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Sociology

Centre for Conflict Resolution Department of Peace Studies Working Paper 17 Complexity Theory and Conflict Transformation: An Exploration of Potential and Implications Diane Hendrick June 2009 Other titles in this Series International Conflict Resolution: Some Critiques and a Response Tom Woodhouse, June 1999 Working Paper 1 The Failure of State Formation, Identity Conflict and Civil Society Responses - The Case of Sri Lanka Sunil Bastian, September 1999 Working Paper 2 International Non-Government Organisations and Peacebuilding - Perspectives from Peace Studies and Conflict Resolution Nick Lewer, October 1999 Working Paper 3 From Conflict Resolution to Transformative Peacebuilding: Reflections from Croatia A. B. Fetherston, April 2000 Women, Gender and Peacebuilding Donna Pankhurst, August 2000 Working Paper Working Paper 5 Psychological 'Conflict Mapping' in Bosnia & Hercegovina: Case Study, Critique and the Renegotiation of Theory Steve Gillard, October 2000 Working Paper 6 Confronting Ethnic Chauvinism in a Post-War Environment: NGOs and Peace Education in Bosnia Working Paper 7 Laura Stovel, December 2000 Developing an Online Learning Pedagogy for Conflict Resolution Training Laina K. Reynolds & Lambrecht Wessels, May 2001 Citizenship Education or Crowd Control? The Crick Report and the Role of Peace Education and Conflict Resolution in the New Citizenship Curriculum Catherine Larkin, July 2001 Working Paper 8 Working Paper 9 " All You Need is Love"... and What About Gender? Engendering Burton's Human Needs Theory Cordula Reimann, January 2002 Working Paper 10 Operationalising Peacebuilding and Conflict Reduction. Case Study: Oxfam in Sri Lanka Simon Harris and Nick Lewer, August 2002 Working Paper 11 Community Peace Work in Sri Lanka: A Critical Appraisal

Dileepa Witharana, October 2002 NGOs and Peacebuilding in Kosovo Monica Llamazares and Laina Reynolds Levy, December 2003 Working Paper 12 Working Paper 13 Post-War Peacebuilding Reviewed. A Critical Exploration of Generic Approaches To PostWar Reconstruction Monica Llamazares, February 2005 Working Paper 14 The Contribution of Critical Theory to New Thinking on Peacekeeping. Some Lessons from MINURSO Andreu SolÃ MartÃn, July 2005 Working Paper 15 Disaster Response, Peace and Conflict in Post-Tsunami Sri Lanka Simon Harris, February 2006 Working Paper 16 “ To study history means submitting to chaos and nevertheless retaining faith in order and meaning. " “‘ The game as I conceive it,’ Knecht once wrote, ‘ leaves (the player) with the feeling that he has extracted from the universe of accident and confusion a totally symmetrical and harmonious cosmos, and absorbed it into himself.’" Hermann Hesse, The Glass Bead Game 1 Abstract This working paper is intended as an exploration of the usefulness of complexity theory to the field of peace research and conflict intervention. I have used the term conflict transformation to indicate a comprehensive and long term approach to social change in situations of violent, often intractable conflict and reference will also be made to development and aid, security and ecology as being relevant to conflict transformation processes. The paper begins by outlining key features of complex systems before going on to illustrate attempts made to apply complexity theory (originating in the natural sciences) in various social science fields with a consideration of some of the difficulties this translation poses. Conflict analysis is the basis of research and strategy formation and indispensable to intervention in conflict situations, therefore, the potential for deepening and sharpening analysis

that complexity theory may offer are discussed and conclusions about the advantages of a complexity-influenced conflict analysis are drawn. Some of the tools available to augment analysis are briefly presented, whereby the main emphasis is given to computer simulation. The understanding of the nature of change processes in complex systems is considered and the implications of a complexity approach for intervention in conflict and development environments in terms of strategy development are discussed. The view is taken that the gains to be made (at least so far) are largely in terms of an altered and, it will be argued, more sophisticated and realistic orientation that affects the way that things are perceived in analysis and done in the field rather than in the introduction of specific new methods. On the basis of the foregoing exploration it will be argued that a change is required in the education and training of peace researchers and conflict and development workers such that the above-mentioned orientation to complex conflict situations may be developed and here transdisciplinarity is seen as playing an integral role. The varying conceptions of transdisciplinarity are discussed and specific examples of transdisciplinary research and education enterprises are presented. The importance of the intra-personal complex processes not only of conflict parties but also of conflict interveners (and even conflict transformation researchers) is highlighted. The view is taken that the peace worker becomes part of the complex system in which he or she seeks to intervene and, therefore, requires self-reflective abilities and the development of awareness and mindfulness in analysis, through strategy development and into actual intervention. The development of these abilities thus becomes part of an appropriate education and training for those

working in the field of peace and conflict. This aspect of the topic is to be elaborated in further research papers. The conclusion briefly reviews the valid concerns and doubts with regard to the application of complexity theory within the social sciences before attempting a tentative balance of the benefits to be gained from continued engagement in the process of adaptation and integration of complexity concepts and approaches in the field of conflict transformation. 2 Contents

