

**Coalescing Effective Community Disaster Response:
Simulation and Virtual Communities of Practice**

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by

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Abstract

This paper discusses the inclusive blend of simulations, models and games and other digital and/or online technologies with local/regional “virtual communities” and communities of practice as a potentially powerful and effective approach to comprehensive community emergency preparedness. It broadly scans a range of important theories, academic papers, software tools, commercial products and prototypes.

In a scanning overview, it looks at people, organizations, disaster event characteristics and some pitfalls in disaster response, multi-organization networks and learning within and among them, communication and information issues, simulations and games, spread-sheet modeling, “virtual reality” and synthetic environments, table-top exercises and drills, de-briefing issues, virtual communities, online learning, virtual conferences, concept mapping, state-of-the-art ‘socio-technical systems’ for emergency management, intellectual capital, social capital, social translucency, and ‘cascade thinking’ (or forecasting 2nd- and 3rd-generation consequences) as they apply to emergency management and disaster preparedness.

Introduction

Our mindset with regard to disaster is book-ended by two phenomena: the Katrina experience in New Orleans, and the projection of pandemic flu.

John Harrald, co-director of the Institute for Crisis, Disaster, and Risk Management at George Washington University, spoke of the Katrina response: "... we are seeing **a failure of imagination.**" ¹

According to the World Health Organization, "Countries around the world need to start **rehearsing plans** ² for tackling a flu pandemic to identify hidden obstacles and ensure the best response once the virus arrives".

How does a multi-organization network rehearse plans effectively?

"In a pandemic, all sorts of horrible economic or sociopolitical factors immediately emerge", says Laurie Garrett, a global health expert at the Council for Foreign Relations. Quarantines and panic temporarily dismember trade and communication networks, creating shortages of all sorts of basic necessities. And American hospitals that have in recent years been increasingly trimmed of excess capacity will lack the equipment, supplies, staff and even the beds for the sudden inundation of new flu-struck patients...." ³

Disaster response within many scenarios (particularly in impact zones in densely-populated areas with complex, critical and interlocking infrastructure, and overlapping and multiple jurisdictions, and especially one involving public health) involves **a complex weave of interdependent hierarchies** at the local, state/regional and national level, hundreds of agencies and organizations, thousands of people, and eventually community and its population. They, and the event itself, are spread out over space and time.

Decisions and information flow back and forth, and up and down, the tapestry of response. Inaccurate perceptions, ineffective and inefficient communications and other factors may combine to generate instability or breakdown in systems responsible for crisis management and communal safety and well-being.

¹ "Understanding Katrina: Everyone knew it was coming. So why couldn't disaster have been avoided?", Dan Gilgoff, U.S. News and World Report, 9/12/05 (<http://www.usnews.com/usnews/news/articles/050912/12neworleans.htm>).

² "WHO urges rehearsal of flu plans", Emma Ross, AP, *Boston Globe*, 11/8/05, p. A9.

³ "The Politics of Pandemics", by Drake Bennett, *Boston Sunday Globe*, November 13, 2005 (E1).

“Decisions at higher levels propagate down the hierarchy, and information about the current state of affairs propagates up the hierarchy. The interdependencies among the levels of the hierarchy are critical to the successful functioning of the system as a whole. If instructions from above are not formulated or not carried out, or if information from below is not collected or not conveyed, then the system may become unstable and start to lose control of the hazardous process it is intended to safeguard.”⁴

“In catastrophe, problems reach a level of intensity that compromises the very institutions we have created to deal with them.”⁵

If uncertainty engages the mind, if the half-life of knowledge is measured in a few short years, if different people learn in different ways, and if learning is a skill⁶, then **some new form of learning management** must be undertaken that will address the complex interdependency of people, teams, organizations, cultures, jurisdictions, mind-sets and objectives which are hinted at above, as well as in any number of scenarios, and which are described in the literature that will be cited.

What is required is **an investment in intellectual capital**.⁷

And in **social capital** as well.

“... We lose sight of not only the human and physical capital in our community, but the social capital as well: the norms and networks that facilitate collective action. Social capital, of course, lies not in the actors – or in this case the convergers – themselves, but in the networks and social structure that can be mobilized by those actors, those decision-makers, and those convergers.”⁸

In order to design and deliver such a sophisticated learning management system, it means **tapping into the greatest minds** in the fields of

⁴ “The Human Factor”, Kim Vincente, National Academy of Engineering Publications (Volume 32, Number 4 – Winter 2002); see <http://www.nae.edu/nae/bridgecom.nsf/weblinks/MKEZ-5HUMD3?OpenDocument>.

