

Complexity Models and Conflict: A Case Study from Kosovo

Introduction

“..the chief characteristic of this emerging world is...the interconnectedness of the destructive forces, the interwoven and increasingly interacting worldwide forces of economic, political and military power: *a global culture of violence*. This is fuelled at all levels, from individual to nation and perhaps even to international bloc, by the hope for power and profit.” *Adam Curle, To Tame The Hydra: Undermining the culture of violence (5)*.

The increasing interconnection of political, economic and social systems with the attendant juxtaposition of differences makes for a volatile mix. Innovative technology is instrumental in connecting rapidly and in real time, events, ideas and actions. Every domain of human society and culture is affected, from language to religion to food. The resulting patterns – often referred to as globalization – are highly complex, inter-dependent and increasingly susceptible to massive changes from seemingly trivial events. As values, interests and identities clash with resulting conflict, the need for a way to confront and focus differences constructively is imperative because the potential for local violence to become regional, national and international is increasing.

Adam Curle (1999) describes these interdependent forces that generate conflict and other patterns, as the Hydra. Like the mythical Hydra, a many-headed water snake that grew a new head as soon as one was cut off, each solution to a problem generates the emergence of another problem or issue. In searching for solutions to this challenge, Curle applies concepts from the Complexity Sciences, specifically applying Prigogine’s dissipative structures to social systems and reference to creative adaptation. In fact, the Hydra that

Curle describes displays the features of a complex adaptive system: many elements interacting in nonlinear ways, displaying emergent/self-organizing characteristics, sensitivity to initial conditions and scalability.

Ramsbotham, et.al. (2005: 6-7) in a current overview of the field of conflict resolution cite three current intellectual challenges to the field: 1) the appropriateness of impartial conflict resolution techniques where war is fuelled by 'greed rather than grievance,' 2) internal wars representing "...the emergence of new types of social formation adapted for survival on the margins of the global economy..." and 3) western cultural bias built into current models of conflict resolution. These challenges are emerging from the dynamics of globalization described above.

Conflict is a part of human intercourse. Disputes between individuals or groups about the distribution of resources, values, or access to power are not uncommon. Under certain circumstances, the unstable, nonviolent patterns give way to unstable violence and ultimately to enduring violence. Peacemakers around the world are engaged in efforts to prevent the shift from unstable, nonviolent conflict to violent conflict, but traditional approaches cannot reliably influence the emergent patterns in such unpredictable dynamics. Linear problem solving techniques work best in stable systems when change is slow, variables are few, uncertainty is low, and past experience is a reliable guide. Unfortunately, none of these characteristics occurs when a nonviolent context moves toward instability and violence. In such situations, traditional linear problem solving protocols can take too much time and depend on too many faulty assumptions.

Human Systems Dynamics (HSD) is a field of research and practice that applies methods, tools and techniques from nonlinear dynamics (Eoyang, 2001). It has much to offer social science and conflict resolution theory and practice. Miller and Page (2007:213,222) note that “The complex adaptive social system view of the world allows us to explore the spaces between simple and strategic chaos between richness and rigor and between anarchy and control....New modeling techniques, combining both mathematics and computation, allow us to make the more realistic assumption that social activity takes place in between these extremes.” Using a complexity lens, conflict de-escalation and conflict transformation can be viewed as self-organizing processes. The CDE (Container Difference Exchange) Model developed by Glenda Eoyang identifies three conditions that influence the process and describe the results of self-organization. We will describe this model and then apply it to a case study of peacebuilding in Kosovo. We will close the paper with a consideration of computer simulation modeling and its potential applications for CDE analysis of conflict in dynamical human systems.

The CDE Model

The CDE model posits three conditions – Containers, Differences and Exchanges – that interact with one another in nonlinear ways (see Table 1).

Containers hold a group of interacting agents together. Containers can be geographic – such as mountains, rivers, and oceans. They can be political – cities, towns, states

(national and international). Or, they can be based on affinity, focused on a charismatic leader or an ideology.

