claims for fractals advanced earlier. The following paragraphs aim to do this. The probe for causality in fractals focuses on three types of phenomena in planning advanced earlier – the distributive phenomenon, the amplification phenomenon and the emergent phenomenon. In instances when this phenomenon is observed, I search for explanations which reveal the mechanisms involved. In instances where it is not observed I search for explanations of why not. Insights from the fractal logic inform my discussions. Finally, I triangulate the conclusions I arrive at in my discussions, using present knowledge from other streams of planning.

Before venturing to discuss the impacts, I first provide a brief contextual description of decentralisation in India and Kerala in a general manner. This shall serve to contextualise and relate the impacts to be discussed later. Ascertaining the impacts of the PPC over the last nine years is a huge exercise in itself. I have not ventured to do this myself in this thesis. I rely instead on data from ‘independent’ study reports, government publications and direct interviews with personnel on the ground involved with the PPC. I also draw upon my own personal involvement with the PPC as a faculty in charge of capacity building for LSGI functionaries during the period 1998-2002. In reporting the impacts and discussing them I have been selective, as the intention is not to be exhaustive or evaluative, but to be searching for unusual results that might be attributed unambiguously to the structure of fractals.

6.4.1 Context of Decentralisation in India and Kerala

In order to understand the impact of decentralisation before and after, it is important that the situation before decentralisation be described briefly. India has, as described earlier, a federal structure enshrined in its constitution with considerable autonomy in key areas devolved to the state. However devolution to levels below was not very effective (Isaac and Franke, 2000, pg 25).

Though tangible efforts towards decentralised planning in Kerala started in the early 1970s, decentralisation in Kerala in full zeal was taken up only after the Constitutional Amendment Act (CAA) in 1992, which recognised the importance of grassroots level planning and governance and mandated that appropriate legal changes be made and institutional structures be set up in each state. In 1996, when the Left Democratic Front was

voted into power in Kerala, decentralisation was their declared thrust political agenda and consequently the mobilisation and institutionalisation of democratic decentralisation and bottom up planning at grassroots level assumed central focus. The People's Planning Campaign described above was the major vehicle for bringing about the change. Some other vehicles include the Committee for Decentralisation of Powers commonly referred to as the Sen Committee, which looked into the legal reforms that were needed to support the programme and the Administrative Reforms Committee which looked into the administrative reforms needed to support the programme.

The PPC was launched politically as a response to the developmental crises of the State. Kerala has made its mark in the development literature as a state exhibiting a unique developmental pattern. Known as the Kerala model of development (Parayil, 2000), it very simply proves and illustrates the possibility of achieving high levels of social development and quality of life even within low level of economic development. The tables below illustrate this paradox

	Kerala	India	LIC's	USA
GNP in US\$	324	390	350	28,740
Purchasing Power Parity	1,371	1,650	1,400	28,740

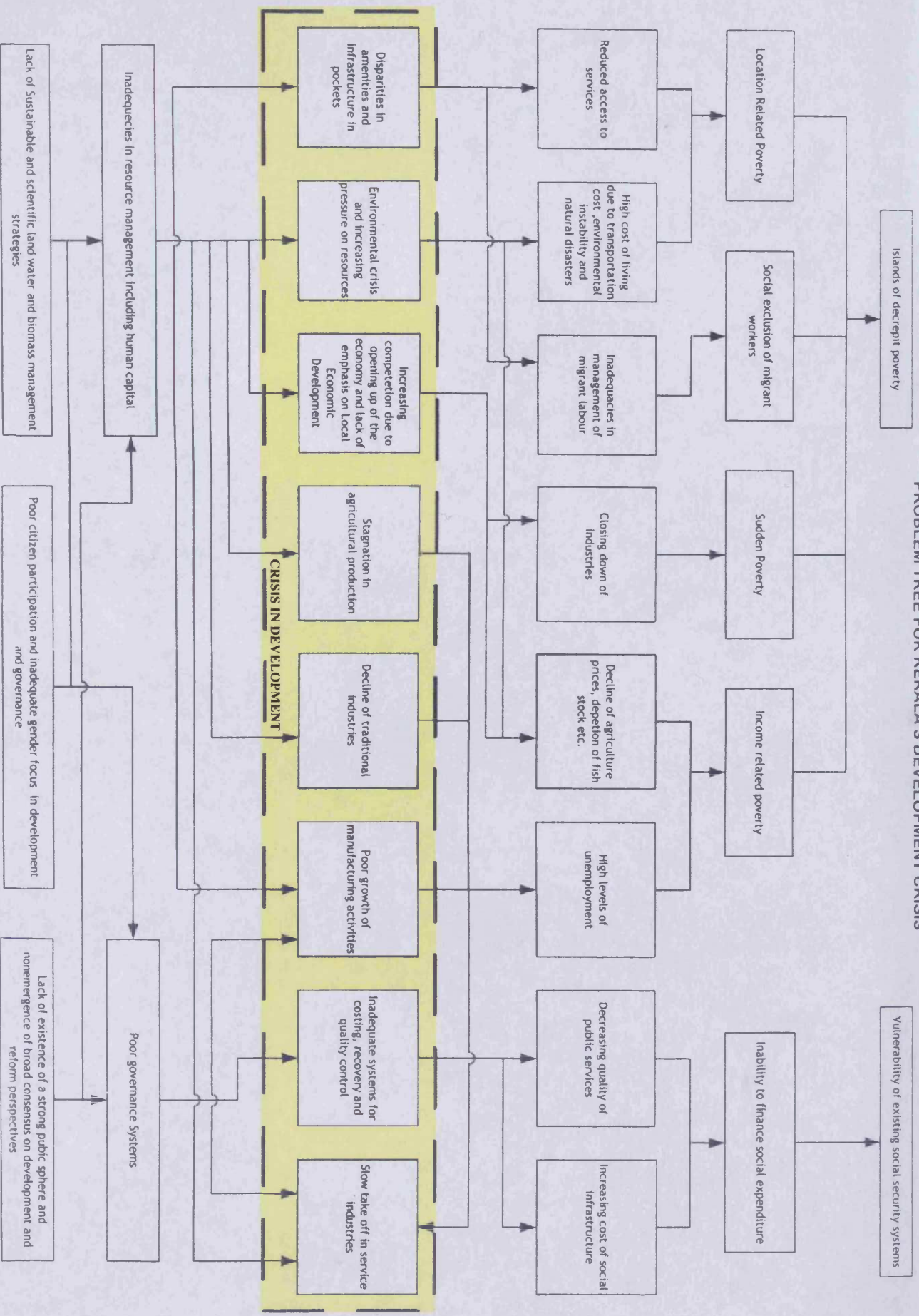
Table-6.1: Economic Position of Kerala in comparison (Data for 1997)

	Kerala	India	LIC's	USA
Literacy rate	94-M, 88-F	65-M , 38-F	65-M, 41-F	96-M, 96-F
Life Expectancy	72	62	58	74
Infant mortality/1000	12	71	80	7
Birth rate/1000	18	27	40	16

Table-6.2: Quality of Life Indicators in comparison (Data for 1997)

Source for tables 6.1 and 6.2: Franke,R and Chasin,B (2000) 'Is the Kerala Model Sustainable? Lessons from the Past, Prospects for the Future' In Parayil,G *Kerala-The Development Experience – Reflections on Sustainability and Replicability*, Zed Books: London & Economic Review 2002,GoK.

Figure - 6.6
PROBLEM TREE FOR KERALA'S DEVELOPMENT CRISIS



Although the quality of life is high, sustained economic sluggishness has become a serious problem for the State, threatening the loss of the high standard of living achieved. The economic backwardness of the state was therefore one of the major rationale for the launch of the PPC. Expectations revolved around the possibility of creating and carrying forward a model of a more sustainable developmental trajectory – one of growth coupled with equity (Isaac and Franke, 2000, pg 4).

I now search for causal claims under the three headings introduced earlier – the distributive effect, the amplification effect and the emergent effect.

6.4.2 The Distributive Effect

In this sub-heading I search for evidence for distributional effects claimed for fractals. I choose two areas of enquiry to probe two types of distribution – first, the outreach to poverty and second, the spatial distribution. It is well-known that these two factors are tightly coupled resulting in an often noted geography of poverty. I shall in discussing the impact of the PPC on these two factors ascertain the mechanisms through which the changes have come about. I hope thereby to illustrate not only the manner in which the fractal mechanism for planning becomes instrumental, but also the manner in which it can combine with different generative mechanisms at lower levels of reality to yield normatively different yet, structurally similar results.

The problem tree for Kerala's developmental crises and ways in which it relates to poverty in the state as analysed by the Decentralisation Support Programme of the Government of Kerala (*Kerala Decentralisation Support Programme – Phase-2- Proposal 2003*) is included in Figure- 6.6 . Though factors that have contributed to the development crises actually includes issues in a national as well as global scale, the analysis presented is essentially self-referential. It relates to ways in which Kerala has responded or not-responded to the issues, pointing at internal factors as causes rather than focusing on factors beyond immediate intervention. Thus the system boundaries are clearly laid and the analysis relates to internal structures rather than what can be termed environmental triggers or causes.

The problem analysis shows that Kerala faces a serious economic problem due to stagnation in all three sectors of productivity- agriculture, industry and service. Besides it also has governance problems, environmental problems and infrastructure problems in selected areas. These lead to tertiary effects that directly impinge on poverty, both as causing poverty as well as preventing the provision of alleviating measures. The statistics on poverty over the years from 1973 to 2000, is given below

Year	Kerala	All India Combined	All India Rank	% Decrease
1973-74	59.79	54.88	21	
1977-78	52.22	51.32	12	12.66
1983-84	40.42	44.48	16	22.59
1987-88	31.79	38.86	10	21.35
1993-94	25.43	35.97	7	20.00
1999-2000	12.72	26.10	5	49.9

Table: 6.3 Statistical Trends of Poverty in Kerala

Source: Extracted from Planning Commission. Reproduced in *Kerala Decentralisation Support Programme – Phase-2 – Proposal* (2003). The final column added on for purpose of analysis

As can be seen from the figures, poverty levels in Kerala are decreasing constantly. The rate of poverty decrease though can be seen as falling from 1983-84 to 1993-94. Thus though poverty alleviation measures were effective the rate of effectiveness was decreasing. This is because of general poverty becoming more and more place specific and caste specific. Thus poverty alleviation programmes designed as a one-for all solution was increasingly becoming less effective. With the introduction of decentralisation since 1996, we find that there is a marked increase in both overall poverty alleviation as well as the rate of poverty decrease. The change is largely attributed to the implementation of the decentralisation programme. The following quotes substantiate the association, highlighting also the mechanisms through which the change was effected.

“The formula based devolution of funds has ensured that funds have flowed to every nook and corner of the State including the hitherto outlying and backward areas, facilitating public investment”.

“Decentralization has resulted in better targeting especially in the case of individual benefits by insisting on a due process in the selection of beneficiaries. The quality of identification has certainly improved”.

“Local government plans have shown a strong anti-poverty bias. More funds have flown to families below poverty line through local governments than would normally have been [the case]’(EconomicReview, 2001).

“There is great realism in tackling problems of poverty. There are no tall promises. The problem of poverty is perceived in its stark reality. It cannot be submerged in academic debates or hidden in statistical sophistry”.

“The innumerable opportunities for participation which has been structured into Kerala’s decentralisation process has helped the poor in gaining confidence and in moving from lower levels of participation into higher forms of direct social action like management of facilities, creation of demand for services and so on”.

(Kerala Decentralisation Support Programme- Phase-2, 2003, pg 17,18)

The mechanisms of poverty reduction identified here seems to be better targeting of resources, *both* due to the fractal structure that spatially allows targeting and also the reliability of the targeting process that mandates beneficiaries of poverty reduction schemes to be chosen in the grama/ward sabhas which then checks bureaucratic corruption by broad based social validation. Also important are more culturally based factors of the grama sabhas/ward sabhas in Kerala being largely attended by the poor rather than the elites, unlike the experience one would expect in western contexts. This is in fact an issue of concern today as the down side of this is that development concerns get sidelined in discussions at the grama/ward sabha level, as only redistribution issues get discussed.

The second area of enquiry is the provision of basic minimum needs in infrastructure. Infrastructure is generally regarded as a public sector activity and it is instrumental to a large extent in perpetuating poverty. The provision of infrastructure though is highly place specific and increasing the target area of infrastructure (as opposed to quality of provision) is largely an issue of precise spatial targeting. How has the PPC fared in this aspect?

“The experience of the first few years of decentralisation has proved that in providing basic minimum needs infrastructure like housing, water supply, sanitation and connectivity, the Local Governments have performed creditably. The speed and extent of coverage as well as efficiency in implementation in respect of provision of minimum needs has been superior to that of Government”. (Kerala Decentralisation Support Programme- Phase-2, 2003, pg 14).

“As is evident from the performance, local governments have done well in provision of minimum needs infrastructure both to households as well as to communities. This is particularly true of housing, sanitation, water supply, infrastructure of hospitals and schools and connectivity” (Economic Review, 2001).

“In respect of physical achievements, the most remarkable one has been in the area of housing. Local bodies have together built 2.14 lakh houses in just three years. Of

these, 48,000 are for the Scheduled Castes (S.C.) and the Scheduled Tribes (S.T.). Compare this with the Eighth Plan, during which in the first three years the total number of houses constructed for the S.C. and S.T. population was just 6,000” (Frontline,2000).

“The other appreciable achievement has been in the drinking water sector. Earlier, government funds were spent on large-scale piped drinking water projects. After people's planning, drinking water projects are based on a variety of techniques, such as rain-water harvesting” (Frontline, 2000).

Some of the mechanisms through which this achievement in minimum needs provision has come about include better targeting and dovetailing of provision to needs through increased participation of local people, stimulation of local creativity and know how based on indigeneous knowledge outside standardised solutions in the provision of minimum needs, better local participation resulting in local voluntary contribution in labour and resources leading to increased cost-effective solutions, side-lining of contractors by direct execution of construction works by beneficiaries, local monitoring and supervision resulting in tighter controls in implementation (Balan and Vasu, 2000, pg 223, 224).

In this example, it is the distributional effect that is most visible. The improvements that have come about show two things in particular – 1) the PPC has been able to find and target the poor more effectively than was done in the centralised system, 2) the PPC has been able to find and target more equitably the spatial expansion of infrastructure provision. This is by i) avoiding areas, sectors and target populations where a particular project or resource may have resulted in duplication or waste, ii) identifying areas, sectors and target populations that require resources that need to be complemented by other forms of support including intangible social support. Overall thus, the targeting of resources have been dove-tailed to the scale of the projects, the sectoral requirements in a locality or community, and also the uniqueness of the locality in terms of cultural preferences, manpower capability and local resource mobilisation potential. This has come about largely due to certain mechanisms being triggered, operationalised, co-ordinated and facilitated by a particular form of institutional support structure that essentially follows a particular logic. The logic that has been operationalised is fractal. The claim follows the isolation of key qualities of fractal structures and its identification within the PPC, which also accounts for how the features come to facilitate the mechanisms. The result, it can be thus seen has been a synergetic outcome of a number of mechanisms all operating through and because of a particular structure of co-ordination. Both the fractal structure and the mechanisms are thus important.

To highlight the value neutrality of this type of causality I shall present the issue of corruption. A forthcoming UNDP sponsored study by Prof. M.A. Oommen, reports the following.

‘the longstanding collusion between the bureaucrats, technocrats, contractors, and the political class has to be broken to ensure sustained decentralized governance and sustained poverty reduction in Kerala and equally so in the rest of India. The PPC failed to resist the concerted onslaught of the rentier class. The beneficiary committee system instead of being fostered as an agency to fight corruption has been discredited and permitted to vanish. Political initiative to dismantle corrupt practices and establish the role of the public accountability mechanism already available in place is very important.’ (quoted in Economic Review, 2004).

Oommen here is reporting on the presence of corruption in spite of checks and balances that have been institutionally introduced in the PPC. The mechanisms to which the failure can be attributed will of course be much longer, than the issue of beneficiary committee, which Oommen refers to, if a study was done on it. This presence of corruption at all levels of Government in fact has led to the claim that ‘devolution has in fact decentralised corruption’ (Frontline, 2000). The earlier form of governance being highly centralised with the grassroots level LSGIs having only a weak (devoid of powers and fiscal resources) presence if at all, the possibility of corruption in these tiers did not exist in any significant manner. With decentralisation and the transfer of powers and fiscal resources, this situation has changed. So along with the benefits of decentralisation, the dynamics leading to corruption in Kerala society also made themselves visible in these new levels of Government, providing grounds for the allegation. An evaluation of the relative increase in corruption through decentralisation is more complex though, since here both the facilitating and counterveiling tendencies will have to be taken into account. Thus Thomas, Isaac, one of those who spearheaded the Campaign remarks,

‘Of course, corruption is still there at the local level also, but the level of leakage is much smaller than what would have occurred if money had been spent through the bureaucratic mechanism. It has been, to a large extent, possible to eliminate nepotism in beneficiary selection and also corruption in administration and technical sanctioning procedures.....There is no doubt that on the whole the leakage of funds has been reduced’ (Frontline,2000).

An explanation for the criticism regarding corruption is also provided by the suggestion that perhaps the issue is really that the corruption now taking place has become more visible, due to transparency measures and closeness of the levels of governance to the public suggesting that earlier bigger corruption taking place at the centre was not very visible though present. Whatever the truth of the relative increase or decrease of corruption, the fact still remains that corruption (more or less) did trickle through to levels closer to the people (for good or bad). Thus the fractal system by replicating factors that give rise to certain tendencies, can easily prove to be vehicles for both healthy and unhealthy practices.

6.4.3 The Amplification Effect

I now probe for the second effect I have claimed for fractals – the amplification effect. I shall first use the growth of thrift itself in Kerala. In urban areas, for the poorer populations there is an additional three tier structure below the ward level consisting of the community development society (CDS) at city level, the area development society (ADS) at a slightly more disaggregated level and finally the neighbourhood groups (NHGs) comprising of around 20 families on an average (G.O(MS) No. 40/2004/Plng; Dated 31st March, 2004). There are at present 1,050 community development societies, 13,924 area development societies and 151,406 neighbourhood groups. This federated network now has 3,098,011 poor families. Anti-poverty measures are overseen by the Kudumbashree programme of the state poverty eradication mission. The increase in thrift and loan activities

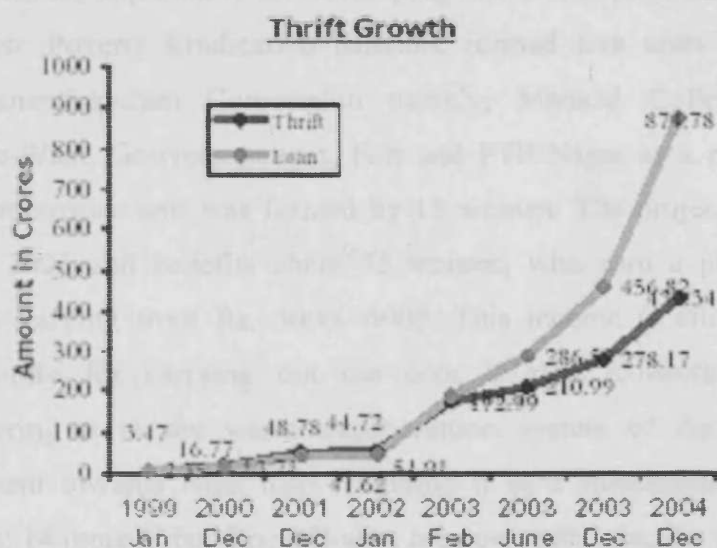


Figure-6.7: Growth of Thrift and Credit in Kerala

Source: Economic Review, 2004, Kerala State Planning Board, Government of Kerala. Pg

of the poor are shown in the graph in Figure-6.7. All together Rs 4,323,400,000/- has been mobilised as thrift and Rs 8,747,800,000/- has been circulated as loan (Economic Review, 2004). Thus, this structure has been able to reach the poor and incorporate them into banking in the State. Some of the salient mechanisms that come into operation are i) dove-tailing of saving pattern required to suit the incomes of the poor, ii) flexibility of financial service achieved through community based self-management that relies on social control for repayment, iii) the coupling of income generation and employment schemes with thrift and credit activities of the federated outreach structure, iv) the ease of collection and deposit, possible due to community management, v) timeliness of service due to local community control, vi) low transaction costs again due to community control, vii) the lack of a need for collateral securities for availing loan as the system is based on trust and community control, viii) all of the above which result in an attractiveness that makes it viable and suitable for the poor to bank at commercial interest rates.

Yet another area in which the amplification effect can be discerned is that of solid waste management. Kerala's poverty alleviation programme has ventured into solid waste collection as part of employment generation schemes. A typical description of one of these employment generation units is given below -

“Two of the major gaps in solid waste management at Thiruvananthapuram Corporation are lack of primary collection and source segregation. Seeing this as a potential opportunity for developing micro enterprise units, Kudumbasree, the State Poverty Eradication Mission, formed five units in five wards of Thiruvananthapuram Corporation namely, Medical College-East, Medical College-West, Gowreesapattom, Fort and PTP Nagar as a pilot project. Each micro enterprise unit was formed by 15 women. The project was launched in March 2003 and benefits about 75 women, who earn a per capita monthly income varying from Rs. 3000- 6000. This income is after meeting all the expenditure for carrying out the door to door collection of waste and transferring it to the waste transportation system of the Corporation and repayment towards bank loan. Finding it as a sustainable micro enterprise venture, 14 more Urban Local Bodies are now replicating the project”.

Source: Extracted in parts from 'Clean Kerala Mission' reported in Economic Review 2004

Each one of these units are organised primarily as an employment generation scheme by the State Poverty Alleviation Programme implemented through the LSGIs as part of efforts

for income generation in order to address poverty. Yet the judicious deployment of these units in well and tightly defined areas, co-ordinated by the LSGIs, lead overall towards tackling of another perennial problem – that of solid waste segregation at source and everyday household door-to-door collection (everyday collection is essential, given the nature of waste in Kerala which is 68% biodegradable vegetable waste and also the warm moist climatic conditions which allow fast decomposition of the waste). The overall city level effect in solid waste management is thus one of amplification through the linear aggregation of effects happening in smaller units of space leading to the possibility of developing higher, area based composting facilities for the segregated waste and city level marketing facilities for the compost produced contributing ultimately to the economy.

6.4.4 The Emergent Effect

In this section I finally examine the third type of effect - the development of scale specific linkages between or within sectors, or spatial units. The possibility for this can be seen in the example of solid waste collection cited above. The mapping of cross-sectoral linkage is income-generation - poverty alleviation - solid waste management - production of compost - contribution to agriculture. This level of inter sectoral linkages in that specific example has not yet come about as the initiative is still new. For the purpose of discussing this phenomenon, I examine the plan document of a higher tier; this being the level where strategic linkages can be most effectively forged. The primary document that I examine is the Integrated District Development Plan for Ernakulam district prepared by the district planning committee of Ernakulam in 2000. I concentrate primarily on examining the type of analysis carried out in the document and the type of suggestions that have been made. As an illustrative example I have dealt in detail with one sector-agriculture.

Ernakulam district is located almost centrally in the state of Kerala (see Figure-5.7) and has a population of 2,817,236 persons living at a density of 2,535/sq m in the cities and 774 sq m in the rural areas. The total urban population in the district is 1,373,177 and rural population comes to 1,444,059. The total area is 2,407 sq kms, which is 6.19% of the total area in the State. The district has 87 grama panchayats, 15 block panchayats and 1 district panchayat. There are 8 municipalities and 1 corporation within the district (Samyojitha Jilla Padhathi- Ernakulam Jilla, 2002).

The plan document starts with an overview of the planning process as it took place within the district of Ernakulam giving some critical description of the level and type of participation. (For instance issues about time availability for engaging in fruitful discussion in grama sabhas, the standard of awareness that is reflected in discussions etc have been

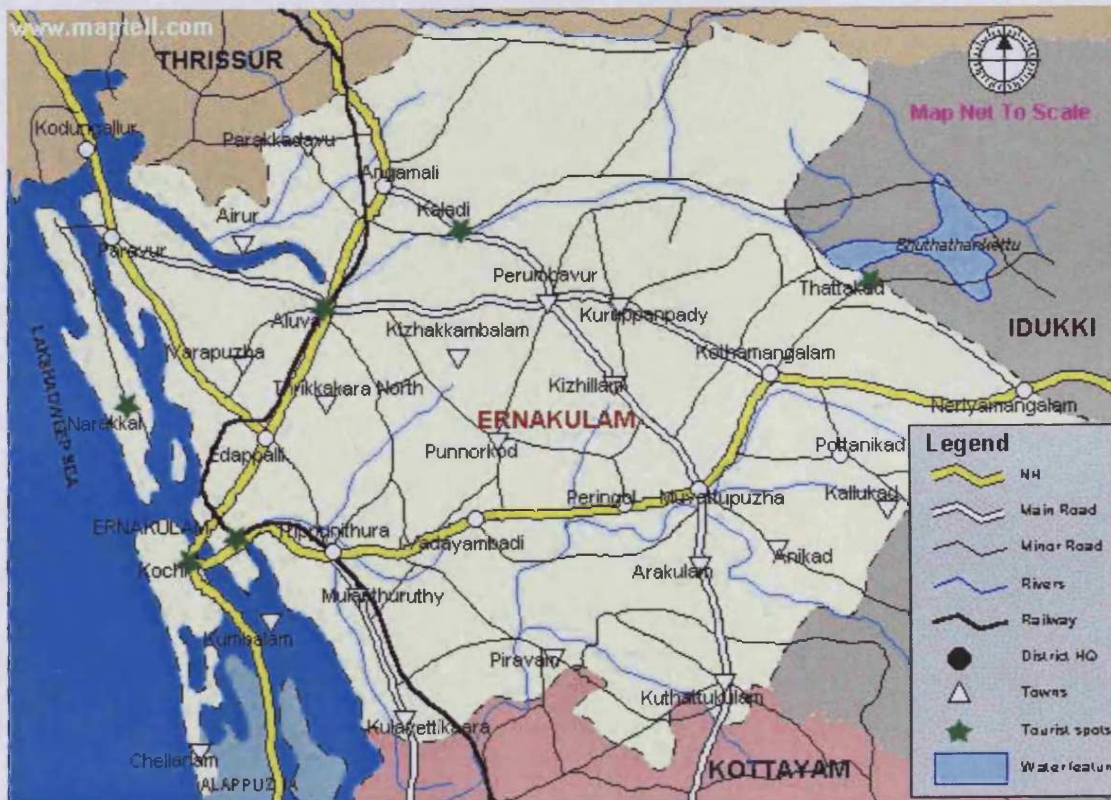
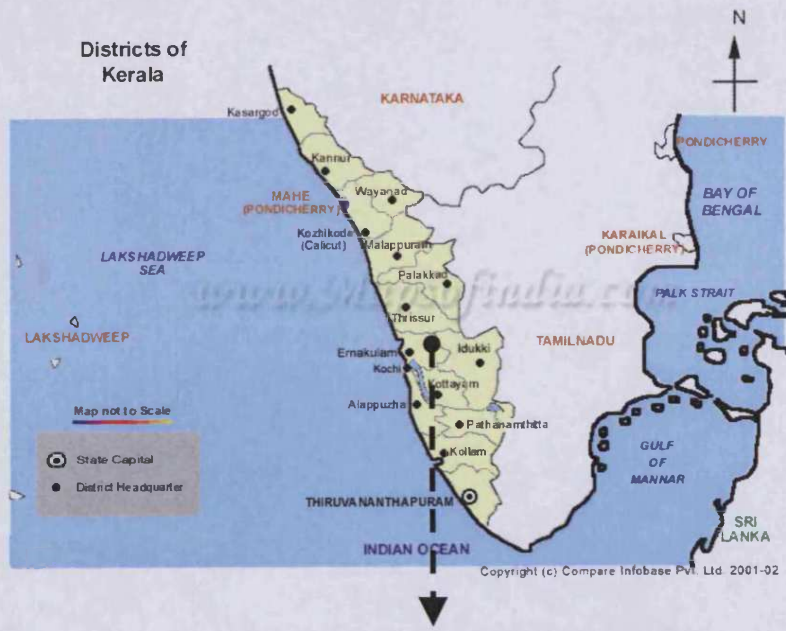


Figure-6.8:
Location and Map of Ernakulam District

Source:

<http://www.mapsofindia.com/maps/kerala/kerala.htm>

<http://www.mapsofindia.org/kerala/Eurnakulam.html>

Accessed: 12-02-05

recorded). Overall the planning process for the year before is criticised for the lack of resource based planning, long-term perspective, or spatial component being fruitfully employed. Lack of institutionalised planning knowledge and skill is cited as the prominent reason for these lacunae.

The second part of the report discusses natural resources in the district including aspects like the relief, terrain, wetlands, water resources and so on, as well as manpower resources including aspects like population growth and distributions, work force participation, urbanisation and so on. It also briefly traces the development history of the region.

Following the above overviews, the plan then goes into sector wise issues. It starts by providing an overview of the relative status of the sector within Kerala economy as a whole and the kind of issues that the state as a whole is facing in that particular sector. It then proceeds to assess the present situation of agriculture in the district, providing information on land utilisation (including categories such as not cultivated for 5 years, not cultivated for 1-5 years etc), type of crops with area under cultivation for each type, picture of the district production of these crops within overall state production. The data then continues to analyse the contribution of agriculture (as a productive sector activity) to the district development including such indicators as workers employed in the sector, contribution to total district income, productive sector income, regional income, etc. Climatic and weather factors are then discussed, particularly stressing the occurrence of rainfall over the year in the district. More detail crop wise analysis of issues follow. These are not restricted to issues in the district but present a more comprehensive and overall perspective of the developments that affect that particular crop, be it global or national or state limited. District wise trends in that particular crop over the years are also presented. These include factors of productivity and crop extent in comparison with state level figures.

The plan document next looks into the documents from the local bodies, and analysis the types of problems listed for that particular crop. A table that documents all the reasons are prepared and the number of local bodies that have reported one particular reason is documented qualitatively by dividing the column into - very serious, serious, not so serious and not a problem. A sample extract is provided below

Problems	No of LSGIs who have recorded that problem			
	Very Serious	Serious	Not serious	Not a problem
1. High level of expenditure, low level of income				
1 Profitable production not possible in fragmented land	18	25	44	11
2. Paddy cultivation is generally not profitable	26	33	23	13
3. Agriculture production relies too much on labour	15	25	42	13
4. Agricultural labour is not available as needed	29	36	24	6
5. Mechanisation in agriculture has not picked up	18	30	37	12
6. Less number of farmers engaged in agriculture exclusively, general apathy to farming	28	23	28	6
7. High cost of fertilizers and pesticides	45	29	10	11
8. Slowness in adoption of organic manure	38	33	13	13
9. Import in cash crops and consequent price crash	48	20	15	13
10. Price crash in paddy	26	31	23	10
2. Service from Govt Krishi Bhavan not received as required				
1. Krishi Bhavans not serving as knowledge centres for farmers	18	20	39	18

Table-6.4: Extract showing Consolidation by DPC of Problem Analysis of Agriculture Sector by LSGIs

Source: Samyojitha Jilla Padhathi- Ernakulam Jilla, (2002) Jilla Aasoothrana Samiti, Ernakulam (Malayalam)

There is a footnote that tells us that in some task forces (the institutionalised body that analyses the grama sabha/ ward sabha discussions at the LSGI level), the analysis has not been effective. A ranking list has then been prepared at district level by adding up the number of LSGIs that have recorded the problem as very serious or serious. A problem relative prioritisation can then be seen to have been done within each overall issue. This is illustrated below :

Sl.No	Problems , Problem analysis	Score	Rank
1.	High level of expenditure, low level of income		
1.	Profitable production not possible in fragmented land	43	9
2.	Paddy cultivation is generally not profitable	59	5
3.	Agriculture production relies too much on labour	40	10
4.	Agricultural labour is not available as needed	65	4
5.	Mechanisation in agriculture has not picked up	48	8
6.	Less number of farmers engaged in agriculture exclusively, general apathy to farming	51	7
7.	High cost of fertilizers and pesticides	74	1
8.	Slowness in adoption of organic manure	71	2
9.	Import in cash crops and consequent price crash	68	3
10.	Price crash in paddy	57	6
2.	Service from Govt Krishi Bhavan not received as required		
1.	Krishi Bhavans not serving as knowledge centres for farmers	38	4

Table-6.5: Extract from Scoring and Ranking of Problems Identified by the LSGIs in Agriculture Sector by the DPC

Source: Samyojitha Jilla Padhathi- Ernakulam Jilla, (2002) Jilla Aasoothrana Samiti, Ernakulam (Malayalam)

A similar exercise is done for each block in itself, thus giving an indication of the spatial spread of the problems, with their relative priority.

Next details of centre and state sponsored schemes implemented in the district in this sector are provided, with budget allotments. Major higher level facilities in this sector within the district are also assessed (district vegetable farm, seed production centres, etc). Details of the budget of the district panchayat is provided as also are the number and budget provisions made for different types of projects addressing this sector (classified by crop type) by the block and village panchayats below. Finally a table of possible solutions is prepared. A development approach is stated, with a list of potentially strategic actions to be undertaken

A similar level of detail analysis is not undertaken in all sectors though. The level of detail of analysis varies across sectors. Most, however do have problem identification and scoring, though without ranking and table of possible solutions clearly documented. Types of

solutions and expenditure patterns in LSGIs below are generally seen as documented. In some sectors though, like in the case of irrigation and soil conservation, there is hardly any reference to details from below.

What can be seen from this analysis is that the district level has clearly attempted to make connections to lower and higher scales of governance while defining its own programme. What can be seen as a lacunae though is the highly sectoralised approach, that has prevented cross-sectoral synergies from developing. Also can be seen the lack of relation to neighbouring districts and the effort to build synergetic partnerships for regional problems. These partly maybe due to the government guidelines which also follow a sectoral approach in the process specified for conduct of grama/ward sabhas and development seminars. The reporting formats consequently have a strong sectoral bias in-built into it. Though efforts have been made to overcome this by repeated requests to LSGIs to consider cross-sectoral linkages this has not happened by and large.

6.5 Linking Systemic Abstraction to Causality

In this section I attempt to consolidate partially the arguments built up so far. Here I *link* the significance of each of the definitional elements identified to the claims of causality by discussing the empirical results observed in the PPC.

6.5.1 Significance of the Vertical and Horizontal Axis

Analysing from a fractal perspective the above issue of institutionalising the building of inter-sectoral linkages, I would reiterate that the failure is in a way due primarily to the particular type of linkages designed for the fractal structure adopted. The vertical axis that connects the levels together has essentially been made along sectoral lines. The hinging together of the different levels of the LSGIs has thus to follow a sectoral logic if it is to function systemically. In principle there is nothing to prevent inter-sectoral linkages from forming, and certain LSGIs have indeed attempted it. But this involves breaking the vertical axis momentarily at least, for which there is no institutionally defined structure in place other than the debating chamber of the LSGI. There are two ways in which one can approach this gap then. First, one can think of an institutionally defined forum that looks into inter-sectoral issues – (possibly a sub-committee formed by gathering one member each from each working group) which can then be linked to a similar forum in the higher level. Another alternative would be to have this inter-sectoral forum modify the sectoral solutions and then feed them back in sectoral form to the vertical axis of transmission (as processes in the next level start off from a sectoral approach), while retaining the more horizontally meaningful (as regarding that particular LSGI) version for implementation at that particular level.

The issue of building partnerships laterally with LSGIs at the same level is another issue. This points to the relative weakness of the horizontal axis at higher levels. The document I have analysed was prepared in the year 2000-2001. During that period, at higher levels, a horizontal axis was forged essentially by giving representation to the presidents of lower level LSGIs in higher level councils. Thus every village panchayat president would also be a member of the block and district that they belonged to. This as can be seen is again essentially vertical. The representation is for the purpose of the higher level rather than for the lower level itself. The Kerala Municipality Act, 2000 permits the forging of joint committees by LSGIs for tackling common problems. But to date this has not happened. Negotiations are conducted sometimes between LSGIs on a one-to-one basis. But positive results are not generally achieved. The system hinges more strongly in the vertical direction than the horizontal. Problems of horizontal coordination are visible and felt though, The following extract from a report of a workshop for the preparation of a district plan for Thrissur district co-ordinated by me in the year 1999 illustrates this.

“In Guruvayoor, there is a problem of drainage. A lot of people from different parts of the nation (it’s a popular religious centre) coming to around 3 crore (30 million) per year come to Guruvayoor. The Municipality by itself does not have enough land to handle this drainage. About 40 cents of agriculture land is available in the central municipal area. In this place it is not possible to make a treatment plant as it is a central area. The Municipality tried to negotiate with Arcot Panchayat. However, Arcot Panchayat is not willing to give land for the purpose”.

“Kunnamkulam municipality has 13 eating houses (large halls for dining used for weddings). But there is no place for waste dumping. The neighbouring Panchayats maintain that their land is not for dumping the waste of the municipality. The Municipality says that in all the 13 eating places, it is not their weddings that take place daily. It is the neighbouring people (from the Panchayats) who use the facility. The Panchayat people come to the Municipality to conduct weddings and the Municipality has to dump their waste to which they do not even own up”!

“...In Malappuram district, public health centres in three Panchayats were located within two kilometres of each other.... It may be beneficial to people in the neighbourhood but is not for the people of the Panchayat collectively considered”. (Chettiparamb, 1999, pgs 21, 23)

I have in the above discussion, stressed and discussed through empirical illustrations the importance of two defining features of fractals - the design of the vertical axis and the horizontal axis. I shall below now discuss two other criteria, the scale of the ruler separating the levels and the criteria of self-similarity.

6.5.2 Significance of the Ruler Separating the Levels

The structure of the three tier system for villages is actually a constitutional requirement that came into force with the 73rd and 74th Constitutional Amendment Act (CAA) of 1992, which came into effect by 23rd April 1993. The CAA mandated the formation of a three tiered system of panchayats in rural areas for the whole of India. This three tier system is based upon the nucleated settlement pattern in most of rural India consisting of small hamlets surrounded by fields. These nucleated settlements generally have a small population, often below 5000. The distances between settlements are also great. The grama sabhas in this context are actually very much inward looking councils of self-governance and village autonomy. The nucleated and separated dispersal pattern also gives rise to a viable size for an intermediate level between the district and the village – the block. This level is quite naturally much larger than the village and much smaller than the district, serving to bridge the remoteness of the village and the vastness of the district.

In Kerala, however the settlement pattern is very different. Firstly, villages in Kerala are large, with a population of 5000 being easily found in a ward of the village. Populations of some villages are in fact much greater than the population of some of the municipalities. In Ernakulam district, the range in population is 9,462 to 51,166 (Samyojitha Jilla Padhathi - Ernakulam Jilla, 2002). Overall through-out Kerala, the average population in a village would be around 30,000 These are semi-urbanised centres (especially when compared to the villages of rural north India) within a settlement pattern that is almost continuous rather than isolated. This urban-rural continuum typical of Kerala, together with the comparatively high level of urbanisation found in its villages makes the intermediate level of the block almost irrelevant. Thus the Committee for Decentralisation of Powers which looked into issues to do with the institutionalisation of devolution in Kerala, comments thus in its report

“A state like Kerala has certain distinctive characteristics. Its Village Panchayats are fairly large having a population of around 30,000 on an average. Every Village Panchayat in Kerala has major institutions like primary health centre, veterinary hospital, krishi bhavan, high school etc.....The Village

Panchayats have their own source of income and get reasonable amount from grants and shared taxes. Moreover Village Panchayats have been provided with the major share of Plan funds. It is widely recognised that the decentralised planning campaign has been most effective in Village Panchayats. All these show that the Village Panchayats of Kerala are viable administrative units capable of performing most of the local government functions envisaged in the Eleventh schedule of the constitution. With a rational redeployment of staff and an earnest capacity building exercise, Village Panchayats could assume even more responsibilities.

The districts of Kerala are not very large in their physical area. At the meso level they are fairly compact units. In this scenario the role of the intermediate tier viz, the block gets blurred. When the functional sphere of the different tiers of Panchayats are delineated, it is difficult to assign clear cut functions to the Blocks which cannot be done by the Village Panchayats.....”

“With the poverty reduction programmes going into the ambit of the Village Panchayat, the relevance of the Block set up has been further reduced. At best it can function as the field level office of the District Panchayat for carrying out local works. In this context, it is evident that the three tier system looks too crowded. Nothing would be lost by omitting the intermediate tier in a State like Kerala. It will only gain efficiency and effectiveness by facilitating clear division of responsibilities between the Districts and the Village Panchayats. Thus the Committee feels that Block Panchayats could be dispensed with in a State like Kerala. Of course this requires amendment to the Constitution and the matter may be taken up with the Central Government which is now in the process of taking stock of the growth of Panchayati Raj in its early stages”.
(Committee on Decentralisation of Powers, 1997, pg 16).

What this points to is the importance of paying attention to the length of the ruler separating the levels. The Committee on Decentralisation of Powers, in charge of delineating the scale of functions to be handed over to the LSGIs, did find it very hard to avoid duplication of functions with the village panchayats. In the context of Kerala, it was found that more effort could be spent on delineating levels lower to the LSGIs as we have seen is done in the urban areas. A move towards this emerged in the year 2001-2002, with the Government Order G.O (Rt) No. 5125/2002/LSGD, dated 4.03.2002, extending the CDS-ADS-NHG structure to rural areas also. Thus, the design and specification of the calibration

and the overall length of the ruler separating the levels in a fractal system is fundamental to the performance of the system as a whole.

6.5.3 Significance of Self-Similarity

In addressing the property of self-similarity, the key question I ask of the PPC is why should it be essential to have a representative governance structure at all levels, rather than just a bureaucratic arm of a higher level? In the first five years of the PPC the political affiliations of the LSGIs were almost equally divided between the two opposing political parties – the Left Democratic Front (LDF) and the United Democratic Front (UDF). Can the LSGI institutions then be said to be self-similar? Or is it the form of the institution that gives primacy to certain functions that is important? Various authors have argued for the need for people’s representation in different levels of government and different institutions of governance more on normative grounds of democracy being inherently good and desirable rather than on functional grounds (Imrie and Thomas, 1999, Murdoch and Norton, 2001). The question I ask however needs clearer understanding of why democracy should be inherently good. The question was consequently asked of one the key actors in the PPC - the Planning Secretary, Government of Kerala, who was interviewed.

“This is a point that we have been repeatedly arguing with the World Bank. They have been stressing project level assistance given directly to project implementers. We have been arguing for the money to be routed through the LSGIs. We have found with experience that only then can synergetic linkages be developed and only then can the development achieved be made sustainable in the long run”.

(Interview of Shri. S.M.Viajayanand, Secretary to Government, (Planning), Member Secretary, Kerala State Planning Board, to Angelique Chettiparamb, dated 31-12-2004)

Searching the literature further for answers, I use what has been termed as the ‘social cognition’ view of democracy to explain the need for self-similarity and the functional logic that is embedded in this. The social cognition view essentially sees democracy as a tool for ‘social cognition’ - a means towards an end, rather than a tool for ‘aggregation of individual opinions’ (Hopkins 2001, pg 171-173). The former gives primacy to deliberation, while the latter values voting. Difficulties in the latter view are partially pointed out by Kenneth Arrow (1951) in his Impossibility Theorem which highlights how overall undesirable outcomes can result from voting as per specific democratic procedures that may be laid down.

In the earlier portions of this argument for fractals we have seen that individual preferences are scale dependent and scale linked. If deliberation is the primary mechanism

through which democracy achieves social cognition as per the social cognition view, then it follows that venues for deliberation need to be fostered in levels that respond to the varied space and time scales of individuals. At smaller scales the logic of numbers make direct participation possible. Besides this fact, the primary focus of concerns that suit that scale (essentially needs based) require much more intense information, specificity and local knowledge. This is possible only through a direct participation process. It is not necessary though that the remit of concerns discussed should be limited to the very local. It can also be global processes. What is local is the tangible effects of these concerns. It is quite common thus to hear effects of the WTO agreement or the Import policy being discussed in the forums of direct participation (Personal experience of attending grama sabha meetings).

As one moves to higher levels, projects suitable for that level tend to increase not only in spatial scale but also in time scale, increasingly attaining what may be termed a strategic character as far as the scale below is concerned. The level of detailed internal information needed tends to become increasingly coarse grained, while issues external to the level tend to become increasingly significant. This may be a) a function of the decreasing distance from the top levels of embeddedness which allows in more external information and also b) the increased emphasis given to external factors that impinge on requirements at lower levels which cannot be addressed at that scale. Thus the deliberation that takes place at this level can be termed as what Hopkins (2001, pg 172) calls a “delegation of deliberative effort”.

What in a deliberation among elected representatives at different scales makes it so essential for planning? Why not have a bureaucratic structure which functions at different scales essentially accountable to one higher tier of government that safeguards democratic norms? Why is it essential that the structures in each level must be self-similar in terms of potential for deliberation? Collective choice mechanisms, one can argue, must seek two basic principles: (1) increased social cognitive capacity which must be quantitative (I understand this in the sense that it must be able to deal with a number of issues simultaneously), qualitative (I understand this in the sense that it must be able to deal with the meaning of the issues as it is felt, experienced and understood by the individuals in the collectivity) , and (2) it must be able to represent difference, be it due to gender, caste, religion, ethnicity, attitudes, beliefs or preferences (Hopkins, 2001, pg 11).

Top-down bureaucratic structures are essentially single purpose or limited purpose compartments. They are not general purpose debating forums. Let us now look at the mechanisms through which deliberation attains its effectiveness. Part of the reasons cited for

the success of the deliberative method is the ability to trade on issues. Hence Haefele (1973) suggests that institutionally it must necessarily be a general purpose legislative body that must decide on issues. After all as Hopkins (2001, pg 195) remarks, 'the complexities of considering many actions are the essence of the purpose of making plans'. Single or limited purpose bodies cannot make use of the positive spin-offs of the deliberative process effectively. They are more suited for following a line of laid down policy (that may be marginally modified to suit local implementation) than engaging in more wider trade-offs that can potentially give rise to scale specific synergetic outcomes. The first criterion for an effective collective choice mechanism is absent here. This we have seen from the above quote from the interview, is also substantiated by field level experience. It is the reason then why, if we need a collective choice mechanism to be effective, we need a self-similar deliberating forum at all scales. The self-similarity criterion then applies to the quality of it being able to debate and trade on issues of collective interest, rather than it belonging to any particular party.

If one were to probe the issue of marginality and power, further, more reasons for a self-similar representative structure rather than a top-down bureaucratic structure to deal with scale becomes pertinent. In the latter instance, the only general level capable of dealing with quantity and quality to whatever limited extent is available only at the top. The policy formulation level then necessarily permits only a coarse grain of internal information to percolate to the top for deliberation. The deliberating forum typically takes in information at levels closest to it, thus incorporating regional or national or supra national issues depending upon the level in which the deliberation is structured. It is also by now commonly known and accepted that the pattern of the coarse grain that gets to the top is very much influenced by power. The constancy of the resolution of representation, allows the masking of the powerless by the powerful, unless the powerless can organise themselves in large numbers sufficient to make themselves visible in the coarse grained information layer of the higher scales. Marginalisation is easier when scales are coarse. Thus, if social cognition through deliberation is the primary achievement of democracy, then the scale of deliberation influences the amount and type of information admitted by the play of power which then can result in marginalisation of diverse or minority interests making the second criterion also ineffective.