⁵ Ford Rowan, in the Foreword (p. xi), *In the Wake of Terror: Medicine and Morality in a Time of Crisis*, ed. by Jonathan O. Moreno, MIT Press, 2003.

⁶ “Meta-Matters: The Value of Learning about Learning”, Jay Cross and Clark Quinn; see <http://www.darden.edu/batten/clc/Articles/LearningaboutLearning.pdf>.

⁷ “The Worst is Yet to Come: Lessons from September 11 and Hurricane Katrina, Donald F. Kettl, Fels Institute of Government, University of Pennsylvania, September 2005; see <http://www.disaster-central.com/Worst%20is%20Yet%20to%20come-Kettl.pdf>.

⁸ Russell Dynes is noted in “Considering Convergence, Coordination and Social Capital in Disasters”, Tricia Wachtendorf and James Kendra, *Canadian Risk and Hazards Network (1st Annual Symposium)*, November 19, 2004 (<http://www.crhnet.ca/docs/presentations/T-Wachtendorf.pdf>)

emergency management, disaster research, public health, community development, computer technologies, online learning, multimedia, virtual community building and facilitation, and simulation gaming⁹. It means tapping into the understanding derived from extensive research conducted by or on behalf of the US military in the last two decades. It means having an appreciation for the work of Enrico Quarantelli, Ph.D. and his acolytes at the Disaster Research Center (as well as many other similar or related academic centers). It means understanding something about “emergent properties”, adaptive and problem-solving systems, social and organizational networks, systems thinking, organizational learning, building alignment and connectivity, and “cascade thinking”. It means having some awareness of the power of simulation gaming and the potential of emerging digital technologies. And, ideally, it means synthesizing and integrating it all.

More importantly, from the other side of the coin, it means **building a system that will improve and enhance the individual and collective minds** of those (at all levels and in all roles) who respond to disaster or communal crisis. (It should be perfectly obvious that these kinds of approaches can be applied to a wide variety of fields of collective human endeavor.) This means building into the system a greater understanding of team development and leadership, of collaborative and double-loop learning, communications, distributed teams, adaptive proficiency training, situation awareness, decision-making under stress, personal stress management strategies, creativity and improvisation, and other meta-cognitive strategies.

“How can we combine and coordinate the multitude of disciplines and organizations— such as businesses, agencies, schools, universities, hospitals, fire and police—and connect across local, state, and federal levels where needed? How can we build a sufficient practice repertoire that must include new databases, protocols, technologies, simulations, standards, case studies, and research?”¹⁰

At the epicenter of all of this lies the human mind, individually and collectively. Responders, coordinators, planners, information gate-keepers, theorists, strategists and tacticians all become involved in time-critical high-consequence perception, observation, inquiry, negotiation, decision and action, all involving individual, team and systems performance.

⁹ Gaming applications are emerging from cross-collaboration between government, industry and academia, or “multiple constituencies coming together to solve problems”. See “How Games Are Re-Shaping Business & Learning”, Dr. James Paul Gee, Dr. Kurt Squire and Constance Steinkuehler (<http://www.academiccolab.org/initiatives/accelerate.html>).

¹⁰ “Communities of Practice: A New Tool for Government Managers”, William M. Snyder (Managing Director, Social Capital Group) and Xavier de Souza Briggs, (Assoc. Prof. Of Public Policy, Harvard University), *IBM Center for Business and Government (Collaboration Series)*, November 2003. (http://www.businessofgovernment.org/pdfs/Snyder_report.pdf)

What is implied is the creation of a system that has high visibility to all, allows for a great degree of awareness about both content and process, and maintains a high degree of accountability among those involved. As a critical part of a community, it becomes "**socially translucent**".¹¹

So the focus and the pressure is not all on a single individual, nor even a "unified command" structure. The new digital technologies constitute and enable the expansion of understanding and experience through memory, communication, perception, theory, knowledge, visualization and rehearsal to the team mind, systems minds, the community mind and, indeed, the global mind. "**The reality of life is embedded in social networks....**"¹²

This paper will be structured in three sections; they include:

- A) Disaster Theory and Organizational Learning
- B) Simulations, Models & Games, & Other Digital Technologies (page 26)
- C) Online Learning and Virtual Communities (Page 40)

This will be followed by a conclusion (page 56), and the list of sources (page 59).