Differences among interacting agents can be physical, ideological, experiential and emotional including gender, education and religion. Significant differences are those to which specific behavior is attached. Differences thus represent a source of potential energy in a system – depending on which attributes are selected for differential treatment. Difference also articulates the systemic pattern. Race, gender, ethnicity, affluence, political loyalties are all examples of differences that delimit the patterns of relationship in human systems. Such patterns can either encompass coherent diversity or unstable conflict.

Exchanges represent transactions involving resources such as money, goods and information. Transforming exchanges are those actions which can amplify or dampen responses. Influencing any, all or some of these conditions can influence the self-organizing patterns of the system.

The CDE model is generalizable, scaled, and pattern-based. It is generalizable in that there may be multiple interacting CDEs in a given situation. Many different locally-determined factors may function as containing, differentiating, and exchanging system features, so the CDE description can transcend the details of a specific situation. A street gang may function within a neighborhood (C), with age and size being significant in role assignment (D), and violent language and action establishing and maintaining

relationships (E). In another context, a charismatic leader (C) may bring a group of people together across economic boundaries (D) to engage in religious ritual (E). The conditions for self-organizing provide a coherent, consistent, and context-free way to observe, describe, and influence the human systems dynamics in these dissimilar situations.

The CDE Model is scaled¹ because it is equally effective in describing patterns of intrapersonal, interpersonal, organizational, political, and community interactions. Interactions among the various levels are also accounted for in the CDE Model. A difference at one level of organization functions as a container at a lower level, and container at one level functions as difference in the level above. For example, a neighborhood (C) includes different families (D), but within a family (C) individuals play specific roles (D), and within a city (C) differences among neighborhoods (D) can be significant. These cross-level relationships allow the CDE Model to represent relationships between the part, the whole, and the greater whole that are critical in understanding conflict and the emergence of violence.

The CDE focuses on patterns as a way of seeing and influencing complex human behaviors. This approach stands in contradistinction to the tradition of reductionist analytical processes that are ineffective in the study of self-organizing or emergent phenomena, including conflict. In the field of human systems dynamics, a pattern is defined as similarities, differences, and relationships that have meaning across time

¹ Here we use “scaled” in reference to reaching across and integrating multiple levels of self-organizing or dissipative structures. In computer simulation modeling and in program design, the term is used quite differently to describe expanding size or reach of a pre-defined structure or the number of engaged agents.

and/or space. Influences on the system shift the conditions (C, D, or E), and the pattern (similarities, differences, and relationships) change in response. In analyzing the configuration of CDEs that form a particular pattern, the conditions influence the degrees of freedom that exist for each of the agents engaged in the system. By influencing the degrees of freedom, the CDE conditions impede or accelerate processes of self-organization that move the system toward fitness with its environment. This process—shifting conditions, changing constraints, formation of new patterns—is how we think about and seek to influence transformation in complex human systems, including those that deal with stable and unstable conflict.

Given these three defining characteristics—generalizability, scalability, and patterns—we are positing the CDE Model as an expression of underlying system dynamics, not merely as a metaphor or heuristic.

Interdependencies among CDE

Each of the three conditions is intimately connected with the other two. A change in one—increasing or decreasing constraint—results in a change in one or both of the others. *Table 1. Condition Interdependencies* summarizes the nonlinear interactions between and among the three conditions.

Each condition influences the amount of constraint or degrees of freedom of the agents individually and collectively. Increases in constraint (small containers, few significant difference, tight exchanges) tend to increase tension and potential energy in the system.

Decreases in constraint (large containers, many significant differences, loose or no exchanges) reduce tension and lower potential energy for change. A mix of increasing and decreasing constraint in conditions may either hold the system in place or result in unpredictable and quite complicated emergent patterns.