 3 Introduction Complexity theory in the natural sciences has brought fresh insight into the nature and working of complex systems and some have hoped that applying this theory to social systems, albeit necessarily in an adapted form, could be equally revealing and useful. I confess to being among their number although the degree and extent of the usefulness and applicability of complexity in these areas is not yet clear to me. I am, however, convinced of the potential to, at the very least, facilitate a more realistic (i. e. closer to the reality of how the social world works) and open approach to analysis and action for change. This working paper is an exploration of ideas, opinions and attempts related to the application of complexity theory to the field of conflict transformation and some early reflections on these. The term conflict transformation has been used here to indicate a comprehensive and long term approach to social change in situations of violent, often intractable conflict. I find the

term sufficiently broad to reflect the agenda of peace research and peace studies in their concern for justice as well as peace and, therefore, reference will be made to development and aid, security and ecology as being relevant to conflict transformation processes. I have also drawn on studies from the field of management and organisational change and military studies. The former as there has already been a relatively longstanding engagement with complexity theory in this field and also due to the historical influence between management and conflict resolution, the latter in order to remain open to insights in processes even where values and methods may be radically opposed. Peace research and peace studies have identified themselves as interdisciplinary, however, have often, in my view, failed to achieve the potential that this term implies. Complexity theory begs integration at theoretical and practical levels and it is possible that transdisciplinarity could spur this development within the peace and conflict field and for this reason it receives attention here. Allied with this must be the integration of an awareness of the intra-personal aspect of conflict transformation that is not limited to taking the psychological processes of conflict parties into account but recognises that the analyst and intervener enter the conflict system and their own inner processes are relevant to achieving the aims they pursue. The importance of the intra-personal level for conflict transformation processes is referred to, but not explored in depth, in this paper and will be the subject of further research and reflection papers. 1) What is Complexity Theory? There is no one theory of complexity but rather several theories, or elements of theories, that have emerged from natural sciences, particularly biology, computer simulation, mathematics,

physics and chemistry. 1 These theories (for ease of reference henceforward referred to here as 1 Stuart Kauffman (Kauffman 1993, 1995, 2000) John Holland (Holland 1995, 1998), Chris Langton (Waldrop 1992), and Murray Gell-Mann (1994) on complex adaptive systems (CAS), Ilya Prigogine (Prigogine & Stengers 1985, Nicolis & Prigogine 1989, Prigogine 1990), Isabelle 4 â€•complexity theoryâ€–) represented a recognition of the limitations of the Newtonian, linear scientific paradigm when applied to complex systems. The dominance of this paradigm had already been shaken by the discoveries within quantum physics but these had been confined to a particular scale and the implication has been the Newtonian paradigm holds for most practical purposes. Jay Lemke describes how our analytic approach developed within the human community, sharing knowledge across distance and time, until we became seduced by its successes into a belief in its universal applicability: â€•In all this, we have adopted the habit of constructing the properties of wholes from samplings of their parts. Confined to the human scale in our specific interactions with the here-and-now, but benefitting from overlaying these with models of the there-andthen, we have had to learn to make sense of higher levels by piecing them together 'from below'. When this same adaptive strategy was turned to the analysis of levels below us (anatomical studies, mechanical and chemical theories) we found first that we were well-served by our technologies (our machines, built by assembling pieces into wholes), and then that we had to sample still lower levels, where changes happened too quickly for our eyes and where units were many. But we still thought in terms of aggregation and piecing together, we sampled and constructed always 'as if from below', our ancient

phylogenetic trick, for which our symbolic systems of communication and representation were themselves long adapted. We were, not very surprisingly, most successful as reductionists. But in order to make the reductionist program work it was essential that we leave ourselves out of the picture. For once we see our representations of the levels below as actually models of our human-scale relationships to phenomena at those levels, then the neat homogeneity of scale that defines the separability of levels is broken. â€– (Lemke, 2000 p. 190) Unlike complicated systems, where there may be many interacting elements such as, for example, wiring in an aircraft, no amount of studying of the parts will allow us to predict what will happen in the system as a whole. Complicated systems are determined and, with sufficient effort, knowable. Complex systems by contrast have many interacting agents where the interaction is unpredictable resulting in surprising outcomes. Clearly this sounds applicable to social systems and the insights gained through complexity theory in the natural sciences have been applied to various fields in social science on the basis of this analogy, where theory is understood as â€•an explanatory framework that helps us understand the behaviour of a complex social (human) system" (Mitleton-Kelly, 2003 p. 2) Complexity provides an explanatory framework for: â€•how individuals and organisations interact, relate and evolve within a larger social ecosystem. Complexity also explains why interventions may have un-anticipated consequences. The intricate inter-relationships of elements within a complex system give rise to multiple chains of dependencies. Change happens in the context of this intricate intertwining at all scales. We become aware of change only when a different pattern becomes discernible.

â€– (Mitleton-Kelly, 2007) Stengers (Prigogine & Stengers 1985), Gregoire Nicolis (Nicolis & Prigogine 1989, Nicolis 1994) Humberto Maturana, Francisco Varala (Varela & Maturana 1992) work on chaos theory (Gleick 1987) 5 Before looking at the validity of this translation from natural to social science, and its relevance for peace and conflict studies, a brief presentation of the characteristics of complex systems is needed to illustrate their character more clearly. Characteristics of Complex Systems Self-organisation is considered to be one of the hallmarks of a complex system. Agents interact within a system without any external governing agency and in the process produce new order. Lemke reminds us that the self-organisation in such systems is the result of interactions with the environment, not a purely internal and autonomous process (Lemke, 1993 p. 247). Early work on self-organisation was influenced by Maturana and Varela‘ s research on biological systems (Maturana, 1980). They coined the term autopoiesis for internal processes in which each component is involved in the production or transformation of other components and hence the system as a whole â^’ the system reproduces itself (Walby, April 2003 p. 6) The outcomes of such self-organising processes are both uncertain and irreversible. The second defining characteristic of a complex system is emergence, a concept familiar from systems theory. Checkland describes emergent properties as the result of the â€•wholeâ€– of the system, deriving from its component activities and their structure but, crucially, unable to be reduced to these (Checkland, 1981 p. 314). â€•Emergent properties, qualities, patterns, or structures, arise from the interaction of individual elements; they are greater than the sum of the parts and may be difficult to predict by studying the individual elements.

