

Disaster: Agent of Diplomacy or Change in International Affairs?

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Disaster is presented as a process of transition which changes relations both within and among states engaged in mitigation and response. The article advances the concept of complex adaptive systems (CAS) as an analytical tool that captures the high degrees of complexity and dynamics characteristic of potential or actual disasters. Consequently, the three case studies in this special section of the Cambridge Review of International Affairs which analyse critically the argument for disaster diplomacy as an opportunity to increase cooperation among rival states are re-examined in a CAS framework. Based on the application of CAS to the case studies, the article concludes that creative diplomacy for disaster reduction is most effective at the 'edge of chaos', that narrow region where there is sufficient structure to hold and exchange information, but also sufficient flexibility to adapt new alternatives to meet urgent needs.

Disasters present unusual laboratories for the study of change and processes of transition. Disaster tends to shatter existing norms and practices among states, creating a (momentary) opportunity for fresh recognition of the fragility of life and common humanity that bond all peoples. In most cases, the disaster event is the result of conditions and policies long in practice that have created a vulnerability to sudden, unexpected events which result in severe destruction and loss of life in the affected communities. Nonetheless, even the temporary suspension of old rivalries can aid in a redefinition of a more constructive profile of cooperation among states exposed to common risks, leading to more productive modes of interaction. Identifying common elements that facilitate constructive engagement in reducing shared risk, and anticipating obstacles that may hinder such engagement, offer an important opportunity for disaster diplomacy, i.e., to build cooperation among states in other areas of interaction as well as disaster reduction.

The concept of disaster diplomacy is based upon identifying the common interests of states at a level of scientific understanding of shared risk. Shared risk

is public risk, one which affects all nations in a risk-prone region, whether or not they have contributed to the conditions producing the threat. Shared risk, consequently, invokes public response to mitigate the threat of danger to a specific region¹. The problem is complex, and involves a full range of activities that include mitigation, response, and recovery.

The three cases presented in this 'Disaster Diplomacy' section² illustrate different phases and dynamics of disaster management. Mitigation includes the activities of monitoring and assessment prior to an actual event, such as tracking hurricanes across the Caribbean Sea and sharing that information among all states that lie in their paths. Michael H. Glantz, in his analysis of 'Climate-Related Disaster Diplomacy', presents a case study of US-Cuban relations in coping with shared climatic risks. Response activities involve the rapid mobilisation of assistance following a severe event, such as the timely deployment of search and rescue teams after the Greek-Turkish earthquakes. James Ker-Lindsay analyses the reciprocal Greek-Turkish response activities following the Izmit and Athens earthquakes of 1999 in the context of growing acknowledgement of shared diplomatic interests in the larger European arena. Recovery involves activities directed toward rebuilding communities ravaged by a disaster, such as restoring croplands and forest after severe drought in southern Africa in 1991-1992. Ailsa Holloway documents the role of the Southern African Development Community (SADC) in transporting food and materials to avoid famine and notes the subsequent need for continued international collaboration in replanting drought-stricken croplands to renew food production for the next agricultural season.

These case studies represent a comparative analysis of efforts either to avert or respond to disasters in states considered to be in conflict in different areas of the world. The disasters are triggered by different agents, continue for varying periods of time, and disrupt governmental performance at different levels of jurisdiction to varying degrees, but in each case, the existing governments faced problems of differing magnitudes in meeting the immediate requirements of its threatened population and, with the exception of the US, in sustaining basic operations in the disaster region without external assistance. They illustrate that it is not the disaster event, but the kind and mode of cooperation that is fostered among states in an environment threatened or altered by severe destruction that creates the opportunity for change in relations among states previously in conflict. In this paper, I will review the earlier analysis of specific cases using the theoretical model of 'Complex Adaptive Systems' (CAS), and suggest a set of tasks that, if integrated successfully into international policy, may contribute to long-term disaster reduction and the development of constructive relations among former enemies.

I. Shared risk and scientific knowledge

With current global media coverage, disaster events capture the world's attention within minutes of occurrence and focus it (temporarily) on the loss and destruction that follow from a sudden, unexpected event or a slowly evolving crisis that crosses the threshold into chaos. This global focus creates an opportunity for documenting risk that states share from hazards. But the moment

of global attention is fleeting, and the goal of common action needs to be articulated clearly in terms of shared responsibility for any significant change to occur in practices that had contributed to the scope and extent of disaster. This task requires policy and analytical skills, as well as a base of shared knowledge that is only now developing among countries facing shared risk from environmental hazards, such as earthquakes, hurricanes, or drought. Such skills are not yet widely practised in regions vulnerable to disaster, but increasing incidence and costs of disaster world-wide are driving a re-examination of policy and practice in disaster mitigation, response, and recovery in the international community.³

The impact of natural hazards upon human communities can be most effectively reduced through informed decisions regarding the location and construction of built environments, informed actions taken by the public exposed to risk, and timely communication and exchange of information among the organisations and jurisdictions that have designated responsibilities for protection of life and property. As such, shared risk leads to shared responsibility among all states exposed to a threat.⁴ Determining the degree, characteristics, and frequency of exposure to hazard for the region is fundamental to reducing its impact upon human communities.