Table 1. Condition Interdependencies

Intentional actions	Adaptive results	
Container	Difference	Exchange
Smaller/tighter	More tension More coherence	More frequent More controlling
Larger/weaker	Less tension Less coherence	Less frequent Less controlling

Intentional actions	Adaptive results	
Difference	Container	Exchange
Greater number	Expanding	More ambiguous
Lesser number	Contracting	Less ambiguous
Greater Magnitude	More tension	Less reliable
Lesser Magnitude	More stability	More reliable

Intentional actions	Adaptive results	
Exchange	Difference	Container
Tighter	More tension	Contracting
Looser	More diversity	Expanding
None	No limit	No boundary

Kosovo Case Study

Background

An application of the CDE model and associated interdependencies of Containers, Differences and Exchanges will be illustrated by a case study from Kosovo (CDA 2006). Major elements of the CDE analysis from the case study are presented in Table 2 below.

Table 2. Partial CDE Analysis Before, During, and After the War

Before the war		
Container	Difference	Exchange
Fushe/Livadje	Mixed (630 Albanian/121 Serb) 12 K from G/G center 5K to D/D 5,000 residents 4 neighborhoods 3 near village center Good neighbor relations	Godparents to each other's children Serbs spoke Albanian
Drvar/Druror	Mono-ethnic Serb 5K to F/L	
Gijalan/Gnijilane municipality	F/L and D/D Distances from town to villages Size of villages	Road from G/G to F/L passes through D/D Back roads from F/L to G/G through P/P (another village not otherwise mentioned)
During the war		
Fushe/Livadje	Police, armed civilians paramilitaries PDK (Democratic Party of Kosovo) local leader "Fascist genocide"	Albanians felt betrayed by Serbs Buses with Serb paramilitaries arrived Albanians forced out Houses of Albanians destroyed Some killed (PDK leader) Alb believe Serbs helped paramilitaries. Serbs marked their houses to avoid attach. Serb story is that some were "killed in course of robbery"
Drvar/Druror	Monoethnic Serb	
Gijalan/Gnijilane municipality	F/L and D/D Distance High proportion of Serbs (10-30%) Many monoethnic Serb villages F/L, E/V, and M/P fared poorly F/L became more tense	Flee from F/L to D/D Road from G/G to F/L passes through D/D Back roads from F/L to G/G through P/P KLA had difficulties penetrating using rural areas as base here as opposed to other places. "delicate system of mutual economic dependence had been developed " Attacked on 27/3/99
After the war		
Fushe/Livadje	No Serbs Leadership of Albanian Support/oppose return Leadership/youth Needs of residents/votes Needs (school, returns, street lights, water distribution, sewage, infrastructure for youth, etc.)	Of 121 households 35 in Kosovo and rest IDPs (Internally Displaced Person) in Serbia. Albanians came back Opposed to return of Serbs Public opposition to leadership Believed and stated
Drvar/Druror	Monoethnic Serb	
Gijalan/Gnijilane	F/L and D/D Less suffering than most of Kosovo 5 K between F/L and D/D F/L largest, most strategically located villages in G/G In city/in village	Intermittent violence after July Serbs die Serbian Orthodox Church and graveyard destroyed Little violence after destruction of church/graveyard No relations between F/L and D/D Commercial dealings between F/L and D/D Organized peace activities between F/L and D/D Verbal abuse and harassment

After the war (continued)