Emergence is the process that creates new order together with self-organisation. â€– (Mitleton Kelly p. 19) In these processes accidental factors may play a role with new â€•couplingsâ€– (to use Maturana‘ s term) of reactions occurring in one particular system but not in another. Random fluctuations, whether internal or external, may also influence the development of the system through jumps to new states (Lemke, 1993) The causal connections in these systems are nonlinear i. e. not proportional. The conventional scientific paradigm leads us to expect that a small input will lead to a small output and, correspondingly, a large input will produce a large output. This proportionality is broken in complex, non-linear systems where feedback plays a key role in the emergence of new order. Negative feedback plays a regulating role (as with the thermostat in a heating system) tending to maintain stability in the system. It is positive feedback that has a reinforcing or amplifying effect. In complex systems that are operating far from equilibrium there is great sensitivity to perturbations. These may be very small scale and yet through the process of positive feedback produce â€•huge, startling effectsâ€– (Prigogine, 1985 p. xvi). A related concept, derived from chaos theory, is that such developments are extremely sensitive to initial conditions i. e. a slight difference in any aspect of the situation from which such a process begins can result in 6 widely different trajectories as the difference becomes amplified through positive feedback âˆ’ Lorenz‘ s renowned â€•butterfly effectâ€–2 Complex systems are open systems, exchanging energy and information with their environment. The agents in these systems interact in such a way that they adapt to the behaviour of other agents, who in turn adapt. This adaptation is cause for

further adaptation and so on. Such complex adaptive systems (CAS) are dynamic and interact also with their environment causing it to change and then responding to these changes themselves. They are thus in a process that may be described as co-evolution. The development of a complex system within the environment, and in relation to other complex systems, can be tracked in what are termed â€•fitness landscapesâ€–. This term was first coined by Wright in the field of evolutionary biology and it has been adopted, and further elaborated, by complexity researchers. A fitness landscape is a " mountainous terrain showing the locations of the global maximum (highest peak) and global minimum (lowest valley) [and] the height of a feature is a measure of its fitness." (Coveney, 1995 p. 108) Within this fitness terrain the landscape alters and deforms as the actors within the environment act and change, in turn altering the conditions for the actors. According to Kauffman: " Real fitness landscapes in evolution and economies are not fixed, but continually deforming. Such deformations occur because the outside world alters, because existing players and technologies change and impact one another, and because new players, species, technologies, or organizational innovations, enter the playing field. Fitness landscapes change because the environment changes. And the fitness landscape of one species changes because the other species that form its niche themselves adapt on their own fitness landscapes . . . " (Kauffman, 1995 p. 208) It is possible to construct such a landscape for any complex system and, by tracking interactions over time, observe how the environment is affected and responds to the changes that are occurring. 2) Application in Social Science There are proponents of the application of complexity theories to the social

sciences in practically every field, particularly where the complexity of social interaction appears evident together with an awareness of system level behaviour that is not amenable to prediction (at least not in the medium and long term). Peace research and peace studies have always regarded themselves as necessarily interdisciplinary and I will highlight a few of the arguments for the potential added value of complexity approaches in a few disciplines traditionally associated with peace research: sociology, international relations, social psychology, development studies but also management studies and military studies. 2 Lorenz first published his findings in 1963 and in 1971 used the image of a butterfly flapping its wings in Brazil causing a hurricane in Japan to illustrate the complex nature of weather systems. 7 Sociology Sylvia Walby sees in complexity theory the opportunity to re-conceptualise old theories in sociology, making them relevant and useful and transcending dichotomies that have frustrated analysis in the past, while at the same time reflecting a more realistic picture of social interactions3. Key is the â€•anti-reductionist analytic strategyâ€– of complexity theory and the reconceptualisation of systems so that the dynamic aspects of the inter-relationships are also included. Walby finds this latter to be particularly important in the face of globalisation where the â€•systemnessâ€– of connections needs to be studied. Complexity theory provides a way out of the reductionism in sociological perspectives, whether expressed in terms of the emphasis on the individual in rational choice theory or an exclusive focus on structures. Interestingly, in this regard Walby sees a return to some of the concerns of classical sociology: â€•such as combining an understanding of both individual and social structure, that

does not deny the significance of the self-reflexivity of the human subject while yet theorising changes in the social totality. â€– (Walby, April 2003 p. 2) Here Walby is referring to what she sees as the major strength of most classical sociology where it is engaged analytically with â€•individuals and social institutions and often several further ontological levels within a single explanatory frameworkâ€– (Walby, April 2003 p. 2). This strength has been lost at times in sociology but Walby sees complexity theory as providing a means to revive it. Walby argues that old versions of systems theory, requiring an understanding of systems as nested, fell into disrepute by virtue of the lack of explanatory power in relation to complex intersections of relations. It was criticised that agency was neglected in any forms of structural or system-led explanations (Walby, 2007). Nevertheless, Walby notes, the essential requirement to conceptualise social interconnections led to the use of systems analyses under other names. Complexity theories allow a solution to this impasse by utilising a distinction between system and environment, where each system takes all other systems as its environment (Bertalanffy, 1968). Here systems are not necessarily nested and the parts do not necessarily constitute one whole: â€•Instead, each social system (whether economy, polity, violence nexus, or civil society) takes all other systems as its environment. Likewise each set of social relations (e. g. gender, ethnicity, class) is a system, taking all others as its environment. Each system, whether domain or set of social relations, can have a different spatial and temporal reach. ... A system does not necessarily fully saturate the space or territory that it is in. This enables us to think of a set of social relations as not fully saturating an institution or domain–it can overlap with