Since scientific knowledge affects the capacity not only of individual states, but also of all states in an exposed region to reduce that risk, shared scientific enquiry offers states a basis for building collaborative relationships to support collective action to reduce the destructive impact of that hazard on their respective cities and communities.⁵ The benefits of such collective action undertaken to achieve the common goal of reducing shared risk may outweigh older hostilities based upon economic, religious, ethnic, or political rivalries. Carried out effectively, collective enquiry can create a scientific knowledge base to support 'disaster diplomacy'. Without a basis in scientific enquiry, cooperative relationships among states forged under the urgent stress of dramatic disasters are likely to founder, with new-found collaboration dissipating over time under the friction of ordinary competitive interactions.

During periods of disaster, a country's governmental system can be disrupted, and the stages of transition in re-establishing governmental function are not clearly demarcated. Failure in one part of the system may, and often does, precipitate failure in others. Consequently, a state that has previously been in conflict with a disaster-stricken state, but is now seeking to improve relations, needs to consider the problem on at least two levels: the macro level of the stricken state's performance within the wider international arena, and the micro level of the specific area of damage or loss and its impact upon the state's internal operations. The macro and micro levels of operation require different types of information and resources for informed action, and represent different modes of learning and feedback for the participants at each level. Interestingly, each level can provide a lever for change at the other level, which, if used effectively, can stimulate dynamic interaction within the whole disaster reduction system. Instances of this type of reciprocal interaction between micro and macro level performance are documented in the three cases included in this section.

In this context, the policy process to achieve the goal of developing collaborative relations operates at four levels of decision-making simultaneously: 1) the individual state(s) exposed to risk; 2) donor states offering expertise, resources, and assistance; 3) the international exchange between risk-prone and donor states; and 4) exchange among risk-prone states. Actions taken at each level create opportunities and set constraints on possible actions at the other levels. This interactive, dynamic policy process generates a 'complex, adaptive system' through which actions are taken to ameliorate crisis for states at risk.

In this essay, I undertake four tasks: 1) to present briefly the conceptual model of CAS in the context of disaster management; 2) to examine transition as a learning process for the system undergoing change; 3) to suggest a model of CAS as a framework for analysis of actual systems that are vulnerable to disaster; and 4) to consider the role of information technology as a mechanism to facilitate collective learning in systems undergoing transition. In the light of these tasks, I will also introduce four proposals that may contribute to long-term disaster mitigation and the development of a cooperative environment between former rival countries. These propositions are: 1) building an information infrastructure to support collective scientific enquiry by states that are exposed to shared risk; 2) assessing the absorptive capacity within the organisations and institutions of these states for valid scientific data; innovative approaches, and new techniques for hazard reduction; 3) identifying appropriate times and modes of intervention in existing policies and practices in risk-prone regions; and 4) coordinating collective efforts to reduce shared risk. The result is not 'disaster diplomacy' defined narrowly as the work of negotiation through official representatives of national governments, but a much broader process of organisational and interorganisational learning that views states as one level of aggregation within a larger and more complex global system.

II. Complex adaptive systems

The conceptual model of CAS offers a means of assessing the change process in states that are exposed to potential disaster or have experienced severe disruption. This model focuses on the transition in different states of evolving social, economic, and political performance. It combines elements of both the economic and ecological perspectives, but accepts the fundamental premise of nonlinearity in social systems. In other words, it recognises that social systems engage, to varying degrees, in continuous learning and self-organisation in reciprocal interactions with the environments in which they are embedded. The CAS model is drawn from a substantial literature.⁶ This literature addresses two basic issues regarding CAS: 1) the conditions under which they emerge and function; and 2) the actual properties and mechanisms which characterise their operations. The two issues are interactive.

CAS evolve in conditions that demand change in the existing order of performance. They emerge out of interaction among component units at the micro or local level which, in turn, produces a macro level response. The link between the dynamics of this conceptual tool observed in physical and

mechanical systems and the application of these concepts to social systems is the assumption that there are generic properties in the process of change, involving interacting components, that can be identified in all systems. Understanding these dynamics offers insight into potential types of emergent macro organisation that are likely to be produced by interaction among components of a social system. More specifically, such an understanding offers the potential for influencing the outcome of the new phase of order that would evolve out of the interaction among organisational units at a micro level. Such potential would prove immensely valuable to interacting states seeking to reduce the likelihood of, and losses from, escalating crisis in states under stress. It also offers a means of linking the micro processes of disaster response to the macro process of change in relations among states engaged in response to the disaster. For difficult problems such as defining appropriate disaster reduction policies in the international arena, the study of CAS offers an important theoretical and methodological tool.