In the above paragraphs I have pointed out reasons - by way of mechanisms - that are brought into play when a particular type of structure is adopted and made self-similar across scales. Essentially the processes taking place are (1) increased resolution of information

which becomes pertinent across scales, enabling more fine-grained error control for distortions (of power in this case) (2) re-enforcement across scales of mechanisms that are unique to the structure chosen for self-similarity resulting again in reinforcement of a particular type of output (in this case the possibility of trade-off between issues so as to arrive at a synergetic more equitable collective decision).

Thus it can be argued that there are reasons that explain why the fractal structure 'causes' the results attributed to it. These explanations are not 'systemic' in that it explains particular aspects of the structure and how and why it operates. In other words they are explanations rooted in terms of abstraction at a lower level, for all the effects claimed of the fractal structure cannot be assigned to any one of them. Yet the fractal structure by itself cannot also solely by itself explain the effects. What we have then is an explanation at two levels – the one necessary and indispensable to the other for a holistic understanding. This again reinforces the epistemological claim of systems science (as discussed in Chapter-3) to be only able to provide explanations in combination with substantive theories. However together they are able to provide a better explanation of the experience. As Bhaskar (1998d pg xiii) points out "even though one mechanism may be explained or grounded in terms of another, it cannot be reduced to or explained away in terms of it".

6.5.4 General Institutional Design Theory and Fractals

In this section I relate in general terms the fractal structure described and discussed herein with current literature on forms of institutional design. My discussion aims to bring out the manner in which it links into this body of knowledge, thereby highlighting both the contribution and the limitation of the concept of fractals for institutional design in general.

Forms of institutional coordination have been classified in general into three broad categories depending upon the mechanisms that each type of coordination activates. Thus we have first the hierarchical form based on command and authority (Alexander, 1995, pg 54). Coordination here we know is by administrative means where political decisions are taken first and then directive action is taken to implement those decisions. These administrative actions often take the form of rule-governed regulatory co-ordination and bureaucratic measures (Thompson, 2003, pg 23). It is often said that the hierarchical form of coordination is a structured mechanism of control most suitable for complex and large organisations. The whole organisation is brought in line with a top-down imposed collectively desired end result (Thompson, 2003, pg 23, 24).

Problems in governance that arise from an excessively top-down bureaucratic approach are too well-known to be fully recounted here. In Kerala centralization has been

seen to lead to 'narrow departmentalism, causing duplication and lack of complementarity among the programmes at the ground level' (Isaac and Franke, 2000). Also hierarchical forms seem to get locked into a somewhat impossible situation wherein as Durant (1992, pg 2) points out 'the greater the degree of bureaucratization, the less effective, responsive, and accountable bureaucratic discretion became'.

The most commonly suggested alternative for the inefficiencies that arise from bureaucracy is the ushering in of market-led strategies, where the job of assuring order is left to the interplay of market dynamics. A 'decentralized' decision making process is involved and economic agents make decisions guided by price mechanisms and defined contractual agreements. No single agent is in control here but it is claimed the mechanism of coordination arrives at an outcome that best satisfies social needs and maximises social welfare (Thompson, 2003, pg 24) under conditions of full information, unlimited buyers and sellers that result in perfect competition, and the absence of negative externalities (Durant, 1992).

The problems with markets are mostly that these conditions do not generally hold true uniformly for all situations within the reality of governance. It has thus been opposed and exposed both in terms of the conditions that fail to be met and also in terms of ultimate ends toward which it aspires. Thus Durant (1992, pg 7) opines 'the primacy....assign(ed) to efficiency is woefully inadequate and impractical in light of competing democratic values'. A fuller discussion of the conditions when market dynamics can and cannot work in governance is provided by Sclar (2000).

If hierarchies are based on command, markets on competition, then the third form of inter-organisational coordination, networks is said to be based on trust or solidarity. Being localized and rooted in personal contact, networks are also considered to be 'informal' ways of achieving coordination towards a common goal. They thus provide a critique of both market-driven self-interested instrumental rationality on the one hand and bureaucratic procedural rationality on the other hand (Thompson, 2003, pg 30).

Ouchi (1980), using transaction cost approach as a framework for evaluation, discusses circumstances in which each of the above mechanisms are useful. The framework is fundamentally based on the criteria of efficiency (pg 130), and it allows him to identify conditions in which transaction costs would be high. He focuses on two such parameters – goal incongruence and performance ambiguity. By goal incongruence he means the lack of a common understanding of goals (pg 129). By performance ambiguity he means the ambiguity that arises from a demand for an equitable transaction based on reciprocity (pg

130). Thus according to Ouchi, “different combinations of these causes distinguish three basic mechanisms of mediation or control: markets, which are efficient when performance ambiguity is low and goal incongruence is high; bureaucracies, which are efficient when both goal incongruence and performance ambiguity are moderately high; and clans (or networks) which are efficient when goal incongruence is low and performance ambiguity is high” (pg 129).

What can be seen from this is that 1) there are three different forms of inter-organisational coordination, each undoubtedly being capable of being sub-divided into sub-categories that are distinguished on more finely defined differences; 2) each of these categories are apt in particular situations, none being apt for all situations alike. In the fractal system of organisation we have what I would term a meta-coordination structure that allows for the working of 1) hierarchy through a command control by admitting the possibility of setting guidelines for plan formulation by higher levels, (in the PPC this is at present done only by the state government, but this is a function that can quite viably be also done at the district level), 2) networks through the working of the grama/ward sabhas where there is an institutionally created space for networks of trust to be formed for information gathering, plan formulation, implementation and monitoring, 3) markets by means of local government level decisions to privatise a particular part of their mandated functions. In other words, the vertical axis of the fractal system emphasises bureaucracy and formal expertise, though the direction of flow in the case of PPC is more bottom-up rather than top-down. The horizontal axis emphasises more informal relationships of lay expertise and inter personal skills. The market remains as a third option that can be ushered in to replace any functions assigned to the LSGI.

Conclusions

In this chapter I have introduced the notion of fractals from the natural sciences, discussing the insights it has given rise to. I have then abstracted four general definitional features of fractals – the vertical axis, the horizontal axis, the property of self-similarity, the length of the scale - and have claimed three properties – the distributional effect, the amplification effect, the emergent effect - that may be causally attributed to this structure.

In the empirical investigation for examining the relevance of the concept of fractals for planning, I have discussed the case study of the People’s Planning Campaign in Kerala, India. First, I have substantiated the possibility for identification of fractals by redefining the PPC to highlight the fractal structure within it. I have then proceeded to investigate if the claims made for fractals can be observed empirically. I have then discussed more widely the concept of an

explanation and the reason why fractals must be regarded as a causal mechanism particularly relevant to the second level of planning, along with the more widely understood meaning of mechanisms as being explanations based on a lower level of reality.

I have also at the end discussed how the fractal structure relates to the by now firmly established three types of organisation in institutional literature – the network model, the hierarchical model and the market model. In doing so I have positioned the fractal structure at a meta-level capable of incorporating all three mechanisms within it drawing on the strengths of all three while arguably limiting the drawbacks.

I have in discussing the substantive issues followed the methodology derived from the theory of metaphors – definition of concept, abstraction of essential properties, building up a case of possibility by constructing a parallel in the target domain, general re-contextualisation, within target domain, empirical validation and more specific contextualisation of theoretical concepts advanced. The last three stages leave enormous scope for further development. However this thesis by virtue of its scoping limits itself at this point. The potential to take the theory forward is open to future research. Some of the ways in which it can be done are discussed in Chapter-9.

Ontologically, the theory transfer undertaken in this chapter follows the systems logic. In abstracting the structural logic of the PPC and equating it to the structural logic of the fractal structure, relational qualities are stressed. In showing how mechanisms impact on each level recursively due to the planning process, dynamic qualities in time are stressed. With the introduction of recursivity, the system becomes ontologically ‘complex.’ It then exhibits qualities associated with fractal systems, qualities that are also seen in the natural sciences. The fractal logic thus represents a way, an ordering, by which society can deal with its own complexity. Fractals point to a way of integration of the local to the global in systemic terms. The ordering that results guides the system along an evolutionary pathway that is determined by the system itself. The planner is not in centre-stage here. The first stage of planning is shared by other actors, in fact owned by *society* itself. Yet the design of the process as a whole at the system level contributes to an ordering of *society* in terms of systemic abstract content less outputs (here the linkage of local to global and very precise targeting is possible), unknown in their details or specificities. It thus advances a strong methodological insight for planning. The methodological insight with respect to planning has been taken further in this chapter and two methods for achieving fractal structures have been identified – the first by specifying a process that iterates to a common fundamental factor which then causes a self-similar form, the second, by specifying a self-similar form that then causes iteration in the

process, that can then give rise to patterns of relative stability that contribute to the achievement of ordering of society. The ontological claim advanced here is thus ‘causal’ in nature. Epistemologically, the analysis here is positioned at the level of second order planning. It thus enables the planning of planning and contributes to the discipline of planning at this level. Within this second level of planning the first level of planning comes into operation, bringing in other considerations of agency, contingency etc, which could modify the effect qualitatively across the domain of application, or even block out the effect due to contingent effects. The actual content of the systemic level abstract outcome is addressed at this level. Thus theories of power can help investigate how power is re-inforced/mitigated by the fractal structure or vice versa. This again potentially gives rise to another set of research agenda – the interplay of fractal effects in contingent circumstances or by the operation of agency.

The writing of this chapter has followed the methodology adopted. The substantive content is essentially analytical as it involves an abstraction of key elements that might have causal properties. The latter part of the chapter is also analytical as it seeks to establish empirical evidence for causal claims advanced earlier. The writing strategy adopted is consequently analytic and ‘linear’ in that sense, rather than heuristic. This can be contrasted with the writing adopted in Chapter-7, which demands a totally different approach to presentation. I now proceed to examine in Chapter-7, the concept of autopoiesis and its potential for theory contextualisation within the discipline of planning.

CHAPTER-7

AUTOPOIESIS IN PLANNING AND GOVERNANCE

Introduction

In Chapter-6, I examined the concept of fractals in some detail and discussed its relevance for the field of planning and governance on theoretical grounds, also illustrated and argued empirically through an examination of the case-study of the PPC, Kerala, India. In this chapter, I focus on yet another concept from complexity theory- the much discussed and debated concept of autopoiesis.

The mode of argument in this chapter varies considerably from that of the previous chapter for a number of reasons. Firstly, the concept of autopoiesis is developed to a very high degree of refinement within the social sciences, especially the German stream. This in turn in discussing its relation to planning demands a different approach altogether. An introduction to the logic of the theory becomes necessary to start with. Secondly, in autopoiesis, the system of argument is conceived of as building upon a circular system of precisely defined theoretical reference points, which it itself introduces. Thus these system reference points need to be introduced and explained. Thirdly, the argument is fundamentally epistemological rather than ontological as in the previous section. This has implications for planning. However, it requires some amount of explanation about the grounds – the how and why of autopoiesis by way of which a de-ontologised approach can be justified.

The theoretical literature of autopoiesis within social science dealing in a theory of society is vast. The problem is first to understand the syntax of the logic that autopoiesis engages in and then to construct an argument out of the myriad of concepts – an argument that would be relevant and pertinent for a practically based discipline like planning. Planning also is vast, encompassing almost all domains of social and human activity. In order to link these two domains, I had to find a third criterion which would help me delimit my argument. This was provided by the case-study - the PPC, with a desire to highlight aspects of it that were not already discussed, it being an exemplar by itself in many ways and therefore of interest. Even then there were a number of areas

which satisfied this three way criterion. The examination for relevance of this concept by itself being only part of the overall thesis, I had to still further narrow down the choice. I also needed a vehicle for carrying my arguments from the abstraction of autopoiesis to issues in the practical world of planning and thereafter to the PPC. Writing constraints which I shall explain below prompted me to go for a secondary case-study based approach. The case-studies were chosen from published articles and the choice was guided by the way it brought out issues that autopoiesis could explain. These issues thus provided the vehicle for drawing out the contributions and added value that autopoiesis could claim for planning. This chapter is then at the intersection of the theory of autopoiesis, certain issues of concern within planning and the empirical experience of the PPC. As a vehicle for constructing the argument, a twin pronged case study approach is adopted which in turn is detailed below. It must be emphasized that though the choice of issues/concerns discussed here necessarily relate to autopoietic concepts, planning literature and the PPC, they are by no means exhaustive of the potential that exists in applying autopoiesis to planning or indeed the PPC. Though one might expect that applying a three fold criterion, especially a conditioned one (that it must be demonstrable through parts of the PPC not already discussed) would narrow down the choice, this is by no means the case. Thus grappling with the interconnections and complexities of the possibilities that the criteria opened was a challenging task in delimitation.

As mentioned earlier, autopoiesis as a theory in social science is quite well defined to a high degree of sophistication through the work of Niklas Luhmann. However it constructs its own reference points. Also, by nature, being grounded in general systems theory dealing with complex social systems, the level of abstraction is also high. In writing, I therefore encountered the dual problem of having to introduce the abstract concepts (as they provided the reference points) while at the same time having to relate them to more applied situations (which planning dealt with). The added value provided by autopoiesis being located in a fundamentally deeper level, bringing it out just by constructing theoretical arguments was possible, but promised to be a long drawn out affair with every risk of losing the reader. (In fact the voluminous work of Luhmann is famous for just this). Also there was a desire to bring out the causal claims of autopoiesis, an issue that the writings of Luhmann do not directly and explicitly address. The chapter

had thus to span the whole range from metaphysical abstraction, through theoretical propositions and discussions, to empirical problem solving, inside the narrow space of two chapters in the thesis. A tight argument was needed, which would have to be selective, yet comfortable in the selection. I chose a two pronged case-study approach to deal with this problem – the first set of case studies as mentioned earlier, are from published journal articles, chosen in order to provide the potential to illustrate the level and type of explanations that autopoiesis allows. The themes of the case studies become vehicles for constructing arguments for the relevance of autopoiesis. Details of the various abstract concepts are introduced after presentation of the questions that an empirical situation throws up, so that the reader is guided as to what sort of issues are being probed for in the recounting of the abstraction. Then the empirical case study is re-analysed in terms of autopoiesis to show the added contribution. The re-analysis thus yields two results – first, the added contribution, second, the particular set of theme based issues that come up. The second case-study on the PPC addresses this set of theme based issues. I use my empirical field to illustrate how the theme based issues can possibly work/not work in planning. Finally as a reflection on what has been said so far, I introduce the causal claims, since by this time enough reference points would have been created both in empirical and theoretical terms to anchor the reader.

The layout of the two chapters that discuss autopoiesis is in five parts. The first part introduces a certain amount of background information of the theory, its development, its claims for being applicable to social systems, and an overall sketch of some of the fundamental arguments. The basic terminologies are introduced in Appendix -10. The second part makes the transition to planning discussing Luhmann's own views on planning and steering, as he is the author of social autopoiesis. The third part deals with planning and autopoiesis. It discusses the first set of case-studies, the planning issues/themes they highlight, and the details of concepts in autopoiesis that relate to these themes. The fourth and fifth parts form the content of chapter-8. The fourth part deals with the planning themes discussed in part three by examining the field work on the PPC. The argument for relevance is therefore indirect in the sense of it being from the theory to planning concepts/issues and then to the PPC. This is necessitated by the nature of the theory, which is drawn out in the fifth part. This part actually leads back to the first in the

sense that it falls back on abstraction from the arguments presented so far to reveal the causal claims that autopoiesis allows. It is circular in that sense.

7.1 The Theory of Autopoiesis

This section provides necessary anchors for a rough understanding of the genesis, development, nature, and use in social science of a selection of basic concepts and arguments associated with the theory of autopoiesis.

The theory has an origin in biology. Hence it owes some of its basic concepts to that field of origin. Some account of its genesis and the claims and propositions advanced by its originators therefore need to be provided. I discuss two claims from the theory of autopoiesis and the concepts involved in some detail – the concept of structure vs organisation and the theory of observation. These concepts point to the ontological status of the theory which, in turn, leads to the epistemological implications of the theory. Details of standards of scientific validity that the theory seeks and therefore claims for itself are included in Appendix-9. Finally, the transfer of the theory of autopoiesis into the social sciences is discussed.

7.1.1 Autopoiesis in Biology

The term ‘autopoiesis’ was first coined by two Chilean biologists, Humberto Maturana and Francisco Varela in the 1970s. The English translation of their work, however became available only by the early 1980s (Kay, 2001). The two biologists were attempting to distil out the real meaning of life in the biological world, choosing as their unit of study a living cell. For them there seemed to be ‘a fundamental imbalance in the understanding of the living organization’ (Varela, 1981, pg 36, quoted in Kay, 2001, pg 461) as life was generally understood in biology as being a property that comes about by being a repository of a list of attributes (Mingers, 1995, pg 9, van Twist & Schaap, 1991, pg 32) or else was reduced to an explanation founded on genetic programs (Viskovatoff, 1999, pgs 488, 489). The authors were interested in an explanation that need not have to be reduced to lower level phenomena, yet held explanatory power.

The term ‘autopoiesis’ translated from Greek approximates in meaning as ‘self-producing’ (autos = self, poiein= to make (Brans and Rossbach, 1997, pg 425)). The term relates to Maturana and Varela’s key finding that what distinguishes a living organism is “the systems specific organization of production relationships” (van Twist & Schaap,

1991, pg 32). The outputs of the systems are its own inputs. This is in contrast to an 'allopoietic' systems where the outputs would be very different from the inputs, say in a chemical factory (Mingers, 1995, pgs 11, 12). The concept of autopoiesis for Maturana and Varela is precise. They argue that the capacity to reproduce a particular organisation of parts self-referentially solely from the parts themselves gives rise to a unity which they term as autopoietic. Their definition of an autopoietic system is then "a network of productions of components which (i) participate recursively in the same network which produced them and (ii) realize the network of productions as a unity" (Varela *et al*, 1974, quoted in Kickert, 1993, pg 263).

One of the important conceptual distinctions that autopoiesis in social science adopted from the original field of biology is a distinction between concepts of 'structure' and 'organization'. With regard to this distinction, Maturana (1992, pg 129) clarifies "I use the word structure to refer to the actual components and to the actual relations that constitute a particular system as it is brought forth in its distinction by an observer. At the same time I use the word organization to refer to the relations between the components of a particular system that define its class identity". Thus the 'organisation' of an entity defines the particular relations that make it a member of a class, say a university. The 'structure' of an entity defines the actualisation of these particular relationships in a particular real example, say Cardiff University. Mingers (1995, pg 15) makes this more clear when he says that "an existing composite unity, therefore, has both a structure and an organization. There are many different structures for an organization, and the structure will have many properties and relations not specified by the organization and essentially irrelevant to it – for example the shape, colour and size of a particular airplane". It also follows from this that an autopoietic system need not produce the same 'structure', but will produce the same 'organisation'. The living entity is thus conceived as being organisationally closed.

Maturana and Varela's concept of organization is important as the particular form of abstraction they aim at is made clear by the assertion of 'organization' being the fundamental entity that describes what it means to be a living system. They identify 'organization' in an abstract form as being something common to living systems whatever its particular manifestation might be in a particular system. Thus,

“it is our assumption that there is an organization that is common to all living systems, whichever the nature of their components. Since our object is this organization, not the particular ways in which it is realized, we shall not make distinctions between classes or types of living systems.....We are emphasizing that a living system is defined by its organization and, hence that it can be explained, as any organization is explained, that is, in terms of relations, not of component properties” (Maturana and Varela, 1980, pg 76, quoted in Viskovatoff, 1999, pg 489).

The same level of abstraction is found in the autopoiesis of social systems, where the emphasis is not on the properties of particular social systems or functional systems as such, but is on the way society is organised and thus how components of it are mutually related to give rise to a theory of society.

If one were to accept the centrality of the notion of organization for living systems, and its closed nature, with the possibilities of a change in structure left open, then this brings forth the question of how change takes place in an autopoietic system. The relationship with the environment is critical here. An autopoietic system is conceived to be interactively open, though organisationally closed to its environment. What this means is that it may interact with its environment in terms of absorbing or discharging matter, energy, information or symbols. But this interaction is fundamentally based upon the maintenance of its own identity and is therefore considered to be in a sense a projection of this identity (Kickert, 1993, pg 262). In classical evolution theory, the environment is the cause of change, as the organism evolves towards a best fit for survival structurally adapting itself. The organism here has no choice other than to adapt or perish. Causality is primarily grounded in the environment. The role of the environment for an autopoietic living organism is however turned around. Here causality stays in the self-referential process of the organization. The environment is reduced to a realm of sources for perturbations or triggers on the structure of the system (Mingers, 1995, pgs 75, 76, Kay, 2001, pg 462, Kickert, 1993, pg 262). The organism chooses whether to respond or not and in what manner to respond, solely with respect to itself. The environment thus cannot ‘determine’ in the strict sense of the term, if there might be a change and further, cannot specify the type of changes that may come about.

Organisational closure is thus maintained, while interactive openness is granted. Thus, "...we must accept living systems as structurally determined systems, namely, as systems that do not admit instructive interactions because everything that happens in them is determined at every instant in their structure at that instant, either through their proper structural dynamics or triggered in them (but not specified) by their interactions with other structurally determined systems" (Maturana, 1992, pg 130, 131). There is a second source of change and that is the purely internal dynamics of the organisation itself (Kay, 2001, pg 462), in its conduct of internal operations in time. For example in ageing. In both these sources of change then it is the particular structure and organisation of the system that is decisive rather than the environment.

Maturana and Varela's concepts of 'observation' and the 'observer' are also important. These concepts lay the epistemological foundations of the theory of autopoiesis. Maturana (1992, pg 131), asserts "it is a constitutive feature of the observer as a living human being that he or she cannot make assertions about an independent objective reality even though this may seem necessary for epistemological reasons". There is an explicit denial of epistemological access to 'objective reality' here. From this it follows that "everything that he or she distinguishes is constituted, or brought forth by his or her operations of distinction" (pg 131). Further Maturana poses that if one can explain how the distinctions that an observer makes, can actually be a mechanism for the way things are organised as we see it, and if this explanation is made in a manner that satisfies particular scientific criteria, then it becomes a scientific explanation. More details of Maturana's criteria for scientific validity and explanation are included in Appendix-9. Below I now discuss the debate surrounding the possibility for autopoiesis in social systems.

7.1.2 Possibilities for Autopoiesis in Social Systems

Maturana and Varela in their writings on autopoiesis vary in opinion on the extension of the concept to the realm of social systems. Varela states "in order to say that a system is autopoietic, the production of components in some space has to be exhibited; further, the term production has to make sense in some domain of discourse. Frankly, I do not see how the definition of autopoiesis can be directly transposed to a variety of other situations, social systems for example" (Varela, 1981, pg 38 quoted in Mingers, 1995,

pg 129). Varela actually advocates for a less precisely defined concept of organisational closure, which then need not carry the imperative for component production which he finds difficult to justify in social systems. So for him “unless a clear distinction is made between the particular (autopoiesis and productions) and the general (organizational closure and general computations), the notion of autopoiesis becomes a metaphor and loses its power” (Varela, 1981, pg 38, quoted in Kay, 2001, pg 462).

Maturana’s stand is slightly different here. For him society essentially is a “medium through which autopoietic subjects realise their autopoieses”. Thus for him, “....a collection of interacting living systems that, in the realization of their autopoiesis through the actual operation of their properties as autopoietic unities, constitute a system that as a network of interactions and relations operates with respect to them as a medium in which they realize their system and, is in fact, one such system” (Maturana, 1981, pg 11 quoted in Mingers 1995, pg 130). Significantly, Maturana makes a distinction between ‘living’ systems and ‘autopoietic’ systems - “the notion of autopoiesis fully characterises living systems as autonomous entities in physical space” (Maturana, 1981, pg 23 quoted in Kay, 2001, pg 463). He adds “we have chosen to identify living systems with only autopoietic systems in the physical space because this is the space in which we exist” (Maturana, 1981, pg 23, quoted in Kay, 2001, pg 463). As Kay (2001, pg 463) argues this then admits the possibility of having non-living autopoietic systems not constituted in physical space.

What does then come out of the above described positions of Maturana and Varela, the original proponents of the theory of autopoiesis, is that both agree that the concept of autopoiesis cannot be directly transported into social systems as such. However they both agree that the concept may be of some significance, though they disagree on how this significance may be realised. Niklas Luhmann with his work *Soziale Systems* (1984) in German, translated into English in 1995, as *Social Systems*, addresses this issue. Luhmann maintains that there are three types of autopoietic systems – living systems, psychic systems (with consciousness) and social systems. He explicitly denies that social systems are living systems, but claims that they are nevertheless autopoietic. Thus he states if “we abstract from life and define autopoiesis as a general form of system –building using self-referential closure, we would have to admit that there are non-living

autopoietic systems, different modes of autopoietic reproduction and that there are general principles of autopoietic organization that materializes as life, but also in other modes of circularity and self-reproduction” (Luhmann, 1990, pg 2).

It is useful to note Knodt’s (1995, pg xvii) clarification in the foreword to Luhmann’s work – “*Social Systems* does not present a sociological analysis of modern society or a theory of society but elaborates the general conceptual framework for such a theory. It supplies the instruments for observing a variety of social systems – societies, organizations, and interactions – not primarily such observations themselves”. This one can see is in tune with Maturana and Varela’s (1980, pg 76) statement found in Viskovatoff, (1999, pg 489), quoted earlier, regarding the level of concern that autopoiesis addresses – not particular living systems and their organisation, but the concept of organisation itself, in general.

7.1.3 Autopoiesis in Social Systems Based on Luhmann’s Conception of Social Systems

Luhmann’s work has been hailed as by far the most “clearly sociological and theoretically complete work” (Kay, 2001. pg 464) that uses the concept of autopoiesis in sociology. He has consequently now emerged as one of the most prominent of contemporary social theorists especially in Germany (Viskovatoff, 1999, pg 481) with his work being debated extensively. I shall not enter into any of these debates as our concern here is with its relevance to planning rather than with the intricacies of sociological debate. I shall also not go into any detail of Luhmann’s concepts (which are very precisely defined) for social systems here. A selection of these are included in Appendix-10. I now present some general notions that must be introduced to help understand the discussions to follow later.

Maturana, (1992, pg 126,127) makes a demand on the reader – “..the listener cannot but listen from the perspective of his or her own accepted notions. One must release one’s hold on one’s accepted notions to allow for change in the process of listening that may permit him or her to hear something new or different.....If the listener (or reader) does not want to follow this invitation because of his or her explanatory preferences, nothing can be done because he or she will not understand what follows”. This is as apt a prelude to Luhmann’s work as it is to Maturana’s work, for many notions,

concepts and explanations advanced have been termed as 'counter-intuitive' by critics and commentators (Viskovatoff, 1999, pg 481, 504, Gumbrecht, 2001, pg 50). Undoubtedly 'original' that it is in many respects, the theory still draws from the work of many others from various disciplines. Thus besides Maturana and Varela, some of those that have been acknowledged by Luhmann and also pointed out by other authors are the influence of Heinz von Foerster's 'order from noise' principle (Knodt, 1995, pg xxii, Luhmann, 2000, pg 45), George Spencer Brown's Boolean logic (Arnoldi, 2001, pg 4, Rasch and Wolfe, 2000, pg 112, Luhmann, 1997, pg 363), Husserl's phenomenology (Paul, 2001,) and Parson's structural functionalism (Knodt, 1995, pg xix, Arnoldi, 2001, pg 3, Luhmann, 1995, pg 103-106).

Rasche and Wolfe (2000, pg 12) point out that traditionally, cybernetics and systems theory has been regarded as politically suspect on the left, primarily because of its emphasis on control and equilibrium dynamics, which essentially allowed the technocratic and bureaucratic class to wield power. The formality that promised order, in practice showed itself to be not only unable to deliver, but was also exposed as marginalising, aiding a totalitarian politics leaving the social and economic order largely unchanged (Merchant, 1993, pg 104). Second generation cybernetics - as the science of complexity and the various systemic implications of it have come to be known - focus on a different set of dynamics that involve recursiveness, contingency, chance and subjectivity. Autopoiesis is one of the concepts within this stream emphasizing a circular form of causality, paying attention to self-reference, self-observation and self-determination. Some of the definitions connected with the theory are included in Appendix-10. A more descriptive account which also traces the way in which autopoiesis leads to a different metaphysics - one that is 'de-ontologised', yet rich in epistemological implications - is now presented.

Theoretical debates in autopoiesis centre on the epistemological dimension rather than the ontological. Habermas in fact calls Luhmann's stand a 'non-ontological' stand. He remarks "... the philosophically reflected changeover to the systems paradigm results in a far-reaching revision of the conceptual framework of the Western tradition, which has been fixated on being, thinking, and truth. The non-ontological frame of reference is unmistakable once it becomes clear that research in systems theory is itself conceived of

as a subsystem (of the scientific and social systems) with its own environment” (Habermas, 1987b, pg 372). To explain this further, for Luhmann, a system comes into being by means of creating a distinction between ‘this’ and ‘that’, ‘inside’ and ‘outside’ and then enforcing a selection. This creation of a distinction is a way of reducing the complexity of the environment – a way of achieving a certain order from complexity. For instance, “ecology has to do with a complexity that is not a system because it is not regulated by a system/environment difference of its own” (Luhmann, 1995, pg 31). Once a system comes into being, the difference between system and environment is repeated within itself to yield functionally differentiated sub-systems each with its own elemental autopoietic processes (law, science, economy, politics etc). A merging of internal differentiation of any subsystem and its environment would result in the whole system itself and it can thus be termed as constituting a unity.

In making a selection the system actually chooses or ‘actualises’ from a range of possibilities. Much in line with Husserl’s conception of ‘free variation’ (Paul, 2001, pg 376), Luhmann calls this actualization ‘meaning’. “Meaning is the continual actualization of potentialities” and “...meaning can be meaning only as the difference between what is actual at any moment and a horizon of possibilities...” (Luhmann, 1995, pg 65). Luhmann claims for a concept of meaning that is meaningful not only at the level of psychic systems (individuals with consciousness), but also at the level of social systems. Psychic systems produce cognitive operations (thoughts) as their mode of autopoiesis, and social systems produce ‘communications’ as their mode of autopoiesis. Each functional system structures its meaning processing on a distinction that is used so often that it emerges as a binary code for that system. Thus, the system of science uses the code truth/untruth, art, the code aesthetic/unaesthetic, law legal/illegal and so on (Arnoldi, 2001, pg 6).

Each of these systems being self-referentially closed, it can only observe based on its own code. There is no position then from which universal observations can be made. What is seen as meaningful by one system can actually be seen as different by another system, the processing of meaning being an actualization from among different possibilities entirely dependent on the self-referential processes of each autopoietic system. Thus, “no system can decompose another analytically to arrive at final elements

(substances) in which knowledge could find an ultimate foothold and secure correspondence with its object” (Luhmann, 1995, pg 35). In the words of Maturana and Varela (1992, pg 135) “everything said is said by someone”. This is foregrounding the act of observation and thereby the problem of observation. “Reality, then may be an illusion, but the illusion itself is real” (Luhmann, 2000, pg 37).

Commenting on Luhmann, Habermas (1987a, pg 372) points out “any premise that in metaphysics, epistemology, or linguistic theory, postulates the ultimacy of a cosmic order, a subject-object relationship, or a relation between sentences and states of affairs is set aside without discussion”. He characterizes Luhmann’s systems theory as “a shift in thought from metaphysics to metabiology” (pg 372), but also claims that it is not really sociology, but is “more like those metatheoretical projects that fill the function of world views” (pg 384). This is then Luhmann’s claim to creating a theory that is entirely self-referential and ‘original’. Reflecting further Habermas concedes “descriptive systems stemming from the natural sciences are too remote from everyday experiences to be suitable for channelling distantiating self-descriptions into the lifeworld in a differentiated manner and along a broad front. This changes with the language of general systems theory that has developed from cybernetics and with the application of its models in various life sciences. The models derived from intelligent performances and tailored to organic life come a lot closer to the socio-cultural form of life than classical mechanics. As Luhmann’s astonishing job of translation demonstrates, this language can be so flexibly adapted and expanded that it yields novel, not merely objectivating, but objectivistic descriptions even of subtle phenomena of the lifeworld” (pg 384, 385).

Examining Luhmann’s links to Husserl, Paul (2001, pg 376) points out “as for Husserl, so too for Luhmann, reality *is* (original emphasis) a construction or a substrate whose underlying object-relatedness or validity is measured by criteria of coherence and consistency that are internal to the construction, but not by objective resistance”. Notwithstanding the strong phenomenological bent implied in autopoiesis, Rasch and Wolfe (2000), draw out ways in which contemporary systems theory goes beyond a seemingly postmodern turn. They contrast the systems epistemology grounded in autopoiesis against pragmatism and deconstruction, two main threads within the postmodern turn. Thus “pragmatism, like systems theory, insists upon the social and historical contingency of all

knowledge; but unlike pragmatism, systems theory believes that the recognition of this contingency requires an ongoing commitment to questions of epistemology, rather than - to use Cornel West's characterization - the 'evasion of epistemology-centred philosophy'". Against deconstruction, Rasche and Wolfe argue "unlike deconstruction (which is suspicious of both universal claims and utilitarian thought in general), systems theory attempts to provide a rigorously coherent means of describing all systems, whether organic or inorganic, and quite unabashedly serves a wide range of practical applications in a variety of fields". Hence the strong epistemological grounding of systems theory in the act of observation and the process of observation, together with its consistency in the concepts, forms of reference and validation criteria that it uses, distinguishes it and helps claim for it a more fundamental grounding than pragmatism or deconstruction.

Autopoiesis then gives us epistemological implications at a very general level which also relates to constructions of causality. These implications are at a broad meta level having more implications on knowledge claims per se. The question that remains before us is how does this shed light on planning? I address this question in the rest of the chapter. Prior to that however I discuss Luhmann's own views on planning and steering.

7.2 Luhmann's Views on Planning and Steering

Luhmann discusses planning both as an activity within society and planning seen as political steering of society. In both instances, his conclusions are not very encouraging. With regard to planning, he starts by making the point that "like everything that happens within a system, planning can only be one process among others" (Luhmann, 1995, pg 469). This also means that the activity can be observed. Essentially planning tries to orient itself in some way to system complexity. This sort of a system - one that is oriented towards its own complexity - is termed by Luhmann as being 'hypercomplex' (pg 471). Planning makes a model of the system to direct itself. It creates a self-description that is oriented towards the future and then this self-description or model is re-introduced into the system. The activities of planning make this model visible. No system can completely describe itself. Hence planning necessarily leaves things out (interests that have been passed over, priorities, hierarchies of values not considered etc (pg 470)). However this activity of self-observation itself can be observed.

Thus one can observe planning and make corrections for its initial observation. A situation of double contingency thus arises, when planning anticipates its observation and makes corrections accordingly. Also planning being oriented towards the future, can also be seen as an 'extension of choice' (pg 471). There are always people who are affected by planning and they will use the "free capacities of communication in the system to experience and if possible change what is planned" (pg 470). It then becomes contingent. Luhmann observes that in planning, "one must therefore give up all fixed foundations, for they must be worked out at any given time as adequate consensus, and consensus is also subject to the law that it must be observable" (pg 472).

In discussing possibilities of political steering, Luhmann relates problems in steering to the self-referential character of systems. According to the theory of self-referential closed systems, systems are structure determined and only the system itself can change its structure and that too by its own operations. Thus any change within the system must be a change that is initiated by the system. The environment can at the most be just a trigger or an irritant and consequently can never have a direct determinate causal relationship with the system. Thus regarding the role of politics in steering, Luhmann argues against any role or rather a role that is largely limited. Politics for Luhmann being a subsystem within society cannot transcend itself. It can only steer itself, based on its own code which Luhmann suggests is power/absence of power. The result may have tremendous impacts on society and other sub-systems, as they must then orient themselves to the differences produced. However Luhmann emphasises "*But this effect is certainly not steering and it is not possible to steer it* (original emphasis) because it depends on the construction of differences in the context of other systems and because it falls under the steering programmes operating in these systems" (1997a, pg 47, 48).

Luhmann however tries to salvage some possibility for steering. He remarks, – "the subject world of the risk society and of normal catastrophes does not render the discussion about the possibility of planning society futile but rather it is all the more important in which sense this 'planning of society' could be used". Further, "it is difficult almost impossible to abandon the notion of steering and to let the future come as it comes". But, "on the other hand, it is not easy to see if and how, at least some of the expectations related to steering could be saved' (Luhmann, 1997, pg 41). One way in

which the concept of steering is still saved by Luhmann is by admitting 'asymmetries' in distinctions. For Luhmann, steering very simply means 'reduction of difference'. It is the reduction of difference from a given or desired path but also can be the construction of a difference when a change is induced (pg 42). The notion of 'purpose' is also reconstructed here. Luhmann sees this as an attribute of asymmetry, within the distinction - an 'indication of direction' (pg 46). Thus "the equalization of educational chances, says the purpose, shall not be reached by decreasing but by increasing the education for all" (pg 46). These asymmetries are 'principles' forced upon steering as a rule of observation by the society as a whole (pg 50). It is this possibility of asymmetry that makes steering a possible activity. The possibility for asymmetry arises because any act of observation will employ its own distinction. "The observation of steering can, and typically will use other distinctions than the steering itself, which produces for its own part its own effects" (pg 45). Thus "...steering is possible because it presupposes only the choice of distinctions with regard to the differences one wants to minimize. As long as observers observe this unexcitedly it may function and, if acceptance is transferred from one distinction to another, steering may follow" (pg 51). Thus what is possible by wider systems is the orientation of the observation which can be specified.

Luhmann sees a bit more of a positive role for political steering than he does for planning implicitly regarded as a rather specialised activity. I now discuss both these standpoints and analyse them for their significance. Before doing so I distinguish between first order observation and second-order observation. First order observations are the distinctions made in the process of planning and steering by the planning system or the steering system resulting in the creation of the model with which the system works. Second-order observations are the observation of planning processes or steering processes by society or those affected.

First, I take up the issue of second order observation. The role for political steering is salvaged by introducing another possibility, the possibility of asymmetry and linking it to the process of self-observation of society which in autopoietic theory is fundamental to the dynamics of self-referential systems. In the case of political steering, the process of observation of politics is grounded in social criticism that allows for asymmetry. In the discussion on planning however, the observation is external, by those

affected by the process of planning. Planning is thus detached from those affected and is seen as separate. This distinction need not be the case as we know that planning is as much a socio-political act as politics is a steering act. Hence the role of social criticism as a positive force that provides asymmetry to steering is equally valid for planning as well. This point shall become clearer in the empirical discussions.

Second, the introduction of asymmetry into the steering process can be seen as the introduction of a 'constraint' on the first level of distinction, which forces it to take the asymmetrical path (given that the power/no power balance is dependent on it). If this is the case, then arguing in parallel, all that is needed to make asymmetry a possibility for planning also (which Luhmann does not examine) is to introduce the possibility of the second-order observation to 'constrain' the first order observation process in planning (if it is not happening). The question then actually is where the second-order observation ought to come from. It is not the question of who should plan as is phrased in the planning literature, but is rather, which system sets the constraints for the first order observation carried out in the process of planning.

The third point of significance is that while as steering is seen as reducing the deviance from a set path, planning is seen as the projection of choices. One of the main dimensions of difference between politics and planning seen by Luhmann is that while politics is envisaged as an on-going activity routed in action in the present, which might refer to the future, planning is envisaged more as an activity primarily concerned with making choices for the future, though it might refer to the present. Thus he argues that planning always leaves a time space for opposition to be organised 'a reaction to planning has time to prepare itself' (pg 470). The present is bracketed in for planning which is primarily future oriented while as for politics, the future is bracketed in while it is primarily present oriented. The outlook on planning is also thus related to the time dimension of planning – the temporal dimension that it grounds itself in primarily.

I have presented the limitations for planning as well as the limitations and potential for steering that Luhmann sees. These do provide a certain amount of direction at a broad level of understanding. Acknowledging Luhmann's arguments, I have moved further to analyse how the outcome of the argument is in fact related to a few fundamental premises or assumptions made about what planning is and the various ways

in which it might take place. These I argue need not characterize or typify planning. The insights that an analysis of the grounds for the opinion however yields useful normative guidelines for how we might possibly conceive of planning. These points are taken up for further discussion in the empirical analysis.

7.3 From Autopoiesis to Planning Issues

In this section, I make the transition from the meta level of autopoiesis to the more applied level of planning practice. As mentioned earlier I use case studies from secondary sources for this. The case-studies are published in journals and report on field experiences conducted for other purposes. In this chapter, their purpose is to serve as a vehicle to ground the abstraction of autopoietic theory. My distance from the case-study is thus an advantage in the sense that I use only what is reported in the articles and the selection of what is reported is not in the least guided by autopoietic theory or by my selection. My selection does enter though as a selection of the case study itself. This was done on the basis of their potential to ground the arguments that autopoiesis makes in a substantive domain. Their use here in this thesis is thus largely instrumental and illustrative, serving to provide substance through which arguments for the relevance of autopoiesis can be made. Also it must be highlighted that the case studies necessarily throw light on a particular set of issues only. The possibilities that exist for applying autopoiesis in planning however are much more than what can be discussed here.

The first case study is presented singly. The second and third case studies are presented together in tandem, as they together highlight substantive issues for planning. Along with each case study I present the issues that the authors raise. Concepts from autopoiesis, of relevance to the case study, are then introduced in more detail. Finally the case study is re-analysed in terms of autopoiesis to highlight additional concerns/issues and normative directions that illustrate the added contribution of autopoiesis.

7.4 Law in Planning – An Autopoietic View

This case study has as its substantive focus the way in which planning can relate to law. The area is as such under-researched within planning (Salet, 2002, pg 26). Much work in planning and law is either on historical, or theoretical or normative aspects of how the both can relate (for example Salet, 2002, Booth 2003, 2002, 1999, Herbert-Young, 1998). Empirically rooted, case study based work on what actually happens on

the ground is not very common. This case study was thus chosen for its focus on law as it relates to planning and the dynamics it gives rise to in implementation.

7.4.1 Case – Study Description

Case-1: Imrie,R and Thomas,H, (1997) ‘Law, Legal Struggles and Urban Regeneration: Rethinking the Relationships’ In *Urban Studies*, Vol 34 No 9, Pgs 1401-1418.

The case study reports on the ‘socio-legal process’ (pg 1401) associated with the use of the Compulsory Purchase Order (CPO) in UK as a tool for urban regeneration by examining its enforcement in the regeneration of South Cardiff. The CPO is explained as a legal tool “which the state seeks to acquire someone’s property without their consent” (pg 1401). Through the exploration the authors, following Blomley and Clark, (1990), aim to illustrate that the influence of law “is often mediated through apparently neutral discourses in jurisprudence or even common sense” and that “the role of law in these circumstances is not obvious, mechanical, or automatic” (pg 1415).

The initial part of the paper citing studies, stresses “the importance of developing a critical stance towards the role of law and legal mechanisms in underpinning and supporting contemporary forms of urban regeneration” (pg 1402). The “claimed value-neutrality of the Anglo-American tradition of law and legal processes” is challenged (pg 1403) and following Blomley (1994) alternate ways of conceiving of the value neutrality are outlined. This is referred to as the ‘interpretive paradigm’ and is contrasted against the ‘socio-technical paradigm’. It includes seeing law as 1) local knowledge and not placeless principles, as against seeing law as universal and applicable to all socio-historic contexts; 2) constitutive of social life not reflective, as against laws determining role on social life and being reflective of social structures; 3) inherently evaluative and potentially indeterminate, as against it being abstract and determinate, known and relatively fixed; 4) comprised of multiple, competing ideologies, as against being a form of higher rationality which is handed down; and finally 5) seeing legal knowledge as the product of a diversity of (competing) views, as against a form of expertise requiring public deference (pg 1404).

The next part of the paper discusses the CPO itself and its use in the docklands regeneration in South Cardiff in UK. The authors provide a background of the project and the context in which the CPO came to be used – to acquire land needed for the

development of the area by a quango, the Land Authority for Wales, and sell it en masse to the developer chosen for the project. The case-study focuses on the displacement of small firms and business in the area and their resistance to forceful eviction brought about through the use of the CPO. Using quotes, the authors report that the firms were apparently more resistant to the manner the eviction was implemented rather than the project itself. This is attributed by the authors to the completeness of the hegemonic discourse that accompanied the regeneration project (pg 1408). Objection to the manner of implementation, centres around the speed of implementation of the eviction, which followed a time-table prepared without consultation, resulting in a schedule that did not allow small firms enough time to find alternate sites that suited various specific needs. This effectively 'criminalised' them, when by doing nothing illegal per se, they still became illegal, just by not complying with the time-table set, primarily due to the impossibility of it. The authors also take issue with the lack of differentiation between different types of firms and the ways in which they were tied to particular sites, sometimes resulting in very serious damage to the future of particular businesses. The optimism and hopes of some of these firms to find recourse in law were to be unfounded as their objections were heard through public inquiry presided over by an inspector, who was ultimately responsible to the political/bureaucratic interests that were attempting to promote the project. At the same time some firms used the legal process as an attempt to lever concessions, an approach the firms termed as being 'realistic'. The authors report – "In the Atlantic Wharf case, we find, on the one hand, the representation of the legal process as universal and partial being used to justify the ignoring of specificities of individual needs and circumstances of small firms affected by the scheme; while on the other hand, the justification of the CPO hinges on an interpretation of the 'public interest' which is, of its essence, deeply rooted in the local political milieu" (pg 1407, 1408).

Connected issues with respect to the ambit of the use of CPO are also brought in – interests that are excluded even when they are affected (due to proximity, linkages with the area), access to resources needed to fight legal battles, the hegemony of 'legal-speak' that excludes people, differences in use values of property, delays of adjudication processes and so on. I shall not go into these issues here as my focus is more on how to understand the role of the legal system. How does it handle a case like this and how does

it produce the results that are empirically observed? The authors in this article advance a view that argues for the embedded nature of law, which makes it an interpretive practice rather than a neutral discourse. They argue

“these interpretations are contested social practices – they are not automatic applications of some universal prescriptions to straightforward cases- and to present them as anything else is ideological, in the sense of promoting a particular set of beliefs or practices as in the common good (or as neutral) when in reality it benefits certain interests. Moreover the application of law, as the case indicates, is not neutral or objective yet, paradoxically contrives to deny the very subjectivities of the legal subjects that it intercedes with” (pg 1416).

Still later on they concede that “in specific cases, the independence and integrity of the law itself (which is a powerful ideological notion) can be a powerful brake on the advantages accrued by the socially powerful” (pg 1416).