other sets of social relations. â€– (Walby, 2007 p. 459) 3 The interpretation of complexity theory by social scientists is also very varied. Byrne (1998) argues that complexity theory constitutes a defence of realism, while Cilliers‘ (1998) considers that complexity theory advances postmodernism. There are several different approaches to the utilization of complexity concepts in Sociology, including Luhmann (1995), Jessop (2002), Urry (2005), and De Landa‘ s (2000). See (Walby, April 2003) 8 In Walby‘ s conceptualisation of institutionalised domains, they are broadened (and thus even more appropriate to a peace research approach) where the economy includes not only free wage labour but domestic labour, the polity includes supranational entities and organised religions that govern areas of life (such as personal life). Her inclusion of â€•the violence nexusâ€– as a domain echoes peace research for, as she argues,: â€•interpersonal violence is so important in the constitution of gender and minority ethnic relations and organized military violence is so important in the formation of nations and states. â€– (Walby, 2007 p. 459) Walby develops a sophisticated and comprehensive approach to understanding complex social systems that deserves attention within the field of peace research: â€•Each set of social relations is a system. Examples of sets of social relations are those of class, gender, and ethnicity; each is a social system. Each of these sets of social relations is not flattened to a culturally reductionist concept of identity, or economically reductionist concept of class. Each set of social relations of social inequality is understood as a social system with full ontological depth, being constituted in the institutional domains of economy, polity, violence, and civil society. Not only are gender relations constituted in the economy, polity, violence, and civil

society, but so also are ethnic relations and class relations. These systems of social relations are constituted at different levels of abstraction; one level is emergent from another. An individual will participate with a number of different sets of social relations. These are overlapping, non-saturating and non-nested systems of social relations. Gender is not contained within class relations; they are not nested. Gender relations are a separate system; it overlaps with class, but neither gender nor class fully saturate the institutional domains. â€– (Walby, 2007 p. 459) The concept of emergence, where macro-level outcomes are the result of numerous microlevel interactions (and furthermore constitute something new in kind and not predictable from a study of the agents or components of the system) also provides a way through the difficulties faced in theorising the connections between agency and structure. The concept of co-evolution contributes to an understanding of the relationship between different social systems, previously problematic in sociology, and here downward causation also plays a role. Particularly, where the intersection of inequalities is a concern, where gender, ethnicity and class play a mutually influencing role in the constitution of inequality: â€•Mutual adaptation, conflictual as well as more harmonious, takes place within changing fitness landscapes (Kauffman 1993). Class, gender, and ethnicity are complex adaptive systems that coevolve in a changing fitness landscape. Gender relations coevolve in an environment that includes both class and ethnic relations. This environment, or fitness landscape, may be conducive to the development of one or other form of gender regime. â€– (Walby, 2007 p. 463) Here also path dependency is useful in understanding the differences in how groups develop in terms of

social relations in different countries despite following a common programme of economic modernisation. 9 Walby‘ s is not the only approach to utilizing complexity theory in sociology, she herself refers to the work of Luhmann (1995), Jessop (2002), Urry (2005), and De Landa (2000). As an illustration of the radically different interpretations of complexity theories it is possible to find Byrne (1998) arguing that complexity theory constitutes a defence of realism, while Cilliers‘ (1998) considers that complexity theory advances postmodernism. Although this appears contradictory, Walby argue that viewing this as a polarization is misguided and unnecessary. (Walby, April 2003) International Relations In international relations Neil E. Harrison makes the case for the value of complexity theory given the unpredictability of events in world politics that has confounded expectations based on existing theories. While there are various explanations proffered for this situation, Harrison sees the tendency of current theories of world politics to work with models of the social world that present it, for analytical purposes, as a simple system as fundamentally misleading. In contrast to realism, that sees political behaviour being driven by essential human characteristics within fixed structures, complexity theory sees world politics as a selforganising complex system in which macroproperties emerge from microinteractions. It is precisely the interactions among interdependent but individual agents within the system that account for the surprising events that defy prediction through the simple models used at the moment. Harrison thus takes the state as a system that is not closed but open to other natural and social systems: â€•defined as a political system, it is open to technological, cultural and economic systems that influence political choices and processes. â€–

(Harrison, 2006 p. 8) The state is also influenced by other states and by numerous transboundary interactions between major corporations, NGOs, terrorist groups, etc. In such complex systems it is not possible to trace linear causal links: â€•Despite occasional attempts to bring in domestic politics the state is usually modelled as a unit with exogenous identity and objective interests. This greatly reduces the range of possible causal explanations for any perceived social event, simplifying causal analysis and hypothesis generation and testing. â€– (Harrison, 2006 p. 11) It is a disconcerting fact that outcomes may have multiple causes and that in different contexts, historically or spatially, the same cause may lead to different outcomes. This cannot be captured by the over-simplified models of international systems. Given the multiple, mutually influencing interactions within social systems it is necessary to look to the evolution of the system rather than to individual events when seeking the causes of observed effects. Complexity theory focuses on processes and relations between components, or in the case of social systems, agents, rather than the components themselves. In a similar criticism to that of Walby, Harrison points to the tendency of theories in international relations to focus on one level of analysis and to present competing theories based on these. Where systems are theorised, they are limited by being presented as nested. Harrison notes that the impact of positive feedback in systems has been acknowledged: 10 â€• â€—(I)ntra-national and inter-national events all impinge on one another in a cyclical and ongoing process within which the self-aggravating propensities frequently exceed the self-correcting ones by an unacceptably large amount‘ (Singer 1970, 165) thus national elites use