French KFOR		Came to FL No communication No violence
American KFOR	Can they or do they want to defend Serbs?	Physical violence Attacks Not guarantee security to Serbs Houses burning Translation unreliable
Road	Through D/D Blocked/open Use by Serbs or Albanians	B locked by Serbs KFOR intervened to force opening
Peacebuilding efforts	Sincere/insincere Visible/invisible Many/few DD/FL Contractors from inside/outside Municipality and community	Rebuild school Dialogue “No problems between D/D and Albanians in F/L”
Dialogue for returns	Many International orgs and INGOS Sustainable Success/failure Early/later Communities F/L and D/D	Facilitation Prepare ground for return Return Accusations Non-acceptance of guilt
New dialogue process	2003 Initial failure F/L Alb residents and IDPs (Internally Displaced Person) in D/D Agriculture/access to land	Prepare the ground for returns to F/L Work with local NGOs Promote inter-ethnic cooperation Usurpation by Alb residents of F/L Dialogue Agreements on land use Gave access to land Cultivate land
March 2004 Riots	No violence: Little movement in or out of F/L Serbs in D/D prepared for an assault with unarmed guards. Serbs did not block road Village already “fighting” Serb return Road open—no problem March events/negotiations re returns Belgrade or UNMIK pushing for return	Participate in demonstrations Traveled to G/G to participate Staged demonstration in F/L but were easily dispersed. Gave up when threat of armed conflict between the communities. Message to Serbs to leave Kosovo
Dialogues	Severe arguments Serbs and Albanians Key issues/politics The “others’ argument” Extreme-not participate /Alternative and open minded did participate Invited/not resented not	Discussion INGO organizes Address key issues Mental blockage

After nearly five years of significant peacebuilding initiatives in Kosovo, violence erupted in March 2004. A number of organizations, concerned about the efficacy of their investments in various peacebuilding processes, undertook an assessment of which peacebuilding activities were making a difference in Kosovo. The study was initiated by CARE International and funded in substantial part by the Foreign and Commonwealth Office of the United Kingdom as well as CARE UK, CARE Austria and CDA (Collaborative for Development Action). CDA conducted the study that included seven case studies, one of which, “No Violence, No Returns in Gjilan/Gnjilane Municipality,” provides the examples that follow.

The case study involves two villages Fushë/Livadje and Drvar/Druror within the Gjilan/Gnjilane municipality. Before the war, Fushë/Livadje was a mixed ethnic village (750 families: 630 K-Albanian, 121 K-Serb) and Drvar/Druror was and is mono-ethnic (K-Serb). Fushë/Livadje was attacked on March 27, 1999 by Serbian paramilitaries. Several people were killed and K- Albanians were driven from the village. French KFOR (Kosovo Force) came to the village and K-Albanians started coming back. There was no violence. When American KFOR replaced the French troops, physical violence and attacks on K-Serbs began. Their houses were burned and ultimately they left the village.

The main peacebuilding activity in Fushë/Livadje involved dialogue facilitated by a number of international organizations and INGOs. In general, dialogue focused on the

issue of K-Serbs returning to Fushë/Livadje and related property issues. Other peacebuilding activities included joint projects. In Drvar/Druror, a K-Serb village, an NGO (non-governmental organization) helped to renovate a school using K-Albanian contractors. KFOR hosted a joint sports event organized by a local (Fushë/Livadje) NGO.

Though there was no violence in these two villages in March 2004, the connection between peacebuilding activities and the lack of violence is not clear. Other factors may have contributed to the lack of violence. The CDA study concluded that the effectiveness of the dialogue/peacebuilding process was limited.

Analysis

The CDA analysis of the case studies focused on six themes that emerged from the data (the CDE condition is indicated in parenthesis):

- Community context (Difference)
- Incidents of violence (Exchange)
- Demographics of community members (Difference)
- Connectors (Exchange)
- Dividers (Exchange)
- Peacebuilding activities (Exchange)

Each of the themes of this descriptive taxonomy can provide insights regarding change over time. It would even be possible to track the change in each theme

over time and see how changes in one correlated in time with changes in the others. What this analysis will not do is to show how the mechanics of one theme influences the mechanics of another one. Each of these emergent themes influences peace and violence, but do they and how do they affect each other?

Considering the thematic categories of the case study defined by CDA, we observed that each one correlated either with differences in the system or exchanges among agents in the system. When we reframe the themes as patterns and consider the conditions that establish and maintain those patterns, we establish the foundation to investigate how the patterns influence each other over time.

As presented in Figure 1, differences were captured in the community context and demographics of community members. Exchanges were described as incidents of violence and peacebuilding activities, while connectors and dividers influence other kinds of exchange.