The initial conditions that give rise to CAS set the direction for their subsequent trajectories over time. These conditions amplify or reduce the pattern of interaction among organisational units at the local level, which, in turn, calibrates the emergent form of order at the macro level. This evolving set of interdependent interactions establishes the rate and form of change in the system. While conditions that demand urgent action often generate CAS, the challenge to public policy makers is to understand, guide, and facilitate this process of change in ways that are humane, cost-efficient, and effective.

John Holland, an interdisciplinary theorist working in the field of CAS, defines a set of basic elements that characterise them.⁷ Holland's characterisation offers a beginning model that allows us to examine actual cases of governments which have requested international assistance to resolve an urgent crisis or internal disruption of performance. Holland's set of elements include four central properties and three mechanisms of operation. These elements are the properties of aggregation, non-linearity, flow, and diversity, as well as the mechanisms of tagging, internal model, and building blocks.⁸ While other theories characterise the conditions under which CAS evolve, Holland's model addresses the actual process of the emergence of CAS.⁹ Understanding this process is critical to determining effective policy at any given level of decision-making, and it is especially useful in determining policy at the level of inter-organisational decision-making that formulates action for states at risk or in crisis.

Holland's CAS model allows us to compare different cases of emergent order and their processes of evolution in a common framework. The four properties may vary by degree or form, but to Holland, these properties are essential to the emergence of CAS. Aggregation represents the capacity for individual units to interact in a recurring pattern to accomplish a shared goal. For example, the capacity of Greece to assemble a well-equipped and trained search and rescue team within hours to respond to the 17 August 1999 earthquake in the Izmit Region of Turkey set the example of spontaneous action to assist its neighbour in need. This action was matched, in turn, by Turkey in its immediate dispatch of the volunteer search and rescue team, AKUT, to Athens within hours of the 7

September 1999 earthquake. The examples set by the Greek and Turkish search and rescue teams spurred individuals and organisations in both states to contribute money, goods, and time to disaster relief in a reciprocal shower of mutual aid. This spontaneous effort illustrates the aggregation of many acts of generosity in both countries, and led to a favourable shift in the perception of each country by the other. Aggregation, in this case, illustrates the capacity of two states, long rivals, to mobilise specialised resources quickly to meet the urgent needs of life safety in disaster, a common goal.

Non-linearity, or the condition in which small changes in a system's performance over time produce large differences in outcome, reflects the shift in energy and action within the component units of the system toward accomplishing a shared goal. For example, in an El Niño Southern Oscillation cycle, the weakening of winds off the western coast of South America leads to flooding rains in Ecuador and Peru, but droughts in Malaysia, Indonesia, and Australia. In Cuba, El Niño events can lead to floods and drought in different parts of the country. Small changes in the temperature of the ocean currents in the western Pacific result in large differences in rainfall in other parts of the world.

Flow is the current of actions, materials, ideas, and people through a common arena that energises interaction among the individual units. For example, the extraordinary influx of money, food, medicine, tents, and volunteers from communities in Greece to the devastated cities of Turkey following the Izmit earthquake on 17 August 1999 illustrates this concept in practice.

Diversity acknowledges that specific types of individuals or units may respond differently to the same events in the flow of ideas and actions, and interact accordingly to generate new flow among the components. During the drought emergency in southern Africa of 1991-1992, different organisations - local, national, regional, and international - responded to different requirements for the transport of food and supplies to the states of Malawi, Mozambique, Zambia, and Zimbabwe. Each mode of transport used contributed to the success of the overall effort, but the varied range of types of transport proved invaluable in meeting the urgent needs for food and other supplies in communities in different locations with varying conditions of access in the region. The transport policy followed by South Africa during this emergency period contributed to improved relations between South Africa and SADC and visible demonstration of its constructive role in this emergency to international assistance organisations.

The three mechanisms create the patterns of exchange among administrative units at the local level. First, tagging facilitates the process of matching a unit seeking assistance with a unit providing assistance. The mechanism of tagging operated, in an emergent form, in the mobilisation of search and rescue teams to search for survivors trapped under the rubble of collapsed buildings following the Izmit earthquake. Each team arrived with specific skills and equipment. Dispatching those teams according to operational demands of the different disaster sites proved critical to effective performance in search and rescue operations.

The internal model reflects the set of shared assumptions upon which reciprocal actions among components of the system are based. For example, the shift in basic assumptions regarding Greek-Turkish collaboration initiated by the foreign ministers of Greece and Turkey proved vital to changing the perceptions of collaborative action among Greek and Turkish citizens in response to the Izmit and Athens earthquakes of 1999.