rhetoric for domestic political consumption that can incite potential enemies, the public and military desire the psychological comfort of discernible superiority, media amplify inter-nation conflicts, and the benefits of participation in the ideological mainstream preserve the distribution of power and inhibit changes in the historic patterns that transform inevitable conflicts into costly rivalries. â€– (Harrison, 2006 p. 28) While Walby refers to examples of the importance of the notion of path dependence with reference to differences in development between countries, Harrison sees its relevance at the level of the international state system. Thus development through time is not wholly random and there are limits or constraints created by the prior development of the system that restrict the possible options for change. In this way the international system may change its structure without becoming another system and here Harrison brings the example of the Cold War. While it is true that the Cold War was produced by historical interactions, it is still not possible to claim that it was an inevitable effect of historical causes. The myriad microinteractions that occurred introduce unpredictability into development, especially given the above-mentioned possibility of positive feedback. Harrison is optimistic with regard to the gains from the application of complexity theory to world politics in theoretical but also in policy terms: â€•This ontological shift from simple to complex systems opens new paths to knowledge and understanding yet incorporates much current knowledge; it validates novel research methods; and theories founded in this approach will generate radically different solutions to policy problems. â€– (Harrison, 2006 p. 2) Social Psychology The complexity of social systems cannot be understood without reference to the

inner processes that guide perceptions and behaviour. Psychology and social psychology are here of great importance. In much of peace research and conflict transformation work psychology plays a central role. At least this is the case in conflict analysis and strategy development in as far as there is a focus on conflict parties and stakeholders. However, the importance of these psychological aspects for the conflict intervener or peace researcher his- or herself, in terms of self-awareness, self-reflection and self-development, are seldom considered worthy of investigation or, in the case of peace practitioners, of development. This is a theme to which I will return later in this paper but first I would like to provide an illustration of how complexity theory is being applied in social psychology. The extent of internal psychological processes becomes evident when one considers the large variety of factors that influence the way people think and behave, covering social stimuli from interactions that vary in duration and significance, also processes of reflection on the past and future as well as aspects of the larger social context, both cultural and institutional (Vallacher, 2002 p. 265). The interaction between these factors increases the complexity potential such that quite diverse patterns of thought and behaviour may be generated across individuals but 11 also different patterns may be established within an individual. In fact, as Vallacher et al point out: â€•Even if we somehow managed to identify all relevant factors and specified how they interact to influence thought and behaviour, we may still be at a loss to explain or predict a person‘ s beliefs, decisions, desires, or courses of actionâ€– ...[as] â€•the complex edifice of interacting causal forces permeating social life can collapse in the face of personal desires, values, and momentary whims. â€–

(Vallacher, 2002 p. 265) In the face of such intricate and multi-faceted interacting processes at intra- and inter-personal or social level, comprehensive description, let alone prediction, is impossible. Vallacher et al also find application for the concept of the emergence of system-level properties by means of self-organisation, for example, in the way group norms may develop through the spontaneous coordination of members‘ impulses and actions without requiring a higher-level authority that imposes rules and standards (Vallacher, 2002 p. 266). They also point to work on social influence and interdependence that has shown that simple social interactions over time tend to promote the emergence of public opinion, altruistic values and other group level properties (e. g. (Axelrod, 1984) (Nowak, 1990)). They posit an application at an intrapersonal level where spontaneous self-organisation of cognitive and affective elements into higher order structures has been revealed in experimental work on social judgment (Vallacher, 1994) and action identification (Vallacher, 1998). Path dependency in this discipline can be demonstrated, for example, within group norm formation, where there might be: the initial dispositions and attitudes of each group member, the nature of the relationships among group members, and the exposure of the group members to ideas and information from sources outside of the group. It is in the interaction of these constraints that the norms emerge. Analogously, Vallacher et al argue that: â€•an individual‘ s attitudes and values presumably arise from the attempt to reconcile his or her pre-existing judgements, diverse pieces of old and new information, and conflicting social pressures and expectations. â€– (Vallacher, 2002 p. 267) The important point here being that external factors

do not cause change within a passive system but affect the course of the internally generated dynamics whether within a person, a group or society. The non-linear nature of the potential changes are characteristic for complex systems: â€•Lacking insight into the ongoing processes within a persona or social group, it is difficult to know what effect a given external influence is likely to have. When external influences are present, the system‘ s macro-level properties may change in a manner that is non-proportional to the magnitude of the influences. Sometimes an external factor produces only resistance, with little or no change in the ongoing processes of the person or group. At other times, the person or group may show an exaggerated response to a lesser value of the same external factor. At yet other times, an external influence may initiate a process that unfolds according to its own pattern of changes, the effects of which may not be apparent for days, minutes or years, depending on the phenomenon in question. â€– (Vallacher, 2002 p. 267) Vallacher et al also see the potential in tools and methods developed in mathematics and other scientific fields for investigating complex dynamics for the study of personality and social 12 psychology. They argue that beyond the generation of specific insights in the field there lies scope for integration: â€•This suggests the potential for developing general laws of psychology dynamics that apply to all levels of social reality, from the flow of individual thoughts to societal transformations. Beyond providing coherence to an admittedly fragmented discipline (..) the discovery of such laws in social psychology may foster new levels of integration with other areas of psychology that have already embraced the dynamical perspective (e. g. developmental and cognitive psychology) and with other

areas of science as well. â€– (Vallacher, 2002 p. 268) Development Development theorists and practitioners have been among the first to try to integrate broader considerations into their domain of interest, for example, the relationships between conflict and development or climate change and development. However, explicitly complexity approaches to development are still relatively rare but there is a cautious exploration of the possibilities in Ramalingam et al‘ s paper for the ODI (Ramalingam, 2008). They argue that a complexity paradigm could help improve understanding of the nature of change processes and modify expectations with regard to development policies and projects. Robert Chambers has written of the potential and implications of complexity sciences for understanding and operating in the aid system (Chambers, 1997). Alan Fowler is also convinced of the value of applying a complexity approach to development: â€•In the broad canvas of social change, an approach drawing on complexity is potentially powerful. It would entail incorporating different views about what is and is not effective. Combining these ideas would offer more robust grounds for action, and provide more realistic insights about processes and measures. It would also provide clearer assessments of how long different types of change in societies need in order to be realized, and a refined understanding of the relational power shifts involved in the process. â€– (Fowler, 2008) Samir Rihani, as with many in the field, has reviewed the achievements of billions of dollars of aid and varying paradigms and found the outcomes to be very disappointing. Some speak of a crisis in development theory and policy and Rihani sees a major problem in the application of linear assumptions to situations where non-linear phenomena within a complex system are