¹¹ "Social translucence: An Approach to Designing Systems That Support Social Processes", Thomas Erickson and Wendy Kellogg, IBM T. J. Watson Research Center (http://www.pliant.org/personal/Tom_Erickson/st_TOCHI.html).

¹² "BioWar: Scalable Multi-Agent Social and Epidemiological Simulation of Bioterrorism Events", Kathleen Carley et al, Carnegie Mellon University (<http://www.sandia.gov/ACG/documents/papers/carley-2003-biowar.pdf>)

Disaster Theory and Organizational Learning

"In a complex world, there is need for shared experience in the decisions, or there is no common perception, no communications and, therefore, neither acceptance of the decisions nor ability to carry them out. The ability to understand presupposes prior communication. It presupposes agreement on meaning.

There will be no communication, in sum, if it is conceived as going from the "I" to the "Thou". Communication only works from one member of "us" to another. Communications in organization -- and this may be the true lesson of our communications failure and the true measure of our communications need -- are not a means of organization. They are a mode of organization."

-- Peter Drucker

"Information, Communications and Understanding"
Technology, Management and Society
Harper and Row, New York 1970

Leonard Marcus Ph.D., ¹³ speaks of **a web of preparedness** as having four major components: **people, organizations, resources, and information**. (A simple exercise for the reader, in his or her community, would be to list as many examples as possible in each of these categories.)

By people, of course, dominantly we think of responders, professionals of one sort or another, or perhaps planners, or experts of one sort or another, or perhaps politicians or other decision-makers and organizational leaders. Given the debate that often surrounds issues of evacuation and self- and home preparedness, we must of course consider the people... the population, in all of its numerous categories and groupings. Given the magnitude of recent and future events, there is a greater understanding that the common man must be prepared to help himself, and hopefully his neighbor as well.

After you consider the kinds of roles and people involved (the essential triad consists of fire fighters and rescue personnel, emergency medical technicians and law enforcement officers of various types ... and, of course, there are many others), consider the number of governmental agencies and super-agencies involved, the number of associations involved in their specific fields, the number of training agencies, etc. Within each of these cultures, disaster response has been a lower priority, if not a step-child or an orphan. This is, of course, quite understandable: disasters are rare, but fires, heart attacks and domestic violence occur at an hourly rate. Yet our history and our future suggest the need for a new level or a new approach to our collective work.

¹³ Dr. Marcus was on the faculty of a conference for senior practitioners and professionals at the John F. Kennedy School of Government at Harvard University in Cambridge Mass. on bioterrorism preparedness (June 10, 2003). He is the Co-Principal Investigator at the Harvard Center for Public Health Preparedness and Director of the Program for Health Care Negotiation and Conflict Resolution at the Harvard School of Public Health. Further work of his will be noted below.

Dr. Marcus notes that, in any preparedness effort focused on public health issues, we will need **the combined skills** of the following:

- scientists (to assemble, test for, and verify evidence of disease/spread);
- clinicians (to understand, assess and map out plans for disease spread);
- strategists (to assess options);
- ethicists (to grasp and communicate the human dimension);
- planners (to chart what must be done);
- organizers (to marshal and link people and resources);
- risk assessors (to appraise choices and consequences);
- politicians (to grasp decision-making dynamics);
- financial officers (to manage money and spending); and
- prophets (to be able to see into the future and plan accordingly).

How can all these people share a common goal, a common context, a common picture? Where is the structure and facility through which they can come together at a local level? How will they find common ground and agreement? Dr. Marcus says that "One of the major sources for conflict in any system, but especially those preparing to or actually responding to an emergency, is **the conflict between power and expertise.**" ¹⁴

Sometimes people don't have the interest or motivation. Sometimes they don't have the time. The everyday world has its own pressing business and, until recently, disasters and catastrophes were off the far horizon of thought and time. "There is often a reluctance to invest even minimal time to learn the frame of reference of others engaged in related work or efforts." ¹⁵

Sometimes they don't have an attractive, convenient and easily-used mechanism for learning, exploration, and discussion. Sometimes they simply don't know the people on the other side of town who hold some knowledge, expertise, interest or key position. But, as Marcus notes, "If people are not paying attention to one another in the planning and preparation phase, they are less likely to do so during an actual emergency." ¹⁶

Sometimes they are simply caught up in their own professional world. "There is a tendency in organizations and among people working in them to think in narrow and self-protective terms. The silo mentality refers to a perspective

¹⁴ Leonard Marcus, Ph.D., *Harvard/MIT Conference on Bioterrorism Preparedness*, JFK School of Government, Harvard University, June 2003.