In using the theory of autopoiesis, my search seeks to understand how this tension between ‘independence and integrity’ of law, which is on the one hand a common enough perception, is to be resolved with an empirical admittance of social specificity (and therefore normative) that we find on closer examination of its application. An explanation rooted in ‘power’ is generally advanced (as is suggested in this case study) and is informative to a certain extent. However one would like to know what actually happens when power is activated, what is the dynamics through which power comes to be influential? This level of explanation is one step further removed and must seek answers at a higher level of abstraction. It must be grounded in either explanations at an individual level focusing on ‘actions’ and agency or at a social systems level. Insights at this level makes it possible to 1) recognize certain dynamics when they do come into play, 2) reflect on what might be the possible ways in which one can deal with it, 3) acknowledge the limitations that the dynamics of the situation sets and 4) consider other levels of intervention which could result in more long-term solutions. A discipline rooted in intervention, as planning is, cannot do without this

7.4.2 Autopoietic Concepts on the Coding of Legal Systems

I have above described the case study that will carry my arguments. I now discuss concepts from autopoiesis that help me relate to the case study. I use the concepts of

coding, observation and rejection values here. In the next section, I use these concepts to revisit this case study.

In the brief overview of autopoiesis, provided earlier, we have seen how systems are formed as distinctions, which then function as a binary code within the system, guiding all operations. Meanings, structure and change are all basically selections determined by the system from a horizon of possibilities. Luhmann, (1991, pg 177) points out “in a functionally differentiated society, it will have to be accepted above all that perspectives and distinctions and processes differ according to the system one starts from, that is, according to the point one observes society from and treats the various other systems as environment”. Since there is no privileged position of ‘objectivity’ here, the need then is for a clarification of the perspective from which an event is viewed.

In a legal system, the binary code operating is the legal/illegal distinction. This distinction does not carry any moral overtones in analysis in tune with autopoiesis, but just denotes the possibility and necessity of choosing between the two. “The terms legal and illegal thus denote nothing other than the universal system of valuation intrinsic to law, which all operations of the legal system and only operations of the legal system come under” (pg 147). Decision as to which value to adopt is again according to the theory entirely contained within the legal system, taking place in the context of operations within that system, and is not an a priori attribute of the event itself. Thus “assignment to the values of legal or illegal is not possible either as an isolated event (with no connection with other operations in the legal system) or as an event within the environment of the legal system” (Luhmann, 1991, pg 146). In every case where legal or illegal is decided, the system refers to itself. It must be mentioned here that this form of stark application of the binary code happens only when the legal functional system is ‘matured’ - differentiated enough from other systems be it religious, economic or politics. If this is not the case, the legal system would not operate strictly on its own code as happens when questions of legality/illegality are decided by the political system or the religious system. In this sense strict application is thought to be a phenomenon of the more ‘complex’ societies, generally designated as ‘developed’.

This state of affairs though resulting in a reproduction of the legal system as a system, need not necessarily lead to reproduction of legality as a universal principle. If

observed from the overview of social systems, though the law has only a strict two-value coding, other systems may assign different meanings to events and incidents. “It is only in the individual’s fate that the code solidifies into a provision about one value and not the other; and only then does it emerge that particular conduct or particular claims are, with far-reaching consequences, lawful (unlawful), and not the opposite” (Luhmann, 1991, pg 149). Then, as Luhmann (pg 147) points out “even the mere distinction between legal and illegal could then count as a hostile act, a breach of the harmony of co-existence in good will”.

One advantage of this strict non-discriminatory use is of course the certainty that it provides. It helps to structure society as the application of the code is assured. To a certain extent it can also help forestall conflict, as the impending decision of a certain course of action is known (pg 148) (or arguably can be found out) in case the conflict envisaged comes about. The gap it leaves is however subtle. Any event to which the legal system is applied is actually a web of contingencies, the actual realisation of which alone, makes the application possible. I shall explain.

With regard to time, Luhmann stresses the present, as Gumbrecht points out “the Present in Luhmann’s theory is the time dimension in which ‘selections’, ‘operations’, and ‘observations’ do actually *happen*’ (original italics) (Gumbrecht, 2001, pg 53). According to Gumbrecht, Luhmann indeed likes to insist that “whatever happens happens in the present” (pg 53). If contingency is defined as “everything that is neither necessary nor impossible” (Luhmann, 1992, pg 96, quoted in Gumbrecht, 2001, pg 52), it is obvious that the legal system cannot tell us what sort of complex web of contingencies may come up in the future. It can only speak about the application of the code on particular courses of actions. Since the contingency itself (which is a complex web) is unknown, one does not know in the strict sense what is legal or illegal in the future. This level of assurance for expectations can be provided by the legal system if only it is bound up by norms (pg 148). According to Luhmann, (1995, pg 321), “we will call expectations not disposed toward learning *norms*. When disappointed, they are counterfactually retained” (original italics). At the very minimum, the norms provide an answer to whether the expectations are justified or not. However the law does not see this justification when dealing with an event in the present. It just follows its binary code. For

the individual seeker of justice then, legality and illegality will appear to be intertwined and unclear while for the law which deals with it in the present, the distinction is just one of legality/illegality.

In order to act however, first an observation must take place - be it internally by the legal system itself or externally by any of the systems in the environment. This introduces another binary code into the process. It could be the power/no power code of politics or the have/have not code of economics. The third value operates on the binary code of the legal system as a 'rejection' value. The binary code of the legal system by itself is not negated here. What is introduced instead is a code that decides if the binary code of the legal system must act or not. Thus as Luhmann (1991, pg 157,158) states "what is rejected is the *criticality.... of the codes* of other systems for the given system, *not the relevance of their valuations*" (original italics). This rejection value is then not entirely internal to the system. It is not entirely external either. To explain further, the rejection value is actually the perspective of other systems. This perspective can very well be anticipated by the system through 'reflection'. "On the level of *reflection* (original emphasis) the system determines its own identity by contrast with everything else" (1995, pg 184). And this happens "in all forms of self-presentation that assume the environment does not immediately accept the system in the way it would like itself to be understood" (1995, pg 444). Thus the legal system can decide first whether to apply the rejection value or not and then proceed to operate or not operate according to its own binary code. The legal system can consequently actually have a multitude of choices before it as there can be many rejection values depending on the systems found within the environment. Luhmann further argues that only a system that can employ the rejection value as a re-introduction into itself can become functionally competent by "hypothetically equating its boundaries with those of the world, although it simultaneously differentiates itself through the autopoiesis of specific operations" (pg 160).

I have in presenting this set of concepts highlighted the following – first, for a society all viewpoints must employ some distinction, there is no universal viewpoint that points to objectivity; second, in a legal system, the code is legal/illegal and the system uses this code for all subsequent operations; third, it is possible for the legal system to be

not differentiated enough and thus have decisions of legal/illegal taken by other systems; fourth, the strictness of the code does not necessarily point to the acceptance of legality as a principle, as social life is also mediated by other codes; fifth, even while the strictness of the code guarantees a measure of certainty, all operations are bound to the present; sixth, the legal system cannot predict the web of contingencies that might arise in the future and therefore cannot predict the associated expectations; seventh, stability for expectations can only be provided by norms; eighth, the legal system observes itself before acting and part of this observation entails reflection – taking into account the possible observations by other systems; ninth, reflection introduces a third rejection value which does not negate the code as such, but decides on whether the code itself must be applied or not. I now return back to the case study to re-analyse it using insights from these concepts.

7.4.3 Analysis of Case Study-1 Using Autopoiesis

In this analysis of the case study, I reconstruct case study -1, in specific ways, different from the framework used by the authors. Generally any re-analysis and the answers it yields are insightful to a certain extent as any data can be re-analysed from different viewpoints to highlight different factors. My attempt here is to go beyond this as only if this insight yields answers to questions at a more fundamental level will the claim of autopoiesis to a fundamentally deeper level be justified and only then will an *equivalent domain* for the theory be established in planning. This is the task.

One might point out that the strict binary code of the law was indeed used in this case, making it seemingly act as a ‘neutral’ system. The security provided by the strict code was actually used by the quango as the quote from the LAW agent shows – “we had the law on our side, we had followed the rule book and sure it was a tight deadline but that was no reason for some of them to break it... they had no chance for resisting it” (pg 1409). The agent here is actually banking on the security provided by the law knowing that the law would not take into account any other distinction. Those who were trying to lever out benefits from the acquiring authority also were in essence using this security, perceiving it as a legal inevitability backed by the assuredness of power. Thus, “we didn’t care for the CPO and we protested knowing we had no control over it. We just had to be realistic” (pg 1411). The authors see this as “interlinking of legitimacy, and authority,

with legality” which they argue “was one of the powerful underpinnings of the process” (pg 1409). This of course is true and it is pitched at a particular level of analysis. Autopoietic theory helps us to deconstruct the ‘interlinking’ a bit further, and reconstruct it as the *use of the binary code of the legal system by authority to further its own ends*. It draws attention to *processes* through which authority might ‘use’ the invariable binary code of the legal system. Deeper answers are then demanded, which aim at a more long term intervention. I take this line of analysis further.

The legal system though clearly and strictly characterised by a binary code, is known to produce not so strict legal/illegal distinctions. This is a point made by the various authors cited in the article, including Chouinard (1994), Blomley, (1994), Pue, (1990) and Kobayashi (1990). Autopoiesis tells us that what comes into play here is the introduction of a rejection value, through which the law decides if the binary code must be applied or not and that this decision is based on contingent reflections from other systems. However the experience encountered in the case study is expressed as “there was no latitude for common sense... they just did it by the law and letter... We went to the public inquiry and tried to fight the CPO on the grounds that it would destroy jobs and our business... the case was a foregone conclusion before we entered the courtroom” (pg 1411). The strict binary code of the legal system is operating here. This is a default position and all that those who were in power had to do was to ensure that no negative rejection value would come into play. The authors comment “the CPO was characterised by a minimalist interpretation by the LAW of their legal duties and obligations...” (pg 1409). The *speed of the process* was one way in which this prevention of negative rejection value was managed. The authors thus point out “In relation to the regeneration of Atlantic Wharf, the overall regeneration scheme was sponsored by the local authority and the underlying approach of the statutory authorities was to ‘get the job done quickly’” (pg 1408). The speed prevented any serious consolidation of any other interests that would if it had happened, made a reflection on the way the legal system observed the situation. Secondly, it was managed by the *promotion of a positive imagery* by the political and administrative system with the help of the media. This positive imagery in turn reduced any chance of the application of a negative rejection value. The authors state “so complete was the hegemony of this view that even the landowners who objected to

the CPO still subscribed to the vision of 'progress' which underpinned it..." (pg 1408). Thirdly, it was managed by *pulling out possibilities of legal recourse, out of the legal system itself*, into the administrative system which then notwithstanding the default position of the legal system, operated on its own code of compliance/non compliance. Thus the authors report that one company termed the process as "the farce of the public inquiry" (pg 1410), while another termed it as "the judge and the jury were one and the same" (pg1411). What was managed by power here, then was the *possibilities of application of a negative rejection value* by which the very application of the legal/illegal position would become ambivalent.

Autoipoesis also tells us that through admitting a rejection value by observation that can cause the binary code to be suspended or used based on contingent circumstances, the legal system cannot tell us what may be legal or illegal in the future as it cannot say what sort of complex web of contingencies may come up in the future. An ordinary decision of investment made by one of the firms, induces it to later behave as what may be termed 'illegal'. The authors quote "I'll never get this type of site again and I've invested so much in it... I'll never get it back... its's going to change the whole way I do everything" (pg 1410). This level of assurance for expectations according to the theory, can be provided only if the legal system is bound up by norms which at least give an indication of whether the expectations were justified or not. In the case study discussed, we see that the law failed to live up to expectations of some property owners which the authors report "became cynical" (pg 1411). These firms expected the legal system to be more 'fair'. The authors cite the instance of a firm that was more "optimistic in the fairness of the legal system.... It will see us right and take care of our needs" (pg 1411). When the binding up with norms is absent and when the desired rejection value is induced/not induced, then for the individual seeker of justice legality and illegality appears to be intertwined and unclear, though the law by itself just preserves its own binary code and continues to operate accordingly. The authors report "for many firms the process effectively criminalised them in that they felt unable to respond to the short deadline that had been set" and "firms who broke the timetable were not seeking to break the law *per se* (yet in effect this was what they did), but were reacting against what they perceived were the impossibilities of the legal strictures that had been placed on them"

(pg 1409). The issue that then comes up is not only one of “law must be sensitive to conflicting interpretations and material interests operating at, and through various levels of the state” (pg 1416), but rather more fundamental in the sense *what are the means and methods available for making law more sensitive to norms and norm based expectations?*

I shall take up the questions raised here in substantive sense and discuss them in the fourth part of this chapter, where I use my own empirical field work to show how these questions can be used for making planning related interventions. One additional point must be clarified here however. It can be argued that the question raised here can be raised by starting from other viewpoints using other theories. I do not wish to deny this. But one would have to start from many viewpoints. For instance one can start from norms and work back far enough to ask the last question, and one can start from theories of use of power and work back far enough to ask the question previous to the last. To reach this level of analysis we at present have different theories, autopoiesis provides us access to this level directly and consistently across different theoretical domains. Thus there is a claim for the type and level of questions that autopoiesis asks, and the consistency of maintaining this level of enquiry, which in a way takes the planner straight to a deeper level of understanding that cuts across many domains leading to possibilities for a more fundamental level of intervention.

7.5 Participation in Planning – An Autopoietic View

As mentioned earlier I discuss two case studies here. Both the case studies deal with the same theme describing different experiences. They thus complement each other and are hence dealt with together. The substantive theme here is the issue of participation and the way in which it aids/hinders planning. Contrary to the previous theme, this is a very extensively researched area within planning with works ranging from the more normative theoretical side of communicative planning (dealing with various aspects of it ranging from micro-dynamics to institutional features) (Healey, 1998a, 1996, 1992, Innes, 1995, Fischer and Forrester, 1993) to more empirically rooted case study based experiences (Boland, 2001, Alfasi, 2003, Abram and Cowell, 2004, Cooke and Kothari, 2001). Being case-studies, both the articles chosen relate to field experiences. They were chosen because together through an autopoietic view, they highlight issues that I argue are not extensively discussed within the planning literature on participation. I show below

how this is so. Later, through discussion of my fieldwork on PPC, I dwell more on the answers.

The discussion also aims at another level of planning application. While the previous case study discussion asked questions at a more general level, in this discussion I raise questions that are related to a more micro level of planning activity. The questions asked are however different and they, besides contributing to literature within planning on participation, also serve to illustrate how autopoiesis reaches into micro situations. I discuss the case studies, one at a time first.

7.5.1 Case-Study Descriptions

7.5.1.1 Case 2a: Tewdwr-Jones,M and Thomas,H (1998) ‘Collaborative Action in Local Plan-Making: Planner’s Perceptions of ‘Planning Through Debate’ In *Environment and Planning B: Planning and Design, Vol 25, pgs 127 -144*

This case study discusses community planning exercises undertaken in the Brecon Beacons National Park (BBNP) which is described as a rural local planning authority in mid-Wales, comprising of parts of 4 counties, 7 districts and 49 communities of various sizes. The authors initially comment that though the wide spread interest in public participation in the UK is largely by-passing local planning, particularly the formulation of development plans, there are still innovative attempts to plan with communities and the case-study is described as one of such attempts (pg 128).

By studying the case reported, the authors aspire to “shed light on the constraints facing democratising tendencies associated with ‘communicative’ or ‘argumentative’ local planning” (pg 128). The framework for analysis is the work of Healey (1992, pg 154-155) and Healey (1996, pgs 222-223), which the authors use respectively for defining main components of communicative planning, and for analysing field-work observations. Reservation on ‘truly democratic involvement’ (pg 128) in UK development plan formulation is expressed, especially in the sense that “there is no sense of participation being promoted as part of a commitment to participatory democracy” (pg 129). The case study is described as an innovative attempt to involve the public from the start in the preparation of the development plan and the objective of the study is stated as “to assess the perceptions of planners to the participation process and to evaluate this in the context of communicative planning” (pg 129).

The core of the park authority's public participation exercise was centered around two rounds of meetings with local communities (pg 130). The first of these rounds consisted of 34 evening public meetings, wherein discussion of the local plan process as a whole was encouraged by the local planners. Fieldwork for the research was however undertaken after this first stage (pg 129). The description provided of this stage, then, is presumably from secondary sources or interviews with planners who were involved. As per the description provided, in the first meeting, after an initial talk from officers outlining the purpose and organisation of the meeting, ideas from the public were encouraged using posters as prompts. These depicted both topics and questions. The public were then allowed to develop questions further, choose land uses for particular sites and mark them by inserting coloured pins into the base map – a modification of the 'Planning for Real' exercise used by the Neighbourhood Initiatives Foundation. The process was co-ordinated by an officer who highlighted topics and provided co-ordination. Discussions were not restricted and as a result they covered a wide range of social, economic and environmental concerns. After the topics were identified, and after some amount of discussion had taken place, assessment questionnaires were given out to individuals to allow them to record their preferences more fully, thus including the less vocal (pg 131). Though meetings were aimed at the local plan, information beyond its scope was also recorded on action sheets prepared by officers. These were handed over to appropriate organisations the day after. The community development officer of the authority also used the meetings to gauge the level of local interest in community development initiatives of various sort. A de-briefing session was undertaken by officers the following morning where issues raised would be highlighted, and attempts would be made to relate them to land-use planning policies and solutions. What had been achieved in the meeting and further scope for improvement would also be discussed. Work which took place in the summer and autumn of 1993 finally led to a draft park-wide local plan by May 1994 (pg 130,131). The second round of meetings then commenced with a more orthodox format. These rounds of meetings were attended by the researchers, but little descriptive account is given, except for the information that the agenda was determined by the contents of the draft plan and local plan time-table. The planners consequently had

to state the definition, format and content of the statutory plan in greater depth in these meetings and explain what the plan could and could not do (pg 133).

In the next part, the authors present the perspective of planners involved in the exercise gauged through interviews conducted in September 1994. The interview concerns are listed and the results are discussed under these following headings. *Planning regulation* - The authors report that the planners found it very hard to explain to the public, institutional and legal barriers that prohibited the planning process dealing with certain types of issues like affordable housing, which was of great popular concern. When the plan was sent to the central government department for comments, the aspirational syntax of the consultation meetings were considerably amended. Other organisations like the highway authority also benefited from the exercise especially with respect to developing their programmes and budgets. They also gained politically because it was now possible to back up concerns with community opinion. The attention of the park authority itself was drawn to design matters which it appeared had elicited interest (pg 133). *Role of politicians* – The overall picture provided is one of low member attendance from the park authority, but more support from community councils, including some attendance from the district council. The authors also report of the planners being annoyed by the way some politicians challenged the planners in the meeting, rather than acting in association with them. In the case of district council's members, the planners thought that they spoke from a viewpoint that reflected the district authority perspective, which in their opinion should not have been the case (pg 133). *Knowledge gained through community interaction* – The planners are generally reported to have enjoyed the first round of consultation, thinking it worthwhile because detailed knowledge of how a community 'ticks' was gained allowing the officers to "bear this in mind when determining planning applications" (pg 134). This according to the authors was also reflected in the more humanised language used in the planning committee, as well as the planning report. Besides the forward planning officers, the development control officers are also reported as having benefited as, according to them, they realised how little the public actually knew about how the planning system worked. This subsequently resulted in the holding of a series of public meetings with community councils and a proposal for the production of informative leaflets. Further, the planners

thought that the people too benefited. One planner is quoted as saying “for the public it was a widening process. For planning, one of narrowing on to local communities” (pg 134). *Importance of a corporate approach* - The authors report on the initiative taken by the community development officer. This led to the format of meetings being modified, so that information of relevance to community work would emerge. An additional full-time officer was appointed to work solely to analyse the information that the meetings yielded, spending 50% of the time working with the community development officer, liaising with the community to ensure that nothing was lost ‘in translation’ (pg 135). The authors also report “the most worrying concern to the community development officer was the expectations that would be raised within communities that the park authority would be expected to ameliorate problems or implement their suggestions within a short timescale” (pg 135). *A worthwhile exercise?* – A general feeling that the BBNP process of public involvement in local plan making was worthwhile and that the public had been supportive is reported. However concerns are reported about the second round of meetings - whether there would be scope for continuation of discussion and negotiation. More was at stake at the deposit stage since the planners had made commitments on paper by then. The authors report that the level of criticism was likely to increase as the plan proceeded. One of the planners reported public cynicism at the second stage, but the authors observe that the number of objections were still relatively few (pg 135, 136).

Finally the authors evaluate the process and argue that in the case-study, “the planning officers were feeling their way towards a communicative or collaborative approach close to Healey’s ‘planning through debate’”(pg 127). They examine the case study by way of questions raised by Healey, in her paper. The report is summarised here in the same way. *The arena of the discussion* – The question of how the planning exercise emerged is discussed briefly. The authors attribute this initiative to individual planner’s motivation, supported by higher authorities. Meetings were organised with the cooperation of local community councils, who publicised the event, and were conducted in village halls in de-centered locations. This, the authors argue, encouraged an ‘inclusionary ethic’ in line with concerns raised by Healey regarding the place of conduct of meetings. *Style of discussion* - Around 25 people on an average were reported as having attended the meeting, which according to the planners made it a difficult thing to

police. Initiation of the discussion was thought to be most problematic as people were reluctant to 'commit' themselves, unless one of the planners introduced a debate agenda. After the first discussion the planners paused and summarised each person's input and attempted to enthuse discussion among those who had not yet participated. Once people started to speak, planners withdrew, leaving the floor open to develop its own dynamics, which could turn confrontational. Sometimes the theme of the discussion was side-tracked. The planners intervened on these occasions. Concern was expressed on how planners could get views from those who had not attended. Additional notices inviting people to comment by written communication were posted throughout each village, including the village shops, post office and local school. The authors report that "the planners were consequently confident that at least they were attempting to generate a high response rate within each community" (pg 139). *Sorting out of issues and arguments* – The authors point to the use of 'planning for real' as a tool for sorting out issues. It allowed participants to observe and comment upon each other's preferences. However summarising and sorting out the issues actually took place only the following day in the planners debriefing meetings. In the second round planners tended to focus on reassuring people that their concerns had been passed on to appropriate authorities. Almost 50% of those who had attended the second round had not attended the first. The authors comment that this was not necessarily a process of translating concerns and shaping the plan. *Translating strategies into new discourses* – In the second round of meetings there were significant constraints on what could be discussed. Matters like the very idea of a national park conducting the participation exercise and the statutory requirements of what a local plan could and could not do for instance are pointed out as non-negotiable items by the authors. Many issues that came up in the first round consequently were lost from the document discussed in the second round, resulting in a loss of holism. Thus the implication is that no significant new discourses came up. *Subjecting the strategy to agreement and critique* – The authors hesitate to comment on this dimension on the basis of one episode. However they point to the commitment expressed by BBNP officers to continue working with the community by organising structured community consultations as a sign that opportunities for reflection on the land-use planning strategies to help relate the residents to a changing context would be available. They also suggest that it would be

interesting to know what impact it had on the statutorily required review some years after. A thorny point is highlighted in that for those who have reservations about the value of national parks and their remits, reconciliation to a policy discourse would be difficult.

The case-study is interesting in the sense that it provides an overview of a near 'successful' form of participation and consultation (at least in the first round as reported by the planners), within a system that is perceived as fairly prescriptive in terms of circumscribing the possibilities that can be catered to. The officers are reported to be motivated and were successful to the extent to which they could work within the constraints. The community is also reported as being enthusiastic and participating in the exercise, though not in the second round when planners had to reveal their constraints resulting in a certain amount of cynicism in the community (pg 136). That being the case we shall now look at the second case-study where another scenario in participatory planning is reported.

7.5.1.2 Case 2b: Campbell,H and Marshall,R (2000) 'Public Involvement and Planning: Looking Beyond The One to the Many'. In *International Planning Studies, Vol 5, No 3, pgs 321-344*

The second case study is situated in the Bay Area of California, where the authors report "public awareness to articulate views and the associated mechanisms to foster such an activity are a much more taken-for-granted part of local government practice than is usually the case in Britain" (pg 321). They lay the background for the paper by arguing that "much of the literature on public participation tends to concentrate on the how, who, where and when of public involvement, that is to say the operationalization and refinement of the process, rather than the why of public participation...." (pg 323). Due to this, "there has been a tendency to concentrate on attempting to refine the approach adopted, frequently leaving to one side how community-led initiatives can be reconciled with the existing structure of representative democracy" (pg 321). Against this background the objective of the paper is stated as – "to explore the rationales for public involvement in planning and to examine the potentiality for the realization of these goals by investigating what happens when people participate" (pg 322).

In the first part of the paper (pgs 324-328) the authors search the literature for a review of rationales of participation. By combining Thornley's (1977) threefold classification with Stoker's (1997) framework of rationales, the authors propose five rationales. These are explained below. Instrumental participation denotes "the basic *right* of the individual to be able to express and pursue their own *self-interests*" (pg 324). Role of the government is seen here as a safe-guarder of this right. There is no interventionist role. The involvement is limited and spasmodic as in voting. It thus provides an opportunity for self-interested individuals to place a check on activities of the state. Communitarian participation "places stress not on individual interest, but on the community and the *duties* and *rights* associated with securing its *collective well-being*" (pg 325). The role of government is seen as a facilitator of this participation for the maximum number of individuals. The process is envisaged as leading to both self-development and confidence of individuals as well as greater appreciation of the interests and aspirations of others. Between these two extremes the authors, following Stoker (1997), suggest that there are three variants. These are first, the 'politics of the consumer' (pg 326) in which "the *rights* of consumers (or customers) to express their preference and to have *freedom of choice*" (pg 326) is emphasized. In 'politics of presence' (pg 326) it is argued that "it is not ...sufficient to be provided with opportunities to be heard, rather the *interests of the excluded* will only become a routine consideration in the decision-making process if they are present at the table and are therefore able *to transform existing structures*" (pg 326). In 'deliberative democracy' (pg 327), "stress is placed on the creation of institutional contexts and practices which promote *open dialogue* and encourage the emergence of *shared solutions* through the uncovering of *new forms of knowledge* and understandings" (pg 327) (all original italics).

After presenting the normative framework, the authors move on to discuss the case study. As a preamble, the authors, following Wolman (1995) and Sharpe (1973), point out that democracy in US is founded on people who, it is expected, will provide checks and balances on actions of government. A contrasting tradition of individual participation, pluralism, representative democracy and efficiency exists. The City of Berkeley itself, which is the case-study area, consists of eight council members, each representing a district of the city plus a separately elected Mayor. State elections are non-

partisan as per the state mandate. The city manager provides the link between the council and professional staff. The council itself is assisted by 40 commissions and boards, each made up of lay appointees, one each nominated by each member of council. The council can ignore decisions taken by the commissions. The general rights of citizens to make representations and scrutinize work of local government are protected by federal and state laws.

The field work for the research consisted of direct observation of a variety of participation arenas, semi-structured interviews with key actors, some of whom were interviewed more than once, field notes concerning council meetings which were also supplemented by video footage as these were broadcast alive. Based on interviews, the authors report that though there was wide spread support for community involvement, there was no real sense of a shared common problem. The participation was strongly individualistic with a “palpable sense of individuals feeling they were engaged in a battle, the result of which each party would judge on a win/lose basis” (pg 330). They quote a consultant – “money, relationships and deals, that’s what wins through” (pg 320). Being present was seen as the only way of furthering personal interest. The authors also report on there being a tendency in the meetings for the ‘community’ that came to be operationalised to be largely home-owners. The capacity for community to be exclusive is also noted. Thus, “failure to conform to group norms appeared to have negative consequences for the individuals concerned” (pg 330). Also, there appeared to be ‘professional activists’ (pg 331) who reappeared in different roles on several bodies. Yet, in spite of high levels of overall participation, the authors report of large sections of society being excluded, difficulties in finding individuals to serve on commissions and advisory boards even making it tough for these bodies to stay quorate on a regular basis (pg 331).

The authors report on the perceptions of politicians and professional staff of the active participation in meetings, generally referred to as citizen-led-government. The politicians, they report, were confused as to their role and function. Given the degree of citizen empowerment, they were fearful if any decision would antagonize some group or the other. Decisions made were often undone depending on who was present in the room and the principle of “whoever yells the loudest gets the results” (pg 332). There was

evidence of inconsistency, and incompatible resolutions being combined, in the hope of appeasing all interested parties. The authors also point to the lack of formal party politics and the avowed attachment to community-led government, resulting in lack of guiding principles or a general policy framework. Further, they report on the lack of respect for bureaucrats, resulting in “frequent verbal assaults on planners by both politicians and members of the community at public meetings” (pg 332). Planners thus tended to be relatively passive, with their professional advice infrequently sought. However there was a lack of cynicism. Planners perceived themselves as walking a tight rope, representing voices not heard or encouraging consideration of collective concerns.

Drawing from observations of meetings, the authors comment that the keenness of the public to exploit opportunities for participation was striking. However politicians, planners and the public did not share a sense of ‘working together’. Certain issues that might be considered problematic are pointed to – “the focus on process left politicians and professional staff bemused and largely impotent” (pg 333) and also the single issue focus of meetings were problematic as planning typically deals with issues that are inter-related, where win/win solutions may be difficult, if not impossible, to find. This, the authors suggest “may make politicians wary of grappling with issues of fundamental importance but which are also highly controversial” (pg 334). Also the lack of representation of disadvantaged groups, causing them to be politically ignored and thus remain socially and economically excluded is pointed out. The authors then move on to point out the problems of a rights based approach to participation and validation of knowledge. Thus “encouraging public involvement is not just about providing platforms, its about developing decision-making environments which have a capacity to make sense of and value the varied knowledge forms with which they are presented” (pg 335). Citing instances of opposition to the inclusion of low-cost housing, and the extension of open spaces because they attract the homeless and drug addicts, the authors concur with Stoker (1996, pg 24) in his statement regarding greater community involvement, - “they can be stifling or disabling in reinforcing relationships of subordination and narrow parochialism” (pg 335). Against the view held by proponents of deliberative democracy that individuals must avoid confrontation, the authors raise the question of why individuals with no strong opinion should bother to get involved at all and if constraints

are to be placed then who should do it? (pg 335, 336). Even when participation brings in non-expert knowledge, which was found to be true in the case study, the traditional forms of technical knowledge were found to be given higher accord and on several occasions decisions were deferred calling for more analysis or factual information. This was also often used as an excuse for not taking decisions that were difficult. Also a lot of time was actually devoted to just the maintenance of meeting rather than any substance (pg 337). Commenting on meetings held by the West Oakland Community Advisory Group (WOCAG), which consisted of wholly community members, the authors report that “focus on process and procedure allowed decision-makers to avoid the more challenging questions of substance” (pg 337) and the ground rules identified was a sort of shadow boxing which “served ...to identify those who have a right to be heard, those who can be ignored and thus whose comments may be dismissed regardless of what they say” (pg 338).

Finally in the last part, the authors discuss the implications. They suggest that even though institutional structures designed to facilitate greater openness existed, people still adopted “relatively fixed positions” (pg 338) and mechanisms for making sense of all the discussions and debates were “stretched to virtual breaking point” (pg 338). The lack of interpretive frameworks available to decision makers to help them make sense of this ‘noise’ is described as “both striking and disappointing” (pg 338). Further,

“in attempting to value all forms of knowledge, decision makers were left without the means to prioritize one set of views over another. The sum of the views expressed by communities mainly replicated conventional status wisdom, warts and all, rather than challenging the status quo. This brought with it a tendency to focus on the short-term and the immediate as well as the neighbourhood and not the city. This presents something of a dilemma for planning as it is framed around the notion that it has a role in facilitating change and not merely recreating what already exists. To simplify planning problems down to a choice between a set of pre-defined options, as often occurs in participation exercises, is to diminish the essence of the activity. Yet once the arena of the meeting is encountered, such may seem the only approach if a clear way forward is to be identified” (pg 338).

Thus, “both technocratic rationality and deliberative democracy represent ideals that it is impossible for human beings to perfect” (pg 339). The capacity of a rights-based approach to public participation to virtually paralyse the decision process is also, in their opinion, one of the most striking findings that the case-study yielded. However, they caution against the ‘we know best’ type of planner, who “embody the worst aspects of the planner as bureaucrat, preferring inertia to innovation and reducing planning to little more than administration” (pg 340). They instead advocate that “the art of the planner must be the informed appreciation of how little they know, awareness of when and where to seek out additional information, and the capacity to develop interpretive frameworks which enable connections to be made and appropriate judgements taken” (pg 340). The importance of the representative democratic structure, which must remain central, and which the planner cannot ‘trump’, is also pointed out. Citing Merrifield (1997) they advocate that “you have to have an understanding of universal values before you can determine the importance of the particular” (pg 341). Thus planning is not about “mirroring the results of social and economic processes”, but is rather about “finding ways to do something about what is perceived to be unsatisfactory”, which is then argued as being fundamentally a matter of values.

We can see how this case study relates to the earlier one. Case study 2a reports in a positive tone on an effort to encourage participation, by concentrating on the micro-dynamics of it. The first round of meetings is on the whole reported to be legitimate in its intentions, careful and reflective in its methodology and enjoyable as well as informative as an experience. The effort however, as it progresses down the planning process, finds itself against a barrier of institutionally imposed constraints, which even threatens to remove the legitimacy of the earlier participatory exercise. The evaluation of the exercise done by the authors is in broad terms. We do not know of the inclusion/exclusion of specific groups, the views of the people who participated or the views of the elected representatives. The research is limited in that sense and the positive tone could well be a result of interviewing those who were behind the project and were thus enthusiastic about it. However, the report of the observation of meetings show that it was at least not chaotic in the way that the authors of the second case study report. The frustration felt later in this case study is attributed to macro-institutional factors that were evaluated by both the

planners and the authors as being restrictive and constraining. Yet in the second case study, this very lack of macro- institutional factors - guidelines, frameworks etc to guide the process and make sense of it - are evaluated to be restrictive and ultimately unproductive. The authors point to the chaotic manner of conduct of meetings, the lack of broad inclusion, the frustrations that all concerned felt, in spite of being supportive about participation per se in broad terms. Thus while in the first case study the authors point to institutional factors and the restrictions imposed as being sources of problems, in the second case study, it is the absence of norms and values for norms that is pointed to as the source of problems.

It must be stressed here that the discussion of both case studies is most definitely not a comparison of likes and as such they yield different sets of concerns which are a result not only of the settings and the participation exercise *per se*, but are also a result of the type of research conducted. What is in common between them and what actually enables them to be analysed together is the focus on participation as a normative ideal for use for planning. Both case studies yield insights for participation and its use for planning which is the concern of this section. The comparison of the two case studies actually bring up a host of interesting questions. First, what is the role of participation itself in planning in the sense of what does it contribute to the larger act of planning? Second what are the limitations inherent to the process itself if seen as an aid to planning? In other words what cannot we expect through participation, however much we refine the process? Third, what are the institutional implications of this wider understanding and what sort of factors come into play when institutionalisation is contemplated? Most of the work in participation is based either on broad normative views of participatory democracy or the Habermasian view of ideal communication conditions which inform the micro-dynamics of participation. I search the autopoietic theory for what it provides as answers that move beyond a theory of normativity, not necessarily denying it, but placing normativity itself within a frame of reference that allows us to see how it bears upon our concerns.

7.5.2 Autopoietic Concerns – System Interactions and System Interpenetrations

To understand participation, I probe two concepts in autopoiesis - ‘interactions’ (Luhmann, 1995, pg 413-436) and ‘interpenetration’ (Luhmann, 1995, pgs 210-254).

These concepts deal with different aspects, both of which are of relevance to participation. The first concept deals with the ways in which interactions can be used by society, while the second concept deals with the dynamics of how individuals relate to society. I explain both below.

7.5.2.1 *Inter-Actions*

Luhmann differentiates between interactions systems and societal systems. They are conceived as two different kinds of social systems, which are not congruent to each other. The relationship cannot be reduced to one equivalent to the system/environment relation either, as both interactions and society are constitutive of each other, interaction being already a social occurrence. The distinctiveness of this relationship is then captured by the term ‘episode’ (pg 406) because it presupposes communication that has gone before it and also is assured of communication that will go on after it.

To define what exactly constitutes interaction, Luhmann maintains “they include everything that can be treated as *present* and are able, if need be, to decide who, among those who happen to be present, is to be treated as present and who not” (pg 412) (original emphasis). The importance of ‘presence’ grants significance to ‘perception processes’ in interacting systems. Perception is defined as the ‘psychic acquisition of information’ (pg 412). It has certain advantages over communication which include it i) being able to absorb information that is not communicated, though with limited analytic precision – is an approximate mode of intelligibility; ii) can process information simultaneously and rapidly, while communication depends on a sequential mode of processing; iii) has slight accountability and thus less chance of being negated; iv) can qualify communication by parallel processing, either weakening or strengthening or modifying it on a different level of indirect communication. Also perception is not exhausted in the process of communication but is rather supportive of it. Thus one cannot not communicate in an interactive system, as even silence becomes communicative. Perception is however highly susceptible to disruption as it can break out into communication, disturb or stop it. Along with the perception of perception, perception serves not only to discipline interactions, but also to make it susceptible to planned disruptions.

The presence of persons in an interaction provides an 'internal environment', through which it is possible to pursue, feed or correct communication. Social perception and the need for keeping communication going, together, act as a selector for admitting the boundaries of what might be pursued in an interaction. This explains the importance of the condition 'presence'. Since interaction systems arrange themselves episodically, social systems can make use of them sequentially. It can then be thought of as a sort of diachronous differentiation of society. Through communication, interactions are indispensable to society and society in turn is indispensable to interactions. "One cannot dismantle the societal system into interaction systems or join together interaction systems to make the societal system; that is what the difference prevents. The difference is a constitutive aspect in constructing societal and interaction systems" (pg 418). Interactions acquire a distinct profile because they are different from what is possible in society at large. The surplus value that interactions can provide to society however can be realised only if they are understood as societal episodes.

Interactions systems constitute themselves in the temporal, social and fact dimension i.e. temporally, they take cognizance of the structures of expectation prior to and after the episode, socially they take into account the other roles of those present in an interaction, and factually, they take account of the themes that are chosen for interaction. When social, temporal and factual constraints are applied, communication acquires 'structure', whereby selected interdependencies emerge in the interaction. The rest of the interdependencies become a redundancy that has the possibility for being selected, thereby giving the interaction system 'structural elasticity' (pg 415). Articulated contingency is one other way in which interactions guide themselves. This is reference to a contingency that creates eventualities within the interaction, like the delay to start a meeting because the guest speaker is late. However the autonomy of the system can be threatened if there is too much of this, making the course of interaction stale and uninteresting. The opposite can be true if the system is "too open, a baseless and programless being together" (pg 421). Thus "interactions must provide for its own eventfulness, must be able to temporalize and surprise itself; but can do this only if adequate structural givens equip it for rapid, non-stop processing and for the self-selection of its own structure and history" (pg 421).

Society in its turn “structures the undifferentiated domain of elemental operations, adding a capacity for abstraction that could not develop through interaction alone. Abstraction then becomes to a large degree relevant for interaction in interaction and not from interaction itself, it cannot be disposed over locally within an interaction” (pg 422). Only society can finally have negation at its disposal and Luhmann points out “their (no’s) use and their encouragement, requires a certain lack of consideration for the interaction system’s fate. Viewed from the perspective of motives, something higher must be at stake,..... if one wants to engage in rejection” (pg 423) (added brackets). Commenting on synthesis Luhmann says “the coherence of the synthesis must have a meaning extending beyond interaction in order to be convincing within interaction. Interaction systems can contribute to societal evolution or not; they contribute if they initiate the formation of structures that prove successful in the societal system. Without the enormous field of experiment that interaction provides and without the societal negligibility of the cessation of most interactions, societal evolution would be impossible, and to this extent society itself depends on a difference between society and interaction” (pg 423). In Luhmann’s view thus interactions form a sort of experimental house where ideas can be tried out within constraints, as they are relatively more autonomous than societies. From this among other things, society makes a selection of what is useful for it for its evolution. Understanding interaction as different from society, Luhmann claims, increases both dependence and independence because each system can follow more fully its own laws (pg 424). What follows is that “interactions guided by motives then must either be standardised, for example, by organization, or be left to reflexive negotiation, agreement, and the negotiation of identities” (pg 426).

Writing and printing are other modes of interaction – “writing and printing make it possible to withdraw from interaction systems and nevertheless to communicate with far-reaching societal consequences” (Luhmann, 1995, pg 427). It is possible to reach larger audiences within shorter time spans, but the withdrawal forces one to compensate by the use of a “standardized, disciplined use of language and to clarify through language much that would otherwise have been evident in the situation” (pg 428).

Formation of interaction nexuses must share an encompassing ethos, if it is to work. Luhmann sees this improbable in today's society and hence is pessimistic of the primacy of interaction systems. Thus,

“less and less can one count on solving societally relevant problems by interaction; for example, by using people's physical presence to gain a consensus or to prevent uncontrollable activities. To imagine one could solve or even attenuate problems in the inter coordination of different societal function systems.....by bringing the participants into discussion with each other would be pure illusion. Thus a gap emerges between the interaction sequences individuals live through, which are accessible and understandable to them, and the complexity of the societal systems, which they cannot grasp, and whose consequences cannot be influenced, let alone controlled” (pg 426).

Also “the immense complexity of society can only be retained if the societal system is more strictly structured as societal system and if interaction systems are more strictly structured as interaction systems: the social system as a closed, self-referential communicative nexus, and interaction systems as the processing of contingency on the basis of presence” (pg 430).

Luhmann's pessimism extends further and he states that society's complexity has made it inaccessible to interactions, though largely dependent on them and consequently no interaction, however highly placed the participants may be, can claim to be representative of society. All views that can be assembled can only be from functional perspectives or regionally delimited perspectives. Luhmann further advocates

“interaction systems can and must continually be abandoned and begun anew. This makes necessary an overarching semantics, a culture, which guides the process toward what is probable and has proven reliable. One can emphasize that society selects interactions, interactions select society and both proceed in the sense of the Darwinian concept of selection, namely without an author. On the level of social systems, it (selection) is a *self-conditioning selection*, and the *selection of selection is set in motion by the difference between society and interaction*” (pg 433) (original italics).

Above is a description of the autopoietic view of the relation between interaction and society. I now present the autopoietic view of the dynamics involved in individual's relationship to any system, which includes both the interactive system and the societal system.

7.5.2.2 *Interpenetration*

Given the autopoietic conception of what a system is, and the limitations to which the environment (to which other systems belong) can influence the system, one needs an explanation of how systems that are essentially autonomous come to be coupled together and to seemingly move through co-evolution, how some elements in the environment may in fact be more important to the system under consideration than the elements of the system itself. The mechanisms of how this happens are explained through the concept of interpenetration. Systems here do not mean social systems or functional systems alone, but includes psychic systems (individuals). Thus interpenetration characterizes both individual-system relationship, system-system relationships as well as individual-individual relationships.

For Luhmann (1995, pg 213), interpenetration carries very specific meaning. Thus, "we speak of 'penetration' if a system *makes* its own *complexity* (and with it its indeterminacy, contingency, and the pressure to select) *available for constructing another system*.....Accordingly, *interpenetration* exists when this occurs reciprocally, that is, when both systems enable each other by introducing their own already-constituted complexity into each other" (original emphasis and brackets). By saying that the interpenetrating systems make available their own complexity for use by the other system, what is meant needs to be clarified in some detail. In interpenetration, the behaviour of each system is co-determined by the other in two ways - internally and externally - which result in both greater freedom as well as greater dependencies. To explain further, we have seen how complexity and structure within a system inevitably make selections which leave out other possibilities. In interpenetration, when systems make each other's environment available for the other, the possibility of alternate selections increases, thus resulting in more freedom. The two systems however are argued not to forego their autonomy and to continue to be part of the environment of the other system. This is because the complexity that one system makes available for the

other is essentially an ‘incomprehensible complexity’ (pg 214) to the other. It supplies a measure of disorder for the other, which is however organised on different terms. “All reproduction and structure formation (in the context of interpenetration) thus, presuppose a combination of order and disorder : a system’s own structured and an incomprehensible foreign complexity, a regulated and a free complexity” (pg 214).

Elements in a system have been seen to be de-ontologised entities that are constituted by the system (refer to the definitions provided earlier). In an interpenetration then, one needs an explanation of how these come to be constituted as there are two systems operating. Luhmann argues (pg 215), “to be sure, interpenetrating systems converge in individual elements – that is they use the same ones – *but they give each of them a different selectivity and connectivity, different pasts and futures*” (original italics). This then means that the elements, though same, signify different things to the interpenetrating systems and consequently different internal selections and thereby different consequences. The autonomy of each system is thus preserved and the other system becomes a ‘structurally coupled’ system in the environment. “Every system can actualize its own superiority in complexity, its own modes of descriptions, and its own reductions in relation to the other and thus make its own complexity available to the other” (pg 217). The ‘contribution of complexity’ that is necessary for interpenetration takes place through communication. Thus the autonomy of the interpenetrating systems assures the continued production of communication, which in turn sustains the interpenetration as newer forms of complexity are made available (pg 216) and interpenetration in turn also allows continued selection of structures that enable the continued reproduction of the interpenetrating systems (pg 220). Pictorially I depict interpenetration as not a) or b) but c).

□

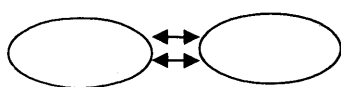


Fig: a

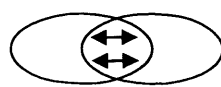


Fig: b

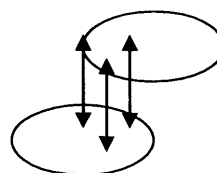


Fig: c

Figure-7.1: Interpenetration of Systems

Having provided an overview of both interaction and interpenetration, I now return back to the case studies to see how these concepts help us identify issues or concerns of importance to planning.

7.5.3 Analysis of Case Studies 2a and 2b using Autopoiesis

In this section, I analyse both the case studies jointly. As in the previous analysis of case study -1 carried out earlier, the task is to establish an equivalent domain for the theory in planning. How this equivalent domain might play out in the context of details of participation in planning is brought out through analysis and re-conceptualisations of the secondary case studies - 2a and 2b. Since the focus is on concepts from autopoiesis, and its relevance for the target domain of participation in planning, I organize the analysis under the concept themes. Through the analysis, I show how autopoietic concepts play out in the case studies, picking up different issues of concern which I argue provide a more fundamental layer of understanding enabling a deeper, more stable, yet more flexible intervention that directs, yet enables adaptation to different concerns and localities by not being rigidly prescriptive in its details. First, I use the concept of interactions and then the concept of interpenetration. As in the previous analysis, in this section also I limit myself to drawing out questions or concerns from the case studies. Illustrations of some possibilities for answering the questions are the subject matter of the next chapter.

