Simulation Methodology for Crisis Management Support

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This paper briefly reviews the classic and more recent literature on crisis simulations. After discussing the essence of simulations, as opposed to scenarios and games, five functions of simulations are highlighted: a research tool; a teaching and training instrument; a planning method; a tool for designing decision support systems; and a personnel selection method. Different design dimensions of educational and research simulations are brought to the fore.

Introduction: The Nature of Crisis Simulations

Today, simulations are widely used in various crisis management contexts, yet they originated in the world of warfare. Combat simulations can be traced back to the eighteenth century (Starr, 1994). In 1798, the so-called *Neues Kriegsspiel* was introduced in the instruction of the Prussian army. Apart from being training devices, warfare simulations were also used to develop military strategies and tactics: on maps and in sandbanks, simulated armies were placed and moved about in order to study reactions of competing forces. Presumably, the game of chess originally was a type of simulation to train superior military commanders (Becker, 1976).

After World War II, military gaming was developed further at the RAND Corporation, Harvard University and the Massachusetts Institute of Technology to accommodate the nexus between military and political dimensions of crisis management. Subsequently, the scope of simulation methodology was widened further to include other types of crises; for example, military conflicts, terrorism, disasters and many other political environments featured by high threats, short decision times and high uncertainty. In short, gaming has gone beyond the Pentagon into other government bureaucracies, universities and the private sector (Goldberg and Opstal, 1990).

Oddly enough, the literature has not followed the pace of developments in the field. Most of the research in this area was conducted at the end of the 1950s and the 1960s, although there was renewed interest in the 1980s and beginning of 1990s.

Few recent studies deal explicitly with the purposes, design and applications of crisis simulations. This paper attempts to fill this gap in the literature by providing an introduction to the basic properties of crisis simulations and by discussing different ways of designing them. The next section will focus upon a number of conceptual issues. The multiple purposes of simulation in crisis management support are discussed and then the design dimensions underlying different types of simulations are outlined. The concluding section reflects on some of the prospects and problems in applying simulation methodology to improve crisis management.

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Conceptual Clarifications

The essential properties of simulations can best be explained when contrasted with related concepts from the world of modeling and interactive learning — scenarios and games — with clarification of the differences and similarities between them.

Scenarios

Scenarios have a dual purpose. First, they are used as an independent heuristic tool in various domains of policy planning and strategy development, both in government and in the private sector. In this sense, scenarios are forms of imagined reality, in that they provide participants with an opportunity to enact possible states and future developments of a particular social system.

When used in this way, they consist of the following elements: (1) a description of the *status quo* in (a particular sector of) a society or organization; (2) a description of a number of plausible and/or (un)desirable future states of the system; and (3) a description of the factors and interaction sequences that may be involved in moving from the current to the future state or in preventing such a development from occurring.

Authorities are thereby challenged to consider a number of delicate but important counter-factual or counter-intuitive ('what-if') questions: what if we have a cumulation of snowstorms and extreme frost at the end of an already long winter; what if we have a major disturbance at a nuclear power station near a metropolitan region; or what if a riot breaks out after an ostensibly quiet strike or demonstration? Provided they stay within certain bounds of logic and plausibility, scenarios can be a powerful tool for questioning conventional wisdom and forcing organizations to face their future more fully and creatively (Rosenthal and Pijnenburg, 1991).

Scenarios, used in this context, are important tools for two dimensions of crisis management. They may facilitate crisis prevention by providing coherent, vivid and analytically plausible accounts of future risks and threats. The task for policy makers becomes to assess whether to minimize the manifestation of these future crises (desirability) and estimate the practical, economic and political benefits and costs of alternative mitigatory policy options (feasibility). For example, the development of major urban ghettos and no-go areas is currently regarded as a realistic worst case in many Western European countries. In individual cities, as well as at the national level, a scenario analysis of how these might look and how they may develop from the given *status quo* in a community may provide an important impetus to strategic discussions about the future course of local economic development initiatives, housing policy, education, social work or law enforcement. Scenarios may also increase crisis preparedness. By sketching various possible and worst-case scenarios of major accidents, compound disasters and escalated conflicts, they can provide individuals and agencies involved in responding to such contingencies with important performance tests.