Building blocks are the elemental units of performance that are used in creating a complex set of recurring interactions, such as communicative acts.¹⁰ The set of meteorological stations established since 1873 to track the movement of hurricanes in the Caribbean region provides the means by which observations of developing storms may be made and reported to states in the region. Together, this set of properties and mechanisms create the dynamics of interaction that produce an emergent CAS which adapts more effectively to changes in its environment.

CAS in operation exhibit an evolving pattern of adaptation in the relationships among its internal components as well as in the relationship between the system as a whole and its environment. This pattern of internal and external adaptation, like a mobius loop, shapes the continuing evolution of the system. Six characteristics, in particular, drive this process of continuing adaptation. They include:

1. Sensitive dependence upon initial conditions.
2. Different rates of absorption of information and skills among different segments of the society, leading to different levels of autonomy and dependency within the system.
3. 'Strange attractors' developing over time that serve as focal points for change in a system.
4. Continual circulation of information, energy, materials, and feedback (flow).
5. Vulnerability to random events that substantially alter performance of different components of the system.
6. A capacity for self-organisation.

Each of these characteristics is apparent in the process of designing policy for states exposed to risk and in the conduct of disaster diplomacy. First, sensitive dependence upon initial conditions means that each system is governed by local conditions that shape and limit the alternatives for action in later stages of disaster operations. This characteristic reflects the basic element of non-linearity in Holland's model. That is, small changes in initial conditions, iterated over time, lead to large differences in outcomes. For example, disaster assistance that is externally designed often does not take fully into account the local conditions which include beliefs, needs, resources, previous alliances, and leadership (or lack of same) among people in the target communities. These local conditions create differences in the implementation of proposed mitigation, response, and recovery programmes that may make them vulnerable to disruption or corruption from unanticipated sources over time.

Second, each national system undergoing change is composed of subunits and sub-subunits that have different rates of absorption of new information, skills, and resources over time. Consequently, these different units perform their respective functions at different levels of autonomy and dependence, which generating diversity, the second element of Holland's model. Diversity may either produce dysfunctional dynamics among its component parts or lead to the exchange of ideas, actions, and resources that spur creative solutions. The task of guiding transition in governmental systems among states with a history of rivalry and conflict involves re-orienting the subunits of, first, the separate national systems and, second, the international system, toward the same system-wide goal, disaster reduction. Further, it means encouraging maximum performance of each unit toward that goal, albeit at different rates. Reorientation may, and often does, entail a re-examination of the basic values and priorities of the sub-unit in order to place its functions within the context of the larger, long-term, system-wide goal. This process of collective learning may be supported by design.

Given different rates of learning, absorption, and adaptation, particular components of a CAS may alter their behaviour slightly from prior patterns of performance. Over time, this variance may increase and attract other components into the divergent pattern of performance. This capacity to draw other components operating within the same system into divergent performance creates, in complexity theory, a 'strange attractor' that may substantively alter the performance of the entire system.¹¹ In disaster-prone environments, the performance of single organisations or individual managers often serves as a 'strange attractor' that sets the example for a new approach to a previously difficult and insoluble problem. For example, in the US-Cuban case, detailed weather reports of Padre Benito Viñes served as an initial variation in performance of hurricane observation that led to the establishment of the network of meteorological stations throughout the West Indies. This capacity for aggregating small changes to produce a large outcome represents a third element of Holland's model of CAS and illustrates the dynamic that can evolve to shift the entire system.

Successful transition requires the fourth element: continual circulation of information, energy, materials, and feedback to allow the subunits to adjust their performance not only to the new goal, but also to the near-neighbours whose performance affects theirs. This circulation represents the 'flow' element of Holland's basic set. The dynamics of flow create the opportunity for exchange among the internal components of the system and between the system and its environment. This process of exchange is facilitated by the mechanism of tagging which matches a specific need with an available resource.¹² Transition can also be facilitated by interjecting a timing mechanism for monitoring performance and feedback of these results into the respective decision processes within the system.¹³ Such a mechanism focuses attention of the component units on the system-wide goal and provides opportunity for review, reflection, and revision - all requirements for learning among the system's participants.

Fifth, CAS are subject to chance as well as choice. Random events may alter the performance of the system, disrupting previous plans and requiring reallocation of resources and attention. Systems in transition need to be able to adapt to unexpected situations, yet keep their focus on the system-wide goal. This condition provides further illustration of the non-linearity of CAS.