7.5.3.1 Interactions

Autopoiesis discusses interaction within and against society. In my analysis, I retain the same level of discussion. I however bring in governance/planning as activities that order the relationship between interactions and society so that it proves to be mutually beneficial. The ordering of society in its wider sense is facilitated, as well as the furtherance of same or different interaction mechanisms that lead to continued inputs to this ordering of ordering are safe-guarded. This conception is rooted in the overall dynamics of autopoiesis and builds on the claim that society and interactions are mutually dependent and that the latter can potentially provide an indispensable role for the evolution of society. The planners then, in *deciding to use* interaction for ordering of society (designing participation spaces, structuring participation processes, moderating participation dynamics, etc) are actually *engaged in a second order ordering - the*

ordering of ordering. The implications of this are first, to see planning in relation to a wider agenda with respect to society; second, to see the participation process itself in relation to a wider agenda rather than just as a tool for planning; and, third, to remove the primacy, but not the importance, of the planner in the participation process. In short, to put planning, the processes of planning and the role of planner in its place in relation to society.

Seen this way, case study 2a becomes an unique (in the sense of one-off) exercise which planners were using to help make decisions regarding ways in which to order society within a particular territorial area through the medium of local plans and the possibilities that they allowed. In the second case study on the other hand the interactions observed were not unique or limited to one episode, and were not led by planners, but were largely part of routine consultation processes taking place in the course of the governance of the territory. This draws attention to the first point of interest that autopoiesis highlights – the dependence of interactions on prior communications and communications that are to follow. In the first case study, a well defined expectation from the planners side, which was communicated to those present, is reported. Since this was not part of any routine exercise, but was rather at least initially conceived as a one-off experiment, no ‘tradition’ had developed with an opportunity to be stabilised over a series of routine interactions. Thus the novelty of the episode was in itself a context for subsequent behaviour. The experimental nature, the absence of ‘knowing what to expect’, the general optimism that the planners were apparently able to generate, and the leadership provided by them, allowed them to be fairly in command of the parameters for framing the micro-dynamics of the consultation, (though they did not venture to command the dynamics itself). Also it is reported that the participants had a ‘free hand’ with freedom to raise any issue they wanted without being restricted by the planners. They were told that the discussions were to eventually lead to the local plan, the land use dimension of which was also a topic of engagement. The interaction process thus used the potential of the future during the interaction itself. In Luhmann’s terms, the ‘present future’ was optimistic.

In Case study 2b, however, the presence of considerable tradition is reported, with occasion for certain dynamics to be stabilised over time leading to almost predictable

patterns of participation, as well as ways of conducting meetings including ways of 'shadow boxing', decision delaying, ways of responding to difficult interrogations and avoidance of crucial issues. There is no suggestion here that these are inevitable products of stabilisation over time. All that is pointed out is that there were discernable patterns developed, which along with other things provided a context for the dynamics observed. The participants, politicians and bureaucrats all seemed here to know what to expect, expectations (or non-expectations) had developed. Besides the interactions were definitely embedded within a system of governance, were firmly institutionalised and extolled for their own worth on normative grounds, whatever the practice in itself developed into. Planners were just one of the numerous actors caught up in governance routines with the interactions also being just one among many governance related routines. The present future here was pessimistic as far as handling of crucial issues and the making of firm decisions were concerned. The 'present future' here is obviously quite different from the previous case.

The two case-studies then differ with respect to their temporal relationship to society, in its durational aspect – (unique vs intermittent), in its temporal position in the dynamics of governance (formative vs stabilised) and also with respect to the way it related to the future (optimistic vs resigned). One is a unique episode in the formative (if not being a one-off) stage, optimistic about the future, while the other, is an intermittent activity, in a fairly regularised and stabilised state, with a fair amount of resignation (of the outcome of the interactions) regarding the future. Given that planning is always an institution related activity in the wider sense - even if practised 'on the borderlands' (Sandercock, 2000), which still uses and targets institutions - the first question, that autopoiesis draws attention to is the *way in which interaction processes must relate to society*. In other words, how can participation processes fulfil their purpose of being a temporal differentiation of society, as autopoiesis claims they must be, if they are to fulfil their function in relation to society?

The second point of interest autopoiesis draws attention to is 'presence' and the 'internal environment'. The importance of presence is not directly connected to empowerment, as is seen in the community participation literature, but is more intricately connected to perception, which when employed along with communication can start it,

modify it or stop it. This power of perception needs presence, which is how presence attains significance. Presence then carries a significance that goes beyond that of 'being heard'. This then carries significance for methods of eliciting participation. Case-study 2a yields a point of interest connected to this issue which is the request for written responses from those who had not attended. We do not have information on the response rates, or the information sought, or the type of responses received. However autopoiesis draws attention to questions of how the structure of dynamics that evolve through the actual interaction process (as it entails the formation of a structure through choice in the social, factual and temporal dimension) can be communicated, if it can be communicated, and if not whether a re-opening of the structure of on-going communication can be done in response to replies that need not necessarily follow the structure that has evolved (given that participation processes are typically seen to entail not just a voting but a move towards consensus) and if there are complications here then to what extent is there an inclusion or empowerment? Autopoiesis thus *sets limits to ways in which participation can be enlisted*, if it is to contribute as a meaningful form of involvement at a fundamental level.

The third point of interest is the formation of 'structure' in the interaction process – as only if interaction enables this, will it be useful to society. Structure in turn is formed by constraints in the selection of communications within the interaction process, the process of selection being mediated by perception. Given the time to stabilise as a governance process, the politics of presence and the formation/non-formation of structure is more visible in case study 2b. I start with presence - how is presence interpreted and understood in this context? The perceived role of a local native American group is reported –

“for them this process was about forming networks so they became ‘insiders’. If they were successfully to promote the interests of native Americans they needed to become insiders, that is, people city managers or mayors automatically thought of and invited to be present at key meetings. It was clear that for this group (the native American group) like many others, presence was seen as the only way of furthering their interests and perhaps not surprisingly they were little concerned about the interests of others or the collective group” (pg 330).

So presence here is first related to being included in what is perceived as a way of furthering one's own interests – this individual rights-based approach being pointed out by the authors as a problematic ethic in the case study. Quoting a planning commissioner, the authors further point out that there was no real sense of “everyone working together on the same problem... it's us and you” (pg 330). Obviously the role of presence or perception here is not geared in any way to selection of communication within constraints that enable the formation of structure. There is evidence however of formation of stable *patterns of participation* and the interests it favours – “whoever yells the loudest gets the results” (pg 332) and “whoever is most persistent – they will get the outcome, they desire...but that's not what's the best. Money, relationships and deals, that's what wins through” (pg 330), “money talked...” (pg 330). These patterns of behaviour are not entirely spontaneous though. They were managed. The authors report that even in a committee consisting entirely of members from the community “the membership showed a positive desire to adopt the trappings of public sector organizations and establish order through similar procedural devices. The ground rules set out in these procedures were crucial in establishing who could speak and when, who could sit where, when a motion could be made and by whom and whose comments were recorded and in what form. The ritualistic qualities of the discussions about such matters and their regular re-enforcement during the course of a meeting are inherent to the shadow boxing which goes on within any group of personalities” (pg 337). The case study then reports on a formation of patterns of behaviour, based on physical presence that enabled the voicing of opinion from a rights-based perspective which was nevertheless managed. In normative terms what we do not have is the formation of structures of interdependencies that are based on perceptive processes shaped by constraints that evolve through the interaction. The question of concern then is *what prevents this?*

Insights provided by normative theories of communication tell us how the micro dynamics might be otherwise, and how they might be moderated within interaction process. They are useful and do contribute to an understanding of participation to that extent. In autopoietic theory the formation of structures of selected interdependencies is by the imposition of constraints in the temporal, social and factual dimensions. I now examine these dimensions in more detail with regard to the case study. The temporal

dimension corresponds to the past that precedes the interaction and expectations of results of the interaction, both of which can constrain processes within interaction. Luhmann elsewhere tells us that “structures of expectation are basically conditions of possibility for connective action...” (1995, pg 289). From the case study report we know that this connective action - in the sense of an ongoing structural evolution - was missing as the authors report “decisions made at one meeting, were often undone at the next. There was considerable evidence of inconsistency, with incommensurable sentiments being combined in resolutions in the vain hope of ameliorating all the interested parties” (pg 332). Also most meetings ended with no decision. Since connective action was missing, consequently expectations were missing or vice versa and the formation of structure in the temporal dimension was forestalled. In the social dimension, interactions take into account the social roles of those present. Luhmann (1995, pg 419) points out, “these external commitments, if they are transparent within the interaction, lead to the self-control of individual participants, for each is expected to maintain role consistency”. The case study reports the use of the term ‘professional activists’ referring to individuals “reappearing in different roles on several bodies” (pg 331). There is some information provided about the membership choice of the committees – they are nominated by the councillors. Presumably the nomination itself was not guided as there is no report of this. What we do know however is that these committees were organised at city level and that there were 40 of them. The amount of social constraint that members would bring with them as part of their other social roles is by nature then limited. In the factual dimension, the themes place constraints, but only when they are chosen contingently from a host of other possibilities. In the case study the meetings are reported to be largely single *issue* meetings, lacking scope for ‘other possibilities’. The authors point out that single issue meetings are inadequate in dealing with the complex issues that confront planning. In the Chapter-6 on fractals, I have also discussed the problem of single issue agencies in planning – they lack the requisite variety within themselves to make the connections and trade-offs necessary in planning. So here the constraints on themes were structurally built in rather than being a result of a complex process of structure evolution over which the interaction had control. We have now 1) an interaction process with connective action that enables the evolution of structure missing, 2) information of the societal roles of

participants not being available within the interaction, and 3) themes for discussion narrowly constrained outside the interaction process. The set of micro-factors that autopoiesis draws attention to are thus different from what the normative theory of communicative planning offers. Attention is drawn to the *institutional factors that embed participation processes*. The theory, in drawing attention to these factors, provides an explanation of mechanisms that must be enabled, within the interaction process. These are different from the micro-dynamics that are based on normative individual action in present explanations of participation processes.

At a slightly more general level, Luhmann points to two ways in which to approach the issue. To re-quote Luhmann “interactions guided by motives then must either be standardised, for example by organization, or be left to reflexive negotiation, agreement, and the negotiation of identities” (pg 426). To revisit my discussion of Luhmann’s reflection on planning, I have argued there that the question for orientation actually turns into which system will be engaged in second order observation to which planning can orient itself. In the case of standardisation by organisation or some other entity it is obviously this entity that observes and towards which planning will orient. In the case of reflexive negotiation, unless there is a trans-individual point of observation that is socially rooted which enables the individual to reflect, be it norms or social criticism the evolution of a structure will be constrained as there will be then no social reflection, resulting in what the authors rightly point out as a rights based negotiation. The issue of norms is taken up again later.

Does this then mean that given institutional factors, participation can be perfected? To answer the question one needs to go into the possibilities and limits of what interaction can achieve. First, interactions are important to society because they provide a venue for experimentation, in the sense of an opportunity for ideas to be tested out without commitment. Planning in using participation processes to order society are then actually involved in the creation of an experimental house for testing out solutions that would not have been possible directly in society. It is thus *only* an experimental house. In case study 2a, to a large extent in the first round of meetings this did happen. Thus planners also felt that the meeting was worthwhile and useful. In the second round however this was not the case and the interaction was not an experimental house with the

result that one planner is reported as having being dissatisfied because she felt that there was a tendency to “talk *at* the public” (original italics). The authors also suggest that the tendency for constraints increased as the participation progressed down the plan preparation process. The question here in autopoietic terms is *how different interactions can be oriented to different types of experimentation* within a plan preparation process, so that as Luhmann suggests they can be used sequentially by society to build up its own complexity?

If one were to examine the reverse - how society becomes important to interaction - Luhmann tells us that interaction cannot entirely rely on itself. It needs society to provide abstractions towards which it can orient itself, because only society can have the power for final rejection of the interaction systems results. Thus to re-quote Luhmann, “viewed from the perspective of motives, something higher must be at stake... if one wants to engage in rejection” (pg 423). The coherence of synthesis between interactions and society must therefore have a meaning that extends beyond interaction (pg 423). In case 2b, meanings were mostly not oriented to any meanings necessary for the ordering of society. The authors point to the importance of values – in place of a rights-based approach – for orienting decisions. Values are seen as indispensable aids to “finding ways to do something about what is perceived to be unsatisfactory” (pg 342). It is also seen as fundamental to an understanding of the incorporation of public participation in planning processes. Autopoiesis tells us how this comes to be so. Norms as stated in the analysis of case study-1 are considered to be expectations that are not refuted, even when not realised. It then structures society by providing a sort of stability to expectations. Expectations, we have seen, are important for the development of structure in interaction processes. Thus, while in the short term as an on-going activity interactions may develop structure by orienting themselves to expectations, it is norms that provide the orientation to a more long term structure. If one were to use terms from autopoietic theory, then norms provide long term ‘organisation’ to the evolution of participatory processes, while expectations provide short term ‘structure’ to the unfolding process of participation. Organisation embeds structure, but it is useful to distinguish between the two in temporal terms as I shall illustrate through the discussion of PPC in the next chapter. For the moment now I turn to the second concept from autopoiesis.

7.5.3.2 *Interpenetration*

I use the concept of interpenetration here to shed light on the dynamics involved when an individual participates in interaction systems. Essentially the concept of interpenetration tells us that both systems involved retain their own autonomy but make their own complexity available to the other system for structuring its own internal dynamics. Thus when individuals are embedded within interactional settings, they make use of the complexity of interactional setting to structure their own autonomy and the interactional setting in turn takes cognizance of the complexity of the individuals involved in structuring its complexity. Also the complexity of each system must be made available to the other through communication, as otherwise the systems cannot structure their own complexity in relation to the other. Interpenetration is however possible only if both systems are autopoietic, in the sense of having a structured complexity. Thus a system cannot couple itself to the environment if it is just 'noise'. The environment in this case can only influence the system through chance perturbations.

In case study 2a, in the first round, individuals in the meeting oriented themselves to information provided by the planners. They were free to explore any issue and suggest land-uses, irrespective of the ambit of the local plan. In fact the authors report that when certain development control officers tried to inform the audience that some suggestions were not possible, they were taken outside by the planners and advised to adopt a more informal approach. Here actually the individuals were being oriented by communication to a complexity that BBNP did not possess. In the second round, the actual complexity became visible since the draft local plan itself was discussed, revealing what was possible and not. This was not compatible with the meanings that the individuals had oriented themselves to in the first round. The resulting lack of synthesis between the individual and the interaction system is evident in the cynicism reported among the public and frustration reported among the planners. This draws attention to issues of *institutional transparency* in structuring interactions. In case 2b, individuals were perceiving 'noise' rather than structured complexity, resulting in the prevention of any structural coupling with the interaction system. All that could happen then is perturbations. Thus depending on who was present and said what, the interaction system swayed idiosyncratically, resulting in patterns, but not maintaining any form of an evolving structure whatsoever.

Autopoiesis explicitly tells us that interactions cannot substitute for society, though it can be used by society in special ways due to the advantages it offers. Society eventually holds the powers of negation through norms in the long term and through imposing constraints in the short term in three dimensions within the dynamics of the interaction process. Planners as intermediaries in this process then have the job of conditioning the possibilities of interaction so as to make them meaningful in terms of processes that utilize the interactions for society. Issues in participation then shift from a primary focus on the removal of constraints for participation within the participation process as is normally the approach in normative participation literature to one of *how and what type of conditioning must be explicitly imposed to not only enable the participation process to realize itself, but also realize it in ways that are useful for the ordering of society?*. Autopoiesis gives us knowledge of mechanisms and relations that connect individuals to interactions and interactions to society to guide this level of intervention.

Conclusions

In this chapter, I have introduced the concept of autopoiesis. First, I have traced the origins of some of the concepts starting from the field of biology. I have then examined and recounted the debate on the possibility for autopoiesis in social systems. Following this discussion, I have introduced Luhmann's conception of social autopoiesis. Second, I have discussed Luhmann's view of the possibility for planning or steering arguing that the view emanates from certain assumptions, which need not always be the case. Third, I have used selected concepts from autopoiesis and discussed it with reference to planning issues using three case studies dealing with two areas of concern to planning – the use of law in planning and the use of participatory processes in planning.

Essentially my argument is that autopoiesis throws up different sets of questions that relate to a higher level of concern in parallel to the level of abstraction in which it exists in the social sciences. The level is consistent with the practical activity of planning of planning – the way the activity of planning itself might be structured. Questions/issues emanating from a systems-informed viewpoint target this level of planning practice in general. Thus the actual nature of questions asked at this level can vary according to the type of systems perspective that one is arguing from. For instance from a Marxist

perspective, one might see class relations as being fundamental in describing systemic properties leading to a set of questions that are targeted at normative/emancipatory goals. Nevertheless an analysis (that retains the systemic level) will throw up questions of second-order (for instance Harvey (1996b), who discusses the ideology of planning). An autopoietic perspective views society as being organised in a way that helps it to deal with its own complexity. An emancipatory perspective (at the systemic level of analysis) is missing here. The answers contribute to the 'how to' question of planning. The questions thrown up are thus related to ways in which an ordering of society might be achieved towards goals that are formed within the system itself. Again as in fractals, this can be combined with normative viewpoints to yield different normative research agendas for the first level of planning (for instance the mechanisms through which norms influence planning- taken up in the next chapter- and the way these mechanisms differentiate in specific situations). It can also be combined with questions of interpretive research that yield more insights into ways in which system dynamics gets not only contextualised but also internalised and it can also be combined with other known 'mechanisms' seen to be operational in social systems to study how these mechanisms 'causal' effects are modified or influenced by higher level mechanisms.

The concerns and issues raised in this Chapter, is carried over to Chapter-8, where it is discussed with reference to the field work done on the People's Planning Campaign. Therein I discuss some ways in which the answers might be visible (albeit not in perfect form, but still visible) in actual planning practice.

CHAPTER-8

THE PEOPLE'S PLANNING CAMPAIGN – AN AUTOPOIETIC RE-INTERPRETATION

Introduction

The last chapter - chapter-7 has thrown up questions for planning from an autopoietic view point. Here I close the argument for the relevance of the concept in planning. The chapter provides a descriptive account of different aspects of the PPC. In doing this it fulfils two purposes. First, it explicitly connects the planning issues raised in the previous section to ways in which possible solutions could work out in actual planning practice by describing certain mechanisms tried in the PPC. Second, it attempts to bring out those causal claims missed in the discussion of the case study by means of a causal narrative of the PPC itself. In carrying out the above two purposes, this part also provides more information about the PPC.

The argument for relevance of autopoiesis is constructed indirectly in the sense of it being from the theory to planning concepts/issues, and then to the PPC. This is necessitated by the nature of the theory, which is drawn out in the second part of this chapter. This part reflects on what has been said on autopoiesis so far, and makes explicit the causal claims that have hitherto remained implicit within the theory. It is introduced at the end. The drawing out of the causal claims conceptually feeds in and illuminates concepts presented in the first part of Chapter-7. The argument in this sense is circular in nature, almost reflecting the nature of the theory it discusses.

8.1 The Legalities of Institutionalisation of the PPC – An Autopoietic View

In this section, I analyse the PPC in temporal terms. First, I trace initiatives at both national and state level to engage with decentralisation seriously. Following this, the launch of the PPC itself is placed in relation to this narrative account. I then analyse my own account of the narrative to bring out twin causal streams. Second, I analyse the evolution of the PPC, especially the institutionalisation of it. I argue that the evolution of legalities framing the institutional processes in the PPC follow very much an autopoietic

conception of 'organisation' and 'structure' – which helped stabilise the process in the long term, medium term and short term. This evolution along differentiated temporal planes also makes a connection with discussions of norms and values in planning. Third, I discuss the ways in which possibilities of rejection values were managed productively. Fourth, I argue that the two main systems involved in PPC – the administrative and political - showed an innate sensitivity to their self-referential character which in fact enabled the co-ordination of both to be more effective.

8.1.1 Autopoietic Narratives - Attempts to Facilitate Decentralisation at National Level

Decentralisation and devolution has been a topic of interest at the national level ever since independence. Though local governance had existed in India from very old times, the system of local governance as existed at the time of independence was introduced by the British. The first local body in India was set up by the British and was in the former Presidency Town of Madras, in 1688 (UNESCAP, <http://www.unescap.org/huset/lgstudy/country/india/india.html>). By the 19th century most urban areas had municipal bodies to carry out their civic duties with limited financial powers. The village panchayats on the other hand, were mainly defunct bodies and had very little financial power (Isaac and Franke, 2000). The pre-colonial village panchayat system of self-governance became an ideal for post-colonial India. (Isaac and Franke 2000). Mahatma Gandhi in particular, wanted a governance system based on village self-rule and strongly advocated for it. However the drafters of the Constitution felt that the dominance of the elite castes in the villages was too powerful for village self-rule to work. They believed that it would only reinforce the existing repressive power structures in rural villages. Hence when the Constitution of India was drafted, the village panchayats were included only in the Directive Principles, with no clear-cut powers or duties demarcated. Article 40 of the Constitution states that “The state shall take steps to organize village panchayats and endow them with such powers and authority as may be necessary to enable them to function as units of self-government” (<http://www.constitution.org/cons/india/p04040.html>). The subject of local government was included in the state list and left to the state governments to further legislate.

A series of committees have since been appointed to look into the issue of local self-governance. The first among them, the Balwantrai Mehta Committee in 1959, recommended *democratic decentralisation and a three-tier system for rural governance*. The Ashok Mehta Committee of 1977 was the next. It was a review of the Balwantrai Mehta Committee study and its main conclusions were that the *Panchayats were not endowed with sufficient power to help them perform efficiently as local self-governments and that they were acting as mere agents of policies framed at the centre and state level*. The G.V.K. Rao Committee in 1985 recommended that the *local bodies needed to be constituted and that elections to them had to be held regularly*. The L.M. Singhvi Committee in 1987 recommended that *more financial resources needed to be made available to the panchayat institutions*. The Sarkaria Commission in 1988, enquiring into Centre-State relations stressed the fact that *elections to the local bodies were not being held regularly and that they were being superseded on flimsy grounds* (<http://business.vsnl.com/gyansoft/HistoryOfPanchayats.htm>).

The first steps towards operationalising decentralised planning were taken by the Planning Commission in 1969, when it issued the 'Guidelines for the Formulation of District Plans'. A *procedure for creating district plans* specifying the approach to be adopted and the factors to be taken into account in assessing the level of development was drawn up. It was to be based on "available statistical and administrative data, the advice of knowledgeable farmers and entrepreneurs, experience of local officials and systematic appraisal of ongoing programmes" (Planning Commission 1969, as quoted in Isaac and Franke, 2000, pg 21). The next important milestone in planning was the 1978 'Report of the Working Group on Block Level Planning' under the chairmanship of Shri. M.L.Dantwala. The working group suggested *methods for preparing block level (sub-district) plans* in selected blocks on experimental basis. The exercise was administratively grounded at the district level, and was essentially bureaucratic planning helped by voluntary agencies and professional institutions (Isaac and Franke, 2000).

The 1984 Report of the 'Working Group on District Planning' headed by Shri. C.H. Hanumantha Rao looked into the progress made by states after the Planning Commission had first issued its guidelines. It concluded that except in the case of a few states, district plans were just *aggregations* of district level departmental schemes of the

state. The report of the G.V.K.Rao Committee on Administrative Arrangements for Rural Development and Poverty Alleviation Programmes, in 1985, was also highly critical of district planning and budgeting degenerating into mere '*mechanical desegregation*' (Isaac and Franke, 2000, pg 25) of state budget and plan. Planning procedures continued unchanged through 1980s and early 1990s, except for innovative experiments in Karnataka and West Bengal where genuine attempts were made to institute a decentralised planning methodology for planning. (Isaac and Franke, 2000).

The series of studies and recommendations traced above finally led to the 73rd and 74th Constitutional Amendment Act in 1992, when Shri. Rajiv Gandhi was the Prime Minister of India. It provided a *framework* for the functioning of the Local Self-Government Institutions (LSGIs) of the country.

The main features of the Constitutional Amendment are the following:

- Granting of constitutional status to the Local Self-Government Institutions declaring them as institutions of local self-government
- Three tier system of government created in rural areas
- In urban areas, one among three types of local Governments could be created depending upon level of urbanisation.
- In metropolitan areas, Metropolitan Development Council to be created including elected representatives from the panchayats and municipalities of that area.
- Mandatory creation of the District Planning Authority, as per respective state legislatures at the district level comprising of elected representatives from the LSGIs of the district, with only planning powers to integrate rural and urban planning.
- Mandatory constitution of ward committees/grama sabhas as per respective state legislatures at sub local body levels in urban and rural areas for closer citizen involvement in governance.
- Mandatory appointment of State Election Commission to oversee local government elections.
- Compulsory elections for the local self-government institutions every five years, with no local body to be left without a government for a period greater than six months.
- Inclusion of 11th and 12th schedule, which listed a minimum of 29 subjects that could be devolved to the Local Self Government Institutions.

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- Local bodies to pursue overall objectives of economic development and social justice
 - Mandatory appointment of the State Finance Commission to look into distribution of state resources between the state and the local bodies and the distribution of resources among the local government institutions.
 - One third of seats in the local governments to be reserved for women
 - Mandatory reservation of seats for scheduled castes and tribes in proportion to their population (Government of India, 1992a, 1992b).

The CAA provided broad terms of reference which essentially embody the idea of village autonomy (in mandating grama sabhas/ward sabhas/ward committees, mandatory elections at local level), multi-tiered governance (three tier governance system), inclusion of marginalised sections (seat reservations for women, scheduled castes and scheduled tribes), and resource distribution (mandating appointment of state finance commissions). Two schedules, the eleventh and twelfth schedules include responsibilities that can be passed on by the state to the local government institutions (LSGIs). Detailing of the law is left to the state as local self governance is a state subject (only state can legislate).

I have above provided a narrative of the circumstances that resulted in the CAA. It serves to explain the types of issues that the CAA addressed as it stresses episodes through which different types of issues in decentralisation were brought to the attention of the government. This narrative then has chosen a particular type of explanation – that of piling up episodes over episodes to explain the issues that the CAA addresses. It becomes a form of explanation because the causal narrative provided builds upon the contents in one episode to throw light on what happened next. The thread of explanation here is from episode to episode. Alternately, a *norms based explanation* that depends on an *analysis of the ideology* of the CAA in terms of challenges of governance can also be provided. The former form of explanation stresses the contingent aspects in the narrative, while the latter would stress an analytical logic. The latter would stress the general nature of issues in decentralisation which aims at a more universal explanation, while the former would stress the causal importance of the different reports aiming at contingent explanation that is tuned to local specificity. Autopoiesis stresses contingent manifestation of systems in events that produce communication. I shall later relate this discussion to the final part of this chapter that discusses causality in autopoiesis.

8.1.2 'Organisation' and 'Structure' - Legalities of Institutionalisation at the State Level

The progress of decentralisation in Kerala is coupled to tides of power within the state. As stated earlier, the PPC was a (or rather 'the') declared prime political programme of the Left Democratic Front (LDF) championed by the lead party within the coalition - the Communist Party of India (Marxist) known as CPM. The first major involvement of the CPM with local bodies was when the first communist government was elected in 1957. At that time a District Council Bill was introduced in the Assembly in 1958 which visualised Councils that would coordinate functions of panchayats and municipalities and gradually take up district administration in a phased manner. However with the dismissal of the ministry by central government in 1959, the bills could not be passed (Isaac and Franke, 2000). The 1960 Act that was eventually passed was focused mainly on providing a uniform law for the three regions in Kerala – Travancore, Cochin and Malabar, which were at that time following different Acts due to historic reasons (The Kerala Municipality Act and Rules, 2004, pg 5). In 1967, the left government again came to power. The Kerala Panchayat Raj Bill was introduced once again proposing a two tier system. This bill also lapsed as the ministry was brought down in 1969 (Isaac and Franke, 2000). Tangible efforts towards decentralised planning in Kerala started in the early 1970s, with the establishment of District Planning Offices for the identification of district schemes. A number of methodological exercises were then carried out and District Plans for two districts were prepared. The left government again came to power in 1987 and the next major comprehensive step towards devolution was taken in 1990, which led to the setting up of the District Development Councils. A greatly enhanced District Plan outlay was set apart by the State Government for implementation by the District Councils. However the vision of decentralised planning moved no further, as the Government was again voted out of office in the 1991 elections (Isaac and Franke, 2000).

After the CAA, when all states were required by constitution to amend their Acts, Kerala instead of amending its existing Kerala Municipalities Act 1960 and Kerala Panchayat Act 1960, enacted new Acts in tune with the spirit of the Constitution – the Kerala Municipality Act 1994 and the Kerala Panchayat Raj Act 1994 (The Kerala Panchayat Law Manual, 2004 and The Kerala Municipality Act and Rules, 2004). With

the launch of the PPC in 1996, a need for more far-reaching changes in the Act was felt necessary in order to stabilise the planning process in the long term. Consequently the State of Kerala constituted the Committee on Decentralisation of Powers around the same time as the launch of the PPC to study and recommend the changes that should be made to the Act (Isaac and Franke, 2000). Following the Committee's recommendation (which was accepted almost in total barring a few details), major amendments were made to both the Acts in 1999 (The Kerala Panchayat Law Manual, 2004, pg 5 and The Kerala Municipality Act and Rules, 2004, pg 5). In its report the Committee recommended 1) a set of norms that would guide the institutionalisation of democratic decentralisation in the state, and 2) two volumes of detailed amendments to be made to the Panchayat and Municipal Acts. These were based on extensive discussions with local government representatives, senior officials in Government concerned with decentralisation, collection of field level data, field visits, formal question and answer sessions etc (Committee of Decentralisation of Powers, 1997, pg 1).

The norms to guide institutionalisation of decentralization and bottom-up planning are set rigidly within the framework of the constitution. These form the almost permanent parameters for change through out the nation. The report of the Committee articulates the state's vision within this framework, picking up the norms in operation within the PPC and building up on it. It not only formed the basis for the reform of the Acts but also became the framework that guided subsequent institutional evolution of the PPC – qualities that were to be preserved whatever the medium and short term change that took place. In other words it spelt out the 'organization' of the PPC. These are summarised below -

People's Participation: Involvement of people is not to be limited to mere information provision or plan formation. They are to be actively involved in all stages of planning, implementation and monitoring. The Committee reports -

'Genuine participation consists of dialogue and partnership leading to full involvement in decision making in the allocation and utilisation of resources meant for collective good that constitutes genuine participation. Thus it is a people centred view of local self government that the committee has taken. The citizen is seen on the centre stage; it is his voice that has to be listened

to; it is his choice that has to be accepted and it is his interest that has to be preserved' (Committee on Decentralisation of Powers, 1997, pg 3).

Following this vision, grama sabhas, ward sabhas and ward committees are given definite functions, powers and responsibilities in the Act (more details on these are included later in this chapter, where it becomes the focus of discussion). Special purpose vehicles like beneficiary committees (committees constituted for carrying out minor civil work by the beneficiaries themselves) and social audit groups (groups of professionals and people of eminence - all volunteers, constituted at LSGI level to audit implementation of work undertaken by the LSGI in any sector) are permitted.

Inclusion of Marginalised Sections: Besides the mandates of the CAA, the Committee also proposed providing status of special grama sabhas to tribal hamlets, so that they could enjoy an autonomy that is equivalent to a grama sabha on their own terms. Also special measures to safeguard diversion of funds earmarked for scheduled castes and scheduled tribes are suggested. The formation of Neighbourhood Groups (NHGs), Area Development Societies (ADS) and Community Development Societies (CDS) targeting the poor are safe guarded by enabling provisions.

Autonomy: Various levels of the LSGIs, though hierarchically organised, are to be perceived as complementary units, not subsidiary units. This is to hold true with respect to functional, financial and administrative matters which meant clear detailing of powers, functions and responsibilities between the tiers. Also the scope for interference of government in day to day functioning of LSGIs is drastically reduced. The committee reports –

For the Local Self Government to function, it has to be relatively free of interference and executive control from above. In order to protect the autonomy of the local bodies, the Committee has reduced the scope of Government interference in their day to day affairs. The resolutions can be cancelled only in extraordinary circumstances. Similarly the dissolution of local bodies has also to be resorted to only as a last step and that too after following the due process and getting the opinion of an independent authority in the form of Ombudsman. Even the appellate functions in respect

to statutory matters need to be removed from the governmental set up and made the responsibility of independent quasi judicial authorities' (pg 4).

Other superfluous committees (such as development corporations, metropolitan committees, high level committees etc) acting in the area are also proposed to be removed vesting full powers with LSGIs.

New checks and balances: A new direction in checks and balances is proposed with accent from below. Social audit teams, grama sabhas, ward sabhas/committees are the main venues for control, with requirements that LSGIs maintain transparency and provide information. Independent, autonomous institutions like the Audit Commission, Appellate Tribunal and Ombudsman are also proposed. The State Election Commission is given more power especially with respect to delimitation of constituency, reservation of constituency as per the CAA (for marginalised communities on a rolling basis) and disqualification of members. A performance audit system is set up that is tuned more to on-going corrective audit than post-audit. The committee reports –

The Committee supports the view that more and more of self-regulation should be introduced with Government laying down broad parameters. The due process and proper procedure have to be prescribed clearly and any mal-administration needs [to] be controlled not by Government but by an independent system. This would foster autonomy and self-responsibility among LSGIs' (pg 5).

Development Orientation: Clear division of powers among tiers to allow development orientation as well as synergetic advantages. Developmental functions transferred to the LSGI to range from mandatory sole responsibility to agency function for government. Methodological lessons learnt from practice in the PPC to be transferred to Act, without disturbing flexibility that provides for local initiative and innovation.

New Work Culture: Creative interface to be encouraged between elected representatives and bureaucrats at local level so that policy formulation and implementation is not strictly separated. Internal organisational structures and procedures of LSGIs are thus modified. Every elected member has a responsibility in one of the mandatory committees. State Government Officers working in line departments at the local level to be transferred to

appropriate LSGIs, and will be subject to dual control – professionally by the cadre, but administratively by the LSGIs.

New Politics: A culture of co-operation to be encouraged. The Committee reports –

It is the desire of the Committee that local self-government would throw up a new political culture marked by co-operation in matters relating to local development. there should be no room for unnecessary conflicts and clashes dividing people and excluding sections from the developmental process'

New and stricter conditions for disqualification of members relating to moral uprightness are consequently recommended. Provisions against political defection incorporated into Act.

Resource Mobilisation: Committee underscores resource raising responsibilities in tandem with spending responsibilities. It reports –

'It is necessary to underscore the fact that the growing expenditure responsibilities must not be seen independent of revenue –raising responsibilities. The 'You-Pay-I-Spend' syndrome should not be allowed' (pg 8).

Consequently LSGIs are enabled to raise user charges and fees besides institutional finance. Only minimum levels of taxation is fixed and greater levels of beneficiary contributions etc that come from participation are expected.

Capacity Building and Nurturing: Additional staff to be transferred from line-departments to LSGIs. Rigorous training and other capacity building programs - both in-house as well as on field - to be provided by an institution (KILA) dedicated for the purpose. Caring and nurturing role by government to LSGIs expected. Enough flexibility to be allowed for genuine mistakes, and their early detection and correction, while malafide to be dealt with seriously. Conditions for working of elected members to be improved.

The operationalisation of such a major overhaul in governance, which allowed for multi-tier autonomy, could not be expected to be cast in laws once and for all. The level of both internal and external uncertainty is too vast for that. Besides the state was experimenting in a huge way, reversing the nature of governance using state resources

without having any of the capacity built in initially or prior to the experiment. As Isaac and Franke (2000) state 'In Kerala, the theoretical sequence of decentralization has been reversed' (pg 8). The reversal in sequence of devolution (devolving finance and responsibilities before capacity was built) besides requiring immense capacity building efforts was also bound to cause problems in implementation. Without some sort of legal guarantee, within this uncertainty, it was clear that officials would not act. Yet, the law had to be mediated to allow for experiment, mistakes and correction. The mediation was in the temporal dimension. I shall explain below.

I have stated that the norms together with the amendments to the Acts provided 'organisation' and stability in the long –term. Planning within the PPC is undertaken broadly in two temporal frames – once every five years, there is a broad review of development activities conducted, assets position, problems/issues, development targets etc. Within this there is a yearly review in which the LSGI sets its annual targets for the LSGI activities within the LSGI total budget. As detailed earlier both these five yearly and annual activities are conducted with people's participation through a bottom-up process. Each year new Government Orders are issued to guide the planning exercise for that year. These are prepared taking into account feedback from LSGIs, results of implementation in the previous year, the plan of action of the State Government (which is still left with around 65% of the plan funds), and also changing development priorities due to global/national level changes, modernisation programmes targeting LSGIs made possible by new technical infusion into administration (softwares etc), new focus for development programmes (women empowerment, watershed based planning, destitute targeting) etc. They provide direction in terms of broad state priorities in development; percentage changes for sectoral allocation – what must be mandatorily spent for the productive sector, service sector and infrastructure; reconstitutions needed in the structure (in broad terms) of various committees, groups, working in association with plan preparation; change in implementation norms in line with accountability parameters; changes in support provided to LSGIs – personnel, training funds; timetables for preparation of plan; special provisions for marginalised sections; etc (G.O.(MS) No. 40/2004/Plg dated 31st March, 2004). The five-yearly and yearly planning cycles of the

LSGI are guided by these Government Orders. They provide 'structure' to the evolution of the process.

It is not enough to limit the temporal differentiation to yearly Government Orders that would guide the plan preparation process. Daily administration brought up fresh sets of problems, need for clarifications, demand for more flexibility in ambit, yet precision in terms of accountability, conflicts between laws, demands according to specific situations that needed extraordinary considerations etc. There needed to be a mechanism that would respond to this almost daily demand. This was provided by the constitution of the Co-ordination Committee. This is a high level committee with delegated powers from the Council of Ministers to take most policy decisions with respect to decentralisation. The Committee is chaired by the Minister for Local Self Government and has as its members the Secretaries in charge of Local Self Government, Scheduled Caste/Scheduled Tribe Development, Planning and Finance Departments, Members of the State Planning Board in charge of Resources and Decentralised Planning and the Heads of Panchayat, Municipalities, Rural Development Departments. The then Secretary of Local self Government – Rural writes

“This Committee which meets every week has been a great success in providing online response to issues arising out of the decentralisation process by virtue of its empowered nature. It has helped in taking quick policy decisions and issue of critical government orders and circulars to remove bottlenecks” (Vijayanand, 2000).

This high powered committee meets every week to discuss up coming issues in relation to decentralisation. There are also state level reviews conducted every month by the minister, district level reviews conducted in the field every month by the district collectors (GO (A) No 69/98/LSGD dated 21st March, 1998), besides numerous feedback forms that are part of the planning process, as well as information that come up through training programmes conducted for local self government functionaries. This sensitivity to field level information and almost immediate rectification or clarification gave rise to a host of Government Orders to aid, enable and clarify procedural problems. Short-term reversals and modifications of Government Orders were also common (modification to GO (A) No 216/97 LSGD dated Sept, 1997 by GO(P) No 105/98/LSGD dated May

1998). But this, as the then Secretary to Government (Local Self Government) stated, in a training session for local government functionaries, is not to be seen as inconsistency or a problem. They in fact are to be seen as an indication of the sensitivity of government to field level information necessary in a launch of this scale. In connection with the parameters that guided day to day decision making, the guiding norms were pointed out as framing the decision making at higher level.

The relative informality of the Government Orders make it possible to 'experiment' with enabling provisions. What is found working can then later be stabilised through Acts. The 1999 overhaul to the Act essentially builds on the lessons thrown up in execution made possible through the use of Government Orders. Regarding institutionalisation the Committee on Decentralisation of Powers reports –

'Government have relied on a campaign approach to carry out functions, particularly those related to decentralized planning and implementation of plan schemes. In the change over phase, when lots of new things had to be done in a very short time, when a distinct break with the past was necessary in the work culture and when harnessing of experience and expertise from all sources was necessary, the campaign approach was the only course open to government. This approach has been able to utilize to its advantage Kerala's traditional forte of public action for development. The People's Planning Campaign, which represents the developmental facet of decentralisation, has succeeded in a large measure in deepening the process of decentralization, bringing about qualitative changes in planning and implementation and altering the mindset about participatory development. However it needs to be noted that a campaign by definition relies on volunteers who are basically social activists willing to lead from the front without any expectation of personal gain. Necessarily the campaign depends on informal and semi-formal systems and on the motive force of committed individuals. The momentum generated by the campaign has pushed things along. This is the time to internalize the essential elements of the campaign and insititutionalize the procedures and systems thrown up by the process (Committee on Decentralization of Powers, 1999, pgs 6-7, in Isaac and Franke, 2000, pg 290,291).

I have drawn a picture of the temporal differentiation of the insitutionalisation of PPC with different types of instruments used with varying degrees of formality for different time-spans and purposes. Underlying all the types of instruments used for varying purposes are the set of norms that express the most stable aims of the PPC. These provide the ‘organisation’ for the evolution of the PPC consequently stabilised in the Acts while different types of Government Orders provide the ‘structure’ for the evolution of the PPC in the medium and short –term.

8.1.3 ‘Self-referentiality’, ‘Reflection’ and ‘Structural Coupling’ between the Administrative and Political system

Ways in which the legalities surrounding institutionalisation were differentiated temporally to produce an organisation and a structure for the PPC have been discussed. This is a sensitive use of the self-reference of the legal system. Knowing from experience that legal systems act only on the legal-illegal code, only tried out and relatively stabilised norms and ways of working are converted into law. All other guidance is kept within the administrative system, out of the strict legal system, which allowed the use of another code – that of compliance/non compliance. This gives enough power to the state to ensure that changes will be complied with at all levels, with non-compliance attracting administrative sanctions.

The administrative system in turn was using ‘reflection’¹ from the political system. I have traced the political commitment of the CPM to decentralisation. With the party in power as the lead party within the LDF coalition, the administrative wing was banking on the political wing when it chose to apply the rejection value in allowing for mistakes and correction. Thus strict administrative witch hunting which is not uncommon in Kerala was, at least for issues connected with decentralisation, suspended. Besides ‘reflecting’ the political wish for furthering decentralisation, the administrative system was also strongly coupled to the political system on this issue. Thus many senior political officials in government shared the same commitment of the political system, resulting in them going to great lengths to make themselves accessible even to the extent of being available on phone at their residence any time (Vijayanand,1999). Though coupled, both the

¹ “An operation by which the system indicates itself in contrast to its environment” (Luhmann, 1995, pg 444)

systems however continued to operate on their own terms. The administrative system, particularly at the top level, saw the PPC more as a means for achieving efficiency in government in terms of delivery and management. Thus the Secretary to Government (Planning and Economic Affairs), Government of Kerala writes,

“Decentralisation throws up exciting possibilities for fundamental reforms. The general atmosphere of change opens up considerable space for far-reaching administrative reforms. There is much scope for modernization and possibilities for introduction of totally new systems and procedures. Thus decentralisation facilitates reforms from below, touching practically every sphere of governance” (Vijayand, 2001).

The political system in its turn saw the PPC more as a means to achieve participatory grass root level democracy that would address issues related to class struggle, it being an end in itself. Thus E.M.S Namboodiripad, a much respected political veteran in the CPM (also Chief Minister in the first two Communist Governments) writes-

“I feel that one big question that we face is whether the organized strength and political consciousness of our people can be used to increase production and productivity. I want to answer in the affirmative. But there is a pre-condition: the government and the ruling classes must change their attitude to the organizations of the people and their demands. Instead of suppressing people’s struggles and adopting negative attitudes, amicable solutions should be found through collective bargaining and discussions. Further, institutions and social mechanisms have to be developed to ensure that the toilers get their due share from increased production. I must emphasize the importance of democratic decentralization in this context” (Namboodiripad, 1994 quoted in Isaac and Franke, 2000, pg 40).

Leadership for actual experimentation and capacity building at field level was provided by the campaign cell constituted under the Kerala State Planning Board. The cell set special focus themes, designed and co-ordinated the processing of feedback forms, along with assessing capacity building requirements, facilitating and carrying out capacity building and liaising with the government. The operationalisation of the general

political agenda of furthering and deepening decentralisation was more direct through the cell.

The coupling of the two systems was essentially forged at the highest level. The efficacy of local level coupling differed from locality to locality, depending on local politics (Chathukulam and John, 2002). The forging of a strong coupling at high levels however enabled the launch of the PPC, as it became possible to use the code of compliance/non compliance through which the administrative system worked, to ensure commitment at lower levels. Even while coupled, the maintenance of each system's autonomy had many advantages. It brought in committed personnel from both systems, who could contribute strictly from within their own system to the objectives and means used in the PPC. Thus mass mobilisation and the management of political risk was primarily handled by the political wing, while the intricacies of operationalisation through systems of procedures, rules and circulars was handled by the administrative wing. Indeed this was the only way in which the PPC could be launched. Thus Shri S.M. Vijayanand, present Secretary to Government, Planning and Economic Affairs writes again –

”It would seem that political decentralization, and that too, a kind of democratic decentralization with accent on people's participation, is more sustainable than administrative decentralization. Power should flow from both the political executive and the administrative executive to the local governments, and through the local governments to the people” (Vijayanand, 2001).

In this section I have discussed the evolution of the legalities surrounding the institutionalisation of the PPC. I have argued that the evolution demonstrates a temporal differentiation leading to the use of different instruments for different temporal spans each of which are also rooted in different functional systems. These systems worked together through reflection as well as strong structural coupling facilitated by clearly articulated norms, arrived at through a process of induction from tried out experiments at field level initiated by the political system, yet consolidated by the administrative system. The maintenance of each system's autonomy even when structurally coupled enabled the enlisting of committed personnel, use of different systems for different purposes and also the use of different types of mechanisms and initiatives. The descriptions provided here

illustrate how autopoiesis gives us different types of insights to the totality of the launch of the PPC – an explanation based on mechanisms as opposed to norms, that derive from a non-reductive systems view of the PPC. In the next section I concentrate more on showing how autopoiesis can give us insights about the ordering of details within the PPC.

8.2 People’s Participation within the PPC – An Autopoietic View

Within this heading, I discuss the process of participation with respect to issues raised earlier, in the previous section. First, I discuss the way in which PPC structures the temporal relation of participation to society and the consequences of this relationship. Second, I discuss the ways in which the evolution of structure within participation is facilitated/ constrained. Third, I discuss the ways in which interpenetration of the individual with the interaction system is facilitated/hampered.

8.2.1 Temporal Analysis of Participation Processes in the PPC

Participation processes within the PPC have been described in its totality earlier in Chapter-6. I shall not recount them here again, as other things need to be highlighted here. However the process must be kept in mind in this discussion. The description there related to the stages in plan formulation that yield eventually the five year plan and the annual plans. Here I concentrate on the linking of the most grassroots level participation system – the grama sabhas/ward sabha/ward committees with plan formulation, implementation and monitoring.