A second way in which scenarios are used is as a basis for the development of more dynamic tools for crisis management planning, namely simulations. Scenarios, in this sense, are often building blocks for simulations that script the simulated 'real world'. Scenarios typically incorporate features of previous crisis events, as well as recurrent crisis management and communication problems. The specific properties of a scenario vary according to the purpose of the simulation and the selection of participants.

Simulations

Simulations are operating models reflecting the core features of a real or proposed system, process or environment (Greenblatt, 1988). Over the years, simulations have taken different forms, yielding various blends of men and machines. First, a computer can be used to explore mathematical models of structures and processes. Mathematical models or equations are then used to represent the relationships in the system and the calculations indicated by the model equations are repeatedly calculated to investigate changes over time (Greenblatt, 1988). Examples of all-computer or machine simulations include flight simulators, air traffic control simulators and dragline and other heavy machinery simulations. This type of simulation is frequently used in situations when the economic and human costs of flawed decisions and inadequate crisis management are high.

A combination of computer and human players can make the model operate. The computer may serve simply as a high-speed calculator or may contain a model or set of models that may be triggered by the actions of the players. An example is the International Communication and Negotiation Simulation (ICONS) Project at the Department of Government and Politics at the University of Maryland. The Project uses a multi-site, computer-assisted simulation to train students in international negotiations. Accessible via Internet, ICONS reaches 75 colleges and universities in at least 20 countries and focuses on issues such as nuclear proliferation, world health and human rights (Starkey and Wilkenfeld, 1996). SimCity, a computer program through which people build a community from scratch or solve urban policy problems under different developmental scenarios programmed into the software, is another example. Those who consider the job of designing and running cities to be prosaic can move on to simulating the development of planetary ecosystems (SimEarth) or the evolution of new life forms (SimLife).

In other simulations, all operations may be generated by human players. Starting from a baseline scenario ($t = 0$), simulations confront participants with a series of inter-related sequences (that is, developments and problems that require decisions and actions on their part at times $t = 1$, $t = 2$, ... $t = n$). These occasions for decision are fed to participants by the controllers of the exercise according to a more or less fixed-script. Each new input into the simulation should serve a particular purpose and should be the focal point for observations, analysis and post-exercise feedback on the part of the controllers. The participants in simulations are usually enacting roles.

As a group, they may be called upon to place themselves in the position of an individual or team operating in the given crisis context. In more complex simulations, such as those described by Preston and Cottam (this issue), each individual participant may be given an individual role and set of tasks, means and responsibilities, while still requiring that the

group as a whole reach collective decisions as if it were a crisis management unit of some kind (for example, a police command centre or a crisis cabinet meeting). In even more complex field simulations, entire parts of existing organizations participate, each enacting its customary roles — often in its normal physical surroundings and with all regular powers at their disposal — but placed in the fictitious context of the simulation scenario. Examples of all-human games can be found in 't Hart's article (this issue) on the Dutch Crisis Research Centre.

In contrast to scenarios, simulations are dynamic: the interaction process takes centre stage. Participants are faced with quasi-realistic crises and are asked to control the course of events as best they can. Their behaviour, the timetable, the equipment and the rules of communication are closely monitored. Often the process is recorded. Learning occurs by the very act of placing oneself into the situation and living it, but is enhanced when controllers are able to provide participants with structured feedback and stimulate them to reflect upon their own and other participants' behaviour.

Games

Another term often used in combination with simulations is 'games'. The distinction between simulations and games is often blurred and the two terms are frequently used inter-changeably. According to Greenblatt (1988: 14), 'games reflect players' characteristics (goals, activities, constraints on what can be done and payoffs) and player decisions are important'. Not all simulations are, therefore, games (think of the flight simulators and air traffic control simulators mentioned above). Similarly, not all games are simulations, in the sense that they are not necessarily designed to epitomize part of the real world. Only simulations which contain the central components of games are taken into account here.