Finally, the capacity for self-organisation is the spontaneous effort to reallocate energy and action to achieve a system-wide goal.¹⁴ This characteristic is based upon the assumption that all systems operate on a continuum that ranges from order to chaos.¹⁵ Systems at either end of the continuum continually seek to move toward the centre. At the centre of the continuum exists a narrow region called the 'edge of chaos' where there is sufficient structure to hold and exchange information, but sufficient flexibility to adapt to changing conditions in the environment.¹⁶ Consequently, according to Kauffman, systems that have experienced disaster or chaos will seek to move toward order. The middle region of the continuum, or the 'edge of chaos', provides the greatest opportunity for creative change. It is in this region where the shifts in constructive interaction among states as they seek to mitigate or respond to disaster, or 'disaster diplomacy,' are most likely to occur.

Using this set of characteristics as a metric for systems undergoing transition, the application of this model to the design of international policy toward states vulnerable to disaster builds on the potential of human populations for spontaneous self-organisation. Such systems depend heavily upon communication and information networks, and rely upon the capacity of individuals and organisations to learn new values, beliefs, and skills in responsible interaction with more experienced actors.¹⁷

III. Transition as a learning process

If one applies the model of CAS to states in transition, then the actual existence of chaos need not be wholly negative. Disaster, by shattering existing habits of thought and action, also creates opportunity for rebuilding governmental systems in a healthier, stronger way. While the tragic losses incurred under the chaotic conditions of disaster cannot be undone, the challenge to the international community lies in facilitating the transition from chaos toward the centre region of creative change. The requirements are clear. First, sufficient structure to hold and exchange information must be established. In emerging, democratic, governmental systems, this is the basic infrastructure for the exercise of legitimate authority: a legal system, a judicial system, a police system, a prison system for those who act outside the law, and the design of governmental institutions that ensure informed, voluntary choice by the citizens. These systems take time to establish, but recognising the need and providing resources and expertise to aid the process is a valid, and valuable, service by the international community.

Second, sufficient flexibility to adapt to changing conditions must be ensured through a professional administrative system. Such a system includes the establishment and training of a professional civil service, the establishment of financial management systems, macroeconomic monitoring and policy

development capacity, information management, effective central/local relations, resource management, and planning and analysis capability. Again, international assistance can be instrumental in facilitating this process.

Once the basic balance between structure and flexibility is established within a nation anticipating or undergoing crisis, it enables local communities to create new ways of meeting their own needs. The system then is in healthy transition, and self-organising processes will likely evolve. Yet, it is critical not to underestimate the forces of resistance and obstruction to this process of transition, as long-established interests fear that they will lose control of previous sources of privilege and power. The process of facilitating healthy change in a system under stress includes identifying the subunits, or sub-subunits, that are still functioning with some degree of autonomy and competence and supporting their performance in ways that, in turn, influence the performance of their near-neighbours in the system.¹⁸ As the influence and example of competent performance spread throughout the system, the dynamics of the system change. Resistance collapses, and the system moves toward the creative centre of the continuum.

For states in transition, chaotic conditions, while destructive and damaging, also provide the opportunity for different segments of the population to learn new skills and develop local capacities that shift the components of the system to a different level of interaction. Whether that dynamic is constructive and moves the system toward order, or deepens the destructive drive toward chaos and total collapse, may depend upon external support. The content and mechanism of international policy prior to an extremely hazardous event, or assistance extended to a nation following disaster, may determine the direction and strength of the dynamic for change.

IV. CAS as an analytical framework for disaster operations

The three case studies of states with histories of conflict, as they interacted in reference to the threat or actual occurrence of disaster, offer an opportunity to review these cases in terms of the CAS framework. This examination explores whether insights may be gained using a CAS framework that could inform policy makers and lead to more constructive outcomes in recurring hazardous events. In each case, it is possible to identify the basic terms of Holland's model of CAS. The application of the CAS model demonstrates that where the functions of CAS were strong, there was scope for positive change, while where they were weak, the process of change was inhibited.

Climate-related disaster diplomacy: a US-Cuban case study

In his analysis of the process of monitoring climate change in the tropical Atlantic, Michael H. Glantz concludes that substantive opportunities for greater cooperation between the US and Cuba were blocked by the intransigent positions of both the US and Cuban governments. These positions restricted travel between the two countries, limited the exchange of information that might affect local governmental operations in each country, and ignored the unequal levels of

technical equipment and training needed to interpret shared meteorological data. Using the CAS model, gaps in the evolution of an adaptive system may be identified in the US-Cuban case, revealing points at which new initiatives might be taken to improve cooperation between the two countries.