¹⁵ "Connectivity and Public Health Preparedness: Resolving Conflicts and Building Collaboration to Enhance System Readiness", Leonard J. Marcus, Ph.D. (Harvard School of Public Health). http://www.mass.gov/dph/bioterrorism/advisorygrps/pdfs/marcus_connectivity.pdf

¹⁶ Ibid.

that is insular, parochial, isolationist, and tilting toward the close-minded... Training and career development occur in silos, knowledge tends to organize itself in silo-oriented literature, and budgets, space, and departments are bunched and distinguished into silos for ease and efficiency of management. The silos offer a reinforcing zone of familiarity that encourages silo-reinforcing pursuits. Connectivity acknowledges the effects and inevitabilities of silo thinking and counters it by constructing **explicit, robust, and purposeful bridges** that ... link and re-motivate preparedness efforts." ¹⁷

Furthermore, people want different things... and see things differently, and are vested in organizational roles that press them into a certain stance. "... Different individuals and units within an organization may hold somewhat different criteria of success.... Advocates of a policy are likely to interpret any difficulties with it as reflecting an insufficiently vigorous pursuit of the policy, while opponents interpret the same data as signifying a bad policy. Feedback about the results of organizational actions may be distorted or suppressed as people rush to protect their turf or to maintain a positive climate..." ¹⁸

In and across multi-organizational settings, funding, publicity, organizational image and organizational vitality are often at stake, even in situations that would seem demand greater collaboration. "Although senior executives strive to achieve common goals..., they also represent powerful sub-units or constituencies.... This creates 'a tension regarding group identities' and enhances the likelihood of goal conflict and self-interested behavior in some, but not all, situations.... Members can find themselves in direct competition regarding the allocation of resources...." ¹⁹

Clearly one of the factors involved in modern-day emergency response systems is that there is some measure of **disconnect** between academic research and theory, and responders in the field. "The crisis management challenge, largely documented since the 80s and the 90s" [is] still poorly known by most organizations." ²⁰ Even today, in the modern era where virtually every major organization maintains a web site, many are not aware of the depth and breadth of work that is being done in many fields. Partly this is because the academicians and researcher speak in dozens of difficult languages reflective of their specialty and culture. Partly this is because their

¹⁷ Ibid.

¹⁸ Mark K. Smith, *Learning and Organizations*, at www.infed.org/biblio/organizational-learning.htm.

¹⁹ "A Dynamic Model of Top Management Team Effectiveness: Managing Unstructured Task Teams", Amy Edmondson, Michael Roberto and Michael Watkins, Harvard Business School (<http://www.hbs.edu/research/facpubs/workingpapers/papers2/0001/01-048.pdf>)

²⁰ Patrick Magadec, "Understanding the French 2003 Heat Wave Experience: Beyond the Heat, a Multi-Layered Challenge", *Journal of Contingencies and Crisis Management* (Volume 12, Number 4, December 2004). (<http://www.blackwell-synergy.com/doi/abs/10.1111/j.0966-0879.2004.00446.x>)

work is not available in convenient, digestible fashion. (It is difficult to think of serious research deliverable through “podcasting”, but it might work.²¹) Partly this is because there has no been no adaptable “common ground”.

A simple enumeration of all of the people involved in response to a major incident, multiplied by the quantity of densely populated areas of the world or any of its nations, will lend some appreciation of the difficulty in **transmuting complex theory and understanding into functionality** within an *ad hoc* team responding to a rare event. Yet “... constant communication between researchers and decision makers is an absolutely essential component of addressing the rising threat of disasters and other extreme events.”²²

Another aspect to this is that we humans tend to learn in the context of our place, our team and our community. “People appear *to think in conjunction or partnership* with others and with the help of culturally provided tools and implements. **Cognitions**, it would seem, are not content-free tools that are brought to bear on this or that problem; rather, they **emerge in a situation tackled by teams of people and tools available to them...** What characterizes such daily events of thinking is that the social and artifactual surrounds, alleged to be ‘outside’ the individual’s heads, not only are sources of stimulation and guidance but are actually *vehicles of thought*. Moreover, the arrangements, functions, and structures of these surrounds change in the process to become genuine *parts of the learning* that results from the cognitive partnership with them. In other words, it is not just the ‘person-solo’ who learns, but the ‘person-plus’, the whole system of interrelated factors.”²³