Why Simulate Crises?

Why do people use crisis simulations, the design and conduct of which are often complex and time consuming? Why might one sometimes prefer simulations over other methods that may be employed to teach decision makers how to act in crises or to understand the dynamics of crisis management?

Crisis Simulations: Purposes

Crisis simulations have often been used as a research tool (Coplin, 1969). Serving as quasi-laboratory environments, simulations enable theorists to define and grasp the underlying mechanisms of crisis behaviour. Relationships can be studied among any or all variables put into the exercise. More specifically, the analyst can use simulations to re-construct the world-views and assumptions about crises and crisis management held by decision makers (Goldberg and Opstal, 1990).

Crisis simulations also serve as a teaching and training instrument. As a teaching instrument, simulations offer students a setting approximating real-life experiences to learn how to apply insights from crisis management theories. Simulations may be played at the beginning and/or end of a course. The Massachusetts Institute of Technology, among others, has employed 'crisis games' in the classroom since 1958. In those simulations, students are presented with a short history of a particular international context, assigned roles as world leaders and confronted with a crisis scenario. Their job is to cope with the crisis by managing their governments, commanding their military forces and influencing decision makers in other countries (Bloomfield and Padelford, 1959). The Preston and Cottam (this issue) paper on the use of class-room simulations of US foreign policy crises will deal more elaborately with their role as a teaching tool.

As a training instrument, simulations offer a close approximation of the stress and flow of events of a real-world crisis, saturating the participants with policy conundrums and demands. Through structured role-playing, policy makers and other professionals 'experience' emergency situations. This allows them to become more familiar with crisis management issues, appreciate their complexity and the political and moral dilemmas they may entail. The simulation provides them with instant feedback to their decisions and coping strategies. In other words, such simulations can be made to feel very real by incorporating various kinds of stressors ('t Hart, this issue) and penalties of failure. The RAND corporation has a long tradition of providing crisis management training for policy-makers (Averch and Lavin, 1964).

Another function of crisis simulations is to help plan for crisis management. The guidance for civil preparedness simulations, first publicised by the US Federal Emergency Management Agency (FEMA), outlines six aims that simulations may accomplish in the context of planning: (1) reveal weaknesses in existing plans; (2) reveal gaps in resource planning; (3) improve coordination among operational elements of the plan; (4) achieve higher levels of individual performance in carrying out disaster plans; (5) gain public recognition of a community's emergency operations capability and raise public faith in this

capability; and (6) assure the effective implementation of emergency plans and procedures (DCPA, 1977: 1). For example, the American Energy Assurance Council, a platform of energy company CEOs, state governors, members of Congress and interest groups, asked the MIT-Harvard Dispute Resolution Program to prepare a crisis simulation demonstrating what would happen if the US faced major disruptions to its energy supply. This simulation was specifically designed to mobilise support for a more proactive energy crisis planning strategy and break through the existing stalemates between opposing coalitions in the US energy policy arena. The crisis scenario involved a confluence of events complicating the energy supply. It, then, went on to highlight the domestic political turbulence and policy paralysis that would arise in the US in response to these events. The intense full-day experience of a simulated energy crisis and the problems of managing it in the face of pre-existing plans and political consensus about crisis measures to be taken convinced participants, who belonged to rival factions in the energy policy debate, that a national consensus building effort was essential (Dolin and Susskind, 1992).

Furthermore, simulations can be employed to help design decision support systems. For example, Kraus et al (1992) have developed the so-called Hostage Crisis Simulation to test hypotheses in crisis decision making, but their ultimate objective is the creation of a prototype automated negotiator based on a strategic model of negotiations. A decision support system, such as the automated negotiator (usually computer-based), is meant to assist decision makers in reaching the best possible negotiating strategy or striking the best available deal. The simulation is used to generate and evaluate a range of options.

Finally, simulations are used in assessment centres as tools for selecting people with critical competencies (knowledge, skills, abilities) necessary for effective crisis management. Contrary to the regular interviews and standard psychological tests, simulations provide a context in which a person can be assessed 'in action' (Yusko and Goldstein, this issue).