The missing condition from this theme-based analysis is the container, which would account for the massively entangled and multi-layered nature of the dynamics of conflict. Throughout the narratives, multiple levels of interaction are described. While the K-Serb and K-Albanian containers were assumed to be the most relevant to patterns of peace, other powerful containers were described including individual, family, neighborhood, village, municipality, organization.

Global organizational, military, political, and economic containers are not mentioned extensively in the case studies, though it is made clear that they also influence the dynamics.

A complete analysis of the case studies and the interactions of the conditions is beyond the scope of the current work, but an example can demonstrate how the CDE can lead to insights about the relationships between and among the descriptive categories identified in the initial case analyses. Patterns of interaction were most peaceful under two circumstances. First, homogeneous ethnic communities were peaceful because smaller (more constrained) differences encourage more reliable exchanges, and more stable containers. Second, when interactions were infrequent (unconstrained), differences became irrelevant, and no boundary conditions were instigated. The CDE dynamics may explain one of the findings of Lim, et.al. (2007:1543): that the spatial distribution of ethnic groups is a strong predictor of violence. Unconstrained differences might be one factor in contributing to the lack of violence in the Gjilan/Gnjilane municipality area:

The OSCE [Organization for Security and Cooperation in Europe] Kosovo Verification Mission noted that 'it is difficult to give a specific reason for the relatively calm situation in Gnjilane during the pre-deployment and deployment period.' They surmised that because of the relatively high proportion of Serbs (10-30%) and the existence of many mono-ethnic Serbian villages around the town and in the northern part of the municipality, the KLA had difficulties penetrating the area through the normal method of using rural areas as a base (72).

Lowered tension in a system is not necessarily a positive sign in a peacebuilding scenario. In the short term, it might be adaptive and avoid impending outbreaks of violence. On the other hand, the increased constraints posed by engagement,

communication, learning, and negotiation may generate tension and potential energy for new, positive patterns to emerge.

Interdependencies among CDE conditions also indicate how the dynamics of violence feed on each other. A tighter container based on geographical boundaries, leads to more frequent exchange. More frequent exchange is tighter and tends to increase tension around differences. Larger differences make exchanges less reliable, which encourage more diversity, which increases pressure in the tight container. The process amplifies tension and instability until the system splits in two (bifurcates).

One example might serve to demonstrate how the CDE Model can provide information about critical shifts in patterns of peace to violence and potentially contribute to the development of intervention strategies. Prior to the attack by Serb paramilitary on 27 March, 1999, Fushe/Livadje peacefully supported a mixed population of approximately 16% Serbs and 84% Albanians (D) (72). This difference was mediated by multiple interactions (E) described in the report. Serbs and Albanians served as godparents to each others' children, and many Serbs spoke Albanian. Arrival of the paramilitary, however, amplified the ethnic difference by aligning Serbs in the village with the attackers (73). Rather than pointing out the fundamental distinction between frightened resident (both Serb and Albanian) and violent paramilitary, exchanges during and after the attack identified Serb civilians and paramilitary personnel as part of the same group (C).

This shift in identity continued to shape relevant differences and patterns of exchange throughout the remainder of the study period. The pattern is quite distinct, for example, when the “village leadership produced a list of Serb war criminals” that was later proved to be spurious (76).

Considering the relevant conditions before, after, and during key pattern shifts can provide insights into the mechanisms of change as well as indicating possible options for action. If the Serbs and Albanians shared their fears and efforts at survival with each other during the paramilitary raids, the shared identities of residency might have counteracted the split identities of ethnicity.

Observations

Any peacebuilding activity is intended to shift one or more of the conditions for self-organizing, but if the design of the effort does not take the CDE and interdependencies into account, the intervention may:

- Work in contradiction to other related or unrelated peace building efforts, so that no net result is observable.
- Generate unexpected consequences as the system adapts other conditions in response to changes in the condition of focus.
- Consume resources to shift the system when the other conditions are highly constrained or locked in by other forces that are beyond the project scope or influence.