As mentioned earlier, grassroot level interaction systems are involved in plan formulation. They are the starting point of the bottom up process. To plan for the future in the present, the grama sabhas need to relate both to the past and the future. They are linked to what has gone before by means of enabling provision in the Act. Thus they are entitled to know “about the budgetary provisions, the details of plan outlay, item-wise allocation of funds and details of the estimates and cost of materials of works executed or proposed to be executed within the area of the grama sabha” (Kerala Panchayat Law Manual, 2004, pg 64). The Act further states “audit report or the performance audit report placed for the consideration of the grama sabha shall be discussed in the meeting and its views, recommendations and suggestions shall be communicated to the concerned village

panchayat”. The same applies to municipal and corporation areas too. Further grass root level interaction systems are also entitled to the following rights –

- To know the rationale of each decision of the council of which the ward is a unit.
- To know about follow up action taken on the decisions of the ward sabha/ward committee and to know the details of not implementing any decisions.
- To get information about detailed town planning schemes, building construction permits etc. (Kerala Municipality Act and Rules, 2004 and Kerala Panchayat Law Manual, 2004)

This set of rights *institutionally* connect the interaction system to what has gone before. Besides this connection, they are also of course *socially* connected to the happenings in the ward, by means of living in the spatially defined area of around 5000 inhabitants on an average. It is clear that the profile of rights actually sees the grama sabhas/ward sabhas/ward committees as monitoring agencies that can if they choose to exercise ‘control from below’.

In terms of orientation to the future, the grassroots level organisations have the following rights/functions/responsibilities according to the Acts. Thus they

- Can get information regarding services to be rendered and the activities proposed to be carried out by the officers concerned during the next three months.
- Can get information on the detailed estimate regarding the works proposed to be undertaken.
- Formulate proposals on development schemes to be implemented in the LSGI area, determine the priority, and make available information in connection with functional schemes for the next three months.
- Prepare order of priority as to the location of street lights, street or community water taps, public wells, public sanitation units, irrigation facilities and such other public utility schemes.
- Discuss and formulate literacy programmes necessary for the ward area, formulate schemes for imparting awareness regarding matters of public interest like sanitation, environmental protection, pollution control, etc.

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- Promote harmony and unity among people belonging to different sections in the ward area and organize arts and sports festivals for promoting goodwill among people in the area.
 - Identify deficiencies in systems of water supply, street lighting, etc in the ward area and suggest remedial measures.
 - Identify lacunae and lapses in compliance to building rules and implementation of spatial planning (Kerala Municipality Act and Rules, 2004 and Kerala Panchayat Law Manual, 2004).

In terms of the future, the grassroots organisations are actually regarded as venues for expression of felt needs. They are not required to 'plan' in the sense of a comprehensive plan for the area. Yet, micro-detailing of needs like locations of utilities in public spaces etc fall under their ambit.

In terms of the present, which is the most important temporal dimension for a venue that articulates felt needs, the grassroots organisations have an active role. They do not just 'voice' in this time dimension, but are 'involved' in many ways. These can be broadly listed under activities connected to information collection and dissemination, developmental activities connected to plan implementation, activities connected to day to day LSGI management and general facilitative activities for well-being of population within the ward. I present the powers/rights/responsibilities so categorised below -

Information Collection and Dissemination

- Collect essential socio-economic basic data.
- Assist the collection and consolidation of details necessary for the formulation of development plans/schemes for the LSGI.
- Disseminate information regarding development and welfare activities.
- Prepare the final list of eligible beneficiaries (for various programmes by the State and the LSGI) in the order of priority by finding out eligible applicants from the ward area based on the criterion prescribed in respect of the beneficiary oriented schemes and to submit the same to the LSGI.
- Verify eligibility of persons getting various kinds of welfare assistance from Government such as pension, subsidy etc.

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- Make arrangements to report immediately the occurrence of epidemics, natural calamities etc.

Developmental Activities Connected to Plan Implementation

- Render necessary assistance for the effective implementation of development schemes providing necessary local facilities.
- Seek and obtain detailed information regarding the development programmes being implemented in the Ward and monitor its implementation.
- Supervise development activities as voluntary teams.
- Provide and mobilise voluntary service and assistance in cash or kind for social welfare programmes.
- Observe and assist beneficiary committees which are working in the area.
- Encourage residents to plant kitchen gardens and engage in horticultural activities [special focus introduced by the state due to decreasing engagement with agricultural activity in Kerala].

Activities Connected to LSGI Management

- Create awareness for prompt payment of taxes, fees, rentals and other dues to the LSGI
- Cooperate with LSGI employees working in sanitation in the ward area and render voluntary service in the removal of garbage [special focus due to particular conditions in Kerala that make waste management involving separation, segregation, collection, transportation and disposal a very difficult area of LSGI activity].
- Adopt moral means for payment of taxes, repayment of loans, improvement of environmental cleanliness and maintenance of social harmony
- Mobilise resources locally to augment financial resources of the municipality

Activities for General Welfare

- Participate and propagate programmes regarding health, literacy and other time bound development programmes
- Assist activities of parent-teacher associations in the schools
- Assist the activities of public health centres in the ward area,

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- Co-ordinate and implement the activities for protection of nature to impart knowledge to the people on environmental problems. (Kerala Municipality Act and Rules, 2004 and Kerala Panchayat Law Manual, 2004)

Interactions within the grama sabhas/ward sabhas/ward committees are thus strongly rooted in the present, in *activities* rather than plans, in *felt needs* rather than comprehensive planning, in *questioning* rather than suggesting. Nevertheless the future is present in the felt needs and the past is present in the questioning. They are in other words involved in what can be characterised as *continuous planning* (following Branch, 1981) of its own kind, forging the link between plan formulation and implementation.

The interactions that take place in the grama sabhas/ward sabhas/ward committees are therefore temporally connected to *society*. It relies on events, communications and actions that have gone before which it collects itself by being contingently situated. It creates its own realm of expectations that is conditioned by information flows from the past, present and the future (as communicated by the LSGI). The temporal situatedness of these venues are therefore vastly significant for what can happen within the interaction system.

8.2.2 Analysis of Evolution of ‘Structure’ in the PPC

Having linked the grama sabha/ward sabha/ward committee to society in temporal terms (the spatial situatedness being in-built in its definition), I now turn to analyse how the evolution of ‘structure’ for communications is institutionally ‘conditioned’ in the PPC. I have in general terms discussed how grass root level organisations are temporally connected to society in the design of the PPC. Here I discuss how the dynamics within the interactions are institutionally conditioned. During the launch of the PPC, grassroots level meetings were structured in general terms by the State Planning Board, so as to ensure that there would be definite outcomes from the meetings. Three types of tools were used. First, volunteers known as Local Resource Person (LRPs) were identified by the LSGI locally. They were the bottom most tier in a system of resource persons. Thus the LRPs worked at the local level and were accountable to the LSGI, the District Resource Persons (DRPs) worked at the block level and were accountable to the Block Panchayat, while the Key Resource Persons (KRPs) worked at the district level and were accountable to the DPC. The KRPs were trained directly by training programmes

conducted by the State Planning Board, the DRPs were trained at district level by the KRPs and the LRPs were trained by the DRPs at the local level. Part of the training dealt with the conduct and facilitation of grama sabha/ward sabha/ward committee meetings. Thus there were trained facilitators for each meeting that knew what the spirit of the campaign was, the outcomes (in structure not content) that are expected and the modalities to be followed.

Second, handbooks on measures to be taken in facilitating the meetings were issued. These were prepared by the State Planning Board and distributed throughout the state to reach every grassroots level meeting. The handbook detailed out the modalities of conduct of the meeting.

Third, standardised forms for recording the outcomes of the meetings were distributed throughout the state so that comparison and consolidation at higher levels would be possible. The LRPs were also given separate feedback forms for recording their impressions of the meeting for consideration by the State Planning Board, so that immediate rectifying actions could be initiated (Isaac and Franke, 2000).

A model agenda for the grassroots level meetings involved opening of the registration counter an hour before the grama sabha/ward sabha/ward committee actually began. Half an hour is allotted to presidential addresses and inaugural speeches (these tended to get prolonged in practice however). In the initial stages 20 minutes each were allotted to the development crises of Kerala and explaining the campaign itself. Thereafter the group split into small groups dealing with a particular subject area. Twelve sub-groups were suggested (there is considerable variation in this aspect too from LSGI to LSGI as some combined groups, while others split them up further). This was necessary because of the large numbers of people that could be potentially involved. (In some places 1500 people have been reported to attend while in some places there were just enough to fill the quorum of 10% of the population). The twelve groups suggested were – agriculture and irrigation, animal husbandry and fishing, education, drinking water, sanitation and health, industry, transport and energy, housing and welfare, culture, women's development, Scheduled Caste/Scheduled Tribe welfare, cooperatives and resource mobilization. At the end, reports from each small group are presented in the plenary and also delegates to the development seminar (the next step in the planning

process) are selected. Within the small group discussion itself, the discussions revolve around, development problems, collection of statistics and information, suggestions for solutions. In order to structure discussions within the small groups (as it was felt that leaving everything to spontaneity may be hazardous), for every sector, two dozen questions were drawn up that would draw attention to key problems and needs. These were in the hands of resource persons who were to use them creatively, subjecting them to modification so as to suit and encourage local initiative (Isaac and Franke, 2000).

The constitution of grass root level committees are mandated by law. Thus for a gram sabha, “each constituency of a Village Panchayat may be specified as a village.....all persons whose names are included in the electoral rolls relating to a village comprised within the area of a Village Panchayat shall be deemed to be constituted as Grama sabha of such village” (The Kerala Panchayat Law Manual, 2004, pg 62). For a ward sabha, “in every municipality where the population does not exceed one lakh, there shall be constituted a Ward Sabha for each of its Wards and all persons included in the electoral roll of that ward shall be members of that ward sabha” (The Kerala, Municipality Act and Rules, 2004, pg 97). The councillor would be the chairperson for both the grama sabhas and the ward sabhas. For a ward committee, “In every Municipality where the population exceeds one lakh, there shall be constituted a ward committee for each ward of that Municipality” (pg 97) and “the ward committee shall consist of the following members, namely –

- a) The councillor of that ward who shall be its chairman
- b) Fifteen persons to be elected in the manner prescribed, from among the members of the residents association of that ward, which are registered in the municipality
- c) Twenty members to be elected in the manner prescribed from among the members of the registered neighbourhood groups of that ward which are registered in the municipality
- d) One person each nominated by every political party having representation in the municipality
- e) The heads of all recognised educational institutions functioning in that ward
- f) Twenty persons nominated jointly by the chairperson and councillor of the ward, of whom-

-
- i. Ten shall be from the persons representing the cultural organisations, voluntary organisations, educational institutions, industrial-commercial establishments which are functioning in that ward;
 - ii. Five shall be from persons representing those working in that ward as professionals (experts in agriculture, industry, health, education, engineering etc; and
 - iii. Five shall be from persons in the registered trade union

Provided that, the members nominated under i and ii need not be the residents of that ward” (The Kerala, Municipality Act and Rules, 2004, pg 98).

An analysis of institutional factors that circumscribe the grassroots level democratic process shows that it is actually strongly constrained and focussed in certain dimensions. These dimensions in broad terms are the temporal, social and the factual. In the temporal dimension, the discussions connect to the past, by way of problems, the present by way of information and the future by way of suggestions. In the social dimension, for small LSGIs, the law does not specify any constitution, as it can be expected that people would know each other and could be identified. In the bigger urban areas however, the social identity is clearly specified. The social roles and identities help structure the outcome as people are identified and come as representatives of a particular social role. In the factual dimension, the themes are broadly structured for each group and prompts are provided in the forms of suggestive lists of questions. The single *theme* (as opposed to single issue in case study 2b) small groups are provided with background information to orient themselves and the results are discussed in plenary so as to provide opportunity for any cross-sectoral priorities. The details of modalities and time allotments provided in the model meeting can be contested and these are actually changed and adapted to local circumstances in practice. What is important is that institutional parameters do constrain the interaction system so as to allow the formation of a ‘structure’ that can be used by society.

8.2.3 Sequencing of Interaction systems

The ways in which outputs of the grassroots meetings will be used is also known, as the planning process is clearly presented. Two representatives from the grama sabha/ward sabha/ward committee are also chosen to represent the committee in the next

higher level of deliberation - the development seminar, where LSGI level issues are discussed. The two meetings in the plan process thus provide two different types of venues for suggestions and debates. The 'experimental' value of these two interaction processes are thus different and separate, yet one needs the other. The logic of selection and synthesis is left to the dynamics of the interaction process itself, which is strongly structured to ensure at least a minimum set of outcomes. I shall not go into the details of structuring of the development seminars themselves, as the point I wish to make is that when a number of interactions are used sequentially along a planning process, then each must provide for different types of experimentation.

8.2.4 Interpenetration in Interaction Systems

The final point is regarding the relationship of individuals to interaction systems. The concept of interpenetration allows us to conceptualise this in particular ways. What is a fundamental requirement for enabling this, is the making of one systems' complexity for the other to use through communication. Thus even when the two interpenetrating systems remain separate they comprehend the other's foreign complexity as a structured complexity on different terms. Institutionally this is enabled in the PPC through requirements of transparency, which include the Rights to Information law. As mentioned earlier, grass root level committees are provided with rights to information that are protected by law. Performance audit reports are to be placed before the committee as well as information on works conducted in the ward. At present government directions mandate that a public notice board must be placed in every ward in the LSGI that gives information on schemes and projects being implemented in the ward (GO No 37805/L3/98/LAD dated 10-9-1998, GO No 37805/L3/98/LAD dated 5-12-1998). More than all these institutional features, the most important feature is the social embeddedness of the interaction system within a spatially defined area's on-going social life, which in turn gives rise to a form of knowledge that is informal, intangible and diverse, yet very real in the interaction system. In terms of individuals benefiting from the interaction system, words from Isaac and Franke (2000, pg 11, 12) best express the vision surrounding the design of the interaction system. (Dr Thomas Isaac was a Professor in the Centre for Development Studies, Trivandrum, and was a member of the State Planning Board spearheading the Campaign. He was one of the foremost leaders that gave shape to

the Campaign. At present he is a Member of the Legislative Assembly of Kerala and an active member of CPM).

”Instead of taking civic culture as historically determined and given, the People’s Planning Campaign approaches it as shaped by the nature of civic and political engagement....The campaign actively seeks to nurture a civic culture that will promote grassroots democratic institutions. A radical transformation of the development culture of the state is a necessary prerequisite for successful participatory decentralization. It also requires basic attitudinal changes towards the developmental process among all the key players involved; the elected representatives, officials, experts and the public at large. In short, the objective of the People’s Campaign for Decentralized Planning is not simply to draw up a plan from below. The process of planning is intended to bring about a transformation in the attitudes of the participants themselves, to generate a new development culture”.

The interaction systems were thus aimed at both eliciting and harnessing individual *social* knowledge into planning and governance, as well as using the interaction systems to bring about a change in the *social* awareness and behaviour of individuals. In the campaign therefore, interaction systems are indispensable units by which ordering of society is achieved. The role of planning and governance here is to facilitate this ordering by means of a second-order ordering that understands the dynamics of both society and planning.

I have, through the description of the PPC, illustrated how some of the issues raised in the previous section might play out empirically. Besides providing insights for planning in the two issue domains that I explored, my intention was also to show how autopoiesis addresses an altogether different level of concerns. Due to the nature of its parent theory, which is systems theory (it being removed one step away from disciplinary theories) it provides us with tools for analysis which are one step away from direct planning practice. In other words it helps us to plan the planning or order the ordering process. I argue that this is the *equivalent* domain of understanding autopoiesis (as also complexity theory in general) in planning. The impacts of this domain are however not limited to the level of its understanding. They extend into planning practice in the first

level also, as new possibilities are opened up demanding new skills and knowledge from the planner. But this cannot be argued for until the domain of understanding is made explicit and visible. This has been my attempt in this chapter hitherto. I now return back to autopoiesis to draw out the new causal claims that run in this argument and thereby to position the theory ontologically and epistemologically.

8.3 Causal Claims and Epistemological Implications of Autopoiesis

In this section, I discuss the implications in terms of causality that flow from the theory of autopoiesis. I present manifestations of causal processes as can be observed within the PPC. From this empirical identification, the causal claims that are embedded in autopoiesis are abstracted. Second, I discuss the epistemological implications of the theory and the way in which this influences planning.

8.3.1 Causality in Autopoiesis

In Chapter- 6, on fractals, causality in three forms were discussed – as generative mechanisms, as relations between entities that constitute a system, and as iterations achieved methodologically by two means. Autopoiesis gives us three other forms of constructing a causal account. I shall discuss this in relation to the PPC first before drawing it out in abstract terms. In the description of the PPC, I have shown how the feedback system (which is essentially self-referential) operated. There is a highly empowered co-ordination committee that meets every week to decide on changes to be made to the institutional parameters that guide the evolution of the PPC. This committee relies on feedback from the field, either collected directly or through feedback forms, and make decisions on matters arising in the course of day to day governance (which is also a form of feedback). The changes made are guided by a set of norms, which also are subject to revision if the case might warrant it. The causal processes operating here are a form of *amplification and damping* which depend on *feedback* loops. Both processes operate through time giving rise to system evolution and are geared to a process of *reduction of difference from a set of norms* as played out in specific issues. Amplification and damping through feedback loops (as opposed to amplification by specifying process or by specifying form as was seen in the case of fractals) that indicate self-reference in time is then one form of causality (a form fundamental to the ontology of complex systems as a whole).

Second, I have shown in my account how the explanation of a certain phenomena can be explained by both recounting different sets of incidents that lead up to it and also by providing an essentially analytical account. In the PPC we find circular recursivity operating in the constant feedback provided by the LSGIs to the lead implementing agency- the state planning board. Yet the evolution of the PPC taken as a whole can be depicted linearly. The recursivity here is happening *inside* the branching straight lines – very much in line with the bifurcation diagram of complex systems. The bifurcations themselves can be imagined in two ways. First, as changes that happened in the particular form of institutionalisation followed by the PPC, which were as much influenced by chance and contextual factors as the ideology (the availability of a group of dedicated committed officers at the high level for instance). It can be thought as points where chance influenced the specificities in the path of evolution of the PPC. This is then as I have argued before the admittance of chance into causality – the second claim of causality. Luhmann (1986) states that the main contribution of autopoiesis is for it to be understood as “the recursively closed organization of an open system” (quoted in Kickert, 1993, pg 271).

Another way in which bifurcations can also be thought of is as local contingencies influencing the main institutional guidelines of the PPC to form numerous possible niches that the numerous LSGIs operate in. In that sense then the branching points correspond to key spatial levels which allow for more variety within. It shows the possibility of numerous positions within a single position (in line with discussion on stability in Chapter-2). Kickert highlights the way autopoiesis treats the issue of stability as linked not to variables or elements of the system but rather to the maintenance of the organization of the system. This, for Kickert, is the most innovative aspect of autopoiesis, for it points to the possibility for this schema to accommodate chaos (or difference) at the object-level, while remaining stable at the meta-level. Thus, ‘chaos can reign in an organizationally stable system’ (pg, 1993, pg 272). This insight gives rise to interesting possibilities as Kickert argues we now have, instead of a mono-stable system, a multi-stable system, which then means the attractiveness of order persisting in spite of chaos and the consequent possibility and desirability of a pluralist order. Then causality here is

produced by the opening of numerous potential possibilities which the system can settle into – the third manifestation.

To recount the claims once more in its abstraction - the first is based on reinforcement of particular aspects within a system due to repeated self-reference by feedback causing both amplification and ‘blind spots’, eventually leading to a crisis or drastic change in the system trajectory. Second, is a form of causality that stresses contingency or the role of chance events in triggering what essentially is the systems evolution, so as to result in either a structure change which is constructed along the time dimension or result in a fine tuning of global accounts to local contingent specificities which is then a spatial account. Third, is the creation of variety in potential system states, that can lead to the same system showing different characteristics even while remaining the same system.

8.3.2 Epistemological Implications of Autopoiesis

The implications of autopoiesis for epistemology have been discussed and are more self evidently clear. It is in fact its most radical contribution. The main epistemological claims relate to the impossibility of arriving at final statements as any statement can only be made from a viewpoint. Yet, autopoietic systems theory itself advances a certain type of conception about the world, which it does not claim to be reality per se, but only its own construction of reality. The implications of this construction of reality also then need to be examined. For Rasch and Wolfe (2000, pg 7) this particular construction offers great political promise as it “offers hope that a world that is contingently constructed can also be *differently* constructed (original emphasis)”. Luhmann (1997b, pg 369), in line with this thinking, reflects “in epistemology this leads to a radical constructivism and to the generation of realities without obligation for consensus”. Metaphysically, Luhmann’s autopoiesis has given rise to a new position, what is known as ‘radical constructivism’ – a term first coined by a cognitive psychologist, Ernst von Glasersfeld (Knodt, 1995, pg xv). Knodt further reports “fuelled by the proliferation of titles on chaos theory, invented realities, and the biology of cognition in the repertoire of major German publishing houses, a new discourse – the discourse of “radical constructivism” - is rapidly transforming the German intellectual

scene” (pg xv). It refers to a growing body of literature that explores a set of problems related to the idea of autopoietic closure.

Autopoiesis also has strong implications for the nature of planning and the concerns which it must necessarily address. As has been mentioned earlier, for Luhmann, steering is geared towards a commitment for reduction of specific differences. These differences in steering or planning, relate to goals which according to Luhmann arise when something the system *does not want is imposed*. Thus “goals arise when a system, remembering the past, anticipates a future which the system does not want to accept” (Luhmann, 1997b, pg 367). This means that goals arise when the system must be forced to adopt a direction which it would not normally do. Thus it is distinct and different and must be realised as separate from the system’s natural evolution. Thus Luhmann again points out “... when one pursues goals, one must be able to distinguish them from the system which pursues them” (pg 367). Self preservation then is not a goal, as Luhmann points out, as the term does not in itself imply any *difference* that must be reduced. One might make use of a drive towards self preservation, among other things, for reducing differences, but in planning it can claim attention only as long as it is oriented towards the reduction of specific differences.

According to Luhmann, the *act* of steering works by using two functions, what he calls the memory function and the oscillator function. The memory function represents the past and is needed because “the system has to identify the state into which it has brought itself, to be able to start from there” (pg 364). This identification is actually a choice between remembering and forgetting, with forgetting being the default state. Thus what is remembered is actually a reconstruction of the past, chosen with the future in mind. Thus “memory constantly *modifies* (original italics) the past to connect it with a possible future in the present” (pg 365). The oscillator function on the other hand represents the future. It is any distinction that the system uses to observe the future. Luhmann remarks “every projection of future states of affairs is a projection of a distinction capable of oscillation” (pg 366). One can manipulate the oscillation by a choice of the distinction which forms a basis for the oscillation. Thus “one may take the ethical distinction ‘good/bad’ or the technical distinction ‘it works/it does not work’ and by choosing a distinction one may divert from another one” (pg 366). The crucial issue in

planning then comes up as “which systems chooses which distinctions on the basis of its memory to forms its own future” (pg 366). The epistemological question raised by autopoiesis then focuses attention on methodological issues in planning which may be informed by normative positions.

The questions asked are one step further from theories in current use in planning. If seen this way, then a two stage application results. In the second level theories from complexity inform the ordering of planning process taking into account the complexity of the situation aiding a steering towards normative goals that are defined by the system itself, not based on its own natural evolution (which could very well result in a re-ification of societal problems rather than an amelioration) but based on a steered evolution, so as to enable it to deal with its own complexity. Below these the next layer of theories – for instance rational choice, consensus theories or conflict theories together with a viewpoint from complexity help define more local specificities. Seen in this sense the *act* of steering or planning is concerned with the *conditioning* of the oscillators of the system one is concerned with. Luhmann remarks “the future is not entered into the system as a final state of affairs (*telos*), not as a decision tree, the structure of which would be surveyable if one takes decisions at the nodal points. Only differences (of which there may be several simultaneously) are projected, ie. fixed as conditions of ‘possible oscillation’. ‘Control’ therefore is not to be thought of as a discovery of errors, which would only make sense with trivial machines, but is the retrospective self-observation of a system which follows upon steering attempts” (pg 368). Here this theory deviates from the older generation of systems theories in terms of its methodological implications.

Conclusions

In this chapter, I have carried forward issues and questions raised through the examination of secondary case studies in Chapter-7. I have used my own field work in the PPC, to illustrate how answers to some of the questions raised might be found empirically. The analysis of PPC gives insights in two ways - first in autopoietic terms highlighting aspects of it that illustrate autopoietic functioning, second, in terms that address planning related concerns. The two are inter-linked and feed into each other forming the substance of the analysis. Finally I have drawn out different causal

implications of the theory by abstracting it from the empirical discussion. I have also drawn out the epistemological implications of the theory especially in relation to methodological issues in planning. In social science the theory is described as the observation of the observer or second order cybernetics (Rasch and Wolfe,2000). In parallel I have argued here that an equivalent domain of planning of planning exists for the theory – dealing with issues like the designing of planning processes so as to result in a self-evolving *societal* order, planning instruments, venues and roles of planners, that need to be recast to facilitate this self evolution of *society*, self-corrective feedback processes which structure and inform the activity of planning by conditioning it so as to allow a reduction of *societal complexity* that enables a normative steering towards internally defined broad parameters - in Luhmann's terms the creation or negation of differences. This is a domain that is under researched within planning, though it is presently gaining importance in the governance literature.

CONCLUSIONS

In this chapter, I recall and reflect on the overall nature, research strategy and scoping of the thesis. Key arguments made within the scoping are discussed and those parts of the arguments that can be claimed as original are highlighted. I then include a reflective section on the structure of the thesis and the challenges faced in the process of doing the thesis including ways in which it has impacted on the writing. The key research agendas that arise out of this contribution are discussed next with respect to future research immediately in the offing. Finally, I sum up and present the core contributions made by the thesis as a whole to planning as a discipline.

9.1 The Nature, Research Strategy and Scoping of the Thesis

This thesis, as was argued in Chapter-1, remains primarily a theoretical thesis. The broad aim that it set out to fulfil was to 'examine the relevance of complexity theory for planning'. Following from this broad aim, the research strategy and the scope of the thesis was more precisely defined, taking into account the requirements of a research programme that aims to fulfil objectives pitched at a theoretical level; the nature of theory development; the practicalities of time and space that can be employed in a thesis; and the nature of complexity theory and the discipline of planning. The scoping of the thesis has thus run all through the 'depth' axis starting from the nature of complexity theory - its manifestation in the natural sciences, its metaphysical dimensions and its status with respect to social science theory in general - requirements that address the realm of generalised discourse in theory development. From thereon, following the grounding of the theory in social science in general terms, the nature of planning and more so planning theory has been discussed. The use of complexity theory in the non-quantitative domain of planning theory is then examined and a general methodology for theory transfer and contextualisation is developed. Building up on the arguments made so far, and employing the methodology proposed, two concepts involving different methodological challenges, are chosen for theory transfer and contextualisation within planning. Reasons for the choice of the case study used for illustrating the theoretical arguments are also stated.

The latter part of the thesis carries out the theory transfer, contextualisation and illustration.

Limits have been imposed on the 'breadth' dimension. Thus all concepts from complexity theory have not been discussed, the metaphysical clarification and the nature of the theory in social science has been discussed only in meta-theoretical terms, as social science theory is not the realm that the thesis aims to contextualise the theory in. However, this level of contextualisation was found relevant because of an *a priori* conception of planning being constituted within the social realm. Similarly, in the actual theory transfer, limited concepts have been chosen and limited areas of planning have been consequently discussed. Reasons for choices made, when it has been made, have been stated throughout in the thesis. Within the scoping defined, the thesis has aimed to provide a 'scientific' argument for not only the relevance, but also the nature of the relevance of complexity theory for planning.

9.2 The Key Arguments of the Thesis

Within this section I summarise key arguments made by the thesis in each chapter and emphasize therein the original contribution made by this thesis to planning. Since the thesis has not started with a problem based or issue based aim, the originality of the thesis essentially lies in its argument. Thus in overall terms originality of the thesis can be claimed for arguments advanced in theory, methodology and empirical field work.

In Chapter-1 of the thesis, I argued for the relevance of the key research question. This argument is undertaken from an *a priori* view of natural science and social science being mutually influential. This view takes off from Kuhn's (1996) argument that what gains prominence for investigation within the natural sciences is in the final analysis socially determined and the writings of various writers who have brought out how the natural sciences have influenced paradigms in social science, planning and governance. The key steps in this recounting include the nature of Newtonian science, the way in which it led to the positivist paradigm in social science and the way in which it led to the 'rational', 'comprehensive' model of planning and governance with an accent placed on instrumental rationalism. The implications in natural sciences that arise from post Newtonian sciences – theory of relativity and quantum theory - are then recounted briefly. Parallel developments in social science characterized by the post-positivist turn and the proliferation of theories in planning that emphasize situatedness, social construction of knowledge, and an engagement

with pragmatism are highlighted. Complexity science is then introduced as being a development within natural science emphasizing and focusing on properties hitherto left un-examined, yet yielding profound insights. The need for social science and planning to pay attention to this emerging science is consequently argued for and the key research question of the thesis is formulated.

In this chapter, I also introduce the research and the thesis. Thus the nature of the thesis as being primarily theoretical is argued for by analytically breaking up the key research question highlighting the areas of investigation that must follow. The research strategy and the rationale for the research strategy is then established from the premise of theory development needing to cover domains of generalised discourse, theory contextualisation and empirical validation. Sub-research questions are posed in line with the research strategy and these questions are further broken down to still finer questions that guide the substantial content of each chapter. The overall structure of the thesis is then presented, drawing out the challenges of presentation posed by the thesis. The ways in which attempts to address these have been made are described.

In drawing out the research strategy and in scoping, since the 'conventional' pattern of a thesis did not 'fit' the research aim, the logic of the research strategy and the methodology had to be drawn out afresh. This logic of the research strategy is drawn out in detail in Chapter-4 and the methodology is drawn out in Chapter-5 as these are part of the substantive arguments as well. Being part of the substantive argument, the research strategy and the methodologies adopted are original in a sense.

In Chapter-2, I examine some of the concepts associated with non-linear dynamics, chaos and complexity theory. The concepts are introduced by way of short anecdotal episodes that recount the discovery of key concepts associated with the theory within the natural sciences. Following this discussion, the nature of chaos science as a science of synthesis and the nature of complexity science as a science of synergy is advanced. Finally the nature of the complexity theory within natural science is drawn out highlighting the dichotomies and dualities that they help resolve. Key elements of the theory - connections and iterations - are stressed. An argument is then advanced for the fundamental nature of complexity theory by discussing the world view that the theory suggests against the world view suggested by the theory of relativity and the theory of quantum mechanics. A discussion of the acceptability the theory enjoys within the natural sciences is also included. This chapter thus

contributes towards understanding the nature of complexity theory and the nature and meaning of some of the concepts associated with it.

Chapter-3 contributes to the realm of generalised discourse in theory development. Here I examined complexity theory for its philosophical dimensions in metaphysical terms. Chapter-4 contributes to the realm of generalised discourse and theory contextualisation. Here I explore complexity theory for its significance to social theory in meta-theoretical terms. Chapter-3 and Chapter-4 was felt necessary both for its contributions to the realm of generalised discourse and theory contextualisation in theory development and also due to an a priori understanding of planning being constituted within the social realm and the nature of social entities being inherently different from the nature of physical entities and thus the realm of natural science. Taking off from the emphasis on relations, highlighted in Chapter-2, the systems domain within social science was taken up in Chapter-3 for examination. The concept of a system and its characteristics was first examined. The nature of systems thinking was then examined, and the level of abstraction involved in systems thinking according to the epistemological hierarchy of Bunge (1973) - being between a level of abstraction that is higher than disciplinary theories, but below metaphysics and mathematics - was discussed. Finally, the history of development within systems thinking in the social sciences is presented, tracing the change from hard systems thinking to soft systems thinking and thereafter to critical systems thinking.

The second part of this chapter dwelt on the metaphysical foundations of systems thinking. Roy Bhaskar's transcendental realism is used as the anchor point. Bhaskar's argument for realism in the natural sciences is examined first and the ontological basis of systems theory within natural science was argued for, by offsetting it from transcendental realism. Over and above causality based on generative mechanisms as appears in transcendental realism, causality based on relations was stressed and argued as constituting the ontological basis of systems science in the natural sciences. Bhaskar's argument for transcendental realism in the social sciences was then examined. Using and building on arguments advanced by Ted Benton, the stark difference drawn by Bhaskar with respect to the divide between the natural and social sciences is disputed. Grounds for challenging this difference and the limitations of the challenge are stated. The argument for transcendental realism advanced by Bhaskar in the realm of social sciences has then been examined and the ontological foundations of systems theory in the social realm, as being a synthesis of analytical

streams within disciplines has been argued. The chapter as a whole thus contributes to an understanding of systems sciences at a metaphysical level (the realm of generalised discourse) and lays the ontological foundations of systems science in both the natural and social sciences. The argument that lays this ontological foundation is an original contribution made by this thesis in this Chapter.

In Chapter-4, the metaphysical argument advanced for systems science in the social stream in Chapter-3 was revisited. The nature of social science theory and the ways in which theory development within social science takes place was examined. The importance of theoretical 'traditions' and 'orienting strategies' were noted, and also the need for generalised discourse, empirical validation and theory contextualisation for overall theory development was substantiated. Three broad 'goals' of theoretical development in social science, that appear in the literature - the nomological, interpretive and normative and the way they link into transcendental realism was discussed. The positioning of systems theory within social science was then discussed highlighting key characteristics – structuralism and functionalism - by which this stream is defined. The way in which these characteristics play out in social science theory development has been illustrated by presenting the example of Talcott Parsons' structural functionalist school, included in Appendix-6.

The second part of chapter-4, introduced complexity theory back again into the discourse and clarified the ontological foundations of the same by off-setting it from systems theory ontology established in chapter-3. Dynamical qualities of systems were stressed and the centrality of feedback through which complex systems acquire 'ontological depth' was emphasized. Types of complexity with respect to its implications for knowledge production was then discussed. The theory was then argued to be not a fundamental paradigm shift in social science though it may have been so in the natural science. However the value in examining concepts that emerge from the natural science was argued by way of the ease by which these can be identified in the natural sciences as compared to the severe methodological limitations of knowledge production in the social realm. The potential for a hypothetically fruitful dialogue between the sciences was then argued. Next, ways in which complexity theory might relate to social sciences was examined in meta-theoretical terms - through the nomological, interpretive and normative dimensions presented earlier in the chapter. Finally the ways in which concepts from complexity is adapted into social science was illustrated by discussing the work of Niklas Luhmann

presented in Appendix -7. This runs parallel to the illustration of system concepts in social science by Talcott Parsons presented earlier. Chapter-4 thus contributes to the realm of generalised discourse and theory contextualisation relating complexity theory to social science and particularly so to social science theory in meta-theoretical terms. The discussion of the way in which complexity theory relates to social science theory in general is an original contribution of the thesis in this chapter.

Chapter-5 onwards, the thesis has dealt with complexity theory and planning. In chapter-5, the transition from social science to planning was made. Building from an *a priori* understanding of planning as a discipline linked to practice, the linkage between theory and practice was first examined from literature review. The nature of planning theory in the sense of its purpose and thus the level of abstraction that follows from this is established from this review. The remit of planning theory positioned between knowledge claims in the way of explanation, and action as played out in specific situations and places, including models, mechanisms and techniques tuned to practice, was advanced. Building upon the claim of Camhis (1979) for two types of planning theory - theories *in* planning and theories *of* planning, the contribution of this thesis was positioned as being towards theories *of* planning. Methodological implications of the positioning of planning theory were then analysed. The nature of linkage between planning theory and planning practice was discussed leading to ways in which knowledge production can happen in planning theory. Next the dichotomy produced by the need for generality and the need for specificity was examined, leading to an argument for the need for a two level engagement and analysis, the first consisting of direct engagement in planning situations which is what is discussed in planning literature by and large, and the second consisting of a level that has been argued as under-researched in planning- the planning of planning. The thesis is positioned as contributing to this second level of engagement.

In the second part of this chapter, ways in which complexity theory has been used is examined in a general sense. Following this general reconnaissance, more rigorous ways of theory transfer was searched for. The theory of metaphors was used, and an evaluative framework for theory transfer developed. This framework was applied to two articles that have used complexity theory in planning and the use has been evaluated. The evaluation serves to explain the scepticism that the theory has produced in the academic community. Following from this evaluation, the evaluative

framework was refined to yield a methodology for theory transfer and contextualisation. Finally the scoping of the thesis in terms of actual theory transfer was discussed. Two concepts were chosen for theory transfer - the first dealing more with theory transfer and the second dealing more with theory contextualisation. Reasons for the choice of the case study used for illustrating the concepts were also stated. This chapter thus made the transition from social science to planning and developed a methodology for theory transfer based upon an understanding of the nature of planning theory and the ways in which complexity theory has been hitherto used in planning literature. The argument for the nature of planning theory in terms of the level of abstraction and generality that it addresses, the argument for a second level of planning and the development of a methodology for theory transfer based on the theory of metaphors are original contributions of this thesis in this chapter.

Chapter-6 dealt with the concept of fractals from complexity theory. The chapter first introduced key notions from fractals. A conceptual descriptive interpretation of fractals was then derived from mathematical equations associated with fractals. Following the methodology of theory transfer through metaphors, an *a priori* hypothesis of possible fractal effects in planning was then sketched. The potential for a much more rigorous inquiry was thus established. Within the fieldwork, key elements of fractals advanced earlier were empirically identified in two parallel fractal formations, representing two ways claimed for producing fractals in planning – one through specifying form giving rise to process and the other specifying process to give rise to form. The claim for the identification of fractals rested on structural attributes derived earlier and causal attributes searched for later, both being valid grounds for a claim to ontology as is argued and established in chapter-3. Notions of causality with respect to mechanisms were then discussed and an argument for causal effects for fractals was hypothetically advanced on metaphysical grounds. The chapter then probed empirically for causal effects of fractals. Empirical evidence was produced for all three types of effects. The chapter then discussed how the abstracted definitional features of fractals can be linked (and thus explained) to the causal effects by means of mechanisms that have meaning at a lower level of reality – the first level of planning. It is also however argued that the mechanism alone could not have led to the results without the fractal formation. The theory of fractals thus becomes positioned at a higher level of theory – the planning of planning. It is also suggested that fractals within itself incorporate the three forms of institutions

normally discussed in the literature – the hierarchy, the network and the market. Fractals being essentially a spatial concept, a discussion of notions of space that inform discussions within planning and the gap towards which fractals contribute is identified and included in Appendix- 8. Chapter-6 thus employed the concept of fractals and using the theory of theory transfer linked the concept to planning issues both empirically and theoretically. It is argued here that the concept in essence represents methodologically a way of dealing with complexity in the sense of pointing to ways in which local specificity can be connected to global dynamics causing a systemic co-evolution. The methodological contribution to planning practice is pitched at the second level of planning argued for earlier. The method of theory transfer, the empirical analysis and the argument advanced for causality of fractals are all original contributions made by this thesis in this chapter.

Chapter-7 and Chapter-8 discussed yet another concept from complexity theory - the concept of autopoiesis. The status of this theory with respect to its 'distance' from planning is slightly different from that of fractals. The theory originates from the discipline of biology, but has been transferred to the social sciences through the work of Niklas Luhmann (1995). Chapter-7 hence first discussed concepts of autopoiesis that originate from the field of biology and then discussed their adaptation into social sciences drawing out the nature of the theory in descriptive terms. Luhmann's own views on admitting the possibility for planning, was presented and argued as being hinged on a particular conception of planning, which need not always be the case. Following this argument, the potential for the relevance of notions from autopoiesis in planning was brought out by discussing secondary case studies. In the first case study, the theme is the employment of law in planning situations. Concepts from autopoiesis that are relevant to the situation described in the case study are then explained in detail and the case study was then re-analysed to yield different sets of questions. The second situation discussed is a set of two case studies discussing participation in two different ways. Notions from autopoiesis that contribute to an understanding of the situation presented was introduced and the case studies were again re-analysed to give rise to different sets of questions. This manner of argument was adopted so as to bring out the nature of the questions that the theory prompts. The questions that the theory raises in general point to factors to be taken into account in the designing of first order planning processes. The theory points to processes and principles that are involved in the evolution of complex systems when

it deals with its own complexity.- processes that can inform a steering towards goals that are normatively set by the *system*, The arguments and questions raised in this chapter are carried over to the Chapter-8. The arguments presented for planning, against Luhmann's own view, and the arguments for the distinctiveness and significance of the questions raised through an autopoietic view are original contributions in this chapter.

Chapter-8 continued with the arguments presented in chapter-7 re-interpreting the fieldwork carried out to suggest possible answers to thematic questions raised in chapter-7. The notion of 'organisation' and 'structure', the notions of 'self-referentiality', 'reflection' and 'structural coupling' are used from autopoiesis to shed light on the way the legal system is used within the PPC. Similarly notions of 'interaction' shed light on the temporal analysis, the evolution of 'structure' and the sequencing of interaction systems within the PPC. Notions of interpenetration shed light on the ways in which the individuals and the state come to influence each other. In this chapter, causal claims associated with autopoiesis are also drawn out from discussions of the empirical situation. The epistemological claims are then made explicit. The causal claims advanced are again argued to be addressing the second level of engagement in planning, highlighting the ordering strategies that can be brought into play when complex systems deal with its own complexity. The analysis of the fieldwork, the illustration of the contribution of autopoiesis to planning and the explicit drawing out of causal claims associated with the theory of autopoiesis made visible by the empirical discussion are original contributions of this thesis in this chapter.

9.3 My Experience in the Writing of the Thesis

In this section I pause to reflect on my experience of doing the thesis, especially with respect to the writing of it. The research questions, research strategy and the nature of the thesis having been decided upon early, what was to be done in strategic terms was fairly clear to me from the start. I did not therefore face much problem in proceeding from each stage to the next, weaving my arguments or constructing it. The challenge I had was in communication- the writing of the thesis. It is this experience that I therefore recount here.

The first challenge for me in writing the thesis was not the abstraction, but the variety of abstraction that I was engaged in. There was here for instance potentially an audience well-versed in metaphysics and social science theory, an audience engaged

in planning theory, an audience engaged in planning practice, an audience familiar with complexity theory, an audience not familiar with complexity theory, an audience familiar with the quantitative application of complexity theory and so on. The difficulty was thus in getting an image of the audience. I found that if I pitched each chapter at one constant image of an audience, I was not really able to do what was demanded in each chapter. For instance, in Chapter-2, my audience was easy to imagine, as it would be somebody not too familiar with the concepts I was discussing. The purpose of the chapter was also primarily to *introduce* the complexity theory and *explain* its nature. So I could and in fact had to be 'gentle' and 'simple'. When I moved to Chapter-3 and Chapter-4, however this simplicity was difficult to maintain due to the level of abstraction that I was dealing with. Also here I had to *advance an argument*, which was sophisticated enough to be appreciated at that level. I had to imagine a 'sophisticated' audience here, an audience comfortable with abstraction. In Chapter-5, I had to move from this abstracted level to a more 'earthy', practical level in order to address the level of planning theory. Again I was *advancing an argument* here, but to an audience who would have a different type of expectation. I imagined that a robust argument would be required but also the potential for practical application might have to be demonstrated. In Chapters 6, my audience changed yet again. While relating to planning theorists, as in Chapter-5, it had also to relate to those in the first level of planning, that is, those involved in planning practice. So my arguments needed to be grounded in empirical experiences of planning. Chapter-7 and Chapter-8 posed the biggest challenge that I had to deal with in this thesis. To me it now seems to be a thesis within a thesis, reflecting all the levels that this thesis goes through as a whole within the space of two chapters. It actually spans the very abstracted domain to the empirical domain of planning practice. Devising a writing strategy for contextualising this theory within the space of two chapters without losing the reader completely was a major struggle.

The second challenge that I faced in the writing of this thesis, emanates from the first. How could I provide consistency and coherence, not losing the reader, even though the chapters necessarily must address different types of audiences? I have extensively used the familiar and common technique of using cross-references, stating relevant matters again where they have become relevant in the context of the on-going discussion. Thus some of the chapters even while dealing with empirical situations sometimes contain short digressions to accommodate relevant theoretical concepts.

The third issue was the need to provide a substantive account in two dimensions – for the theory and for planning, while at the same time make an argument for the theory. The abstraction involved in some concepts (for instance autopoiesis) are presently quite difficult to access in the form that it exists. Bringing this abstraction to a practical discipline like planning required the liberal use of anecdotes, case studies, examples and field work illustration. Yet, the analytical component which carried the argument had to be integrated. The only way in which this seemed possible was by alternating between these two distinct styles of writing—the narrative account and the analytical account. To tie these two accounts together and carry the reader through, a parallel reflective account that runs through the text was also found needed.

Finally, the problem that had to be grappled with was the limits of space. More illustration could be provided, more detailed exposition could be given, more concepts could be tried, more linkages could be made. As far as this thesis is concerned, this could be claimed of every chapter. The scoping of the thesis was thus important and had to be very strictly maintained so that robustness could be claimed of what is attempted within the scope. Supportive arguments that may be informative and illustrative but are not really central to the thesis are included thus in the Appendix. Listing of potential research agendas that can flow from the thesis are many. I have not attempted to map them all – a futile exercise, given that it is left to the academic community to take what each feels as relevant for further enquiry. I have however included - the purpose being illustrative of the ways in which the thesis can develop - an indication of the type of work that I would like to continue with immediately.

9.4 Research Agendas that Arise out of the Thesis

First, I describe the research agenda for fractals, since some initiative has been already made on this front. Essentially I seek a refinement of the concept of fractals and an investigation of the possible ways in which it can aid planning in practice. Out of the many different ways in which this broad aim can be developed, my choice is necessarily shaped first by the type of interests that I see possible to mobilize and the type of expertise that I see possible to collaborate with. The attempt is to collaborate so as to establish a link to the quantitative work undertaken in the field of fractals by using concepts developed in this thesis. An initial foray into this domain has been made at present (through general discussions in terms of a research proposal to be

submitted to both GoK and other funding agencies) in collaboration with Prof Chris Webster. My interest here is to develop the concept of fractal dimension in a way that can be of use for the PPC. I hope to examine the potential for it to be used as an evaluative index that can lead to assessment of how far or how tightly the fractal structure is actually absorbing information or responding to felt needs across different spatial units. The index if properly conceptualised can be grossly applied for specific purposes like problem identification (in the sense of spotting the blocks in the fractal structure that needs to be further investigated qualitatively) establishing training needs etc across the 1,215 LSGIs in the state.

The second research agenda also necessitates collaboration, but locally this time and dealing with the concept of autopoiesis. The questions I would like to take further concern the way in which local institutional variations have influenced/are influencing actual dynamics in interaction processes. This research essentially will try to link the first and the second level of planning, using the concept of autopoiesis, showing how second level planning parameters show up in the first level of direct planning engagement and in what way and though what types of feedback do the first level of planning influence the second. In other words it will contribute to an understanding of how the structure of the PPC actually evolves.