Three of the four properties in Holland's model of CAS - aggregation, non-linearity, and diversity - are easily identified in the US-Cuban case. Aggregation is evident in the cumulative collection of scientific records and information about hurricanes, conducted and maintained by scientists in both countries over decades, as well as in the growing understanding among US and Cuban scientists of the need for an international framework to manage the recurring threat of hurricanes more effectively. Non-linearity characterises the phenomenon of tropical storms under study, the conditions in which they emerge, shift, disappear, and recur with a wide range of intensity over time. Given the existing legal constraints on interactions between the two states, exchanges of hurricane-related information, policies, and material between Cuban and US organisations reflect the same non-linearity, depending more upon informal networks of contacts than any systematic programme of shared effort in disaster mitigation. Diversity is evident in the different groups that are interested in bridging this critical gap in a policy of hurricane disaster reduction. The groups include scientists, researchers, managers of non-profit and private organisations, policy makers at different jurisdictional levels, and citizens in both countries.

The missing property of CAS in this case is flow. The US embargo on trade with Cuba, in effect since 1960, has seriously restricted the exchange of goods, information, and people between the two countries. The 1992 Cuba Democracy Act and the 1996 Helms-Burton Act added to the barriers between the two governments. These acts, instead of compelling Cuba to change its form of government in order to participate in economic trade with the US, have had the opposite effect. Cuba, under Castro's leadership, has actively and defiantly sought to limit its relations with the US, seeking to brand the US as the aggressor and doubling the constraints on flow between the two countries. Recent activity since the case of Elián González indicates some change in this area, but legal constraints have clearly limited the communication and information exchange between the two states that are central to adaptive performance in reducing their shared risk of hurricanes.

The severe constraints on the rate and content of flow between the two states have inhibited the development of mechanisms central to adaptation in relations between the US and Cuba. Without free and full exchange of information, goods, and people, the mechanism of tagging cannot function well. Nor can an 'internal model' or vision of improved relations between the two countries develop to any significant degree. Some change is documented by Glantz in the exchange of scientific information between the two states, and hurricane monitoring falls in this category. As noted earlier, a significant set of building blocks is already in place for improved relations between the US and Cuba. The network of meteorological monitoring stations that developed as the relatively unnoticed product of scientific exchange between the US and Cuba has gained significant

respect and international recognition, not only by different groups and organisations in the US and Cuba, but also by the wider set of states interested in climate change and international disaster reduction in the region. While this case currently does not fit the narrow definition of 'disaster diplomacy', elements of an emerging CAS are identifiable.

'Disaster diplomacy' in this case would require the sustained support of communication among Cuban and US scientists, the development of a shared knowledge base, and responsible investment in information infrastructure to facilitate rapid access and dissemination of relevant information among diverse groups in both societies. Small shifts in the practice and perception of individuals and organisations regarding the need to share data about climate change for disaster mitigation could serve as the 'strange attractor' that draws other organisations and groups into the position of favouring substantial shifts in the respective policies of the US and Cuba. If this shift occurred, 'disaster diplomacy' would not be the work of national policy makers in reference to a single disaster event, but the cumulative process of organisational and inter-organisational learning over time that allows a redefinition of specific national interests in a broader international context.

Greek-Turkish rapprochement: the impact of disaster diplomacy?

In public accounts, the case of reciprocal exchange of search and rescue teams and mutual assistance between Greece and Turkey following the 17 August 1999 earthquake in the Izmit Region of Turkey and the 7 September 1999 earthquake in Athens appears to be a classic case of 'disaster diplomacy'. Yet, James Ker-Lindsay's analysis reveals that other factors were operative in changing the relations between the two states, long hostile, before the earthquakes occurred. In his assessment, the shift in redefinition of national interests toward a more constructive, cooperative strategy had begun months before the earthquakes. The substantive actions were taken by the foreign ministers of the two countries, and their respective actions once the earthquakes occurred, based upon new premises of national interests, served to re-orient and mobilise popular perceptions in their respective states in favour of an already-designed strategy of greater cooperation. The dynamics of change in the relations between the two states, however, become clearer when viewed from the perspective of CAS.

The four properties of CAS as outlined by Holland can be identified in this case of Greek-Turkish interactions in disaster response. Nonetheless, key mechanisms preceded the earthquakes, enabling the response system to function once the earthquakes occurred. Understanding this sequence of interactions is important, not only in accurately characterising relations between the states, but also in probing more rigorously the concept of 'disaster diplomacy'. Aggregation is evident in the cumulative effect of discussions between the two foreign ministers, Ismail Cem of Turkey and George Papandreou of Greece, initiated not in response to the seismic threat, but to the shared need to cope with the unstable situation in Kosovo as well as the anticipation of Turkey's potential accession to the European Union. These discussions led to reciprocal offers of disaster assistance when the

earthquakes occurred, and set the example for reciprocal exchange of voluntary contributions from public, private, and non-profit organisations.