Crisis Simulations: Unique Characteristics

It is often difficult to gain experience with a particular phenomenon except from simulating it. Insights come hard when they concern questions beyond the range of human experience. In those cases, a simulation is the closest one can get. For example, the question of how to react in case of nuclear war is one we do not want to be able to answer on the basis of human experience.

Knowing that nations cannot afford to experience nuclear conflict, leaders, nevertheless, face the task of building appropriate contingency plans. Likewise, scholars need to construct theories about nuclear crisis management, not only on the basis of technical assessments of physical consequences and formal planning documents, but also on the basis of insights about individual and institutional behaviour under extreme duress. Simulations are indispensable to this end.

Simulations offer a unique way of understanding the crux of complex social phenomena. Contrary to standard modes of transferring knowledge (written material, oral presentation, observation) in which the material to be learned is presented sequentially and learners are passive recipients of information, simulations ask more from the learner. They convey an appreciation of the simultaneousness of events and actions which gives the student insight, empathy and a greater understanding of the world seen by real decision makers. Moreover, they assume an active participatory role for the learner. Research and practice suggest that this highly stimulates and motivates students to learn (Raser, 1969). It is a form of learning by doing, a learning philosophy based on an old Chinese proverb (cited in Greenblatt, 1988: 17): I hear and I forget, I see and I remember, I do and I understand.

Moreover, when compared with real-life experiments, simulations can provide a more economical method of testing contingency plans and practising coordination between different agencies during emergency response operations. This is particularly the case for all-computer simulations (Raser, 1969). Similarly, all-human simulations can be cost-efficient if one takes into account the costs of making mistakes in real-life crises.

Futhermore, when used as a selection procedure, a simulation is often the only feasible way to analyse a person's abilities in crisis management. Psychological tests and interviews provide a picture of a person's cognitive and communicative abilities but cannot reliably predict how he/she functions under stress. Efficiency considerations provide the main rationale for the use of this, seemingly costly, recruitment method: the costs of having a crisis commander unsuited for his job outweigh, by far, the short-term costs of the assessment centre (Flin, 1996).

Finally, as a research instrument, simulations offer a relatively large degree of control on the part of the analyst. Used in this way, simulations are quasi-experiments as the participants are involved in a process which, if deemed necessary, can be changed. The controlled conditions can be shaped in such a way as to resemble the characteristics deemed salient in the reference

situation. However, a drawback with a laboratory experiment is the fact that not only the analysts, but also the participants, can change these conditions. For example, at the beginning of a simulation the rules of communication between players are usually outlined. During the course of the simulation, however, communication patterns may arise which deviate from the original rules set by the instructor; interaction between participants generates new rules and conventions.

Crisis Simulations: Forms and Shapes

Simulations can take different forms and can be constructed in different ways. Which form is chosen depends on the strategic aims of the exercise. Focusing only on educational (teaching and training) and research simulations, this section will point out a number of dimensions along which designs can vary.

Educational Simulations: Design Dimensions

Simulations entail different combinations of plausibility and desirability. The plausibility of a scenario refers to the likelihood that the future state described in it may actually occur. Most plausible scenarios present us with foreseeable futures that do not require radical deviations from the *status quo* or from developmental trends established by systematic research. To be convincing, plausible scenarios should be reasonably accurate. Target groups must be convinced that contingency plans may well be useful. It follows that most plausible scenarios generally have a relatively narrow time-span. The desirability of a scenario refers to the values placed on the future state described in the scenario. Designers select particular social values and develop future states which vary on a normative continuum, usually concentrating on the extremes. Participants in the simulation should consider what can be done to: (a) make it happen (optimal-case scenario, for example, full employment); (b) prevent it (potentially avoidable worst-case scenario, for example, new currency crisis); (c) prepare for it (unavoidable worst case, for example, a major earthquake along the San Andreas fault). Most scenarios contain a mixture of these two properties.