The third research agenda will remain my own to be carried out by myself. This involves examining the ways in which concepts from complexity theory can inform the understanding of design. This desire stems from around 12 years of being a practising architect, still intrigued by the *theoretical* understanding of the design process. It will also provide an opportunity to examine more concepts from complexity theory which might lead to other research agendas - in both planning and design - unforeseeable at present.

9.5 The Key Contributions

Even though the contribution of the thesis has been stated in discussing the summary of each chapter, I draw these together in this section to present an overview of the key contributions. The thesis set out to address just one research question – ‘What is the relevance of complexity theory for planning?’ If one were to summarise the findings of the thesis, in a sentence, it could be stated as an argument that advances the relevance of complexity theory for planning as contributing to methodological insights that arise from a systemic conception that argues for planning in the second level, foregrounding *society* such that planning as an activity undertaken

by *society* leads to an ordering emerging out of local specificity and detail. Over the span of 9 chapters, the argument for the relevance has been advanced argued, and demonstrated. The key contributions have been

- a. In philosophical/metaphysical terms – providing an ontological grounding for systems theory as well as complexity theory
- b. In social science theory – positioning the potential of complexity theory at a meta-theoretical level
- c. In planning theory – i) argument for the nature and position of planning theory within a hierarchy of theories; ii) argument for the second level of planning
- d. In methodological terms – i) devising research strategy that encompasses broad parameters for theory development entailing theoretical generalised discourse, empirical validation and theory contextualisation ii) framing general methodology for theory transfer using theory of metaphors; iii) modes of interpreting abstraction by drawing out key relational elements from mathematical equations and abstract general social theories, both of which maybe devoid of content.
- e. In substantial domain of planning – methodological contribution that highlights how a system might be ‘conditioned’ to result in an ordering that takes into account its own complexity while responding to goals/objectives defined by the system itself in a process of co-evolution. These include i) illustrations of ways in which global and local can be connected without giving primacy to both in turn leading to potential application in a number of domains (poverty, institutional theories, planning process, resource optimisation, etc); ii) illustration of ways in which the legal system can be used in second-order planning to steer system evolution towards goals that might not result if the system was left on its own; iii) illustration of ways in which participation processes can be structured and ‘used’ in institutional terms to give rise to different micro-dynamics within the process so as to allow the system to take into account its own local specificity while retaining broader level systemic goals .
- f. In terms of field-work – analysis and illustration of ways in which concepts from complexity theory can be observed in empirical situations involving planning practice.

9.6 Limitations of the Thesis

The thesis has been limited in its scope. As has been mentioned earlier, though concepts from complexity theory has been intuitively appealing in many ways for the

sort of world view it advocates, a 'scientific' work that examines the worth of the theory in a rigorous way which has not been undertaken within planning outside the quantitative modelling stream. Hence a major part of the work in this thesis had to be in the realm of generalised discourse and theory contextualisation that clarifies the nature of the theory itself. In a way this could not be avoided given the confusion regarding the worth of the theory.

Work contributing to the realm of day to day issues in planning addressing problems and advancing 'solutions' or suggestions has therefore not been undertaken in this thesis. The research aim also skirts these issues. This level of work is however necessary for the theory to mature within planning. Work within the overall ambit of complex systems theory and the way in which it might contribute to an understanding of planning problems is thus relegated towards a future research agenda. To that extent the thesis is limited in its scope.

A parallel limitation is the choices made on the concepts chosen for discussion in this thesis. More concepts from complexity theory itself and autopoiesis within it also need to be systematically examined and understood to give a full picture of the contribution of the theory. This has also not been possible due to the time and space limits of a PhD thesis. To that extent also then the thesis is limited in what I have called as the 'breadth' dimension of the thesis.

APPENDIX-1

THE DIFFERENCE BETWEEN OLD ECONOMICS AND NEW ECONOMICS

Old Economics	New Economics
Decreasing returns	Much use of increasing returns
Based on 19 th century physics (equilibrium, stability, deterministic dynamics)	Based on biology (structure, pattern, self-organisation, life cycle)
People identical	Focus on individual life; people separate and different
If only there were no externalities, and all had equal abilities, we'd reach Nirvana	Externalities and difference becomes driving force. No Nirvana. System constantly unfolds.
Elements are quantities and prices	Elements are patterns and possibilities
No real dynamics in the sense that everything is at equilibrium	Economy is constantly at the edge of time. It rushes forward, structures constantly coalescing, decaying and changing
Sees subject as structurally simple	Sees subjects as inherently complex
Economics as soft physics	Economics as high complexity science

Table-A.1: A Comparison of Old Economics and New Economics

Source: According to Brian Arthur, reproduced from handscript in Waldrop, M.M, (1992). *Complexity*, Penguin Books: London. pgs 37-38.

TWO APPROACHES TO CONSTRUCTING THEORY IN SYSTEMS SCIENCE

The first of two approaches in the construction of theory in systems science is to pick out *general phenomena*, which can be found in many disciplines and to build up theories that are pertinent to these general phenomena. Kuhn and Beam (1982) provide a good example of this type. Their DSE mechanism identifies three basic mechanisms in any control system whatever it may be. Thus there will always be a *detector (D)*, a *selector (S)* and a *effector (E)*. The detector is the function or mechanism that detects the state of some variable. The selector is the function or mechanism that contains or reflects the preference that the system may have for a particular condition. The effector is the function or mechanism that contains the capacity of the system to move towards the preferred state. Kuhn and Beam further point out that there maybe different names for these functions depending on the system. From the table of different names identified for different systems, I pick out three to illustrate the point they are making - the actual, ideal and gap-closing; or cognitive, affective and motor functions; or also the error signal, the reference signal and the corrective action.

The second approach that Boulding advocates is to conceptually operate through a hierarchical arrangement of complexity. The arrangement he proposes is first that of *static structures* – a level which he calls the level of *frameworks* containing knowledge about things like the geography of the earth, the pattern of atoms in a molecule, the anatomy of a gene etc. This level is an essential level without which no further knowledge can be built. The second level is that of *simple dynamic systems* with predetermined simple motions. He terms this level the *clockworks* and it contains knowledge of simple and complicated machines, simple equilibrium systems, stochastic dynamic systems etc. The third level is that of *control or cybernetic systems* which he nicknames as the *thermostat*. Here transmission and interpretation of information is integral and is an essential part of the system. It includes thermostats or any homeostasis model - one which maintains a variable at or near *any* constant level.

The level is not however determined solely by the system. The fourth level is that of the *open system* with a *self-maintaining* structure even though exposed to a throughput of materials - the level of the *cell*. The fifth level is what is called the *genetic-societal* level, typified by the *plant*. Here a division of labour among cells to form a cell-society takes place. The level though may not be capable of much throughput of information via highly specialised sense organs except in a diffuse manner. The sixth level is that of the *animal kingdom* and is characterised by *mobility, teleological behaviour and self-awareness*. There is an increase in the information intake by specialised information-receptors and behaviour is dependent on a knowledge structure or image of the environment. This is not a simple piling up of information but consists more of an active structuring of information. The seventh level is the *human* level, where each individual can be considered as a system. *Self-consciousness* characterises this level in the sense of a *self-reflexive* quality. S/he not only knows but also knows that s/he knows. With this comes the capacity to “produce, absorb and interpret *symbols* (original emphasis) as opposed to mere signs’ (Pg 204). The eighth level is that of *social organisation* in which the components are not individual humans but are rather the ‘role’ the person plays. Social organisation or social systems are defined as a set of roles tied together with channels of communication whereby “content and meaning of messages, the nature and dimensions of value systems, the transcription of images into a historic record, subtle symbolizations of art, music and poetry and the complex gamut of human emotion” (Pg 205) all become important. The ninth and final level is the *transcendental* level which contain the “ultimates and absolutes and the inescapable unknowables” (pg 205).

According to Boulding, each level in the above hierarchy builds upon knowledge accumulated from the levels below, so that the higher levels contain all the information of all the levels below. Thus explanations of animal behaviour will contain explanations at level one, two, three, four and five. The certainty of the knowledge we possess also diminishes as we move up the hierarchy. The utility of the model is greatest however in pointing out that though there may be explanations that derive from a lower level, we cannot accept as final an explanation that is analytically derived from a lower level. Thus though behaviour can be explained to a large extent by means of physico-chemical changes in the brain, it cannot be wholly attributed to it. In other word biology is not just physics or chemistry. Boulding in expounding this

in his paper written in 1956, comments “most of the theoretical schemas of the social sciences are still at level (ii), just rising now to (iii), although the subject matter clearly involves level (viii)” (pg 207).

**ATTRIBUTION OF CAUSALITY TO RELATIONS –
METAPHYSICAL JUSTIFICATIONS**

On what basis can causation be attributed to this disjointed picture of the universe? Debates on this question can be found in metaphysical discussions. Thus Lowe (2002, pg 245), discussing the real nature of the world and what might constitute basic entities in it, speculates on the possibility of a ‘non-reductive pluralism of things and events’. The pluralistic view is best understood by contrasting it against monistic views that hold that either ‘things’/‘substances’ or ‘events’ are real and constitute a ‘basic particular’. (The meaning of the term ‘event’ here being ‘a change in the properties of or relations between some thing or things’ (pg 239)). The pluralistic view on the other hand hold that both these entities are particulars of different basic types due to which they hold different properties and enter into different types of relations. However Lowe points out that this view takes us no further down the explanation line. He thus laments (pg 244, 45) “If things and events are items of two basic and mutually irreducible ontological categories, it would seem that the relationship of ‘participation’ between things and events must itself be something basic and incapable of analysis or explication. If so, this is a deeply unsatisfactory feature of the non-reductive pluralist’s position. For this reason, I am inclined to view non-reductive pluralism as being a position of last resort, to be adopted only if no reductive or eliminative position proves to be tenable”. Yet he does concede that “to the extent that there are difficulties besetting the reductivist and eliminativist positions, non-reductive pluralism may emerge as the victor by default” (pg 244). Thus though frustrated by the lack of a full fundamental explanation, the pluralist conceptualisation explains observed phenomena to a far greater extent than its rivals. This then is a case of explanation or allocation of reality based on effects - a conceptualisation that cannot yet fully explain in terms of mechanisms, yet proves to be the only tenable concept among rivalling viewpoints that can account for phenomena observed.

Further to the above is the discourse that is now gaining currency in metaphysics – the discourse of supervenience. According to Kim (1999, pg 542), the term in philosophical discourse was first used by Leibniz in his doctrine concerning relations. Kim (pg 542) interprets the claim of Leibniz: “His (Leibniz’s) thesis could be interpreted as the claim that relations supervene on the intrinsic properties of their relata”. There is here embedded in this discussion another type of stratification of the world starting from intrinsic values of objects/things, to relations that form a whole. But what is supervenience? Explaining the concept Kim (1999, pg 544) introduces two ideas put forward by Davidson (1980). “First, supervenience is to be a relation of *dependence*: that which is supervenient is dependent on that on which it supervenes. Second, it is to be a *non-reductive* relation: supervenient dependency is not to entail the reducibility of the supervenient to its subvenient base”.

Hare (1952, 1984) and Sidgwick (1874), have also used the concept of supervenience in relation to discussions on morals (Kim, 1999, pg 543). Similarly ‘emergentists’ have used it in their debate. The doctrine of emergence basically claims “when physico-chemical processes achieve a certain level of complexity of an appropriate kind, genuinely novel characteristics, such as mentality, appear as ‘emergent’ qualities” (Kim, 1999, pg 542).

However does the supervenience stream have anything further to offer by way of mechanisms as a way of explanation? Schifler (1987 quoted in Kim, 1999, pg 552) remarks: “...invoking a special primitive metaphysical relation of supervenience to explain how non-natural moral properties were related to physical properties was just to add mystery to mystery, to cover one observantist move with another.” Asking for an explanation is a legitimate scientific process without doubt. However one must not confuse the transitive and intransitive domain. For as Schifler himself comments in the editorial, supervenience is a ‘brute metaphysical fact’. What is also evident in the opposition against supervenience is not an ontological opposition against the occurrence, but rather dissatisfaction with the lack of knowledge of generative mechanisms that can explain the phenomena.

But need causation be always ultimately explained in terms of generative mechanisms? As pointed out by Aristotle (2004, pg 380-81) causation can be in different ways, though science has traditionally followed the line of efficient causation. If one is to accord ontological status to both properties and relations positing that they are basic entities of two different kinds, then might not different

modes of synergetic combinations result in different 'powers' being granted to the whole? Cannot causation then be in terms of an explanation that picked up ways of combination (which thereby might activate certain types of mechanisms resulting in the formation of a totally different whole)? And cannot these ways of combination be empirically related to effects? If realism in the social sciences ultimately relies on an allocation of reality primarily on the basis of effects (as can be seen in chapter-4), then it cannot be amiss to rely on causation that finds justification not only in effects, but takes a step further back and relates it to the relations present in subvenient categories. What we have then is a form of explanation that is true to the philosophical position of the systems sciences with a stress on non-reductiveness to lower levels and a stress on relations. This form of explanation, it can be seen, is also true to the experiences that have led to the development of complexity theory – experiences that stress holism, connections, and emergent properties that result from these relations. This stress is not to deny the ontological existence of a generative mechanism altogether. It is rather to provide a scientific way of working with phenomena that are known to exist yet elude a full explanation at the moment.

APPENDIX-4

NATURE OF SOCIAL SCIENCE AND ITS IMPACT ON KNOWLEDGE CLAIMS

Much has been written and discussed about the nature of social science mainly with reference to the nature of entities it studies. The nature of entities that is studied indeed influences the production of knowledge of those entities. In chapter 3 I have concurred with Benton (1998) to suggest that specificities encountered in the social realm can be thought to be time-space manifestations of universal processes. However what exactly is the significance of this statement? As Hodgkiss (2001, pg 40), points out “The idea of individuals as nothing more than co-ordinates in social space or as standing at the intersection of a range of social forces has become increasingly the fare of social scientific discourse and analysis”. So how is a claim for reality sustained in the social production of knowledge? The discussion that follows searches for answers to these questions.

To start with, I briefly recount difficulties and opportunities in knowledge production encountered within the social realm due to the nature of entities the social sciences study. Difficulties encountered have been broadly allocated as due to the nature of the subject-object relationship – the subject being the observer and the object being the observed entity. These are mainly due to the subject dependent character of the act of observation, the observation dependent character of the object and the dynamic ever-changing nature of the social realm that encompasses the subject, object and the act of observation. The nature of objects studied have been shown to be observer dependent and thus socially conditioned in many ways, not only within social science, but also within natural science by studies that unravel the social dimension of the practice of science (Kuhn, 1996). What makes the social sciences still more distinctive within this acknowledged relativity is the existential dependence of what is observed to the subject. As Sayer (1992, pg 26) points out “even though it (the relationship between subject and object in the natural sciences) requires the application of concepts and a language which can only be gained in a social context, the object itself does not include concepts or meanings. Non-social phenomena are impervious to the meanings we attach to them. Although one could say that such

objects are socially-*defined* (original italics), they are not socially-produced. Definition and production are utterly different....” The dependence of the object being studied on the subject in the social sciences comes about because the object under study is not impervious to meanings allotted to it. The very process and act of research itself can cause change, making it difficult to have an unmediated account of the object not penetrated by the subject and the process of research.

The possibility of change in the social setting through the act of research also constitutes another difficulty with regard to outcomes in that the research can produce results which are outdated even when they are being produced, in the sense of their being negated by the very act of carrying out the research itself. Thus research that predicts undesired outcomes can prompt or induce corrective action that invalidates the outcomes of the research. Similarly research that ‘conclusively’ proves the inevitability of a particular course of action can itself become a trigger for bringing it about, thus reifying the outcomes of the research. Yet another difficulty is the problem of meaning allocation. The meanings that an object of study, say an individual, may allocate to an external situation or setting may be different from that which the researcher holds. Thus what the researcher perceives is mediated by both the social filter of the object - the individual, who is part of the study, as well as the social filter of the subject - the researcher. Besides the problems related to the subject-object and the effects of the research act, there is also the problem posed by the very diversity of social reality. The social world is constituted of a multitude of meanings that are space-time specific, which then makes the possibility of formulation of universal laws questionable. Posited against these difficulties in social research however is the enabling idea that the subject being actually within and part of the social world that the object inhabits, it is possible for the subject to be in possession of innate knowledge about the object which enables the conduct of research itself.

Possibilities for Constructed ‘Universals’

Given these generally recognized difficulties and opportunities in the conduct of social research, what then is the position of social knowledge evaluated as a scientific enterprise? Alexander (1990) provides an argument rooted in, first, a decentering of the individual and second, the discursive practice of science. With respect to decentering of the individual, he argues “even when rationality is acknowledged to be an agentic accomplishment, objectivity can also be seen as an eminently worthy goal. To achieve grounded rationality, social actors promote a

decentered understanding of the social and natural world, establish norms and frameworks that negatively sanction personalization and that reward not only the ability to see the world as 'out there' but the willingness to 'subordinate' one's personal opinions to that world's exploration" (pg 538). This 'hermeneutically rooted development of universality' must now be explained. Alexander points out that reason establishes 'frameworks for understanding', not the world itself. Validity claims are to be ultimately judged on the basis of the correspondence between 'reality' and these 'frameworks'. This correspondence is seen as that between 'reason created conceptual structures' and 'reasonable observational statements'. Theories do not exist as 'absent reasons' but are to be understood as reflections of "thoughtful efforts, sometimes generations and centuries long to understand and develop approximations of the society". Discursive practices rooted in mutual understanding, which acknowledge the decentredness of human reality and accept at least some impersonal claims, allow theories or conceptual structures to stake claims to universality. The movement towards universalism is argued as "inherent in contextual interpretation itself, for actors make efforts to understand their own understanding in increasingly general ways" (pg 540). This means "the more shared ground, the more neutral this ground not only seems but is in fact" (pg 539). Thus "a scientist is always under the obligation to give a rational account of what is right and wrong in the theory that is being displaced and to explain how his or her theory can account for what is 'true' in the preceding theory" (Bernstein, 1983, quoted in Alexander, 1990, pg 538). Thus "discourse becomes as important a disciplinary activity as explanation" (pg 542).

This argument then takes into account the constructed nature of social science, and rests on the correspondence of conceptual frameworks to observations, validated through the discursive practice of science that essentially demands both a decentering of the individual from the practice of research and a reasonably successful defence of theoretical propositions.

APPENDIX-5

THE DEBATE ON TELEOLOGICAL/ FUNCTIONAL EXPLANATIONS

Harvey (1969, pgs 433-46) in discussing functionalism distinguishes between philosophical and methodological functionalism. Philosophical functionalism makes an *a priori* claim on metaphysical grounds. Concurring with Hempel (1959) and Lehman (1965), who regard functional analysis as a weak form of explanation, Harvey (1969, pg 434) concludes that “it is, apparently better viewed as some kind of *approximation* (original italics) to more efficient forms of explanation- an approximation often necessitated by the complexity of the phenomena investigated”. Hempel’s views are based primarily on an analysis of the logic of functionalism, in which he concludes that it would be difficult to conclusively prove that a particular trait is both necessary and sufficient for attaining a pre-determined goal. Thus for him functional analysis “affords neither deductively nor inductively adequate grounds for expecting *i* rather than one of its alternatives” (Hempel, 1959, pg 283 quoted in Harvey, 1969, pg 435).

In the logical analysis of functionalism by Hempel, the system is viewed as oriented towards just one function or just one set of functions. It is legitimate then to ask how one could determine a given set of traits as both sufficient and necessary. This is however a uni-dimensional view and can hardly be viewed as being the case in the real world where systems have multiple goals and multiple constraints. At least logically then, it is possible to uniquely determine a given set of traits, by virtue of intersecting causalities as being both necessary and sufficient for fulfilling multiple set of traits. If so, then the logical argument against functionalism could in principle be contested.

This view of functionalism is contested in the literature as well. Thus Braithwaite (1960, pg 334-5, quoted in Harvey, 1969, pg 438) argues “in general irreducible teleological explanations are no less worthy of credence than ordinary causal explanations.... It seems ridiculous to deny the title of explanation to a statement which performs both of the functions characteristic of scientific explanations – of enabling us to appreciate connexions and to predict the future”. This

is an argument against regarding functional explanations as being different in kind from other forms of explanations. Harvey commenting on this concludes “it seems that the only important decision we need to make regarding such explanatory forms is how long and under what circumstances we are willing to put up with first-stage approximations of this sort. It may well be that rough functional and teleological explanations are the best we can achieve in the given state of our understanding. But in principle there seems no reason why we should not resort to more complete explanatory forms”.

There is a philosophical argument against functionalism here. It comes from that against teleology, which is that teleological arguments are essentially empirically untestable being causally dependent on something in the future, due to which they do not contribute to our understanding of the world. However here too, the argument is rather weak if considering social systems - which anyway preclude experimental controlled test conditions. Also the nature of the kind of entities and relationships social science studies could very well be motivated by goal directed behaviour emanating from expectations located in the future. Thus philosophically, functional analysis in social systems may not only be just feasible, but may in fact be inevitable due to the thinking, reflexive, purposeful, meaning forming nature of the subject of study.

The above discussions pertain to an examination of functionalism on *a priori* assertions – the case for philosophical functionalism. Harvey makes a rather more pragmatic case for what he calls ‘instrumental functionalism’, this being a form of functionalism that “relies upon assertions that can in some measure be empirically and objectively evaluated” (pg 441). This form of functionalism he suggests “was originally construed as an alternative, and more palatable, philosophical position to mechanistic determinism” (pg 441). In favour of methodological functionalism Harvey writes “Whatever may be said about the logic of functional explanation or functionalism as an *a priori* assumption, there can be no doubt of the very substantial achievements and insights that have been gained through adopting functionalism as a working hypothesis. To attack functionalism as a philosophy is not, therefore to attack it as a methodology” (pg 445). Harvey sees methodological functionalism as a useful first stage device to explanation. Thus for him, “In a discipline still heavily dependent upon ‘first-stage approximations’ a strong case might be made for a fuller employment of methodological functionalism as a heuristic device, and even for

explanations in terms of functions. But first-stage approximations must presumably give way at some stage to full-blown theory” (pg 446).

THE STRUCTURALIST-FUNCTIONALIST SCHOOL OF TALCOTT PARSONS

The nature of society is an important concern in sociology. The main schools of thought have traditionally revolved around an emphasis on agency or an emphasis on societal structure, with interesting attempts to bridge the two. The structural-functional school may be thought to be a fore-runner in such an attempt of bridging. Craib (1992, pg 38), for instance remarks, “he [Parsons] is concerned with the organisation of individual actions into systems of action, with employing the holistic and individualistic approaches at the same time”. As has been pointed out in chapter-3, the concept of relations is a basic entity in the analysis of society and social systems, and hence a systemic approach is not unfamiliar in the development of sociological theory, especially so in those theories that attempt to explain the fundamental nature of societies. What distinguishes Parson’s theory however is what has been claimed to be its ‘holistic’ character, going beyond dominant analytical streams, which place it well within the systems tradition. There are many ways in which one can approach Parsons theory, including a general overall evaluation. The attempt here is however to focus on the ‘holistic’ character that is been claimed for the theory and the way it has been attempted.

The work of Talcott Parsons dominated post-war social theory till around the 1960s, especially in America (Zhao, 2001, pg 389). Parsons has been described as a “confirmed anti-positivist and anti-behaviourist” (Hamilton, 1985, pg 8), very much influenced by biological concepts of the organism which became the crucial analogue or metaphor in his theory (Craib, 1992, pg 39). Very broadly and briefly his work is positioned by Hammond (2003, pg 93) as “Parsons...opposed...positivism in his attempt to develop a ‘voluntaristic theory of social action’ although structural elements tended to dominate in his work. Parsons rejected the atomistic focus of the utilitarian tradition, although he agreed with its view of individuals as purposive and goal-oriented. While he acknowledged the German idealist tradition for its treatment of the influence of ideas, he felt that it did not give sufficient consideration to social structures. Parsons sought to account for the dynamic interaction between ideas and

social structures, incorporating a consideration of actors, goals, choices, constraints, norms and values". This is a very broad range indeed. I now examine the theory in more detail to see how it does all of this.

In his *The Structure of Social Action* (1985a, pg 73, 74), Parsons defines a 'unit act' as a basic analytic unit. This act logically involves 1) an agent, the actor, 2) goal or end towards which the act is oriented, 3) a situation in which the act is initiated which contains both constraints and means of action and 4) a normative orientation in the form of a choice among alternative courses of action – a value. He then moves on to discuss the implications of this conception of the unit act, for the social scientist in his/her task of making sense of how choices are made.

In *Psychoanalysis and the Social Structure* (1985b, pgs 125-132), Parsons moves on to discuss ways in which the psychological realm of individual action viewed as a psychological system can be integrated with the social system without giving primacy to either the psychological or the social. Thus he says "there is no reason to attribute any fundamental logical or ontological priority to either the social system or the personality" (pg 126). Parsons here sees social structures as "a system of patterned expectations of the behaviour of individuals who occupy particular statuses in the social system" (pg 126). These patterned expectations form a system of roles which when strategically significant for the social system is referred to as an institution. These institutions are the fundamental elements of the structure of the social system and are the means by which action can be regularized to meet the functional requirements of society. As far as the individual is concerned however, institutions fulfil two primary functions. First, they structure reality for the individual by defining expectations of behaviour of other individuals and second, they embody the moral standards that are imbibed in the socialisation process of the individual and as such remain a strong influence whether the particular individual conforms to it or not. Parsons is careful here to point out that uniformity at the social level has no direct correspondence with uniformity at the personality level independent of the institutional context. Thus what is involved in an institutionalisation is the "structural generalization of goals" (pg 128). This then points to the existence of mechanisms whereby behaviours of individuals are motivated to conform to institutional expectations.

In *The Social System: The Pattern Variables* (1985c, pgs 131-144), Parsons differentiates further and develops a systematic scheme for the analysis of orientation

in roles. In order to do this he identifies patterns, which enter into relational institutions. In motivational terms, Parsons says that “it may be presumed that the ‘ultimate’ interest of any actor is in the optimisation of gratification” (pg 134). Five pattern variables are identified – the gratification-discipline dilemma, the private vs collective interest dilemma, the choice between types of value-orientation standard, the choice between ‘modalities’ of the social object and the definition of scope of interest in the object - the details of which I shall not enter into, as it is more in the nature of substantive content of structural-functionalism, not specifically contributing to the purpose of highlighting the employment of system concepts in social theory. However Parsons’ comments in relation to pattern variables are worth noting: “when the pattern variables are seen in the context of the general action scheme, they fall into a pattern of mutual interactions; they do not, that is, simply constitute a list, but they have important systematic interrelations” (pg 135). Ways of these systematic interrelations form the content of subsequent discussions illustrated through tables and charts.

The differentiation in the theory as described above is on the level of the individual viewed as a social being. Parsons now takes up the integration of the patterns, at the individual level, to an adaptive context at the level of functional problems of the social system. Differentiation now is at the level of the social and deals with types of social systems. In *A Paradigm for the Analysis of Social Systems* (1985d, pg 168-78), Parsons first deals with features of systems. Thus he maintains that social systems are open, engaged in complicated processes of interchange with the enviroing systems. They may also be constituted of open sub-systems, each of which are engaged in exchanges with its environment. Parsons then goes on to describe the fundamental modes of analysis in his theory.

He identifies three “bases of selective abstraction” (pg 169). The first is the structural reference. The concept of structure consist of those phenomena which show “sufficiently definite patterning and stability over time” (pg 168) in relation to its ‘external situation’ (pg 169). The second is the functional reference. It has an integrative significance and mediates between the relative constancy of the structure and the relative constancy imposed by the enviroing situation that is external to the system. As there is bound to be a deviance here, there must exist dynamic processes or mechanisms for mediation. Parsons here stresses “when using this model in analysing social systems, however we treat not only the environment but the structure

of the system as problematical and subject to change” (pg 170). The third is the ‘dynamic’ modes of analysis. Within this there are two orders of problems. The first is concerned with the maintenance of equilibrium and the second is concerned with changes in the structure of the system itself. For Parsons the concept of equilibrium is a fundamental reference point, which explains persistence of structure over a changing environment. Explaining the concept he writes, “theoretically, the concept of equilibrium has a normative reference in only one sense. Since the structure of social systems consists in institutionalised normative culture, the ‘maintenance’ of these normative patterns is a basic reference point for analysing the equilibrium of the system. However, whether this maintenance actually occurs or not, and in what measure, is entirely an empirical question. Furthermore, ‘disequilibrium’ may lead to structural change which from a higher-order normative point of view, is desirable” (pg 171). Problems of equilibrium for the social system are viewed as involving “primarily its relations to its individual members as personalities and organisms, and, through these, to the physical environment” (pg 171). Problems of structural change however are viewed as “primarily involving its relations to the cultural systems affecting its patterns of institutionalized normative culture” (pg 171).

With regard to functional imperatives of the social system, Parsons argues that any system regardless of the level of analysis has four such imperatives. These are briefly 1) the function of pattern maintenance, which concerns itself with maintaining the stability pattern of institutionalised culture in terms of the normative pattern itself and also its state of institutionalisation; 2) the function of goal-attainment, which concerns itself with the maintenance of equilibrium, tending to reduce discrepancy between the needs of the system and the conditions in the enviroing systems; 3) the function of adaptation, which concerns itself with assuring flexibility by the provision of ‘disposable facilities’(pg 176) that may be rejected in the choice associated with goal attainment; 4) the function of integration, which concerns itself with integrating various subsystems into a larger whole. All of the above four needs or requirements (commonly referred to as the adaptive – goal-attainment – integration – latent pattern maintenance - AGIL scheme) according to Parsons are found in any system, whatever the level.

This being a brief recount of the structural-functionalist school of thought associated with Parsons, I now examine in more detail how ‘holism’ has been attempted in this tradition – the tradition of ‘grand theories’ within social science

The Holistic Component of Parsonian Social Theory

Parsons sees the social system of action as having needs that must be met and being composed of parts that meet these needs – the twin components of function and structure. The overall trend is towards equilibrium, stability and order. As described above, Parsons structural-functionalist theory encompasses the realm of personality at the individual level, the realm of social structures at the society level, the more general realm of norms and values, as well as the specific contingent situatedness of individual social action. Let us now reflect upon the form and method of synthesis.

The approach can be analysed into three components. First, the identification of general ideas, at two levels, that of the social and that of the individual, which incorporate and interpenetrate each other in its conceptualisation, so that the individual is social and the social is individual. Second, these general ideas are organised into concepts, which are really generalisations that identify important aspects of the world based on Parsons particular overall conception about the world – the trend towards equilibrium. Third, the set of concepts are used as a template that can be repeatedly applied to every differentiated level of analysis, yielding a logically coherent argument, which explains also the logical structure of the social world. This then gives rise to what Craib (1992) terms the ‘filing cabinet’ structure of explanation. I dwell on each of these components in a little bit more detail.

The fundamentally two level analysis, that Parsons adopts is at the individual and the social level, which incorporates and reflects the other in its analysis. Thus for him, “the typical problems of the psychologist and the sociologist are different and therefore they need to use the same concepts at different levels of abstraction and in different combinations” (Parsons, 1985b, pg 129). For the sociologist, the problem is concerned with “the balance of motivational forces involved in the maintenance of, and alteration in, the structure of a social system. This balance is a particular sort of resultant of very complex interaction processes. It can only be analysed by abstracting from the idiosyncratic variability of individual behaviours and motivations, in terms of strategic relevance to the social system” (pg 129). Thus his conception of the unit act reflects the social though situated at the individual level and his conception of the institution reflects individual personality, though situated at the level of the social. These interdependent yet cross-cuttingly conceptualised abstractions - the unit act and the institution - are the preliminary units of analysis.

It is easy to see in the conception of the voluntaristic theory of action, the teleological element in the goal, the structural element in the situation, the voluntaristic element in the actor and the normative element in the value. The conception thus allows for the incorporation of metaphysical aspects in the value dimension, environmental aspects in the teleological element, and societal aspects in the structure related social situatedness, of voluntary action, which is itself actor specific. This integration of the social level and the individual level with the value dimension and the motivational dimension can also be seen to be maintained in the definition of social structure and institutions. A broad ranging synthesis is thus achieved primarily through describing an abstracted structure which is defined by what is considered as key factors that are important to the system as a whole – a structure that comes into being through a functional identification.

After having *defined* the preliminary units of analysis at both levels thus, Parsons goes on to identify fundamental *modes of analysis* at both levels. Thus he has the five pattern variables at the level of the individual, which analyse individual action in terms of socially relevant factors and he has the three modes of reference – the structural, the functional and the dynamic at the social level that takes into account the individual level. These concepts again reflect, what for Parsons are important generalisations about the nature of the world. The employment of the concept of four functions provide the template which when applied to the real world at any level, gives rise to particular sub-systems that are important for the survival of the social system as a whole at that level. Thus a process of differentiation and specialisation is advanced as necessary for the attainment of system goals. The mechanisms of interaction within the systems are centred around what is regarded as ‘generalized media of exchange’ which are constituted of such entities as power, money, influence, media and so on. (Holton, 2001, pg 158). To illustrate the template model of repeated differentiation and specification, a table given by Craib is reproduced below:

Major System	Adaptation	Goal Attainment	Integration	Pattern maintenance
The general system of action	The <i>biological organism</i> which provides the link between the physical world and the meanings (norms, values, etc) that make up the world of action	The <i>personality system</i> which is formed by socialisation in such a way that it internalises general cultural values and societal norms. It thus becomes the instrument through which the major system achieves its goal	The <i>social system</i> of status roles governed by norms which define which actions are or are not allowable	The <i>cultural system</i> - the most general ideas, ideals and values of the major system, made more concrete in the norms of the social system and internalised in the personality system
The social system	The <i>economy</i> , the link between social organisation and the physical world or nature	The <i>political system</i> - including all forms of decision-making and resource mobilisation	The ' <i>social community</i> '- the institutions of social control – ranging from the legal system to informal rules of conduct	The <i>socialisation processes</i> , by means of which individuals are educated into the cultural values and societal norms of the system

Table- A.6: Subsystems Fulfilling Functional Prerequisites

Source: Craib, I (1992) *Modern Social Theory – From Parsons to Habermas*.

Harvester Wheatsheaf: London. pg 44.

The structural-functionalist theory of Parsons thus lays a claim to being synthetic and cutting across broad disciplinary categories, in trying to explain the social world. There is definitely an analytical abstraction in this theory, but it is essentially one derived from what can be described as a fundamentally synthetic approach. Holton thus comments on how for Luhman - one of the more recent social scientists who have ventured into the systems field – Parsons has been very influential.

Critique of the Structural –Functionalist School

The above analysis of Parsons theory has focused more on its mode of abstraction and the systemic components in it. It has avoided more substantive discussions of the content of the theory and its contribution to social knowledge. In reviewing the criticism of the theory, I again follow the same lines focusing on criticisms that aim at the mode of abstraction and the systemic qualities.

The main critique launched against the structural-functionalist school is directed to its emphasis on equilibrium and homeostasis. It is generally felt that the model envisaged an utopia which always tended towards maintaining a world of balance, allowing no place for conflict or social change (Craib, 1992, pg 50). The fundamental abstraction put forward in the model that serves to give it its systemic qualities – the process of continuous differentiation and specialization is legitimised in terms of functional imperatives of the larger system. In doing so it is argued, the model has an inherent conservative bias, which tends to maintain status quo conditions by legitimising inequalities of power, wealth or status as being functional and directed towards larger social goals. However Craib points out that Merton and Gouldner have argued against this interpretation. Thus Merton (1968) points out that there are both manifest and latent functions, and functions and dysfunctions, which can be fruitfully used to explain the occurrence of change and conflict. Gouldner (1970), points out that the concept of system integration encapsulates not only complete dependence but holds within it the concept of complete independence as well. Both of the above are essentially default definitions by negation, given the positive statement of the system goals.

Criticism directed against the structural-functionalist school, have also pointed out its inability to generate testable propositions as a failure. It has been argued that the theory limits itself to the realms of grand theories that attempts to explain everything, none of which can be conclusively tested empirically. However Craib

(1992, pg 50) points out that conclusive testing is not the only criterion by which theories are to be judged and the inability to conclusively 'test' theories in the social world anyway makes this criterion inevitably not a very relevant one. In connection with this, it is relevant to point to one other opinion by Craib. He points out that Parsons theory is essentially an abstraction. That is the concepts, systems and sub-systems actually provide a descriptive statement of society with the explanatory element being weak. This is so if explanation is seen to be identifying causal processes and causal mechanisms. Parsons does not attribute any causal priority to anything whatsoever (pg 55). This then makes it essentially an elaborately thought out descriptive proposition of the world.

The inability to test a theory of this sort, all at one go, is actually inherent in the scope of systems approach in general. The approach is by definition grounded in a wide-ranging abstraction, which is synthetic and cross cutting. Given the nature of the social world, the processes identified in the abstraction can easily be non-observable in concrete phenomena (as argued in the discussion of realism in chapter-3) even though it might have an ontological existence and referent. Under these circumstances it can be argued that the utility of the theory is to be judged in terms of its heuristic potential (arguably having a real referent) – the new concepts it provides us with, in order to help re-order existing categories in possibly diverse subject spheres, bringing to light systemic qualities that when tested across domains could then help validate the claim for the existence of systemic processes. This is the potential for reconceptualisation. Any sort of agenda for empirical testing of these systemic processes is therefore to be necessarily informed by discipline and subject specific knowledge which will enlighten the researcher to the type of counter-vailing forces (in terms of the existence of mechanisms already identified within the discipline, teleological intentions, goals, etc) that may be in operation. Thus a systemic abstraction can be legitimately expected to 1) provide new heuristic devices that it claims to have an ontological existence and causal effects, 2) have an influence on discipline specific knowledge by promoting the reconceptualisation of familiar entities, 3) yield a varied and diverse set of research agendas, which provide varied empirical results that can be analysed for their systemic consistency only with the heuristic concepts that the systemic abstraction provides. Judged in this vein, Parsons theory has indeed been very influential. Thus Holton (2001, pg 156) remarks "One particular defence of Parsons, with relevance to economic life is that his theoretical

approach had within it the elements of an integrated research programme, capable of promoting many neglected issues in economic sociology. In a situation where conventional forms of economics neglected the social determination of ends, and radical political economy produced accounts that emphasised power and coercion at the expense of norms, Parsons framework offers ways of bringing norms and values back in..... This legacy.....has exerted a diffuse influence on later discussions of economic values, the social meaning of money and trust”.

Craib (1992, pg 51) in his discussion of structural-functionalism, particularly takes issue with the model’s failure to explore the analogy of social systems with organisms more fully. His main objection is “Persons are, amongst other things, biological organisms; it does not automatically follow that the same is true of societies”. Lines of argument that follow are that “we cannot claim that social systems have needs which must be met in order to survive (pg 51)” and that “to say that a social system has needs does not explain how those needs are met” (pg 52), a subject of more interest to sociology. He goes on to point “If a social system had organs that could experience, the need for, say, an education system as the body can experience hunger; if the experience could be communicated to a system brain, translated into symbolic thought, pondered and analysed; if the social brain could decide what sort of education system it wants and then transmit the appropriate messages along its nervous system so that an education system were constructed then- and only then- would these criticisms not apply” (pg 52). Craib further points out “the difference is that the human organism is made up of parts which are not capable of independent reflective thought and are controlled by a part that is.Social systems are made up of parts which are capable of reflective thought as they occupy their status roles; the organic link is very different to that between parts of the body” (pg 52). This to me is a valid criticism and I would imagine that an explanation involving functionalism would necessarily have to limit the functionalist dimension of the explanatory scheme to the level of actors or any other agency capable of purposeful thought resulting in a functionalist explanation at the social level as emergent.

Parson’s theory has also been criticised on the dimensions of society that it gives importance to. We have seen that norms and values play a large role in the way which social systems and individual systems are organised. Lockwood (1967) has pointed to the lack of regard given to what he calls the ‘material substratum’, which structure social life by influencing material access to goods and property. Also

Lockwood (1964) highlights the relevance of another concept that of social integration, signifying relationship among actors, that needs to be distinguished from that of system integration, signifying relationships among different parts of the systems (discussed in Craib, 1992, pg 53-54). Differentiating and distinguishing between these two concepts help us realise that value satisfying social integration could very well be possible, without implying system integration ultimately leading to crises, as also very well engineered system integration could be possible without implying any value based social integration that could also in turn lead to crises. This criticism throws light on and is a good example of the way disciplinary knowledge concerns interact with systemic knowledge concerns. It does highlight the importance of systems theories to be not only disciplinarily grounded, but also aware and reflexive about the type of concerns that they raise and the disciplinary domain within which the concerns may be seen as significant.

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APPENDIX-7

THE THEORY OF SOCIAL SYSTEMS BY NIKLAS LUHMANN

The theory of social systems advanced by Niklas Luhmann is a ‘grand theory’ aspiring to universal claims. It is thus concerned more with nomological goals. Developed within close to 600 pages, this theory lays out an elaborate but exceptionally abstract argument for the theory of social systems. In discussing this theory of social systems then, I remain selective as the intention is to provide an illustration of how complexity has influenced social theory. Finer details of the theory – in its substantive sense are hence not discussed.

Luhmann’s theory of social systems builds on the theory of autopoiesis, originally developed by Spanish biologists Humberto Maturana and Francisco Varela in the 1970s (Bailey, 1997) but translated into English in the 1980s (Kay, 2001). It was developed in relation to questions raised in relation to life and the nature of its fundamental entities. The basic concept of autopoiesis has been introduced and explained in chapter-2. However to recapitulate, an autopoietic system is ‘a dynamic system that is defined as a composite unity, as a network of productions of components that a) through their interactions recursively regenerate the network of productions that produce them, and b) realize their network as a unity in the space in which they exist by constituting and specifying its boundaries as surfaces of cleavage from the background through their preferential interactions within the network’ (Maturana, 1980, pg 29, quoted in Mingers, 1995, pg 15). Luhmann’s theory of social systems is strongly founded on general systems theory and can be termed as an advanced reconstruction of the systems movement. It also takes off from the work of Parsons (Mingers, 1995, pg 139) with whom Luhmann had trained for a year (Knodt, 1995, pg xiii).

Luhmann’s basic claim is that societies are autopoietic. The focus is on the abstraction of the concept of autopoiesis from life and its biological connotations to produce a general definition of autopoiesis, which is then re-applied to societies dealing with questions of how social autopoiesis is defined, what its components are and how the process of autopoiesis comes about. The result as mentioned earlier is a highly abstract piece of work involving concepts with special meanings allocated to

terms. To highlight some of the salient features of Luhmann's theory of autopoiesis I shall discuss some aspects of the theory as a whole and then discuss the theory from Luhmann's own point of view briefly mentioning also the type of comments it has invited.

The social system in Luhmann's theory of autopoiesis is conceptualised as operationally closed, though interactively open (Luhmann, 2000, pg 36), meaning that processes inside the system are dependent only on the system, though it 'communicates' with the environment. As Mingers (1995, pg 146) explains "the environment... can trigger or irritate society, and society may then generate a communication, but its nature and form will be determined by society or a particular subsystem, not by the environmental disturbance". This is because "'information' is not something that the system takes in from the environment. Information doesn't exist 'out there', waiting to be picked up by the system. As selection it is produced by the system itself in comparison with something else" (Luhmann, 1990, pg 4). Selection can in turn be described from two viewpoints – that of the system itself and that of an observer (say the scientist) (Luhmann. 1995, pg 9).

Just as Parsons had the unit action as the basic element of analysis, Luhmann has an interactive term as the basic unit of analysis – communication, which only, he claims, can be the basic unit given that society is basically a social entity. Thus, he argues against the more familiar notion of an act being the basic unit of analysis - "for a theory of autopoietic systems, only communication is a serious candidate for the position of the elementary unit of the basic self-referential process of social systems. Only communication is necessarily and inherently social; action is not" (Luhmann, 1990, pg 6). Communication here is used in a specific sense though. It is imagined as events that disappear as soon as they are produced thus constituting 'decay' in the social system. This decay is what causes the autopoietic nature of society driving the autopoietic process. Thus for Luhman (1990, pg 9), "all structures of social systems have to be based on this fundamental fact of vanishing events, disappearing gestures or words that are dying away. ...The events themselves cannot be saved; their loss is the condition of their regeneration. Thus, time and irreversibility are built into the system not only at the structural level but also at the level of its elements". The notion of communication is fundamental to Luhmann's theory of autopoiesis since "autopoiesis here (in the case of social systems) means : to continue to communicate" (Luhmann, 1990, pg 14).

Communication involves the unity of three entities – utterance, information and understanding which come together in the communicative act, a synthesis produced by the network of communication itself within the system. Utterance refers to the ‘how’ and ‘why’ of communication, while information refers to the content of communication (Luhmann, 1990, pg 4) produced by perturbations from the environment (Mingers, 1995, pg 143). In the case of utterance, the system is auto or self-referential, referring to previous communications and the system itself for cognition, while in the case of information, the system is hetero referential, referring to the environment (Luhmann, 1990, pg 4 ; Mingers, 1995, pg 143). Understanding makes the distinction between utterance and information and also recognizes that they are selections in both cases in different dimensions (Mingers, 1995, pg 143). Communication then is related to many other communications and possibilities, and the production of communication is a selection from the many possibilities – “distinguishing what it is by what it is not” (Mingers, 1995, pg 145).

The concept of meaning and the relation of communication to meaning are also complex and specific in this theory. For Luhman (1985, pg 101) “meaning is nothing but a way to experience and to handle enforced selectivity”. He explains this further “Meaning always involves focusing attention on one possibility among many:.....There is always a core that is given and taken for granted which is surrounded by references to other possibilities that cannot be pursued at the same time. Meaning, then, is actually surrounded by possibilities. The structure of meaning is the structure of this difference between actuality and potentiality. Meaning is the link between the actual and the possible, it is one or the other” (Luhmann, 1985, pg 101,102). With regard to communications, this becomes something that accounts for the “newness of and difference between communications. On the other hand, a particular communication closes this off; it fixes one possibility in order that something might actually happen. Autopoietic communication can thus be seen as *meaning-processing* (original italics) (Luhmann, 1989, pg 17) generating distinctions to convert the open field of meaning into the particular information or utterance that thereby constitute a society” (Mingers, 1995, pg 145).

This then is a description of some of the concepts that Luhmann works with. I shall limit my presentation of Luhmann’s work here, as the material presented will suffice to inform the reflexive account by Luhmann himself about the employment of

concepts from complexity from other scientific disciplines in social science theory. This account is presented below.