operating and he would favour a complexity paradigm in development research and policy (Rihani, 2002). Groves and Hinton are concerned with aid practice and policy and have observed that the complex interrelations that are familiar to many on the ground are not reflected in the structures of aid relations and development projects (Groves, 2004). Ramalingam et al point out that in many disasters there are rarely single causes but rather many interacting and interdependent dimensions and factors: â€•Famine can be caused by drought, a rise in the price of grain, a drop in the price of livestock, inadequate road infrastructure, a lack of food aid, or by all these factors simultaneously (Pirrotte et al., 1999). â€– (Ramalingam, 2008 p. 13) 13 Sen has long argued for a more complex understanding of the emergence of poverty including such factors as: income consumption poverty, deprivation of capabilities linked to health, education, mortality, under-nourishment, illiteracy and participation in the activities of society, which involves freedom, social inclusion, employment, dignity and human rights (Sen, 1999). It is the interaction of these factors that is the reflection of the complexity in the situation. Therefore, any intervention to tackle one dimension will have effects on other dimensions, intended and unintended. Evaluation of impact along a purely separate dimension is then not possible. Furthermore there are different perspectives on the nature of the system itself and these must be taken into account including the perspectives of those affected by aid initiatives: â€•As there are many perspectives on how to understand the complex social, economic and political contexts of aid work, it is important to bring together as many of these as possible in order to gain a rich picture of constraints and opportunities. This means that the

practical, social and institutional dimensions should be of as much concern to aid agencies as the scientific and scholarly concerns. â€– (Ramalingam, 2008 p. 14) The 1990s saw much attention being paid to the link between environment, population and conflict in the context of human security. There are significant debates about the nature of the processes at work and differing conclusions about how, and where, to intervene to reverse downward spirals. Thomas Homer-Dixon is one of the theorists in this field who stresses the value of a complexity approach. He advises that: â€•At the methodological level, we need to explore how causation works at the interface between the physical/ ecological and social worlds. Environment-conflict research brings us face to face with some of the most intractable issues in philosophy of science, specifically whether causal generalizations describing the social world have the same status as those describing the natural world. Because systems in both these domains are fundamentally complex–characterized by huge numbers of components, causal interactions, feedback loops, and nonlinearity–environment-conflict researchers can gain insights from complexity theory. We urge greater receptivity to the concepts and findings of this rapidly developing field. â€– (Homer-Dixon, 2000 p. 89) Homer-Dixon is scathing towards those who deny the relevance of complexity approaches rather than taking up the challenge to find new ways to research complex problems: â€•The problem of complexity exists in the real world. It cannot be wished away by assuming that it resides only in the mind of the researcher. ...Researchers in a variety of fields increasingly acknowledge the reality of complexity and are developing powerful theories to understand complex systems. These theories raise serious questions

about conventional (often mechanistic) explanations of social phenomena and about the conventional methodologies used to study these phenomena (Cowan, Pines, and Meltzer, 1994). Rather than denying complexity‘ s existence, … social scientists should explicitly acknowledge the problems it creates for their research and try to develop methods–such as those focusing on causal mechanisms–for dealing with it. â€– (Homer-Dixon, 2006 p. 87) 14 Management Peace research owes a debt to this field, for example, some of the approaches familiar from conflict resolution have emerged from management studies and practices going back as far as the work of Mary Parker Follet in the 1920‘ s (Follett, 1995) on integrative negotiation, identifying interests, breaking down problems into sub-issues, etc. As the field of management studies and organisational consultation has taken up complexity theories with enthusiasm and creativity there is much that can be drawn from here that is of relevance for peace and conflict. An influential early attempt to bring the insights of complexity from the natural sciences to bear on issues of organisation and business were the writings of Meg Wheatley (Wheatley, 2006).) Also Peter Senge et al and their book entitled the Fifth Discipline, which links systems theory to complex dynamics (Senge, 1990; 2006), is often quoted in the field and beyond. Since then research interest has grown and the applied nature of the discipline means that there are also valuable action research projects such as those carried out at the LSE Centre for Complexity. Eve Mitleton-Kelly describes the link to practice and evaluative opportunities: â€•If organisations were managed as complex evolving systems, co-evolving within a social ecosystem, emergence would be facilitated rather than inhibited, and self-organisation would be

encouraged, as would exploration of the space of possibilities available to an organisation. Managers would understand that an organisation is an entity capable of creating new order, capable of re-creating itself. Management would focus on the creation of conditions that facilitate constant co-evolution within a changing environment, and would encourage the co-creation of new organisational form with those directly affected. â€– (Mitleton-Kelly, 2003 p. 23) With the journal Emergence: Complexity and Organisation, a collaboration between academic researchers, businesspeople and practitioners, there is a broad platform for exchange on ongoing work in the area. Already in the second issue in 1999 (co-edited by Stuart Kauffman, Steve Maguire, and Bill McKelvey) the journal conducted a review of some thirty â€•complexity theory and managementâ€– books, indicating the level of interest in this field. In the field of economics, Brian Arthur has argued that conventional theory is based on the implicit assumption of negative feedback loops in the economy, which lead to diminishing returns, which in turn lead to (predictable) equilibrium outcomes. Thus negative feedback has a stabilising effect, and implies a single equilibrium point, as â€•any major changes are offset by the very reactions they generateâ€–. (Arthur, 1990 p. 92) However, Arthur posits that such stabilising forces are not always at play in the economic system: â€•Instead positive feedback magnifies the effects of small economic shiftsâ€–, and increasing returns from positive feedback makes for many possible equilibrium points, depending on the negative feedback loops that may also operate in a system (Arthur 1990)â€–. (Mitleton-Kelly, 2003 p. 17) 15 The oft-quoted example is of the establishment of VHS video tape dominance over the rival Beta system due