Plausibility and realism may involve a lot more than just a good scenario, especially if one wants to provide a realistic learning environment for operational units in the police, the military and other crisis agencies, where a large-scale operation may be needed. For example, many organizations use simulated command centres in purpose-built or adapted suites with video recording and multi-channel communications. Real-life events are replicated as closely as possible. But, things can be much more comprehensive:

> The Fire Service College at Moreton-in-Marsh [in Britain] has a 550 acre campus containing a number of full-scale buildings that can be set alight, including industrial units, a house, a five-story shopping complex, a 4000-tonne dry cargo ship with engine room, situated in a lake, a chemical plant, a motorway (complete with vehicle pile-up), a plane and a railway system (Flin, 1996: 74).

Not every organization may be willing and able to make such investments. It is important to assess, on a case by case basis, what constitutes an acceptable price for making the simulation environment resemble the real world.

A second design dimension is the degree of comprehensiveness. At one extreme, there are crisis simulations based on 'grand scenarios', taking a broad macroscopic view of the development of societies as a whole, encompassing a broad range of variables and entailing complex transitions from the *status quo* to future states. To make these scenarios come alive, a large number of players and a highly differentiated interaction structure is needed. This is not only quite costly, it is also difficult to control and to provide meaningful educational feedback to all participants. At the other end, one finds crisis simulations focusing on a highly-limited number of essential variables in a given, well-defined social context. They specify, for example, the potential effects of an explosion in a local petro-chemical plant at a given time of day and with a more or less specified weather pattern. The more limited the scope of the scenario, the more detailed it can be in its contextual data and the more useful it becomes as a tool for operational response planning. The more comprehensive scenarios tend to be used primarily in strategic policy planning or, more widely, to put future crises on political agendas.

Research Simulations: Design Dimensions

Two types of distinctions are relevant when designing simulations for crisis research (Vissers, Heyne and Peters, 1995). The first distinction involves the research objectives for which simulations are used. Simulations may be used for theory development or for more practical, applied problem solving. The second distinction concerns what will be called, here, the methodological strategy. Here, simulations in which phenomena are explored in order to arrive at potentially relevant hypotheses (exploratory simulations) should be distinguished from simulations designed to test existing hypotheses (testing simulations). If one combines the two

Figure 1: Purpose and Methodology of Research Simulations

Method	Exploratory: Hypothesis Development	Testing: Hypothesis Testing
Theoretical Research	A Example: The Outbreak of World War 1 Simulation (Hermann and Hermann, 1967)	B Example: The Hostage Crisis Simulation (Krause et al, 1992)
Applied Research	C Example The Policy-Type Political-Military Exercise (Bloomfield and Whaley, 1969)	D Example: The Prisoner's Dilemma Simulation (Axelrod, 1984)

dimensions, four different simulation designs emerge (see figure 1). An example of each is discussed below.

Simulation A: Hypothesis Development

A first type of research simulations is one in which the effect of a particular variable or the relationship between certain variables is explored to account for a particular phenomenon. For example, Hermann and Hermann's (1967) provided a *milieu* in which to explore the relative effect on political actions of personal characteristics as compared to variables more frequently associated with political analysis. In a modified version of Guetzkow et als' (1963) Inter-Nation simulation, groups of students represent decision makers in five nations (Austria–Hungary, England, France, Germany and Russia) allocating the military, consumer and natural resources industries available to their nation. These various types of resources serve distinct functions in domestic and international affairs. Using their resources, the participants make decisions concerning internal matters such as economic growth, government stability and defense preparations. Decision makers may enter alliances, negotiate trade or aid, engage in hostilities and/or participate in international organizations. Two separate runs of the simulation were performed as a pilot project.

An attempt was made to select participants whose personality traits resembled those of actual political leaders in charge of these nations during the crisis of 1914 (Hermann and Hermann, 1967). Five of the individuals whose personality profiles best matched those of the historical figures participated in the first run (run M); one took part in the second (run A). It turned out that the course of events during run M approximated the actual political crisis prior to World War I much more closely than the A-run. The personality matching between simulation participants and historical figures seemed to have an impact on whether or not correspondence existed between the simulation and a reference system. In short, the results of the simulation suggested that 'personality matters' in world affairs.