Complexity Science and Luhmann's Social systems

Luhmann himself gives a clear exposition of the way his theory of social systems relates to systems theory (Luhmann, 1995, pgs 6-11). He introduces two concepts relating to theory building – first, that of super-theory and second, that of guiding differences. “Super theories are theories with claims to universality” (Luhmann, 1995, pg 4). By universality Luhmann means that these theories include everything social, including the theory itself in its claim. It does not thus by excluding itself deal with sections (Luhmann, 1995, pg xlvii). Guiding differences on the other hand “are distinctions that steer the theory's possibilities of processing information” (Luhmann, 1995, pg 4). If a guiding difference organises a super theory in a particular way such that the difference or change that has come about acquires a position of centrality within the super theory then a Kuhnian paradigm change can occur (pg 4, 5).

Given these concepts, systems theory is characterised as a super theory with claims to universality. The argument centralises around the reduction of complexity in the real world by theory and the similar reduction within the proliferation of theories achieved by the systems theory, making the systems theory's claim of creating a distinction apply to itself (Luhmann, 1995, pg xlviii, xlix). Within the systems theory, Luhmann identifies a series of guiding differences. Thus, initially systems theory dealt with concepts of part and the whole. This was the key ‘difference’ (part/whole) that the theory worked with. Later, with Bertalanffy, this difference was replaced by system/environment differentiation, giving rise to concepts of ‘open’ and ‘closed’ systems (pg 7). With the autopoietic systems theory, yet another guiding difference is introduced – the theory of self-referential systems. Here the system constantly refers to itself in constituting its elements and operations. This replaces the system/environment differentiation with an identity/difference difference (pg 10) as in order to become self referential “systems must create and employ a description of themselves” (pg 9) as a unity, be it that of system or elements.

Changes in guiding differences in a theory, promote radical conceptual shifts. Thus Luhmann observes that the shift from the part/whole to that of system/environment created a change in interest from design and control to autonomy and environmental sensitivity, from planning to evolution, from structural stability to

dynamic stability (pg10). In the second guiding difference - the system/environment differentiation, relatively simple theories were still possible, as causality was still identified with causal relations that had to now entail a co-production of not only internal factors as in the earlier model, but also external factors. With the onset of the third guiding difference however a more complex change takes place. This mode of causality is by-passed or rather subsumed within the still higher level concern of how causality itself comes about as a product of self-reference (pg 9, 10). The concern is thus at the level of 'relating relations' (pg 10) what is known as second order cybernetics or the observation of the observer.

Luhmann's theory of social systems confronts complexity in a uniquely self-referential manner. Thus what the theory of social systems does as a theory, also happens within the theory. To explain further, according to Luhmann, "sociology is stuck in a theory crises". This is the opening statement of his book - *Social Systems*. There are two concepts of theory – one which links it to "empirically verifiable hypothesis about relations among data" and the other to "conceptual efforts in a broad somewhat indeterminate sense" (pg 1). Those employed in theoretical work have by and large, according to Luhmann returned to classical authors and texts that already bear the label of 'theory'. The task is then "one of dissecting, criticizing and recombining already-existing texts" (pg 1). New insights arise from these recombinations. Thus "action theory is reconstructed as structural theory, structural theory as linguistic theory, linguistic theory as textual theory and textual theory as action theory" (pg xlvi). These efforts are interesting and undoubtedly have their effects, but Luhmann argues that with passage of time as the classical authors recede into history, the genealogies of theories that are produced actually give rise to a confusion. "The unity of sociology then appears, not as theory, and certainly not as the concept of its object, but as pure complexity. The discipline not only appears opaque, but it finds its unity in this opacity. Complexity can only be approached perspectively, and every advance varies more than it can control" (pg xlvi, xlvii).

Within this critique of theoretical development in sociology, Luhmann sees the core issue as a relation between complexity and transparency or rather opaque and transparent complexity. Thus "theory establishes its relations to its objects as a relation of opaque to transparent complexity. It claims *neither* to *reflect* the complete reality of the object, *nor* to *exhaust* all the possibilities of knowing its object. Therefore it does not demand *exclusivity* for its truth claims in relation to other,

competing endeavours. *But* it does claim *universality* for its grasp of its object in the sense that it deals with *everything* social and not just sections” (original italics) (pg xlvii).

Seeing theory normatively in this way, Luhmann distinguishes three points of departure for the self-referential theory of society. First, he says that not since Parsons has anyone attempted to establish a universal theory for the discipline. Second, is the difference between asymmetric and circular theories. There is no transcendental epistemological criteria assumed. In circular theories, whatever is said in terms of acceptance, rejection or validating criteria applies to itself. Third, a sociological theory that aims at consolidating the conditions of a discipline must necessarily be complex. This means it requires different criteria for validity and connectivity which must bear out both internally within the theory as well as externally. The theory building activity is thus constrained by what it itself produces as criteria, excluding arbitrary decisions. What this means is that the concepts produced by the theory are increasingly produced with reference to one another, thus causing every concept produced to act as a constraint to the others. The theory then is constructed in a ‘self-limiting context’. Each concept then can be explained along different lines, causing a reduction of complexity because the explanation is constructed along certain lines, though not causing an exclusion as each of these concept can be further connected to other possibilities that exist.

The presentation of the theory itself is as a consequence very abstract. Luhmann himself admits “this theory design pushes the presentation to unusually high levels of abstraction” (pg 1). He ventures to justify this however. The concepts employed by the theory are not mere abstractions but refer to actual entities that can be experienced like events, meanings, etc. Though correspondences between concept and reality can be drawn, systems science goes beyond this level to, as he expresses it, “organize experiences of difference and with them the acquisition of information” (pg li). What is referred to here is the explanation of the meanings of the concepts employed, as an outcome of the way the system organises the central autopoietic function of creating differences and applying it to itself. The continuous process of creating differences leads to an accumulation of information within the system, which is also linked to the explanation of the meanings of the concepts. Thus an external correspondence with reality is not all that is involved. Abstraction then is presented as

an 'epistemological necessity' (pg li) though the problem in writing and the demands placed on the reader are acknowledged.

The process of theory construction and adaptation is described by Luhmann as one of generalization and re-specification. Thus, "methodologically, we do not choose the shortcut of analogy, but rather the longer path of generalization and re-specification. Analogy would lead us into believing similarities to be essential. The longer path of generalization is more neutral; in any event, it increases the sensitivity of analysis to differences among system types" (Luhmann, 1995, pg 14). However Luhmann goes further and is more reflexive on this process of generalization itself, constructing an argument thereby for a methodology that fundamentally formulates problems, not possibilities that demand resolution. Thus, "one should not believe that reverting to the most general level of statements that hold valid for systems provides the best possible abstraction of premises for further analysis. That would mean trusting unreflectively in a sort of logic of generic concepts that holds the conceptual requirements of the construction of genus to be the characteristics of things themselves. There is, however, no guarantee immanent to things of a coincidence of generalities and essentialities. Generalities can be trivial. If one wants to check the fruitfulness of generalizations, one must position the concepts used at the most general level of analysis, not as concepts describing possibilities but as concepts formulating problems. Thus general systems theory does not fix the essential features to be found in all systems. Instead, it is formulated in a language of problems and their solutions and at the same time makes clear that there can be different, functionally equivalent solutions for specific problems. Thus a functional abstraction is built into the abstraction of generic forms that guides comparison of different system types" (Luhmann, 1995, pg 14, 15).

Critique of Luhmann's Theory of Social Systems

Luhmann's theory of autopoiesis has been criticised most famously by Habermas. While Habermas criticises Luhmann for 'technocratic functionalism', Luhman criticises Habermas's 'consensus-oriented discourse ethics' as a 'hopelessly inadequate response to the complex issues that arise in highly differentiated postindustrial societies' (Knodt, 1995, pg xiv) The criticism has led to the formulation of two schools in communication theory, one based on 'linguistically generated intersubjectivity' and the other on 'self referentially closed inter-subjectivity' (Leydesdorff, 2000, pg 280). There are other criticisms against the theory and also

appreciations. These are more in the vein of omissions, obscurity and some also on the substantive content of the theory (Mingers, 1995, pgs 148-150; Kay, 2001, pgs 461-477; Bausch, 2002a, pgs 599-602; Bailey 1997). A detailed exposition of this is again beyond the scope of this thesis. What is brought out in the theory of autopoiesis of social systems is the possibility for advancing a valid and rigorous argument adapting concepts from the natural sciences into the social sciences through a theoretically and methodologically grounded scientific process.

THE CONTRIBUTION OF FRACTALS TO CONCEPTS OF 'SPACE' IN USE WITHIN PLANNING

Planning literature in recent times has shown an interest in re-conceptualisations of space to better suit the complex cities of today. Earlier notions of space in planning, consequently, have been critically examined for the ways of thinking they embody, the frameworks for action they suggest and the very actions that they give rise to. These have tended to characterize older notions of space as 'euclidean' (Graham and Healey, 1999) and 'absolute' (Massey, 1999). Opposed to this concept of space is posited the 'relational' concept (Healey, 2000, 2002; 2004; Graham and Healey, 1999; Massey, 1993; Murdoch, 1998; Soja, 1996, 1989) qualitatively distinguished from the older concept.

Euclidean planning quite simply refers to planning based on physical attributes of proximity, continuity or containment within physical boundaries. This notion of planning approaches space as an *a priori* entity, given, existing independent of what might constitute it. It manifests itself as an inert container for what may be ascribed to it – a space that is objectively definable by measurable *absolute* attributes of distance, proximity, continuity etc. The planner's task is to manage this physical space to remove economic, social and environmental problems (Graham and Healey, 1999).

A slightly modified version of Euclidean space, not radically disturbing it, is the concept of *relative space* (Raper and Livingstone, 1995 discussed in Massey, 1999), often mistaken with either absolute space or relational space. Relative space is an object-oriented vision of space, wherein space is removed from its absolute status and is conceived in terms of the *objects* that occupy it. The concept of relative space brought in a qualitative dimension to space, which gave rise to relations (hence the identification with relational space) realised materially, still measurable by distance (hence the identification with absolute space). The still measurable space became amenable to normative ordering on measurable criteria, giving rise to a rationalism dictated by the logic of measurable dimensions emphasising those attributes of the objects that rendered themselves to this logic. The instruments that allowed the

practice of the logic occupied centre space in planning practice, and the era of instrumental rationalism in planning was born of the tools and techniques employed.

Also defined in relative space within the practicalities of planning practice, is the off-setting of the internal from the external – a world of intervention and ‘logical’ order from a wilder external environment (which also needed to be tamed). Order came to be equated with visible homogeneity, formal linkages and functional efficiency realisable within bounded spaces balanced via planning in a normative ideal of harmony.

Relational space is defined by the relations that constitute the material and social reality of our times. Hence it is a notion of constructed dynamic ‘social space’ conceptualised in terms of a process of ‘becoming’, as opposed to physical static containerised space, conceptualised in terms of objects and things in a state of ‘being’. This view is increasingly acknowledged to be constitutive of present times, and has consequently stimulated much academic debate, leading to normative discourses that influence the practice of planning.

Relational space privileges time over space and focuses on actualisation of larger forces - which are determined by relations defined historically by political-economic forces of capitalism (Harvey, 1993), by larger level networked phenomena (Murdoch, 1998, 2000), by broader global trends of post-modernity (Soja 1989,1996) or by some other reference criteria like environmental processes, etc (Graham and Healey, 1999). Space, defined thus, is seen as an *instantaneous* and ‘static cross-section through time’ (Massey, 1999). The post-modern perspective sees time-space (Massey, 1999) as a manifestation of a larger global trend. Challenging the generalisation implicit in a unitary conception, it stresses heterogeneity of time-space experiences and spatial processes. Here time-space is internally relational and varied, unlike the instantaneous, intense manifestations of larger processes described earlier. Finally, there are also time-spaces defined by glacial processes of environmental change or even spiritual processes of eternity. The coupling of time with space also lead to notions of ‘time-space distancing’ (Giddens, 1984) - ‘the stretching of social systems across extended time-space, on the basis of mechanisms of social and system integration’ (Soja, 1989) and ‘time-space compression’ (Harvey, 1993) - the collapse of spatial barriers resulting in increased alienation and insecurity. The relational view thus essentially questions the physical, social, cultural, economic, environmental and psychological closure of time-space within physical demarcated boundaries.

Massey, following Raper and Livingstone, asserts “the way that spatio-temporal processes are studied” (and so dealt with) “is strongly influenced by the model of space and time that is adopted” (quoted in Massey 1999, pg 262). Since knowledge informs action, this has implications for planning. Below, I briefly highlight and reflect upon notions of time-space within planning discussed within current studies and understandings of cities.

Normative Discussions In Planning And Concepts of Space

Debates and discussions within the planning profession have and are reflecting upon how concepts of time-space inform planning theory and more importantly translate into policy, facilitative institutional settings and planning practices. Contributions range from those that strongly advocate the ‘place’ concept, privileging multiplicity, to those that strongly advocate the ‘instantaneous space’ concept. Key concerns centre around ways to integrate multiple time-spaces of cities, with more distanced time-spaces of networks and global flows. The problem is one of accommodating difference and integrating marginality, thereby achieving social justice with a schema where processes may be externally and powerfully determined by networked connections that may only incidentally have a local presence, yet are important for the locality, economically and culturally. In other words, both ‘place’ and ‘instantaneous space’ is stressed.

Friedmann’s position on the ‘place’ side of the continuum is clearly established in *Towards a Non-Euclidean Mode of Planning* (Friedmann, 1993). Here, he advocates that “regions, cities and neighbourhoods are places where meaningful citizen participation can take place” (pg 483) and that “it is far less likely to occur at superordinate levels” (pg 483) because “it is not the space where ordinary people can exert influence on events”(pg 483). He claims that “a decentered planning is attractive for other reasons as well: the wider distribution of risks, the potential for social experimentation and the revival of democratic practices” (pg 483). Within this admittedly ‘humanist’ perspective his reflections are broad-ranging. Thus his “innovative planning is ... focussed, rather than comprehensive in scope, present, rather than future oriented and concerned chiefly with institutional and procedural changes appropriate to the case at hand. Innovative planning is concerned more with resource mobilisation than with central allocation” (pg 483) and “it is entrepreneurial” (pg 483). He further links planning to practice saying “planning becomes less a way of preparing documents, such as analyses and plans, and more a way of bringing

knowledge and practice to bear directly on the action itself.(pg 482)
Implementation is therefore built into the planning process as a critical dimension, involving strategy and tactics designed to overcome resistance to change within the limits of legality and peaceful practice” (pg 484). On modes of practice, Friedmann stresses “because experiential knowledge is not codified, it becomes manifest through speech. It is in the face-to-face transactions between planners and the affected population that a basis of knowledge adequate to the problem can be found” (pg 484) and also that planning argues for an open process and “openness requires democratic procedures” (pg 485). On the type of projects, Freidman continues “large-scale projects, are the exception rather than the rule, and increasingly, small-scale, flexible solutions are the appropriate answer” (pg 485).

Social justice goals predominate in this vision, and the way to the same is primarily imagined through the local - addressing the multiplicity of time-space scales within the local. This then encompasses an internally relational view of space. Little thought is spared for distanced space-times or global flows and how they may influence the local. Neither is there much thought about how the local might assert an influence on the global. Thus though useful at one end of the spectrum, the view helps us little, if we are concerned with forging a link between varied types of time-spaces that cities are subjected to.

For the other end of the spectrum, I search within the actor-network tradition, it being the analytical frame that most abstracts and stresses ‘flows’ and ‘relations’. In an article discussing *The Spaces of Actor Network Theory* Murdoch (1998) highlights that the geographer’s definition of space, based on proximity and connections is of little use for Actor Network Theory (ANT) as space is ‘constructed within networks’ (pg.359) and ‘times are also forged within network configurations’ (pg.359). ‘Space becomes ‘a question of network elements and the way they hang together’ (Mol and Law, 1994 quoted in Murdoch, 1998, pg.360). On the matter of scale, Murdoch quotes Latour ‘there are continuous paths from the local to the global’ (pg.362) and providing the paths are followed, ‘no change in scale is required’ (pg.362). Thus ‘scale becomes defined within particular networks’ (pg.362). Two main types of networks - those which are stable with predictable standardised links and those which are divergent, with frequently compromised hard to establish norms - give rise to two types of spaces, which Murdoch terms ‘spaces of prescription’ (pg.362) and ‘spaces of negotiation’ (pg.362). Citing studies by Law and Akrich (1996), he notes that even

in the most prescriptive of spaces there is always scope for negotiation and that actors can carve out a degree of autonomy. Following Heatherington's (1997) work, Murdoch however asserts that the two types of spaces need not always occur within two types of networks, they may in fact occur within the same network. He goes on to raise issues of further interest to ANT, but I shall stop here, the concern being the balance between 'place' defined in unique terms and 'space' defined in 'instantaneous relational' terms of ANT.

The account raises important questions for the concern with space. First is the notion of 'spaces being fully constructed within networks. If there are negotiated spaces, then surely they must also have an existence that is not fully determined by the network, for if not how can a negotiation rise? Space cannot then be just 'a question of the network elements and the way they hang together' (pg.360). Again if they have an independent existence is it due to their being part of other networks or is it due to some other essential qualities which ANT denies to the spaces? Might this not lead to a questioning of the closure of an actor network implied by statements like 'it is the set of associations that define and constitute spatial qualities' (pg.361) and 'space, although partly physical is wholly relational' (pg 361)? Second, regarding the notion of scale, it is not clear how exactly ANT defines it within particular networks. Is it as folded entities or is it as independently stretched out entities or is it as both depending on the network? The answer may have an impact on the claim 'there are continuous paths from the local to the global' (pg.362), for we then allow scope for discontinuous emergent properties.

By raising the above points, I wish to highlight that the ANT perspective of just 'relational time-spaces' is difficult to reconcile with empirical results cited by Murdoch in his paper. Thus while Friedmann is silent on 'relational time-space', ANT explicitly denies time-space any quality other than relational. While Friedmann gives us some normative concepts and tools to grapple with one end of the spectrum, ANT alerts us to the possibility of local space-times being remotely controlled and enrolled into specific actor networks. We are now left with the task of what to make out of the two extremes. I shall now discuss attempts in this direction.

For Harvey (1996a, pg 260), 'the way in which multiple processes flow together to construct a single consistent, coherent though multi-faceted system' is the key concern. He therefore stresses the need for maintaining multiple perspectives of the city – "learning to see the world from multiple positions - if such an exercise is

possible – then becomes a means to better understand how the world as a totality works” (pg 284). Towards this overall aim Rob Shields calls for “multi-dimensional analysis which rather than imposing monological coherence and closure, allows parallel and conflicting representations to co-exist in analysis” (Shields, 1995, quoted in Graham and Healey, 1999, pg 629).

The problem of accommodating and maintaining multiple views in envisioning the city is the debating point here. Though the normative tone is clear, the solution is vague as we still do not know how this may be done. I suggest that the problem stems from adopting a planner centred view. This creates the problem of having to synthesize the multiple visions to a ‘consistent’, ‘coherent’ one, demanding in the process a somewhat unrealistic super-human role from the planner, not far-removed from traditions of ‘planner knows all’, originating from commendable empathy this time, rather than techniques and tools of planning.

Building on the notion of time-space distancing, Paul Adams discusses how a subject’s (telemediated and physical) access can serve to extend his or her domination over excluded groups and so support the production of divided spaces and cities (Adams, 1995 cited in Graham, 1998). Swyngedouw (1993) points out that “increased liberation and freedom from place as a result of new mobility modes for some may lead to the dis-empowerment and relative exclusion for others” (quoted in Graham, 1998, pg 176). Graham and Healey (1999) consequently note that ‘freedom to extend one’s action in time and space is a form of power over space, time, social processes and people’ (pg 629) and that this is a “recognition that is central to an understanding of contemporary cities” (pg 629) for in the interstices of urban life, where flows stop, “in these, often-forgotten places, time and space may remain profoundly real, perhaps *increasing* (original emphasis) constraints on social life” (pg 629). Thus one needs to acknowledge the ways in which multiple time-spaces are inscribed into the ‘power-geometry’ (Massey, 1993) of a city.

Here the concern is with including the most marginalized, and empowering them to participate fully in urban life, while preventing suppression. The stress is on material and infrastructure linkages like telecommunications, transport, financial flows etc. Thus Graham (1998, pg 174), explicitly states “the power to function economically and link socially increasingly relies on constructed, place based material spaces intimately woven into complex telematics infrastructure linking them to other places and spaces” and Graham and Healey (1999, pg 629, 630) notes “considerations

of the 'openness' or 'cohesion' of a city needs to understand how its material spaces and infrastructure networks are constituted *in parallel* (original emphasis) to create and define the internal differentiation of spaces, neighbourhoods and life-chances, as well as the uneven integration of parts of cities into geographically-stretched economic, social and cultural relations". Dematteis (1994) notes "a passage from a functional organisation in which the centres are graded with a multi-level hierarchy to interconnected networks on the basis of corresponding complementarities of the nodes and synergies produced" (quoted in Graham and Healey, 1999, pg 630).

Though the flow of networks and the 'power-geometry' they inscribe is indeed important, there still seem to be no clear conceptual or concrete suggestion of how we might approach this differential layering of networks. I would like to suggest here that the answer might lie not in an abandoning of multi-level hierarchy for a network system, but rather an embedding of the one into the other. We shall return to this point later in our discussion of the significance of fractals.

In relation to urban economic development, Amin and Graham (1997, pg 415) stress the importance of 'place'. Thus they argue 'soft, intangible factors, based on tight propinquity and close relational interweaving within the urban fabric are seen as the central underpinnings of urban competitiveness and creativity, tying cities, in turn, into globalizing networks of productive, informational and human exchange'. Citing Knight (1995), they further point out that "reflexive knowledge based urban strategies must tie in to their particular urban arenas, so releasing synergies between the elements of a city's knowledge, fabric and the urban built environment" (pg 415). The inter-connection of 'instantaneous relational' spaces to 'place' is brought out here. Amin, Massey and Thrift (2000) stress a different approach to urban economies. They point out that it is not only the networks that count. The city in fact has "an array of personal, professional and commercial services, light industry, and small firms of one sort or the another, second-hand and recycling traders, recreation and leisure activities, transport and distribution trades and so on. These are the enduring activities of cities defined as an internal economy, drawing opportunity from the sheer density of population within them" (pg 24).

We have then a more place based approach here. However, small business does not uniformly thrive in cities. It is true that small business thrives in cities, especially in thriving areas. But when we turn to blighted or depressed areas, quite often firms cannot market at viable economies of scale and also they may find it

difficult to forge the necessary forward and backward linkages, so necessary for small business to survive. Thus once again we have a normative goal with an unclear path toward it. I would like to suggest that the gap signifies the need for a new concept, one that can facilitate the viability of 'internal economies' and their easy linkage into networked flows.

Graham and Healey (1999, pg 642) focus on the power of agency. They advocate that "planning practice should recognize how the relation within and between the layers of the power geometries of place are actively negotiated by the power of agency through communication and interpretation". They advocate the adoption of consensus building and conflict mediating skills and practices, "which leave behind mutual understanding of different points of view rather than increasing the entrenched divisions between winners and losers" (pg 642). Much work in this line has been done within the planning profession, looking into both the processes and institutional factors that might impede or encourage dialogue (Healey, 1999; 1998a; 1998b; 1996; 1992; Innes, 1995). However Graham and Healey also point out that "the time-scale of a landowner is different to that of a small builder. People's spatial reach varies in daily, weekly, annual and lifespan time" (pg 642). There are two questions for planning and governance that a consideration of agency raises. First, there is the issue of varying space-time scales and how they might be meshed together meaningfully, for unless sensitive institutional structures are in place to absorb space-time scale differences, systematic linkages and synergetic solutions may be impeded. Second, we also need strong institutional backing for not only facilitating micro-level transactions, but also for systematically linking it to larger macro level processes so that the richness of participatory democratic processes is retained in larger level processes and not just subsumed into top-down totalizing policies that function on representative democratic dynamics.

From the above review of time-space concepts in the normative literature within planning, it can be seen that a theoretical gap centres around ways to practically integrate multiple time-spaces of cities that define city life, with more distanced time-spaces of networks and global flows. The problem is one of accommodating difference, integrating marginality and thereby achieving social justice in tandem with a schema where processes may be externally and powerfully determined by networked connections that may only incidentally have a local presence, yet are important for the locality economically and culturally. In other

words, both *relative* time-space and *relational* time-space are stressed. Place, physical connections, continuity and proximity are as important as instantaneously defined time-spaces of relational space. As Kevin Robins (1995) asserts in relation to the influence of information technology, “through the development of new technologies, we are indeed, more and more open to experiences of de-realization and de-localization. But we continue to have physical and localized existences. We must consider our state of suspension between these two conditions” (quoted in Graham, 1998, pg 172).

I have discussed the problems in adopting extreme normative stand-points on either end of the continuum linking place to space. I have then discussed normative view-points with reference to four issues – the integration of multiple time-spaces into a whole, the issue of empowerment and inclusion of marginalized time-spaces into the whole, the issue of ensuring the complementarity and viability of varied time-spaces in city economics and finally the issue of ensuring that the diversity of individual time-space is retained without being masked over in institutional dynamics. With regard to each of the four issues I have suggested that it signifies a gap. We may perhaps need to look into yet another time-space concept in order to adequately address these issues.

The theoretical context and gap in planning literature towards which fractals contribute is described here. Fractals spaces provide a way of integrating multiplicity and specificity of spaces to global or networked spatial scales. The argument leading to this statement is the content of Chapter-7.

MATURANA'S CRITERIA FOR SCIENTIFIC EXPLANATION

Maturana's criteria for scientific explanation is explained here. According to Maturana (1992, pg 131,132), "if one shows how the entities brought forth by the observer in his or her distinctions in the praxis of living in language constitute a mechanism that gives rise as a consequence of its operation to language, to objects, and to observing, one shows the generative mechanism that gives origin to systems that do what they do so as living systems, indistinguishable from us. If this is done in the context of the satisfaction of the criterion of validation of scientific explanations, the generative mechanisms proposed are a scientific explanation of language, objects and observing, in the process that gives rise to the observer as a living entity. To do this through language as an observer does not constitute a contradiction because under no circumstance does an explanation replace what it explains – it only shows how it arises".

As regards the standards of scientific explanation that Maturana lays out, "scientific explanations are propositions of mechanisms that produce as a consequence of their operation the phenomena to be explained, and that are accepted as such when they are presented as part of the conjoined satisfaction of a particular set of four operational conditions realizable by the members of the community of observers that accepts them" (1992, pg 128). Maturana calls these observers 'standard observers' and the set of four conditions that must be satisfied 'criteria of validity of scientific explanations' (pg 128). This set of four criteria are detailed as-

- i. "the description of what a standard observer must do to experience (in his or her domain of experiences) the phenomena to be explained;
- ii. the proposition of a generative mechanism which, if it were allowed to operate, would generate as a consequence of its operation the phenomena to be explained in the domain of experience of a standard observer;
- iii. the deduction from the generative mechanism proposed in (ii), and from all the operational coherences that it entails in the domain of experiences of a standard

observer, of other phenomena and of the operational conditions that a standard observer must realize in his or her domain of experiences to experience them;

- iv. the experience by a standard observer in his or her domain of experience of the phenomena deduced in (iii).

If these four operations conditions are satisfied in the domains of experiences of the standard observers, and only as long as they are satisfied, (ii). is accepted as a scientific explanation in the community of standard observers' (pg 128).

**TERMINOLOGIES AND DEFINITIONS IN LUHMANN'S
AUTOPOIESIS**

Here I introduce terminologies and definitions of some key concepts in autopoiesis. The concepts that I introduce are by no means exhaustive of the terms used in autopoiesis. They are limited to fundamental concepts in autopoietic social systems and its exposition here helps provide an understanding of the precision of the theory. The terms clarified herein are system and environment; elements, relations and conditioning; complexity; differentiation; meaning; communications; actions; events and structure.

- a. *System and Environment*: The system and its environment and the difference between them is 'the point of departure' (Luhmann, 1995, pg 16) for all systems theory today. A system is essentially formed by a distinction, and indication of one side of the distinction, not the other (Luhmann, 2000. pg 36). The unmarked side is the environment. The environment of each system is then different and it is the system that constitutes the unity of the environment for itself. However, "it is not a unity capable of operations; it cannot perceive, have dealings with, or influence the system" (Luhmann, 1995, pg 181). The formation of the system enables a reduction in complexity and hence the environment is usually always more complex than the system itself (unless it is itself organised into systems) (pgs 26, 182.). All consequent actions of the system are henceforth directed towards maintaining this distinction with the environment and thus preserving its identity. But, "the system is neither ontologically nor analytically more important than the environment; both are what they are only in reference to each other" (pg 177). The system/environment difference is also not an ontological difference. It is actually a "correlative to the operation of observation, which introduces this distinction" (pg 178). This act of observation draws the boundaries by observing the way the system itself carries out its operations. Thus actually it is the system itself that creates the distinction and maintains its boundaries (Luhmann, 2000, pg 36).

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- b. *Elements, Relations and Conditioning:* Elements of a system are “what functions for a system as a unity that cannot be further dissolved” (Luhmann, 1995, pg 22). It must be pointed out here that further dissolution of an element is arguably possible, but then one needs to move into a different ontological level of analysis. The element of a system “is constituted as a unity only by the system that enlists it as an element to use it in relations” (pg 22). Thus “whatever functions at any time as an element cannot be determined independently of systems” (pg 24). This relativizes the concept of an element, de-ontologising it. Further the element becomes emergent by constitution from above, not below. Relations are what elements are enlisted into, so that the system can use it as a unity (pg 22). However systems are not just elements and relations. It is a regulation of the connections among relations as well. This is known as conditioning. Thus “a determinate relation among elements is realized only under the condition that something else is or is not the case” (pg 23). When successful they act as constraints. Thus “systems must at least be collections of relations among elements, and ...they typically distinguish themselves through further conditionings and therefore through greater complexity” (pg 23). In social systems, communications not actions constitute elements, while in psychic systems, thoughts constitute elements.
- c. *Complexity:* There are two types of complexity that a system deals with. In the first, the definition of complexity is conceived in terms of elements and relations. Thus Luhmann maintains “we will call an interconnected collection of elements ‘complex’ when, because of immanent constraints in the element’s connective capacity, it is no longer possible at any moment to connect every element with every other element” (pg 24). This ‘immanent constraint’ refers to the complexity of the elements themselves, which are decomposable at lower levels of analysis. The element though complex at lower levels is constituted as a unity at the level of analysis of the system in which it serves as an element. Thus for every higher level of formation, complexity grows, as the elements that make up the system itself have to be complex. Complexity here then also means ‘being forced to select’ (pg 25), and “‘organized complexity’ means nothing more than complexity with selective relations among its elements” (pg24). This is one type of selection. It points to the possibility of very different systems being possible at higher levels by means of different selections from the same set of elements. In the second

instance, the concept of complexity relates to the system/environment difference. We have seen that for a system, the environment is always more complex, because very simply following Ashby's principle¹, systems lack the 'requisite variety' to enable them to react to everything in the environment. The system's inferiority in complexity vis-à-vis its environment, is compensated by strategies of selection of ways in which it will relate to the environment. Thus we have another selection taking place here. "The system's own complexity already forces it to make selections; the order the system chooses in relating its elements results from the difference in complexity between it and its environment. But they form two sides of the same fact, because a system can become complex only by selecting an order" (pg 25,26). The one refers to environmental complexity and the other refers to system complexity, with the one enabled by the other. "In both cases the difference between two complexities is the real principle compelling (and therefore giving form to) selection" (original brackets) (pg 27).

d. *Differentiation*: Again there are two types of differentiation that a system employs. The first relates to system/environment relationships. The environment for every system is bound to contain other systems and systems within it. Depending on the depth and level of understanding of the system under consideration, these other system/environments can be viewed as such. "It can distinguish the systems in *its* environment from *their* environment" (pg 187). The environment then appears differentiated into various system/environment perspectives that may overlap. Strategies of aggregation are then formed by the system to cope with this. It combines and orders system/environment relations by some model (same type/different, near/far, friend/foe, etc (pg 188)) that is dependent on its own 'differentiation schemata' (pg 187). This is related to "the requirements for the system to *observe* the environment and is both stimulated and limited by this" (pg 189). This is external differentiation. The second type of differentiation – internal differentiation - relates to the system's internal autopoietic reproduction. It occurs within the boundaries of the already constituted system. This is treated as a special domain within which further systems are formed. The systems thus formed are therefore secured by the larger system boundaries and are similar in some respects. This presupposes some

¹ Ashby's Law of Requisite Variety (1956) claims that for the 'control' of its environment, the system requires a greater amount of relations- greater complexity than its environment (Jantsch, 1980)

capacity for regulation (pg 190). In internal differentiation, the system repeats the formation of the larger overall system within itself many times over. It multiplies its own reality as different distinctions are now available. Thus “the social system of modern society is at once the political function system and its environment within society, the economic function system and its environment within society, the religious function system and its environment within society and so on” (pg 191). Every subsystem recreates the overall system for itself. The process of internal differentiation occurs at random, but there is a selection that chooses what is to be permanent. Luhmann suggests when external differentiation is complex and internal differentiation becomes greater, a transition to functional differentiation becomes necessary, and conversely a drive to functional differentiation intensifies external differentiation. Thus, the schematic of differentiation is largely internally and autonomously chosen, guided by internal functional problems. An increase in internal differentiation also affects possibilities for acquiring information as the overall system that maintains the boundaries can now distinguish and connect environmental phenomena according to different perspectives it has chosen for itself. Thus “whatever functions as an external system boundary no longer filters something out, but instead allows more to pass through” (pg 194) thus increasing the sensitivity of the system to the environment.

- e. *Meaning*: Meaning in systems theory takes off from a phenomenological viewpoint. Meaning stands as a focal point with other possibilities indicated marginally within a horizon. In Luhmann’s words “one could say that meaning equips an actual experience or action with redundant possibilities” (pg 60). This implies a selection from among possibilities; and the existence of possibilities in turn, by its latency or redundancy, makes mistakes possible. Every meaning selected suggests specific possibilities of connection, and makes other possibilities impossible, difficult, remote or excluded. The selection of meaning occurs only by reference to some other meaning. Thus, “every intention of meaning is self-referential” (pg 61). Not all systems are meaning processing systems. But social and psychic systems are, and for them meaning is the only possibility for viewing the world, overlapping with system/environment boundaries. Thus boundaries for them are “constituted in meaning” (pg 61) and they can “never experience or act in a manner that is free from meaning” (pg 62).

f. *Communication*: Communication is again a process of selection, whereby something from the referential horizon, that it itself constitutes, is chosen. It is conceptualized as a unity of a three pronged selection. The first is the selection of the information, the second is the selection of utterance, the third is the selection of understanding, with communicative success overall being the successful coupling of these selections. Since communication entails more selections than just the selection of utterance alone, it is not by nature just an action event. The notion is by itself symmetrical around the three selections. This means “at one moment the bottleneck and the sticking point may reside in what is capable of being understood; at another, new information is urgently needed; soon after, the requirement that communication be uttered supervenes” (pg 165). Communicative systems are regarded as the only means by which social systems can decompose into elements (pg 164). They then need to be continuously reproduced, in the sense of “reflexive production, production out of products” (pg 49). This reflexivity however, creates a need for self-observation and self-description, which is only possible if it is reduced to action. This is because first, “actions are easier to recognize and deal with than communication” (pg 168) and second, it “facilitates a temporal asymmetrization of social relations” (pg 169) which means while communication involves a certain degree of uncertainty regarding the management of the three components (something can be uttered but not understood or an utterance can be even denied or corrected) action fixes things in time making something follow from something chronologically. There is thus a temporal asymmetry in action that influences social relations. It is only through this process that action becomes a necessary component of social systems for “only by action does communication become fixed at a point in time as a simple event” (pg 165). It plays a supportive role to the final element in social autopoiesis, which is communication.

g. *Action*: Actions are constituted by processes of attribution and come about only if selection can be attributed to the system (pg 165,166). Thus, “what an individual action is can be ascertained only on the basis of a social description” (pg 166) for social systems. The necessity of this description requires a selection, which is then a simplification from complexity. Action is thus also another form of selection. For Luhmann, this is connected with the autopoietic need of societies. Thus, “the continual production of individual actions within social systems can

best be conceptualised as the performance of a concurrent self-observation by which elemental units are marked in a way that produces support points for further connective action” (pg 166,167). This connective action is the requirement for autopoiesis. “ A social system is thereby constituted as an action system, but it must presuppose the communicative context of action. Both action and communication are necessary, and both must constantly cooperate in order to enable reproduction out of the elements of reproduction” (pg 169).

- h. *Events and Structure:* Following Allport (1940), ‘events’ are defined by Luhmann as ‘an indivisible, all-or-nothing happening’ (pg287). It is a ‘non-quantifiable happening’, which will on a spatio-temporal model appear just as a point. Events pass away in time and nothing can change their relationship to the course of time. However every event by giving itself up from the present to the past, brings a change to the past and the future. “This minimal displacement can change the perspective of relevance that structures and bounds the horizon of past and future” (pg 287). Because of this capacity, systems need to regulate events if they are to form any structure. Further to the general understanding of structure, in normal sociological theoretical terms, as being an abstraction from reality constituted of elements and relations which endure through time, in the autopoietic conception, structure becomes a ‘*selection from a plurality of combinatorial possibilities*’ and it is ‘*this selection (that) can be held constant across change in elements*’ (original italics) (pg 283). Thus the concept denotes constraint – ‘*how permissible relations are constrained within the system*’ (original italics) (pg 283).

REFERENCES

- Abbott,A,D (2001) *Chaos of Disciplines*, University of Chicago Press: Chicago
- Abraham,R.H and Shaw,C.D (1985) *Dynamics – The Geometry of Behaviour. Part-2. Chaotic Behaviour* Aerial Press: California.
- Abram,S and Cowell,R (2004) ‘Learning Policy – The Contextual Curtain and Conceptual Barriers’ In *European Planning Studies*, Vol 12, No 2, pgs 209-228.
- Ackoff,R.L (1974) *Redesigning the Future – A Systems Approach to Societal Problems*, John Wiley & Sons : London
- Adams,P (1995) ‘A Reconsideration of Personal Boundaries in Space-Time’. In *Annals of the Association of American Geographers*, 85(2) 267-85
- Alexander,E.R (1995) *How Organizations Act Together-Interorganizational Coordination in Theory and Practice*, Gordon and Breach Publishers: Amsterdam
- Alexander,G (2001) ‘Institutions, Path Dependence, and Democratic Consolidation’ In *Journal of Theoretical Politics*, 13(3) pgs 249-70
- Alexander,J.C & Colomy,P (1998) ‘Traditions and Competition: Preface to a Postpositivist Approach to Knowledge Cumulation’ In Alexander,J.C *Neofunctionalism and After* Blackwell Publishers: Oxford.
- Alexander,J.C (1990) ‘Beyond the Epistemological Dilemma: General Theory in a Postpositivist Mode’ In *Sociological Forum*, Vol 5, No 4, pgs 531-544.
- Alexander,J.C (1998) *Neofunctionalism and After* Blackwell Publishers: Oxford.
- Alfasi,N (2003) ‘Is Public Participation Making Urban Planning More Democratic? – The Israeli Experience’ In *Planning theory and Practice*, Vol 4, No 2, pgs 185-202.
- Allen,P,M (1997) *Cities and Regions as Self-Organizing Systems: Models of Complexity*, Gordon and Breach Science Publishers: Amsterdam.
- Alvesson,M and Skoldberg,K (2000) *Reflexive Methodology- New Vistas for Qualitative Research*, Sage Publications: London
- Amin,A and Graham,S (1997) ‘The ordinary city’. In *Transactions of the Institute of British Geographers. NS 22: 411-29.*

-
- Amin,A, Massey,D and Thrift,N (2000) *Cities for the Many Not the Few*. Policy Press: Bristol.
- Aristotle (2004) 'Selections from Categories' In Crane,T and Farkas,K (eds) *Metaphysics – A Guide and Anthology* Oxford University Press: Oxford
- Arnoldi,J (2001) 'Niklas Luhman- An Introduction' In *Theory, Culture and Society*, Vol 18(1), pgs 1-13.
- Arrow,K (1951) *Social Choice and Institutional Values*, John Wiley: New York
- Arthur,W.B (1999) 'Complexity and the Economy'. In *Science* Vol 284, April,2nd.
- Bailey,K.D (1997) 'The Autopoiesis of Social Systems: Assessing Luhmann's Theory of Self-Reference' In *Systems Research and Behavioral Science* March-April, 14, 2 pgs 83-
- Bak,P (1997) *How Nature Works – The Science of Self-organised Criticality* Oxford University Press: Oxford.
- Balan,P.C and Vasu,K (2000) 'Nirmana Pravarthikaludae Nirvahanam'(Implementation of Construction Works) In Sreedharan,E.M, Prasad & M.K, Manmohan,V,G (eds) '*Janakeeyasoothranam, Oru Swayam Vilayiruthal*' (People's Planning- A Self-assessment) (Malayalam) People's Planning Campaign, Kerala State Planning Board: Trivandrum
- Batty,M and Longley,P,A (1987) 'Urban Shapes as Fractals' In *Area* 19(3), pgs 215-221
- Batty,M and Xie,Y,C (1999) 'Self –organized criticality and urban development' In *Discrete Dynamics in Nature and Society*, 3(2-3), Pgs 109-124
- Bausch,K (2002a) 'In Response to Robert Kay: Luhmann's Ontology, Ontogeny, and Epistemology' In *Systems Research and Behavioural Science* 19, pgs 599-602
- Bausch,K. (2002b) 'Roots and Branches: A Brief, Picaresque, Personal History of Systems Theory' In *Systems Research and Behavioural Science* 19, 417-428
- Benton,T (1998) 'Realism and Social Science: Some Comments on Roy Bhaskar's 'The Possibility of Naturalism'. In Archer,M, Bhaskar,R Collier,A, Lawson,T and Norrie,A *Critical Realism –Essential Readings* Routledge: London
- Bernstein,R.J (1983) *Beyond Objectivism and Relativism*. University of Pennsylvania Press: Philadelphia
- Bertalanffy, Ludwig von (1951) 'General Systems Theory: A New Approach to Unity of Science' *Human Biology*, Vol 23, Dec 303-361.
- Bertalanffy, Ludwig von (1968) *General Systems Theory* George Braziller: New York

-
- Bertaux,D (1979) 'Ecire la sociologie' *Information sur les sciences sociales* (1980),
'L' Approche biographique', *Cahiers internationaux de sociologie*, 69
- Bhaskar,R (1979) *The Possibility of Naturalism : A Philosophical Critique of the
Contemporary Human Sciences*, Harvester Press: Hassocks
- Bhaskar,R (1997) *A Realist Theory of Science* Verso:London
- Bhaskar,R (1998a) 'Philosophy and Scientific Realism' In Archer,M, Bhaskar,R
Collier,A, Lawson,T and Norrie,A *Critical Realism –Essential Readings*
Routledge: London
- Bhaskar,R (1998b) 'The Logic of Scientific Discovery' In Archer,M, Bhaskar,R
Collier,A, Lawson,T and Norrie,A *Critical Realism –Essential Readings*
Routledge: London
- Bhaskar,R (1998c) 'Societies' In Archer,M, Bhaskar,R Collier,A, Lawson,T and
Norrie,A *Critical Realism –Essential Readings* Routledge: London
- Bhaskar,R (1998d) 'General Introduction' In Archer,M, Bhaskar,R Collier,A,
Lawson,T and Norrie,A *Critical Realism –Essential Readings* Routledge:
London
- Black, M (1962), *Models and Metaphors*. Cornell University Press: Ithaca
- Black,M (1993) 'More about Metaphor'. In Ortony,A (ed) *Metaphor and Thought*
Cambridge University Press: Cambridge, pgs 19-41
- Blauberg,I.V, Sadovsky,V.N, Yudin,E.G (1977) *Systems Theory – Philosophical and
Methodological Problems* Progress Publishers: Moscow.
- Blomley,N (1994) *Law, Space, and the Geographies of Power*, Guildford Press:
London.
- Blomley,N and Clark,G (1990) 'Law Theory and Geography' *Urban Geography*, 11,
pgs 433-446.
- Boland,P (2001) 'Community Involvement In Spatial Planning: Economic
Development in Merseyside' In Albrechts, Alden and Pires (2001) *The
Changing Institutional Landscape of Planning* Ashgate: Aldershot.
- Booher,D,E and Innes,J,E (2002) 'Network Power in Collaborative Planning' In
Journal of Planning Education and Research, Vol 21, pgs 221-236
- Booth,P (1999) 'From Regulation to Discretion: The Evolution of Development
Control in the British Planning System 1909-1947'. In *Planning Perspectives*
Vol 14 (3) pgs 277-289.

-
- Booth,P (2002) 'From Property Rights to Public Control' In *Town Planning Review*, Vol 73(2) pgs 153-170.
- Booth,P (2003) *Planning by Consent*. Routledge: London.
- Boulding,K.E (1956) 'General Systems Theory – The Skeleton of Science'. In *Management Science* Vol 2, No 3. pgs 197-208
- Bourdieu,P (1998) *Practical Reason – On the Theory of Action* Polity Press: Cambridge
- Boyd, R (1993) 'Metaphor and Theory Change: What is "Metaphor" a Metaphor For?', In Ortony, A (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 481-532.
- Braithwaite,R.B (1960) *Scientific Explanation* Harper Torchbooks : New York.
- Brans,M and Rossbach,S (1997) 'The Autopoiesis of Administrative Systems; Niklas Luhmann on Public Administration and Public Policy' In *Public Administration* Vol 75, pgs 417-439.
- Briggs,J and Peat,F.D (1990) *Turbulent Mirror* Perrenial Library: London
- Broad,C.D (1999) 'Mechanism and Emergentism' In Kim,J and Sosa,E (eds) *Metaphysics – An Anthology* Blackwell Publishing: Oxford.
- Bryer,R.A and Kistruck,R (1976) 'Systems Theory and Social Science' Working Paper 735/76 Warwick University School of Industrial and Business Studies
- Bunge,M (1973) *Method, Model and Matter* Reidel : Boston
- Bunge,M (1997) 'Mechanisms and Explanation' *Philosophy of the Social Sciences* 27(4): 410-65
- Bunge,M (2004) 'Clarifying Some Misunderstandings about Social Systems and their Mechanisms' In *philosophy of the Socail Sciences* Vol:34, No 3 September 371-381.
- Byrne,D (1997) ' Chaotic Places or Complex Places – Cities in a Post Industrial Era'. In Westwood,S and Williams,J (eds) *Imagining Cities*. London: Routledge, pgs 50-70
- Byrne,D (1998) *Complexity Theory and the Social Sciences- An Introduction* Routledge: London
- Byrne,D (2001) 'What is Complexity Science? – Thinking as a Realist About Measurement and Cities and Arguing for Natural History' In *Emergence* 3(1) pgs 61-76

-
- Byrne,D (2003) 'Complexity Theory and Planning Theory: A Necessary Encounter'.
In *Planning Theory*, Vol 2, Issue 3, 171-178.
- Camhis,M (1979) *Planning Theory and Philosophy* Tavistock Publications: London
- Campbell,H and Marshall,R (2000) 'Public Involvement and Planning: Looking
Beyond The One to the Many'. In *International Planning Studies*, Vol 5, No 3,
pgs 321-344
- Campbell,N,R (1957) *Foundations of Science – The Philosophy of Theory and
Experiment* Dover: New York.
- Casti,J.L (1994) *Complexification*, Abacus: London
- Chambers,R (1995) '*Poverty and Livelihood- Whose Reality Counts?* (University of
Sussex: Brighton.
- Chathukulam,J and John,M.S [2002] 'Five Years of Participatory Planning in Kerala
– Rhetoric and Reality'. In *Economic and Political Weekly December 7th*
- Checkland, P (1981a) *Systems Thinking Systems Practice* John Wiley and Sons: New
York
- Checkland, P.B (1981b) 'Science and the Systems Movement'. In Open Systems
Group (ed) *Systems Behaviour* Harper & Row, Publishers: London
- Chettiparamb,A (1999) '*Proceedings of 'Learning by Doing' Workshop on District
Spatial Plan- Trichur*' Kerala, Institute of Local Administration, Trichur.
- Chouinard,V (1994) 'Geography, Law and Legal Struggles: Which Ways Ahead?' In
Progress in Human Geography, 18, pgs 415- 440.
- Churchman,C.W (1979) *The Systems Approach and Its Enemies* Basic Books Inc :
New York
- Cicourel,A.V (1981) 'Notes on the integration of micro- and macro-levels of analysis'
In Knorr-Cetina,K and Cicourel,A.V (eds) *Advances in Social Theory and
Methodology – Towards an Integration of Micro- and Macro- Sociologies*
Routledge & Kegan Paul: London
- Cilliers,P (2000) *Complexity and Post Modernism- Understanding Complex Systems*
Routledge: London
- Coleman,James,S (1986) 'Social Theory, Social Research and a Theory of Action'. In
American Journal of Sociology 91(6): 1309-35
- Collins,R (1981) 'Micro-translation as a theory-building strategy' In In Knorr-
Cetina,K and Cicourel,A.V (eds) *Advances in Social Theory and Methodology –*

Towards an Integration of Micro- and Macro- Sociologies Routledge & Kegan Paul: London

Committee on decentralisation of Powers, Final Report, Vol-1, 1997, Government of Kerala.