to an early gain in market share but other examples of technical standards or conventions that became established due to positive feedback, increasing returns and path dependence, are the gauge of railway tracks, the English language becoming established as the standard language of air navigation and a particular screw thread, and these often â€•cannot be changed even if alternative techniques or conventions may be betterâ€– (Mainzer, 1996 p. 271). The number of publications in organisational theory, business studies and economics related to complexity theory is evidence of the extent of the influence in these fields if not yet an indication of the impact of the application of a complexity approach in practice. Military Theory Complexity theory has influenced military thinking implicitly since the work of John Boyd through training and briefings in the 1970s and 1980s and has increasingly come to be explicitly discussed by academics and students in the military field. The application of complexity theory in analysis and strategy development is, as elsewhere, shaped by the beliefs and mental models emerging from intra-personal complex systems, or in other words viewing the world through a complexity lens can lead to many differing conclusions depending on the personal and cultural context. This point is reflected in the â€•OODA loopâ€– originally developed by Boyd for training fighter pilots but later expanded and developed to apply to war fighting and also competition in the world of business. Boyd posited that all intelligent organisms and organizations undergo a continuous cycle of interaction with their environment. He created a model that describes four interrelated and overlapping processes that are continuously repeated: Observation: the collection of data through sensory perception Orientation: the analysis and

synthesis of data to form one's current mental perspective Decision: the determination of a course of action based on one's current mental perspective Action: the physical playing-out of decisions 16 Figure 1 John Boyd’s OODA Loop Orientation is of key importance, shaping not only decisions and actions but further observation (similarly to the selective perception described by Argyris in the construction of mental models (Argyris, 1978)). Feedback is analysed in the context of cultural traditions, genetic heritage, previous experiences, and new information in the orientation process. Often the OODA Loop was understood as a simple linear process and the complexity of the processes involved not recognised. â€•… the entire " loop" (not just orientation) is an ongoing, many-sided implicit crossreferencing process of projection, empathy, correlation, and rejection. Boyd emphasized that this decision cycle is the central mechanism enabling adaptation (apart from natural selection) and is therefore critical to survival. â€– (Hammond, 1997) Boyd understood the world as containing three elements âˆ’ matter, energy and information âˆ’ which exist in space, time, and the mind of those sensing the environment. In fact, the environment is to be understood as a composite of mind-time-space. We are in a constant process of adapting to the environment, assessing changes consciously and unconsciously and interpreting within the constraints of our personal and cultural make-up. Here co-adaptation is being described with other words. Boyd‘ s observations on the nature of strategy in a complex world are as relevant to peace and conflict work, though the response to conflict may be quite another, where strategy may be understood as: “ A mental tapestry of changing intentions for harmonizing and focusing our efforts as a basis for

realizing some aim or purpose in an unfolding and often unforeseen world of many bewildering events and many contending interests. â€– (Boyd, 2005 p. 58) Lost in Translation As already indicated above, in its application to social sciences there is no complexity theory as such but a number of concepts and approaches that are utilised by different researchers and 17 practitioners to aid in understanding complex systems and to shape responses or interventions in various fields. As complexity concepts were developed within the natural sciences there have been some concerns about importing them wholesale into quite distinct disciplinary environments. I present here some of these concerns, which I group around three themes: a) the use of some but not all concepts; b) the definition of terms ; and c) the extent to which complexity concepts are to be considered metaphor or analogy. a) The particular concepts that are identified as relevant, and the relative importance given to them in the application, varies from researcher to researcher. For example, in the field of peace education, Lynne Davies (Davies, 2003) refers to the six features of complexity theory4. In management and research at the LSE Eve Mitleton-Kelly (Mitleton-Kelly, 2003) refers to 10 generic characteristics5, Walter C. Clemens Jr. (Clemens Jr., 2001) refers to nine basic concepts6. Recently, Ramalingam et al (Ramalingam, 2008) have referred to ten basic concepts, which they have divided into three sets7. These lists all have overlaps and share key features but definitions of some terms also vary. A further significant difference is the extent to which these concepts are seen as bound together in a theory or relatively autonomous to be applied as when required. Ramalingam et al : â€•the concepts can be used in a highly flexible manner — for example, in

combination or individually, to augment existing models or frameworks or as a framework in their own right. â€– (Ramalingam, 2008 p. 60) Contrast with Mitleton-Kelly: â€•It is not enough to isolate one principle or characteristic such as self-organisation or emergence and concentrate on it in exclusion of the others. The approach ... argues for a deeper understanding of complex systems by looking at several characteristics and by building a rich inter-related picture of a complex social system. It is this deeper insight that will allow strategists to develop better strategies and organisational 4 Davies, Lynn, Conflict and Chaos: War and Education, Non-linearity, Sensitive dependence on initial conditions', self-organisation, attractors information. edge of chaos' 5 Self-organisation, emergence, connectivity, interdependence, feedback, far from equilibrium, space of possibilities, co-evolution, historicity & time, path-dependence 6 Fitness, co-evolution, emergence, agent-based systems, self-organization, self-organized criticality, punctuated equilibrium, and fitness landscapes. Walter C. Clemens, Jr., Complexity Theory As A Tool For Understanding And Coping With Ethnic Conflict And Development Issues In Post-Soviet Eurasia 7 Ramalingam et al, 2007. Complexity and systems: These first three concepts relate to the features of systems which can be described as complex: 1. interconnected and interdependent elements and dimensions 2. Feedback processes 3. Emergence Complexity and change: The next four concepts relate to phenomena through which complexity manifests itself: 4. nonlinear 5. Sensitivity to initial conditions 6. Phase space 7. Chaos and edge of chaos Complexity and agency: The final three concepts relate to the notion of adaptive agents, and how their behaviours are manifested in complex