Simulation B: Theory Testing

In these types of simulations analysts attempt to probe aspects of crises by simulating them under controlled conditions in a laboratory. By systematically holding some conditions constant and manipulating others in successive runs of a simulation, the analyst can observe and measure the potency and assumed relationship between certain variables.

The Hostage Crisis Simulation (Kraus et al, 1992) involves a hypothetical case of an international crisis involving three real-world parties: Israel, Egypt and the Palestinians. The scenario reads as follows: a commercial airliner, *en route* to Europe, is hijacked and forced to land at Cairo International Airport. The passengers are predominantly Israeli; the hijackers are known to be Palestinians, although their identity is not apparent at the beginning of the simulation. They demand the release from Israeli security prisons of an un-determined number of Arab prisoners and safe passage for the hijackers. Each party has to consider six possible outcomes of the crisis. In addition, each party to the negotiation has a set of objectives and a certain number of utility points is associated with each. Utility points are assigned in order to express a complex set of preferences in such a way that subtle distinctions can be made among them. In combining the range of utility points associated with each objective with the six possible

outcomes, a matrix can be generated that yields a point output total for the various outcomes.

During 32 runs with undergraduate international relations students at the University of Maryland, in the spring of 1991, researchers tested the hypothesis that the use of the Hostage Crisis Interface (a menu-driven decision support system) increases the effectiveness of parties' negotiations. The effectiveness was measured in terms of average utility scores at the conclusion of the simulation. The Hostage Crisis Interface facilitates decision making by human players by enabling them to create and examine hypothetical future situations, based on alternative negotiation strategies. For example, a player can hypothesise what event a, b and c will occur and, then, see how these occurrences will be reflected in his or her utility point score. The results of the simulations supported the hypothesis: for all three types of simulation participants, the average utility scores were higher for the interface users than for the non-interface users.

Simulation C: Developing Crisis Management Strategies

In the 1950s and 1960s, researchers at the Massachusetts Institute of Technology developed crisis simulations to assist policy makers in the field of international and security affairs in developing contingency plans (Bloomfield and Whaley, 1969). Using role-playing techniques, players simulated the decision making process at the top level of government in two or more parties (countries, but also international organizations such as the United Nations). The crisis was generated by a basic scenario and pre-programmed on *ad-hoc* follow-up messages, distributed by a control group running the game. By varying the strategic properties of the basic scenarios across different runs of the game, the researchers began to develop ideas about the role of, among others, strategic nuclear weapons; the deployment of advance forces; different forms of signalling commitment to adversaries; and the role of international organizations. In addition, these early simulation experiences strongly suggested that crisis management is not only a matter of finding an appropriate mix of strategies and tactics, but also of delicate process management at the level of the decision making group. Bloomfield and Whaley (1969: 662) observe, for example, that 'a tendency to euphoria permeates teams as they begin to play out their initial strategy, remains despite setbacks and even persists into the post-game plenary critique sessions when the teams assess the outcome'. These types of behaviour later became known as 'groupthink', which, along with other potential pathologies of decision making under stress, became an important area for developing policy prescriptions to improve the crisis management process (Janis, 1972; Lebow, 1981).

Simulation D: Testing Crisis Management Strategies

An example of the fourth type of simulation design is Axelrod's (1984) study of how cooperation may emerge in Prisoner Dilemma (PD) Games. The PD game epitomizes the structure of many real-world conflicts and crises in that it provides the players with a set of mixed motives: they can gain the most by trusting each other and cooperating, but the penalty for being the only one to cooperate while the other party is deceiving you and taking a hard line is severe. Many parties in such games take a confrontational stand, even if this means highly suboptimal outcomes for everyone. Like many others, Axelrod wondered whether there would be a way to avoid this trap of self-sustaining conflict. What he did was invite specialists from different disciplines to develop well-specified strategies of conflict management that would provide the best long-term results; for example, in cases of an iterated PD game. He asked each of them to write their preferred strategy into a computer program which he then ran through an infinite series of PD iterations. In this way, the computer simulation provided the opportunity for a comparative assessment of the effectiveness of the strategies. The 'tit-for-tat' strategy, submitted by psychologist Anatol Rapoport, that won the tournament, was amazingly simple: taking a cooperative stance on the first round of the game and, then, simply following whatever move the other party is making. The intriguing simulation results inspired Axelrod to write a book on how cooperation may emerge in a world of egoists that has become highly influential among policymakers around the world. It has inspired game theorists and other analysts studying crisis behaviour, bargaining and negotiation to look for ways in which to increase the chances of cooperation, rather than coercion, being used in responding to conflict (Leng, 1988; Brams, 1990).