Cooke,B and Kothari,U (eds) (2001). *Participation: The new tyranny?* Zed Books: London

Corning,P,A (2002) ‘Devolution’ as an Opportunity to Test the ‘Synergism Hypothesis’ and a Cybernetic Theory of Political Systems’ In *Systems Research and Behavioural Sciences* 19, pgs 3-26.

Cox,R (2004) ‘The Path-dependency of an Idea: Why Scandinavian Welfare States Remain Distinct’ In *Social Policy and Administration, Vol 38, No2*, pgs 204-219

Craib,I (1992) *Modern Social Theory – From Parsons to Habermas*. Harvester Wheatsheaf: London

Davidoff,P (1996) ‘Advocacy and Pluralism in Planning’ In Campbell,S and Fainstein,S,S (eds) *Readings in Planning Theory* (First edition) Blackwell:Oxford, pgs 305-322

Davidson,D (1980) *Essays on Actions and Events* Clarendon Press: oxford.

Davies,P and Gribbin,J (1992) *The Matter Myth – Beyond Chaos and Complexity*. Penguin Books: London.

Dematteis,G (1994) ‘Global Networks, Local Cities’. In *Flux*, 15, 17-24

Ditto,W.L and Pecora,L.M (1993) ‘Mastering Chaos’. In *Scientific American* Aug 1993.

Dubin, R (1978) *Theory Building* The Free Press: London

Dunsire,A (1996) ‘Tipping the Balance: Autopoiesis and Governance’. In *Administration and Society*, Vol 28(3), pgs 299-334.

Durant,R.F (1992) ‘Beyond Markets, Hierarchies, or Clans: Lessons from Natural Resource management in the Reagan Era’ In *Administration and Society*, 24(3) 346- 375)

Economic Review, 2001, Kerala State Planning Board, Trivandrum

Economic Review, 2002, Kerala State Planning Board, Trivandrum

Economic Review, 2004, Kerala State Planning Board, Trivandrum

Eve,R,A, Horsfall,S and Lee,M,E (eds) (1997) *Chaos Complexity and Sociology: Myths, Models and Theories*, Sage Publications: California

-
- Flake,G.W (1998) *The Computational Beauty of Nature – Computer Explorations of Fractals, Chaos, Complex Systems and Adaptation* MIT Press: London.
- Flood,R.L and Carson,E.R (1988) *Dealing with Complexity: An Introduction to the Theory and Application of Systems Science* Plenum Press: New York
- Flyvbjerg,B and Petersen, V.C (1982) ‘Planning in the 33 Years after ‘1984’’. In Healey,P, McDougall,G and Thomas,M.J *Planning Theory – Prospects for the 1980s*. Pergamon Press: Oxford.
- Fischer,F and Forrester,J (eds) (1993), *The Argumentative Turn in Policy Analysis and Planning*, UCL Press: London.
- Forester,J (1993) ‘Learning From Practice Stories: The Priority of Practical Judgement’ In Fischer,F and Forrester,J (eds) *The Argumentative Turn in Policy Analysis and Planning*, UCL Press: London.
- Forrester, J (1999) *The Deliberative Practitioner: Encouraging Participatory Planning Processes* The MIT Press: London.
- Franke,R and Chasin,B (2000) ‘Is the Kerala Model Sustainable? Lessons from the Past, Prospects for the Future’ In Parayil,G Kerala-The Development Experience – Reflections on Sustainability and Replicability, Zed Books: London & Economic Review 2002,GoK.
- Friedman,J (1987) *Planning in the Public Domain – From Knowledge to Action* Princeton University Press: Princeton.
- Friedmann,J (1993) ‘Toward a Non-Euclidean Mode of Planning’. In *Journal of the American Planning Association; Autumn 93, Vol 59 Issue 4; 482-85*
- Friedmann,J (1994) ‘Planning Education for the Late Twentieth Century: An Initial Inquiry’ In *Journal of Planning Education and Research*, Vol 14(1), pgs 55-64
- Friedmann,J (1998) ‘The New Political Economy of Planning: The Rise of Civil Society’ In Douglass,C,M and Friedmann,J (eds) *Cities for Citizens*, John Wiley: Chichester.
- Frontline (2000) , ‘Democratic Decentralisation - A New Development Culture is Coming Up’ - Interview of Dr T.M. Thomas Isaac to Parvathi Menon, *Vol 17 Issue 13 June 24-July 7*,
- Gentner,D (1982) ‘Are Scientific Analogies Metaphors?’. In Miall,D.S (ed) *Metaphor; Problems and Perspectives* The Harvester Press: Sussex, pgs 106-132.

-
- Gentner,D and Jeziorski,M (1993) 'The Shift from Metaphor to Analogy in Western Science' In Ortony,A (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 447-480
- Georgiou,I (2000) 'The Ontological Constitution of Bounding- Judging in the Phenomenological Epistemology og von Bertalanffy's General System Theory' In *Systemic Practice and Action Research* Vol 13, No 3 pgs 391-424
- Giddens, A and Turner,J (1987) 'Introduction' In Giddens,A and Turner,J (eds) *Social Theory Today* Polity Press: Oxford.
- Giddens,A (1984) *The Constitution of Society –Outline of the Theory of Structuration* Polity Press: Cambridge.
- Giddens,A (1990) *The Consequences of Modernity* Polity Press: Cambridge.
- Giddens,A (1993) *New Rules of Sociological Method- A Positive Critique of Interpretive Sociologies* (Second edition) Polity Press: Cambridge.
- Giddens,A and Turner,J.H (1987) 'Introduction'. In Giddens,A and Turner,J.H (eds) *Social Theory Today* Polity Press: Oxford.
- Gleick,J (1987) *Chaos – Making a New Science* Abacus : London
- Glucksberg,S and Keysar,B (1993) 'How Metaphors Work'. In Ortony,A, (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 401-424.
- Goatly,A (1997) *The Language of Metaphors* Routledge: London
- Gouldner,A.W (1970) *The Coming Crises of Western Sociology* Heinemann: London
- Government of India (1992a), *Seventy Fourth Constitutional Amendment Act*: New Delhi
- Government of India (1992b), *Seventy Third Constitutional Amendment Act*: New Delhi
- Graham,S and Healey,P (1999) 'Relational Concepts of Space and Place: Issues for Planning Theory and Practice'. In *European Planning Studies Vol 7, No 5; 623-46*
- Graham,S (1998) 'The End of Geography or the Explosion of Place? Conceptualizing Space, Placeand Information Technology'.In *Progress In Human Geography* 22, 2; 165-85
- Green,T.F (1993) 'Learning without metaphor' In Ortony,A, (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 610-620.
- Gregersen,N.H (2004) 'Complexity: What is at Stake for Religious reflection?' In Niekerk,K. K and

-
- Gribbin,J (2004) *Deep Simplicity, Chaos, Complexity and the Emergence of Life*,
Allen Lane: London
- Gumbrecht,H,U (2001) 'How is our Future Contingent? – Reading Luhmann Against
Luhmann' In *Theory, Culture and Society Vol 18 91*). Pgs 49-58.
- Gurian,P,H, Elliott,E and Everett,E (1996) 'An Application of Non-Linear Dynamics
to the Presidential Nomination Process' *Behavioural Science*, 41, pgs 271-289
- Habermas,J (1974) *Theory and Practice*, (Translated by Viertel,J) Heinemann:
London.
- Habermas,J (1987a) *Knowledge and Human Interests*, (Translated by Shapiro,JJ),
Polity Press: Cmbridge.
- Habermas,J (1987b) *The Philosophical Discourse of Modernity*. (Translated by
Lawrence, F,G), MIT Press: Cambridge.
- Habermas,J (1992) *Toward a Rational Society- Student Protest, Science and Politics*,
(Translated by Shapiro,JJ), Beacon Press: Boston.
- Haefele,E.T (1973) *Representative Government and Environmental Management*,
John Hopkins University Press, Baltimore.
- Hamilton,P (1985) *Readings from Talcott Parsons* Ellis Horwood Limited: Chichester
and Tavistock Publications: London.
- Hammond, D (2002) 'Exploring the Geneology of Systems Thinking' In *Systems
Research and Behavioural Science* 19, 429-439
- Hammond,D (2003) *The Science of Synthesis- Exploring The Social Implications of
General Systems Theory* University Press of Colorado: Colorado.
- Hare R.M (1952) *The Language of Morals* Oxford University Press: London
- Hare,R.M (1984) 'Supervenience' *Proceedings of the Aristotelian Society*, Vol 58, pg
1-16
- Harre, R (1972) *The Philosophies of Science: An Introductory Survey* Oxford
University Press: London
- Harre,R (1988) 'Modes of Explanation' In Hilton,D.J (ed) *Contemporary Science and
Natural Explanation – Commonsense Conceptions of Causality* The Harvester
Press: Sussex
- Harre,R and Bhaskar,R (2001) 'How to Change Reality: Story vs Structure – A
Debate between Rom Harre and Roy Bhaskar'. In Lopez,J and Potter,G (eds)
After PostModernism – An Introduction to Critical Realism The Athlone Press:
London.

-
- Harris,N (2001) 'Collaborative Planning from Theoretical Foundations to Practice Forms' In Allmendiger,P and Tewdwr-Jones,M (eds) *Planning Futures- New Directions for Planning Theory*, Routledge: London, pgs 21-43
- Harrison,P (2001) 'A Pragmatic Attitude to Planning' In In Allmendiger,P and Tewdwr-Jones,M (eds) *Planning Futures- New Directions for Planning Theory*, Routledge: London, pgs 157-171.
- Harvey,D (1969) *Explanation in Geography* Edward Arnold: London
- Harvey,D (1993) 'From Space to Time and Back Again: Reflections on the Condition of Postmodernity' In Bird,J, Curtis,B, Putnam,T, Robertson,G and Tickner,L [eds].*Mapping the Futures – Local Cultures, Global Change*. Routledge: London.
- Harvey,D (1996a) *Justice, Nature and the Politics of Difference*. Blackwell: Oxford
- Harvey,D (1996b) 'On Planning the Ideology of Planning' In Campbell,S and Fainstein,S,S (eds) *Readings in Planning Theory*, Blackwell :Oxford.
- Hayek, F,A (1996) *Individualism and Economic Order*, University of Chicago Press: Chicago
- Hayles,N.K (1990) *Chaos Bound – Orderly Disorder in Contemporary Literature and Science*. Cornell University Press: London.
- Hayles,K (2000) 'Making the Cut: The Interplay of Narrative and System, or What Systems Theory Can't See' In Rasch,W and Wolfe,C (eds) *Observing Complexity – Systems Theory and Postmodernity* University of Minnesota press: London.
- Healey,P (1992) 'Planning Through debate: The Communicative Turn in Planning Theory'. In *Town Planning Review, Vol 63, 2*.
- Healey,P (1996) 'The Communicative Turn in Planning Theory and Its Implications for Spatial Strategy Formation'. In *Environment and Planning B. Planning and Design, vol 23, 217-34*
- Healey,P (1998a) 'Collaborative planning in a Stakeholder Society' In *Town Planning Review 69[1]1-21*.
- Healey,P (1998b) ' Building Institutional Capacity through Collaborative Approaches to Urban Planning'. In *Environment and Planning A, Vol 30, 1531-46*.
- Healey,P (1999) 'Institutionalist Analysis, Communicative Planning and Shaping Places'. In *Journal of Planning Education and Research 19, 111-21*.

-
- Healey,P (2000)'Planning in Relational Space and Time: Responding to New Urban Realities'. In Bridge,G and Watson,S [eds] *A Companion to the City*. Blackwell: Oxford.
- Healey,P (2002) 'On Creating the 'City' as a Collective Resource'. In *Urban Studies*, Vol 39, No 10, 1777-1792.
- Healey,P (2004) 'The Treatment of Space and place in the New Strategic Spatial planning In Europe'. In *International Journal of Urban and Regional Research*, Vol 28.1, 45-67.
- Hedstrom,P and Swedberg,R (1996) 'Social Mechanisms'. In *Acta Sociologica* 39 (3) 281-308
- Hempel, CG (1959) 'The Logic of Functional Analysis' in Gross,L (ed) *Symposium on Sociological Theory*. Evanston
- Herbert-Young,N (1998) 'Central Government and Statutory Planning Under the Town Planning Act, 1909' In *Planning Perspectives* 13(4) pgs 341-355.
- Hester,M,B (1967) *The Meaning of Poetic Metaphor*, Mouton: The Hague
- Hetherington,K (1997) *The Badlands of Modernity: Heterotopia and Social Ordering*. Routledge; London.
- Hodgkiss,P (2001) 'The Intersecting Paths of Critical Relations: Multiple Realities, The Inner Planet and Three Dimensional Worlds' In Lopez,J and Potter,G (eds) *After PostModernism – An Introduction to Critical Realism* The Athlone Press: London.
- Holland,J.H, Holyoak,K.J, Nisbett,R.E &Thagard,P.R (1989) *Induction – Processes of Learning, and Discovery* MIT Press: London.
- Holton, R.J (2001) 'Talcott Parsons: Conservative Apologist or Irreplaceable Icon'. In Ritzer,G and Smart,B (eds) *Handbook of Social Theory* Sage Publications: London
- Hopkins,L.D (2001) *Urban Development- The Logic of Making Plans*Island Press: London
- Horgan,J (1995) 'From Complexity to Perplexity' In *Scientific American*, 272, pgs 74-79
- Hunt,S.D and Menon,A (1995) 'Metaphors and Competitive Advantage: Evaluating the Use of Metaphors in Theories of Competitive Startegy'. In *Journal of Business Research* 33, pgs 81-90

-
- Imrie,R and Thomas,H, (1997) 'Law, Legal Struggles and Urban Regeneration: Rethinking the Relationships' In *Urban Studies*, Vol 34 No 9, Pgs 1401-1418.
- Imrie,R and Thomas,H (eds) (1999) '*British Urban Policy –An Evaluation of the Urban development Corporations*, Sage Publishers: London
- Inayatullah,S (1994) 'Life, the Universe and Emergence'. In *Futures* 26(6).
- Innes,J (1995) 'Planning Theory's Emerging Paradigm'. In *Journal of Planning and Education and Research*, 14[3] 183-90.
- Innes,J.E and Booher,D.E (1999) 'Consensus Building and Complex Adaptive Systems – A Framework for Evaluating Collaborative Planning'. In *Journal of the American Planning Association* Vol 65, No 4, pgs 412 – 423.
- Innes,J,E and Booher,D,E (2000) 'Indicators for Sustainable communities: A Strategy Building on Complexity Theory and Distributed Intelligence' In *Planning Theory and Practice*, Vol 1(2) pgs 173-186.
- Innes.J.E and Booher,D.E (2001) 'Metropolitan Development as a Complex System; A New Approach to Sustainability', In Madanipour,A, Hull,A and Healey,P (eds) *the Governance of Place: Space and Planning Processes*. Aldershot: Ashgate, pgs 239-264
- Isaac,TTM and Franke, RW; (2000) *Local Democracy and Development – People's Planning for Decentralized Planning in Kerala*. India: Left Word.
- Jackson,M.C (2001) 'Systems Thinking and the Social Sciences' In Ragsdell, G and Wilby,J (eds) *Understanding Complexity* Kluwer Academic/ Plenum Publishers: New York
- Jantsch,E (1980) *The Self-Organising Universe- Scientific and Human Implications of the Emerging Paradigm of Evolution* Pergamon Press: Oxford.
- Jensen,H.S (2004) 'Complexity and Non-Completeness' In Niekerk,K. K and Buhl,H (eds) *The Significance of Complexity – Approaching a Complex World Through Science, Theology and the Humanities* Ashgate: Aldershot.
- Jessop,B (2001a) 'Regulationist and Autopoieticist Reflections on Polanyi's Account of Market Economies and the Market Society' In *New Political Economy* Vol6, No 2, pgs 213-232.
- Jessop,B (2001b) 'State Theory, Regulation and Autopoiesis: Debates and Controversies' In *Capital and Class*, 75, pgs 83-92.

-
- Kast,F.E and Rosenzweig,J.E (1981) 'The Modern View: A Systems Approach'. In Open Systems Group (ed) *Systems Behaviour* Harper & Row, Publishers: London
- Kay,R (2001) 'Are Organizations Autopoietic? A Call for New Debate' In *Systems Research and Behavioural Science* 18, 461-477.
- Kay,A (2003) 'Path Dependency and the CAP' In *Journal of European Public Policy*, 10:3, June, pgs 405-420.
- Kerala Decentralisation Support Programme – Phase-2 Proposal* (2003) , Government of Kerala, Trivandrum
- Kickert,W,J,M (1993) 'Autopoiesis and The Science of (Public) Administration: Essence, Sense and Nonsense' In *Organization Studies*, 14(2) pgs 261-278.
- Kiel,L,D and Elliott,E (eds) (1996) *Chaos Theory in the Social Sciences:Foundations and Applications* University of Michigan Press: Ann Arbor.
- Kim,J (1999) 'Supervenience as a Philosophical Concept' In Kim,J and Sosa,E (eds) *Metaphysics – An Anthology* Blackwell Publishing: Oxford.
- King,I,T (2000) *Social Science and Complexity: The Scientific Foundations*, Nova Science Publishers: New York.
- Knight,R.V (1995) 'Knowledge-Based Development: Policy and Planning Implications for Cities'. In *Urban Studies Vol 32, No 2; 225-260*.
- Knodt,E.M (1995) 'Foreword' In Luhman,N *Social Systems* Translated by Bednarz,J Jr with Baecker,D Stanford University Press: California
- Knorr-Cetina,K (1981) 'The Micro-sociological Challenge of Macro-sociology: Towards a Reconstruction of Social Theory and Methodology' In Knorr-Cetina,K and Cicourel,A.V (eds) *Advances in Social Theory and Methodology – Towards an Integration of Micro- and Macro- Sociologies* Routledge & Kegan Paul: London
- Knorr-Cetina,K and Cicourel,A.V (1981) (eds) *Advances in Social Theory and Methodology – Toward an Integration of Micro- and Macro- Sociologies*. Routledge & Kegan Paul: London
- Knudsen,S (2003) 'Scientific Metaphors Going Public' In *Journal of Pragmatics* 35, pgs 1247-1263.
- Kobayashi,A (1990) 'Racism and the Law in Canada: A Geographical Perspective', *Urban Geography*, 11, pgs 447-473.

-
- Kooiman,J (ed) (1993) *Modern Governance – New Government – Society Interactions*, Sage: London
- Kooiman,J and Vliet van, M (2000) ‘ Self-Governance as a Mode of Societal Governance’ In *Public Management, Vol 2(3)*, pgs 359-377.
- Kuhn,A and Beam,R.D (1982) *The Logic of Organisation : A System-Based Social Science Framework for Organization Theory* Jossey-Bass Publishers: London
- Kuhn,T.S (1993) ‘Metaphor in Science’ In Ortony,A (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 533-542.
- Kuhn,T.S (1996) *The Structure of Scientific Revolutions*. (Third edition). University of Chicago Press: London.
- Lakoff,G (1993) ‘The Contemporary Theory of Metaphor’ In Ortony,A (ed) *Metaphor and Thought* Cambridge University Press: Cambridge, pgs 202-251.
- Laplace,P,S (1951) *A Philosophical Essay on Probabilities*, Dover Publications: New York.
- Laszlo,E (1972) *Introduction to Systems Philosophy – Towards a New Paradigm of Contemporary Thought*, Gordon and Breach Science Publishers: London.
- Law,J and Akrich,M (1996) ‘On Customers and Costs: A Story from Public Sector Science. In Power,M [ed] *Accounting and Science: Natural Inquiry and Commercial Reason*. Cambridge University press: Cambridge
- Le Moigne,J.L (1985) ‘The Intelligence of Complexity’ In Aida,S *et al* (eds) *The Science and Praxis of Complexity – Contributions to the Symposium held at Montpellier, France, 9-11, May 1984*. United Nations University
- Lee,M.E (1997) ‘From Enlightenment to Chaos: Toward Non-Modern Social Theory’ In Eve,R.A, Horsfall,S and Lee,M.E (eds) *Chaos, Complexity and Sociology – Myths, Models and Theories* Sage Publications: London
- Lehman,H (1965) ‘Functional Explanation in Biology’ *Philosophy Science* 32, pgs 1-20
- Lelithabhai.K.N, Rajasekharan,K and George,S (eds) (1997) *Handbook on Transfer of Functions, Institutions and Schemes to Local Self Government Institutions* Kerala Institute of Local Administration: Thrissur, Kerala
- Lenoble, R (1969) *Histoire de l’idee de nature* Albin Michel : Paris.
- Lenzer, G (ed) (1975) *Auguste Comte and Positivism: The Essential Writings*, Harper Torchbooks: New York.
- Lewin,R, *Complexity – Life at the Edge of Chaos* JM Dent Ltd: London.

-
- Leydesdorff,L (2000) 'Luhmann, Habermas and the Theory of Communication' In *Systems Research and Behavioral Science* 17,pgs 273-288
- Lindblom,C,E (1996) 'The Science of 'Muddling Through'', In In Campbell,S and Fainstein,S,S (eds) *Readings in Planning Theory* (First edition) Blackwell:Oxford, pgs 305-322
- Lo Presti,A (1996) 'Futures Research and Complexity – A Critical Analysis from the Perspective of Social Science' In *Futures, Vol28(10)*, pgs 891- 902.
- Lockwood, D (1964) 'Social integration and system integraton' In Zollschan,G.K and Hirsch,W (eds) *Explanations in Social Change* Routledge &Kegan Paul, London, pgs 244-57
- Lockwood,D (1967) 'Some remarks on *The Social System*' in Demereth,N.J and Peterson,R.A (eds) *Systems, Change and Conflict: A Reader in Contemporary Sociological Theory and the Debate over Functionalism*' Free Press pgs 281-92.
- Lowe,E.J (2002) *A Survey of Metaphysics* Oxford University Press: Oxford
- Luhman,N (1984) *Soziale Systeme*, Frankfurt aM: Suhrkamp
- Luhmann,N (1985) 'Complexity and Meaning' In Aida,S *et al* (eds) *The Science and Praxis of Complexity – Contributions to the Symposium held at Montpellier, France 9-11, May 1984*. The United Nations University: Tokyo.
- Luhmann,N(1989) *Ecological Communication* Polity Press: Cambridge
- Luhmann, N (1990) 'General Theory and American Sociology' In Gans,H.J (ed) *Sociology in America* Sage Publications: Newbury Park.
- Luhmann,N (1990) *Essays on Self-Reference* Colombia University Press: New York
- Luhmann,N (1991) 'The Coding of the Legal System'. In Teubner,G and Febbrajo,A (eds) *State, Law and Economy as Autopoietic Systems – regulation and Autonomy in a New Perspective* Dott.A.Giuffre Editore: Milan
- Luhmann,N (1992) *Beobachtungen der Moderne*. Opladen:Westdeutscher Verlag.
- Luhmann,N (1995) *Social Systems* Translated by Bednarz,J Jr with Baecker,D Stanford University Press: California
- Luhmann,N (1997) 'Limits of Steering' In *Theory, Culture and Society, Vol 14(1)*, pgs 41-57.
- Luhmann,N (2000) 'Why does Society Describe Itself as Post Modern?' In Rasch,W and Wolfe,C (eds) *Observing Complexity – Systems Theory and Postmodernity* University of Minnesota press: London.

-
- Maffesoli,M (1996) *Ordinary Knowledge – An Introduction to Interpretive Sociology*
(Translated by Macey,D) Polity Press: Cambridge
- Mandelbrot,B,B (1982) *Fractal Geometry of Nature*, Freeman: San Francisco.
- Manorama Yearbook 2003*. Malayala Manorama. Trivandrum, Kerala.
- Margulis,L and Sagan, D (1986) *Microcosmos*, Summit Books: New York.
- Martin,J and Harre,R (1982) ‘Metaphor in Science’ In Miall,D.S (ed) *Metaphor:
Problems and Perspectives* Harvester Press: Sussex, pgs 89-105.
- Massey,D (1993) ‘Power Geometry and a Progressive Sense of Place’ In Bird,J,
Curtis,B, Putnam,T, Robertson,G and Tickner,L [eds].*Mapping the Futures –
Local Cultures, Global Change*. Routledge: London.
- Massey,D (1999) ‘Space-Time, ‘Science’ and the Relationship between Physical
Geography and Human Geography. In *Transactions of the Institute of British
Geographers. NS 24; 261-76*.
- Maturana,H (1980) ‘Man and Society’ In Benseler,F, Hejl,P and Kock,W (eds)
Elsevier-North Holland: New York, pgs 11-31.
- Maturana,H (1981) ‘Autopoiesis’ In Zeleny,M (ed) *Autopoietic systems in the Social
Sciences* Elsevier- North Holland: New York, Ch-2
- Maturana,H,R (1992) ‘Cognition and Autopoiesis: A Brief reflection on the
Consequences of their Understanding’ In Teubner,G and Febbrajo,A (eds) *State,
Law and Economy as Autopoietic Systems- Regulation and Autonomy in a New
Perspective*, Dott.A.Giuffre Editore: Milan.
- Maturana,H,R and Varela,F,J (1980) *Autopoiesis and Cognition: The Realization of
the Living*. D Reidal: Dordrecht, The Netherlands
- Mayntz,R (2004) ‘Mechanisms in the Analysis of Social Macro-Phenomena’ In
Philosophy of the Social Sciences 34(2) 237-259
- McFaul,M (1999) ‘Institutional Design, Uncertainty, and Path Dependency during
Transitions: Cases from Russia’ In *Constitutional Political Economy, 10, pgs
27-52*.
- Merchant,C (1993) *Radical Ecology*, Routledge: New York.
- Merrifield,A (1997) ‘Social Justice and Communities of Difference: A Snapshot from
Liverpool’ In Merrifield,A and Swyngedouw,E (eds) *The Urbanization of
Injustice*, New York University Press: New York, pgs 200-222.
- Merton,R.K (1967) ‘On Sociological Theories of the Middle-range’. In *On
Theoretical Sociology*, The Free Press: New York

-
- Merton,R.K (1968) *Social Theory and Social Structure*. The Free Press, Glencoe, New Jersey
- Midgley,G (1997) 'Mixing Methods: Developing Systemic Intervention' In Mingers,J and Gill,A (eds) *Multimethodology: The Theory and Practice of Combining Management Science Methodologies* Wiley, Chichester pgs249-290
- Mingers,J (1995) *Self-Producing Systems – Implications and Applications of Autopoiesis* Plenum Press: London.
- Mingers,J (2000) 'The Contribution of Critical Realism as an Underpinning Philosophy for OR/MS and Systems'. In *Journal of the Operational Research Society* 51, 1256-1270.
- Minkowski, H (1923) *The Principles of Relativity* Dover Publications: New York.
- Mol,A.M. and Law,J (1994) 'Regions, networks and Fluids: Anaemia and Social Topology'. *Social Studies of Science* 24, 641-671.
- Morgan,G (1998) *Images of Organization* Berret- Koehler: San Francisco
- Mouzelis,N (1995) *Sociological Theory: What Went Wrong?- Diagnosis and Remedies* Routledge: London
- Murdoch,J (1998) 'The Spaces of Actor-Network Theory'. In *Geoforum, Vol 29, No 4*; 357-374
- Murdoch,J (2000) 'Space against Time: Competing Rationalities in Planning for Housing'. In *Transactions of the Institute of British Geographers. NS 25*; 503-519.
- Murdoch,J and Norton,A (2001) 'Regionalisation and Planning: Creating Institutions and Stakeholders in the English regions' In Albrechts,L, Alden,J and Pires,AR (eds) *The Changing Institutional Landscape of Planning*, Ashgate: Aldershot.
- Namboodiripad,E,M,S (1994) 'Presidential Address' *International Congress on Kerala Studies*, A.K.G Centre for Research and Studies' Thiruvananthapuram.
- Nicolis,G (1995) *Introduction to Non-Linear science* Cambridge University press: Cambridge.
- Nicolis,G and Prigogine,I (1989) *Exploring Complexity* W.H.Freeman & Co: New York.
- Noveck,IA, Bianco,M and Castry,A (2001) 'The Costs and Benefits of Metaphor' In *Metaphor and Symbol* 16 (1&2) pgs 109-121
- Olsen,S.H (1982) 'Understanding Literary Metaphors'. In Miall,D.S (ed) *Metaphor; Problems and Perspectives* The Harvester Press: Sussex, pgs 36-54.

-
- Ortegon-Monroy,M,C (2003) 'Chaos and Complexity Theory in Management: An Exploration from a Critical Systems Thinking Perspective' In *Systems Research and Behavioural Science* 20, pgs 387-400.
- Ortony,A (ed) (1993) *Metaphor and Thought*, Cambridge University Press: Cambridge
- Ouchi,W.G (1980) 'Markets, Bureaucracies and Clans' In *Administrative Science Quarterly* 25(1) 129-141
- Outhwaite,W (1994) *Habermas- A Critical Introduction*. Polity Press: Cambridge
- Owens,S,E and Cowell,R (2001) *Land and Limits: Interpreting Sustainability in the Planning Process*, Routledge: London.
- Palmer,T (1993) 'A Weather Eye on Unpredictability. In Hall,N *Exploring Chaos – A Guide to the New Science of Disorder* W.W.Norton and Company: London.
- Parayil,G (2000) In Parayil,G [ed] *Kerala-The Development Experience – Reflections on Sustainability and Replicability*, Zed Books: London
- Parsons,T (1985a) 'The Structure of Social Action' In Hamilton,P (ed) *Readings from Talcott Parsons* Ellis Horwood Limited: Chichester and Tavistock Publications: London.
- Parsons,T (1985b) 'Psychoanalysis and the Social Structure' In Hamilton,P (ed) *Readings from Talcott Parsons* Ellis Horwood Limited: Chichester and Tavistock Publications: London.
- Parsons,T (1985,c) 'The Social System: The Pattern Variables' In Hamilton,P (ed) *Readings from Talcott Parsons* Ellis Horwood Limited: Chichester and Tavistock Publications: London.
- Parsons,T (1985,d) 'A Paradigm for the Analysis of Social Systems' In Hamilton,P (ed) *Readings from Talcott Parsons* Ellis Horwood Limited: Chichester and Tavistock Publications: London.
- Paul,A.T (2001) 'Organizing Husserl – On the Phenomenological Foundations of Luhmann's Systems Theory' In *Journal of Classical Sociology, Vol 1(3)* pgs-371-394
- Percival (1993) 'Chaos: A Science for the Real World'. In Hall,N *Exploring Chaos – A Guide to the New Science of Disorder* W.W.Norton and Company: London.
- Porpora, D.V (1998) 'Four Concepts of Social Structure' In Archer,M, Bhaskar,R, Collier,A, Lawson,T and Norrie,A (eds) *Critical Realism – Essential Readings* Routledge: London.

-
- Price,B (1997) 'The Myth of Postmodern Science' In Eve,R.A, Horsfall,S and Lee,M.E (eds) *Chaos, Complexity and Sociology – Myths, Models and Theories* Sage Publications: London
- Prigogine,I and Stengers,I (1984) *Order out of Chaos- Man's New Dialogue with Nature*. Fontana Paperbacks : London.
- Pue,W (1990) 'Wrestling with Law: (geographical) specificity versus (legal) abstraction, *Urban Geography*, 11, pgs 566-585.
- Radcliffe-Brown,A.R (1952) *Structure and Function in Primitive Society*. London.
- Rapaport,A (2001) 'The Systemic View of the World: } logo of General Systems Research' In Ragsdell, G and Wilby,J (eds) *Understanding Complexity* Kluwer Academic/ Plenum Publishers: New York
- Raper J and Livingstone, D (1995) 'Development of a Geomorphological Spatial Model using Object-oriented Design' In *International Journal of Geographical Information Systems* 9 359-83.
- Rasch,W and Wolfe,C (2000) 'Introduction: Systems Theory and the Politics of Postmodernity' In Rasch,W and Wolfe,C (eds) *Observing Complexity: Systems Theory and Postmodernity* University of Minnesota Press: London
- Rasch,W and Wolfe,C (eds) (2000) *Observing Complexity – Systems Theory and Postmodernity*, University of Minnesota Press: London.
- Reed,M and Harvey,D.L (1992) 'The New Science and the Old: Complexity and Realism in the Social Sciences'. In *Journal for the Theory of Social Behaviour*, 22 (4) pgs 353-380.
- Rhodes,M,L and MacKechnie,G (2003) 'Understanding Public Service Systems: Is There a Role for Complex Adaptive Systems Theory?' In *Emergence* 5(4) pgs 57-85.
- Ricoeur,P (1978) *The Rule of Metaphor – Multi-disciplinary Studies of the Creation of Meaning in Language* (Translated by Czerny,R with McLaughlin,K and Costello,J,SJ) Routledge: London
- Ritzer,G and Smart,B (2001) 'Introduction: Theorists, Theories and Theorising' In Ritzer,G and Smart,B (eds) *Handbook of Social Theory* Sage Publications: London
- Robins,K (1995) 'Cyberspace and the World We Live In' In Featherstone,M and Burrows,R (eds) *Cyberpunk/cyberspace/cyberbodies*, Sage Publishers: London

-
- Rorty,R (1991) *Objectivity, Relativism and Truth – Philosophical Papers, Volume- 1*, Cambridge University Press, Cambridge.
- Ruelle,D (1991) *Chance and Chaos* Penguin Books: London
- Rundell,J (2001) ‘Modernity, Enlightenment, Revolution and Romanticism: Creating Social Theory’ In Ritzer,G and Smart,B (eds) *Handbook of Social Theory* Sage Publications: London.
- Salet,W,G,M (2002) ‘Evolving Institutions – An International Exploration into Planning and Law’ In *Journal of Planning Education and Research*, Vol 22, pgs 26-35.
- Samyojitha Jilla Padhathi- Ernakulam Jilla, (2002) Jilla Aasoothrana Samiti, Ernakulam (Malayalam) Integrated District Plan – Ernakulam (2002) District Planning Committee, Ernakulam.
- Sandercock,L (2000) *Towards Cosmopolis*. John Wiley & Sons: New York
- Sardar,Z (1994) ‘Conquests, Chaos and Complexity – The Other in Modern and Post-modern Science’. In *Futures* Vol 26, No 6.
- Sardar,Z and Ravetz,J,R (1994) ‘Complexity: Fad or Future?’ In *Futures*, Vol 26(6), pgs 563-567.
- Sawyer,R,K (2004) ‘The Mechanisms of Emergence’ In *Philosophy of the Social Sciences*, Vol 34(2) pgs 260-282.
- Sayer,A (1992) *Method in Social Science – A Realist Approach* Routledge: London.
- Schatzi,T,R (2001) ‘Introduction; Practice Theory’ In Schatzi,T,R, Knorr Cetina,K and Von Savigny,E (eds) *The Practice Turn in Contemporary Theory* Routledge: London
- Schifler,S (1987) *The Remnants of Meaning* MIT Press: Cambridge.
- Schon,D,M (1991) *The Reflective Practitioner: How Professionals Think in Action*. Ashgate: Aldershot.
- Sclar,E,D (2000) *You Don’t Always Get What You Pay For- The Economics of Privatisation* Cornell University Press: London.
- Series,C (1993) ‘Fractals, Reflections and Distortions’. In Hall,N *Exploring Chaos – A Guide to the New Science of Disorder* W.W.Norton and Company: London.
- Sharpe,J (1973) ‘American Democracy Reconsidered, Parts I and II, In *British Journal of Political Science*, 3 (1-2), pgs 129-167.
- Shields,R (1995) ‘A Guide to Urban Representations and What to Do About It:Alternative Traditions in Urban Theory’. In King,A [ed] *Re-presenting the*

-
- City: Ethnicity, Capital and Culture in the Twenty-First Century Metropolis*
Macmillan: London
- Shoemaker,S (1999) ‘Causality and Properties’ In Kim,J and Sosa,E (eds)
Metaphysics – An Anthology Blackwell Publishing: Oxford
- Sidgwick,H (1874) *The Method of Ethics* Macmillan: London
- Simms, J.R (2001) ‘System Science Fundamental Principles’ In Ragsdell, G and
Wilby,J (eds) *Understanding Complexity* Kluwer Academic/ Plenum Publishers:
New York
- Simon,H,A (1977) *Models of Discovery and other Topics in the Methods of Science*
R. Reidal Publishing Company: Dordrecht
- Smuts,J.C (1926) *Holism and Evolution* Republished (1967). Viking: New York
- Soja,E.W (1989) *Postmodern Geographies: The Reassertion of Space in Critical
Social theory*. Verso: London.
- Soja,E.W (1996) *Thirdspace – Journeys to Los Angeles and Other Real and Imagined
Places*. Blackwell: Oxford.
- Stewart,I (1990) *Does God Play Dice?- The Mathematics of Chaos*. Penguin Books:
London.
- Stewart,I (1993) ‘Portraits of Chaos’.In Hall,N *Exploring Chaos – A Guide to the
New Science of Disorder* W.W.Norton and Company: London, pgs 44-58.
- Stewart,P (2001) ‘Complexity Theories, Social Theory and the Question of Social
Complexity’ In *Philosophy of the Social Sciences*, 31 pgs 323-60.
- Stoker,G (1997) ‘Local Political Participation’ In Davies,H; Skelchner,M; Clark,M;
Taylor,M; Young,K; Rao,N and Stoker,G (eds) *New Perspectives on Local
Governance: Reviewing the Research Evidence*, Joseph Rowntree Trust: York
pgs 157-196.
- Strand,R (2002) ‘Complexity, Ideology and Governance’ In *Emergence*, 4 (1/2) pgs
164-83.
- Sullivan,D’O (2004) ‘Complexity Science and Human Geography’ In *Transactions of
the Institute of British Geographers* 29, pgs 282-95
- Swyngedouw,E (1993) ‘Communication, Mobility and the Struggle for Power over
Space. In Giannopoulos,G and Gillespie,A [eds] *Transport and Communication
in the New Europe*. Belhaven: London
- Taylor,C (1985) *Philosophy and the Human Sciences: Philosophical Papers 2*.
Cambridge University Press: New York

-
- Tewdwr-Jones,M and Thomas,H (1998) 'Collaborative Action in Local Plan-Making: Planner's Perceptions of 'Planning Through Debate' In *Environment and Planning B: Planning and Design*, Vol 25, pgs 127 -144
- The Kerala Municipality Act and Rules (2004) Em Tee En publications, Kochi, India.
- The Kerala Panchayat Law Manual (2004) Em Tee En Publications, Kochi, India.
- Thomas,H (2004) 'What Future for British Planning Theory' In *Planning Theory*, Vol 3(3) pgs 189-198.
- Thompson,G,F (2003) *Between Hierarchies & Markets – The Logic and Limits of Network Forms of Organization* Oxford University Press, Oxford.
- Thornley,A (1977) 'Theoretical Perspectives on Planning Participation' In *Progress in Planning*, Vol 7(1), pgs 1-57.
- Thrift,N (1999) 'The Place of Complexity'. In *Theory, Culture and Society* Vol 16(3) pgs 31-69.
- Toffler,A (1984) 'Science and Change'. In Prigogine,I and Stengers,I *Order out of Chaos- Man's New Dialogue with Nature*. Fontana Paperbacks : London.
- Tooley,M (1999) 'The nature of causation: A Singularist Account' In Kim,J and Sosa,E (eds) *Metaphysics – An Anthology* Blackwell Publishing: Oxford.
- Tourangeau,R (1982) 'Metaphor and Cognitive Structure'. In Miall,D.S (ed) *Metaphor; Problems and Perspectives* The Harvester Press: Sussex, pgs 14-35.
- Tugwell,R.G (1940) 'The Super Political' In *Journal of Social Philosophy* 5, No 2 (January) 97-114.
- Turner,F (1997) 'Foreword: Chaos and Social Science' In Eve,R.A, Horsfall,S and Lee,M.E (eds) *Chaos, Complexity and Sociology – Myths, Models and Theories* Sage Publications: London
- Ulrich,W (1983) *Critical Heuristics of Social Planning: A New Approach to Practical Philosophy*. Haupt : Bern
- Urry,J (2003) *Global Complexity* Polity Press: Oxford
- Van Twist,M,J,W and Schaap,L (1991) 'Introduction to Autopoiesis Theory and Autopoietic Steering' In In't Veld,R, Schaap,L, Termeer,C,J,A,M and Van Twist,M,J,W (eds) *Autopoiesis and Configuration Theory: New Approaches to Societal Steering* Kluwer Academic Publishers: London.
- Varela,F (1981) 'Describing the logic of the living'. In Zeleny,M (ed) *Autopoiesis: A Theory of Living Organization* Elsevier: New York, pgs 36-48

-
- Varela,F.G, Maturana,H,R, and Uribe,R (1974) 'Autopoiesis: The Organization of Living Systems, Its Characterization and a Model' *Biosystems*, 5: 187-196
- Verma,N (1996) 'Pragmatic Rationality and Planning Theory' In *Journal of Planning Education and Research* 16, pgs 5-14
- Vijayanand ,S,M (1999) Address in Capacity Building Session for Local Self Government Functionaries, Kerala Institute of Local Administration, Thrissur, India.
- Vijayanand,S,M (2000) 'Status of Panchayat- Raj in Kerala' Available at <http://www.localgovkerala.net/lsgd/Links/Research/Statusofpanchraj.htm> (Last Accessed 9th April, 2005)
- Vijayanand,S,M (2001) 'Issues related to Administrative Decentralisation and Administring of Decentralisation – Lessons from the Kerala Experience' Paper presented at Workshop on Decentralisation organised by the Institute of Social and Economic Change, Bangalore, Available at <http://www.localgovkerala.net/lsgd/Links/Research/Vijayanand.htm>(Last Accessed 9th April, 2005)
- Viskovatoff,A (1999) 'Foundations of Niklas Luhmann's Theory of Social Systems' In *Philosophy of the Social Sciences* 29(4) pgs – 481-516
- Vivaldi (1993) 'An Experiment with Mathematics'. In Hall,N *Exploring Chaos – A Guide to the New Science of Disorder* W.W.Norton and Company: London.
- Wagner,D.G and Berger,J (1985) 'Do Sociological Theories Grow?' In *American Journal of Sociology* Vol 90, No 4 Pgs 697- 728.
- Waldrop,M.M (1992) *Complexity – The Emerging Science at the Edge of Order and Chaos* Penguin Books : London
- Warfield,J.N (2003) ' A Proposal for Systems Science' In *Systems Research and Behavioural Science* 20, 507-520
- Weaver,W (1968) 'Science and Complexity' *American Scientist*, Vol 36, pgs 536-544
- West,C (1989) *The American Evasion of Philosophy: A Geneology of Pragmatism*, University of Wisconsin Press: Madison
- White,L (2001) "Effective Governance' Through Complexity Thinking and Management Science' In *Systems Research and Behavioural Science*, 18, pgs 241-257.
- Whitehead,A.N (1969) *Process and Reality* Free Press: New York

-
- Wilson, T.P (1987) 'Sociology and the Mathematical Method' In Giddens, A and Turner, J (eds) *Social Theory Today* Polity Press: Oxford.
- Wolman, H (1995) 'Local Government Institutions and Democratic Governance' In Judge, D; Stoker, G and Wolman, H (eds) *Theories of Urban Politics*, Sage: London, pgs 135-159.
- Xu, S (2000) 'Linguistics as Metaphor: Analysing the Discursive Ontology of the Object of Linguistic Inquiry' In *Language Sciences* 22, pgs 423 – 446
- Zetterberg, H.L (1965) *On Theory and Verification in Sociology* The Bedminster Press: Totowa
- Zhao, S (2001) 'Metatheorising in Sociology' In Ritzer, G and Smart, B (eds) *Handbook of Social Theory* Sage Publications: London
- Zwick, M (2001) 'Understanding Imperfection' In Ragsdell, G and Wilby, J (eds) (2001) *Understanding Complexity* Kluwer Academic/Plenum Publishers: New York

Government Orders of Government of Kerala, India

- G.O (Rt) No. 5125/2002/LSGD, dated 4.03.2002
- G.O(MS) No. 40/2004/Plng; Dated 31st March, 2004
- G.O. (MS) No 10/96/Plg, Dated 30th July 1996
- GO(A) No.161/97/LAD dated 7-7-1997
- GO(P) No 113/98/LAD dated 02-06-1998
- GO(P) No 113/98/LAD dated 2-6-1998
- GO(P) No 114/98/LAD dated 2-6-1998
- GO(P) No. 189/95/LAD dated 18th Sep 1995
- GO(Rt) No.82/97/SC-ST. dated 13th Feb, 1997
- GO (A) No 69/98/LSGD dated 21st March, 1998
- GO (A) No 216/97 LSGD dated Sept, 1997
- GO(P) No 105/98/LSGD dated May 1998

Interviews

- Interview of Shri. S.M.Viajayanand, Secretary to Government, (Planning), Member Secretary, Kerala State Planning Board, to Angelique Chettiparamb on 31-12-2004.