systems: 8. Adaptive agents 9. Self-organisation 10. Co-evolution 18 designers to facilitate the creation of organisational forms that will be sustainable in a constantly changing environment. â€– (Mitleton-Kelly, 2003 p. 3) Walby sees complexity as offering a set of theoretical and conceptual tools rather than a single theory to be adopted in its entirety. She describes her own approach thus: â€•My utilization of complexity theory is not a simple adoption of concepts from other disciplines, but an active process of selecting insights that can be synthesized with social theory, rather than imported or transplanted in their entirety. I offer my own hybridization of complexity theory with social theory here to address the challenge of intersectionality. â€– (Walby, 2007 p. 458) b) Diaz argues that there are discrepancies in the understanding of complexity theory and offers his interpretation of the situation with reference to three, as he terms them, â€•approximations to complexityâ€–: (DÃaz, 2004) â€•First, complexity as science: the study of self-regulated dynamical systems - of their dynamics — from the most diverse disciplinary and interdisciplinary perspectives. Second, complexity as method: the attempt to extract ideas that favor the construction of a method of thought and education inspired by the advances of what has become known to us through the particular research on nonlinear dynamics, self-organization and emergence. Third, complexity as worldview: the attempt for a new look at the world and at its relations, at man and at its place in society, in life and in the world. Although all three approximations are, to my judgement, absolutely legitimate, necessary and complementary, I believe that to make no distinction in their different degree of generality produces more than one misunderstanding. So much for my

thesis. â€– (DÃaz, 2004 p. 50) There may also be varied definitions for particular terms such as, for example, â€•emergenceâ€–. Sawyer presents some of the differing interpretations: within social systems properties are said to be emergent when they are unpredictable even given a complete knowledge of the lower-level description of the system — a complete knowledge of the state of each component and of the interactions of all the components; or properties could be seen as emergent when they are irreducible, in any lawful and regular fashion, to properties of the system components; or again when they are novel i. e. when they are not held by any components of the system (Sawyer, 2004 p. 4). c) Complexity theory in the social sciences has been called a useful metaphor, a misleading metaphor and more than a metaphor. James Rosenau speaks of the attractiveness of complexity theory for those seeking to better understand the unpredictable, multipolar political world and the uncertainty that seems characteristic of our times, where our existing theories do not seem capable of adequately explaining processes or predicting events. However, he sees theoretical weaknesses and high expectations for something that possesses merely metaphorical utility in the description of social reality. Saperstein echoes this scepticism when he asks: â€•Do we gain any useful policy making and/or strategic tools as a result of the concordance of the new metaphors, derived from the physical sciences, with the long recognized chaotic-complex aspects of war and national security in a competitive anarchic world? 2 Has anything been gained by the transfer of the growing popularity of these paradigms from " hard" to " soft" scientists or the recognition of the growing prevalence of these " fads" by the military and

political elites? A new set of metaphors 19 to describe a world does not imply new or different behaviors of that world–we must be very careful not to confuse changes in an intellectual outlook with changes in world events or patterns which we hope to understand and master. â€– (Saperstein, 2003) However, he does qualify this assessment when he argues that such metaphors could be useful in â€•educating that majority of citizens, soldiers, and statesmenâ€– as: â€•It is clear that the set of metaphors which underline our thoughts and discussions about the political world determine our responses to matters of war and peace. Action often follows theory. ... Moreover, we also recognize that our metaphors may also shape that political world. The " field of endeavor," within which we are trying to find appropriate responses, is not itself fixed a priori; its contours may be molded by our metaphors; the topographic maps relied upon by the competing forces may be altered by the plans and actions of these forces. Hence policy and response are easier and more effective, the more appropriate the available metaphors. â€– (Saperstein, 2003) Eve Mittleton-Kelly is careful to stress that a direct mapping of the characteristics of complex natural systems on to complex social systems is neither desirable nor possible where the unit of analysis may differ or the domains may have fundamental differences, e. g. human capacity to reflect and choose. She believes social systems need to be studied in their own right. She finds metaphors to be â€•both limiting and limitedâ€– and unhelpful for understanding the fundamental nature of a system under study. Where they are useful is as â€•transitional objectsâ€– in the sense that they help the transition in our thinking when faced with new or difficult ideas or concepts (Mitleton-Kelly,

2003). For others complexity theory can be used metaphorically but metaphors themselves are understood as being more than merely bridges of understanding or â€•transitional objectsâ€–. Alan D. Beyerchen, influenced by cognitive science research, sees metaphors as: â€•indicators of networks of meanings and entailments that dilate or constrain both our perceptions and our conceptionsâ€– (Beyerchen, 2003). Thus metaphors shape the world that we see and the way in which we act. Wendell Jones reflecting on complexity, conflict resolution and how the mind works, is influenced by Lakoff and Johnson‘ s (Lakoff, 1980) arguments about the fundamental influence of metaphor on human perception and cognition: â€•Metaphors are very powerful tools in constructing reality. We can limit possibilities by being unaware of the metaphors we‘ re using, or we can create new possibilities by choosing new metaphors. Individual experience also has a powerful effect on this aspect of perception. ... each new experience is in intimate co-formation with the complex whole of the person‘ s life. What each person â€•learnsâ€– from an experience is only to a small extent defined by the experience; the formative context plays the dominant role. â€– (Jones, 2003 pp. 10-11) However, that different mental models of complexity exist for different theo