The foreign ministers' strategy of moving toward greater cooperation exhibited non-linearity when the earthquakes, unrelated to previous discussions regarding Kosovo and economic strategy in Europe, abruptly shifted the direction and content of the exchange to the immediate needs of disaster assistance. The property of flow was illustrated by the reciprocal exchange of search and rescue teams following the earthquakes. The flow continued with a remarkable level of voluntary contributions from Greece to Turkey in response to the Izmit earthquake, followed by a similar level of contributions from Turkey to Greece in response to the Athens earthquake. The level of contacts between the Greek and Turkish peoples increased dramatically following the two earthquakes. Diversity was represented by the range of views articulated on issues involving the two states, including security and the treatment of minorities.

The mechanisms of CAS were more problematic. The process of tagging - matching contributed resource to demonstrated need, and vice versa - was under development. After years of hostile relations between the two states, the infrastructure for this kind of information exchange and matching process was not fully functional. The internal model - or a set of valid goals for improved cooperation between the two states - had just been initiated by the two foreign ministers and had not yet been fully articulated and explained to their respective publics. The building blocks of cooperative action were just being formed. With a basic shift in policy between the two countries only months old, the basis for cooperative action was still not clearly defined.

Although a range of new initiatives for improving collaboration between the two countries was introduced after the earthquakes, no systematic set of actions developed that could serve as building blocks for subsequent programmes. As the first flush of empathy faded after the earthquakes, spontaneous contributions of time, money, and goods to earthquake victims appeared to drop. This drop indicated a return to daily interests and possibly scepticism regarding continued collaboration between the two states. The case illustrates that systematic efforts to build upon the exchange of mutual assistance initiated after the earthquakes are needed to sustain the redefinition of interests and shift the balance toward continued cooperation between the two states. This is a matter not only for foreign ministers, but also for the full range of scientific, voluntary, and private organisations in both societies.

Drought emergency, yes...drought disaster, no

The case of SADC anticipating the threat of famine and organising an effective response to avoid disaster represents the clearest case of CAS in action. Ailsa Holloway's analysis of the changes in strategy and practice by a range of local, national, and international organisations in response to the threat of famine in southern Africa illustrates the powerful influence of a clearly-articulated goal upon an existing set of properties and mechanisms that evolved to form a functioning CAS. This process of adaptation led to the implementation of an

effective strategy to avoid famine, and contributed to a redefinition of relations among the southern African states that formed SADC and South Africa. But this process of adaptation was more complex than the initial concept of 'disaster diplomacy' and to be sustained, must be understood as such.

Each of the properties and mechanisms identified by Holland as essential to CAS is present in the evolving relations among states of SADC and the wider set of international organisations that responded to the call for assistance. Aggregation is evident in the cumulative support for the strategy of food transport that built within each nation of SADC as public and private organisations agreed to participate. It developed further as international organisations and donor states outside Africa contributed money and goods to sustain the operation. The effective mobilisation of money and goods from many external sources, aided by the network of transport services offered by South Africa and linked to local transport modes within each nation, created the resources needed to maintain minimum food requirements in the region. Non-linearity is shown by the variable rainfall in the region that precipitated the emergency. Flow is shown by the intense levels of communication and information exchange that developed among the member states of SADC and between SADC and the international donors. Diversity is found in the range of organisations that participated in the food transport strategy - international, national, local, public, private, and non-profit.

The mechanisms identified by Holland also functioned well in this complex operation. Aided by high levels of communication and information exchange, the mechanism of tagging proved effective in matching available goods to expressed needs. The internal model of providing sufficient food to the states of southern Africa to avoid famine was clearly articulated. Painful memories of the 1982-84 famine in southern Africa reinforced this model for international as well as national organisations. The building blocks of South Africa's transport network were already in operation, and South Africa's willingness to adapt its transport strategy to meet the urgent needs of other southern African countries proved an important element in the evolution of the system.

The conditions and characteristics of this case fit the requirements for an operation at the 'edge of chaos', where there was sufficient structure in the form of an existing regional organisation, SADC, as well as international organisations and public, private, and non-profit organisations within each nation. Furthermore, there was also sufficient flexibility to allow the participating states and organisations to adapt previous strategies to meet the urgent need of food security in the region. The success of the operation demonstrated the capacity of SADC to carry out a cooperative strategy, supported by donor states and international organisations, for the benefit of the peoples of southern Africa. This strategy successfully averted the potential disaster of famine.

As pointed out by Holloway, to classify this case as an example of 'disaster diplomacy', narrowly defined, misses the complexity of issues and inter-organisational changes involved. The threat of famine provided the clear goal around which other activities and strategies were organised, but the shifts in perception and practice occurred system-wide, among organisations at local,

national, regional, and international levels of operation. This case more accurately represents the successful evolution of a CAS to meet a specific goal. The challenge becomes, in less urgent times, to sustain the adaptiveness of this functioning system in relations among southern African states, lest it drift toward either extreme, order or chaos.