- Set conditions for transformations at other levels (either above or below the level of intervention), so that changes occur (either positive or negative) that are unpredictable.

Issues with Modeling

Computer simulation models have proven effective tools in the study of the complex dynamics of conflict and peace. Simulation models support human systems dynamics research because they operationalize conditions for self-organizing, allow replication of conditions, and provide a more rigorous and reliable laboratory than collections of human beings. For all these reasons, we would like to develop a computer simulation modeling to support on-going research and practice with CDE Model. In this section of the paper, we will consider the strengths and limitations of various simulation approaches when dealing with the CDE Model and its view of pattern-based dynamics.

Computer modeling processes take one of three approaches.

- Inductive models take a time series of data and determine the mathematical relationships that could have generated such a series over time.
- Deductive models begin with a mathematical or rule-based description of a problem (in the form of an equation or a set of simple rules for an agent-based model) and solve the problem repeatedly to discern patterns that are formed within each cycle and across multiple cycles.
- Inductive/deductive models begin with one or the other approach and pursue it as long as it is fruitful. When it reaches an impasse, the investigator switches to the other approach, as long as it is fruitful.

Inductive models work in both linear and nonlinear systems. Nonlinear time series analysis, sometimes called attractor or state space reconstruction, can give a great deal of information about the number of nonlinear variables and the complexity of their interaction over time. The constraint for a CDE model here is that reliable analysis requires a time series that is very long, including thousands of data points. Consistent, long-term, time series data is difficult to obtain from real-life, emergent human systems. On the other hand, you don't have to predict which will be a critical variable ahead of time. If a system demonstrates coherent chaotic attractors, then any one of the many nonlinearly coupled variables will provide evidence of the same patterned behavior over time. The other limitation here is that that method can tell you whether the system is coherent and the dimensionality of the system as a whole, it cannot indicate what variables determine each of the dimensions. So, it could say that a particular situation was coherent beyond the apparently random patterns and that the dynamics were driven by three parameters, but it could not identify those parameters as containers, differences, or exchanges.

Some researchers also use agent-based simulations for inductive models. If enough is known about individual decision-making rules, then an agent-based model can inductively simulate what system-wide patterns might emerge from those local rules. Of course the limitation of this approach in real-world system is that the local rules may be inconsistent, and they are often implicit. HSD strategies that help groups identify the

short list of simple rules that guides their group behavior might prove helpful in establishing the foundations for inductive agent-based models.

Deductive models assume that you have some underlying idea of what the variables are and how they interact. Frequently called connectionist models, these deductive approaches begin with theory and/or model of systemic behavior, use those hypotheses to model system-wide patterns, and compare results to observable patterns in the real world.

We anticipate two possible paths for CDE in deductive modeling. First, working with an agent-based model, we could give agents the simple rules of the institute—operationalized so any agent could follow, and see what patterns emerge. Second, we could write a set of coupled, nonlinear equations in three variables (C, D, and E) and explore the conditions under which they generate coherent patterns and how that coherence compares to observed phenomena.

In either case, we need to have realistic data to either generate or test the model. One of our current challenges is to determine what that data would look like and to see how we might access it. To some extent, our use of the CDA Kosovo case has served such a function in this paper, but we seek a method that is more rigorous and replicable.

Increasingly, researchers are using mixed methods. Inductive or deductive methods are invoked, depending on the data available and types of systems to be simulated. When a

limit is reached, or when promising questions have been formulated, then the other methods are invoked.

These mixed methodologies are evolving, and are proving useful in network modeling, adaptive agent-based modeling, and fitness landscapes. All of these methods are variations of simple agent-based modeling. In each of these methods, system-wide patterns can be posited, simulated, and compared to existing population data. They can also posit individual actions based on system-wide influences, and test those against individual-level performance data. Again, access to data and rigorous and robust systemic descriptors limit the practicality of these methods in the study of conflict and other emergent patterns in human systems.