Each type of simulation outlined above entails different requirements for designers and controllers that should be well-thought out in advance. If there is a mis-match between design parameters and staffing, one might end up with a situation where designers lack the essential manpower and tools to control, monitor and evaluate what is going on among the participants.

Concluding Remarks

This brief review of classic and more recent literature suggests that there is no single,

immutable set of principles and rules for designing an effective crisis simulation. It all depends on the context of their use: what is the main purpose, who are the participants, how much time and resources are available? The article has reviewed the various purposes to which simulations can be put and has specified some crucial design parameters to be observed. Three final observations are in order.

First, simulations are a seductive proposition for crisis management trainers and planners. They provide an opportunity to provide their often reluctant clients (see 't Hart, this issue) with a vivid experience showing them the importance of taking crisis management seriously. Crisis simulation may reveal the penalties of mismanaged crises. They show how a lack of interest, knowledge, skills, planning and organizational flexibility with respect to crisis management may increase vulnerability. However, it is important to keep in mind that simulations should always be embedded in a total crisis management strategy. They should not be one-shot events, but should be used repeatedly to avoid organizational complacency, test contingency plans and train new generations of decision makers.

Moreover, whatever type of simulation is used, systematic feedback to participants is a crucial aspect of simulations, especially when they are used for teaching, training and planning purposes. Unfortunately, there is often too little time scheduled for a thorough reflection upon the way in which the simulation proceeded. Feedback should be critical but constructive (Flin, 1996). For the analyst, the feedback stage is a chance to obtain participants' recommendations for improving the simulation. For the participants themselves, the feedback stage provides an opportunity to review and evaluate their own behaviour, explain the reasoning behind their actions during the simulation and discuss the problems and frictions encountered during the simulation. Participants should be given a clear review of the strengths and weaknesses of their performance during the simulation. Areas of vulnerability and low performance should be explored further in terms of alternative, 'what-if', strategies to broaden individual and organizational crisis response repertoires for future contingencies.

Finally, it stands to reason that simulations face a bright future. For one thing, they become cheaper to conduct. Advances in software technology have made it profitable to develop and market highly sophisticated computer simulations. Advances in communication technology have widened the scope for mega-simulations involving simultaneous participation by officials and organizations around the world. More importantly, political awareness of risks and vulnerabilities has been on the increase. The current era is now commonly referred to as that of the 'risk society', where there is low tolerance for misfortune and a general tendency to protect and insure oneself against negative contingencies. More and more, corporate and governmental decision makers are aware of the rapid changes occurring around them and the need to analyse these in terms of the opportunities and threats they entail. In order to play this role, simulations themselves have incorporated new trends. For example, the classical inter-nation (particularly super-power) crisis scenarios that provided such an important impetus in the early development of simulation methodology, have rapidly become obsolete in recent years. The current demand is for simulations that deal with complex ethnic conflicts, a prominent role for NGOs, international monetary turbulence, transnational crime and high-technology terrorism. Similarly, in urban crisis management, one of the key issues today is multi-culturalism: what does the presence of different national, ethnic and religious groups within the city mean for local emergency management? The issue is not only one of multiple languages but of sub-cultures: different informal community structures, self-help traditions, attitudes towards police and other authority figures, sensitivity to warning and patterns of grief and recovery. Simulations can explore the ramifications of these complexities, in advance, and prevent authorities from being overwhelmed by them when caught unprepared (Rosenthal et al, 1994).

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