V. Role of information technology in facilitating transition

The evolution of CAS depends upon the capacity for intense levels of communication and exchange of information to coordinate the activities of many organisations engaged in a common task of disaster mitigation or response. The continual circulation of information, energy, materials, and feedback, or 'flow', requires a technical infrastructure as well as organisational design and procedures to facilitate this process. The difference made by the presence of flow is shown in the case involving the international mobilisation of food transport to avoid famine for the states of southern Africa, while the absence of flow is particularly acute in the US/Cuban case on climate change. In each of the three cases discussed above, the complexity of the operations was such that the flow of information needed to facilitate adaptive performance required an information infrastructure to support it.

In complex disaster operations, the capacity for information exchange can be greatly increased by investment in an information infrastructure that spans the communications channels of the states involved in collective efforts to minimise losses from disaster. Information technology, appropriately designed, can create the structure essential to hold and exchange information among states engaged in operations to avert, or respond to, disaster. In doing so, it creates a 'socio-technical system' that represents a distinct system for the countries exposed to risk from disaster.¹⁹ In times of threat or exposure to natural disaster, this overarching system may supersede the separate national systems that have histories of conflict on other issues. Current uses of information technology - including distributed knowledge bases, Geographic Information Systems, interactive communication via internet and intranet, and intelligent reasoning by the computer - bring the technical means to support larger, more complex inter-organisational problem solving processes. New uses of information technology integrated into existing organisational frameworks for disaster management increase the likelihood of flow among the participating organisations.

Once the technical, legal, and organisational structure for the timely exchange of information on disaster mitigation and response is in place, then the flexibility of alternatives designed by governmental policy makers can facilitate the learning processes needed to sustain a shift from conflicting to cooperative relations among participating states. Without both structure and flexibility, diplomatic approaches regarding disaster are not likely to be effective.

VI. Conclusions

Disaster events clearly produce an opportunity for change in relationships among the participants in response to shared risk. The challenge is to use that opportunity to guide actions at the micro level of disaster management so they

will support and lead to substantive change at the macro level of greater cooperation among states previously in conflict. In the process, the rival states discover common goals in the reduction of risk or response to disaster. If small actions taken cooperatively at local levels to reduce risk or to recover from disaster are understood as levers for change on larger issues of shared risk at national and international levels, it is possible to build a cumulative flow of actions, concepts, material goods, and knowledge that shifts the whole pattern of interaction among the states in a positive direction. To do so, however, it is vital to ensure that the mechanisms of 'tagging', 'internal model', and 'building blocks', terms in Holland's concept of CAS, are active and used appropriately.

International policy, designed in accordance with the concept of disaster management as operating within a CAS, can support this function. If incoming materials, experts, and techniques are 'tagged', or matched with their appropriate needs in a nation at risk or already damaged, they become 'building blocks' for a new pattern of interaction among donor and recipient countries. If these building blocks of cooperative actions are fitted, cumulatively, to an 'internal model' or set of shared goals for disaster reduction, they are aggregated into a new set of assumptions that differs from the previous pattern that resulted in collapse. This new order represents the ability of the system to aggregate the flow of incoming ideas, materials, and skills at a new level of stable performance. This level of performance likely includes a more diverse set of elements and occurs, as an outcome of disaster events, in a non-linear way.

The critical process of transforming actions taken by countries in disaster management situations into a process of building cooperative relations in future interactions depends upon creating an information infrastructure for the timely and accurate exchange of information among the participants in the response system. Through an evolving process of integrating new information more effectively, providing feedback to all participants in a more timely manner, and fitting new ideas to old problems, significant steps can be made in advancing constructive relations among states following disaster.

In summary, five conclusions may be drawn regarding the concept of disaster diplomacy:

1. 'Disaster diplomacy,' narrowly defined, captures only a partial aspect of the more complex set of interactions that characterise organisational and inter-organisational learning induced by disaster management activities and processes.
2. Information flow is crucial to enabling actors at the micro level of households, neighbourhoods, and cities to adapt their performance in accordance with changes at state, national, and international levels to reduce hazards and losses from disaster.
3. Disaster - or threat of disaster - provides opportunities for enhancing collaboration among states, but the properties and mechanisms for adaptation must either exist or be developed for effective results.
4. Creative diplomacy for disaster reduction is most effective at the 'edge of

chaos', the region where there is sufficient structure to hold and exchange information, but sufficient flexibility to adapt new alternatives to meet urgent needs.

5. Maintaining creativity for disaster reduction as well as developing cooperation among states perceived to be in conflict requires a broader conception of their shared goals. It also requires practical engagement by a range of local, state/provincial, national, and international public organisations, as well as private and non-profit organisations in achieving this clearly articulated set of common goals.

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