There are other limitations of simulation modeling tools and approaches:

- 1) CASs are multiple levels—whole, part, and greater whole. Simulation models usually address only two levels—the emergent and emerged. Simulation models are excellent at modeling paired interactions. The Prisoner's dilemma is a prime example of pair-based models. They also can model system-wide behavior that includes infinities of bodies, where statistical and stochastic methods are valid. The most interesting dynamics for conflict study and practice, however, emerge when there are more than two and fewer than a practical infinitude of agents and where multiple levels (individual, family, tribe, nation) exhibit mutual influence.
- 2) The functions of the conditions can be served by any number of parameters in the system. Multiple parameters are present at any time, and they become more or less

evident/effective depending on context. (Context is also established by other sets of C, D, and E.) Translating out of this indeterminate space and into a more determinate modeling space brings a whole array of uncertainties.

- 3) Though these phenomena are not fundamentally stochastic, they can be influenced by random shifts in CDE that form context or pattern. Any simulation model would need to include both uncertainty derived from randomness in an open system and the uncertainty that emerges from an n-dimensional, nonlinear, dynamical system.

Conclusion

Traditional conflict resolution and peace building methods, based on linear causal models of human systems dynamics and thematic categories of behavior, have not resolved issues in ways that are reliable, generalizable, or sustainable. Where theory seems reliable, practice is unpredictable; and where practice is effective, theory is weak, if present at all. The sciences of nonlinear dynamics—chaos and complexity—offer a new approach to these age-old issues of peace and conflict.

We have used fundamental constructs of complex adaptive systems (patterns, agents, and self-organization) to describe the dynamics of conflict emergence and peacebuilding. We have applied the conditions for self-organizing—containers, differences, and exchanges—to describe how peacebuilding activities in a region of Kosovo influenced emergent dynamics there. We have illustrated how these three conditions influence and are influenced by each other as they shape the dynamical system-wide patterns and influence the actions of individual agents in the system. In the CDA description of

peacebuilding activities in Kosovo, we see efforts to influence containers by establishing, weakening, or reinforcing , differences and exchanges.

Our future work will involve developing and testing computer simulation models based on the CDE Model that will allow us to test the reliability, generalizability, and sustainability of interventions based on this understanding of the nonlinear dynamics of peace and conflict.

Our questions for future research include:

- Based on the historical theory and practice of peacebuilding, are containers, differences, and exchanges the necessary and sufficient conditions for patterns of peace?
- What innovative options for peacebuilding action are generated in light of the CDE Model?
- What will be needed for individuals engaged in local and global conflict to use the CDE model to influence their own emergent, complex adaptive patterns for themselves and their communities?
- What mode of simulation modeling is most effective to represent the CDE Model and how can that simulation model be tested against objective, subjective, and normative data regarding peace and peacebuilding activities?

References

CDA Collaborative Learning Projects (2006). *Has Peacebuilding Made a Difference in Kosovo?*

<http://cdainc.com/publications/rpp/articles/CDAPeacebuildingReportKosovo.pdf>.

Curle, A. (1999). *To Tame the Hydra: Undermining the culture of violence*, ISBN 1897766513.

Eoyang, Glenda H. ((2001). *Conditions for Self-Organizing in Human System*, (Unpublished Dissertation), <http://www.winternet.com/-eoyang/dissertation.pdf>.

Lim, M., Metzler, R., Bar-Yam, Y. (2007). "Global Pattern Formation and Ethnic/Cultural Violence," *Science*, ISSN 1549-3636, 14(September): 1540-1544.

Miller, J.H. and S.E. Page (2007). *Complex Adaptive Systems*, ISBN 139780691127026.

Ramsbotham, O., Woodhouse, T. and H. Miall. (2005). *Contemporary Conflict Resolution: The prevention, management and transformation of deadly conflict*, ISBN 0745632122.

Yellowthunder, L., (2007) "An Application of Complexity Theory to Globalization Issues," in L.K. Brandt (ed.), *Cultural Analysis and the Navigation of Complexity*, ISBN 139780761836827, pp 55-64.