Indeed, even organizations learn from strategic partners (‘learning from network’) when they share knowledge and understanding, when they adopt and cross-adopt new tools and technologies, and when they understand more about the marketplace or community they serve.²⁴ Benini speaks of the

²¹ “Somatic Digital Announces TGUI-Enabled Podcasting Development”, December 16th, 2005, “Publishers Can Now Connect Podcasts Directly to Print Materials to Enable Audio Supplements to Paper and Ink Products”. For Further information, see <http://biz.yahoo.com/prnews/051216/clf013.html?.v=27>.

²² “Extreme Events: A Research and Policy Framework for Disasters in Context”, Daniel Sarewitz and Roger Pielke, Jr., (<http://www.cspo.org/products/articles/xepaperfinal.pdf>)

²³ “No distribution without individual cognition: a dynamic interaction of view”, G. Salomon, in *Distributed Cognitions -- Psychological and Educational Considerations*, Cambridge University Press, 1993 G. Salomon (ed.), as noted by Mark K. Smith, *Learning and Organizations*, at www.infed.org/biblio/organizational-learning.htm.

²⁴ “Organizational Learning in a Knowledge Economy”, Hoang Van Phuc, http://www.aeaf.minfin.bg/documents/Van_Phuc_Hoang_paper_CMTEA2005.pdf.

symbiosis, or **stable and reciprocally profitable relationships**, that occur between organizations in disaster response.²⁵

So what can we glean quickly about how organizations learn?

We can quickly *google*²⁶ that **organizational learning** will tend to be:

- Situated in and concerned with communities of practice.
- More "informal" and involve far less "teaching" than in the individual case;
- Relatively unregulated; and
- Contradictory.

Another source²⁷ tells us that there are **four dimensions** of organizational learning:

- Levels of learning;
- Modes of learning;
- Types of learning;
- The learning process.

Peter Senge, one of the major gurus of organizational learning, says in his seminal book *The Fifth Discipline* that a learning organization is defined as one "where people continuously expand their capacity to create the results they desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together."

Organizational learning focuses on critical information, where it is, what it means, and how to get it into the hands of others in the organization. "Valuable knowledge generated in the course of both routine and non-routine operations tends to become compartmentalized. **An essential aspect of improving organizational learning is removing barriers that block the flow of information from where it is available to where it is needed.**"²⁸

²⁵ "Network Without Center?: A Case Study of an Organizational Network Responding to an Earthquake" (Natural Hazards Research Working Paper #100), Aldo A. Benini, Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado (<http://www.colorado.edu/hazards/wp/wp100/wp100.html>).

²⁶ Mark K. Smith, *Learning and Organizations*, at www.infed.org/biblio/organizational-learning.htm.

²⁷ "Organizational Learning in a Knowledge Economy", Hoang Van Phuc, http://www.aef.minfin.bg/documents/Van_Phuc_Hoang_paper_CMTEA2005.pdf.

²⁸ "Building Learning Organizations: The Design and Implementation of Organizational Learning Mechanisms", Ranaan Lipshitz et al., *Journal of Applied Behavioral Science*, Vol. 32, No. 3, September 1996.

Senge ²⁹ speaks of **five developmental paths** for acquiring skills competencies that comprise organizational learning; they are systems thinking, personal mastery, mental models, building shared vision, and team learning.

Systems thinking is a way of examining and understanding the dynamic interconnections of events that are distant in time and space, and of finding the critical leverage points which allow change, refinements or other improvement. Our normal tendency is to use a "snapshot" approach that examines one element, at a given time and place, in a dynamic system.

Personal mastery refers to the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and in seeing reality objectively.

Mental models are **deeply ingrained assumptions, generalizations or images** that influence how we understand the world and how we take action. Organizational learning brings these to the surface for rigorous scrutiny through a balance of inquiry and advocacy, where people expose their own thinking effectively and make that thinking open to the influence of others. Learning organizations not only tolerate open-minded skepticism, they support it.

The practice of **shared vision** involves the skills of unearthing shared "pictures of the future" that foster genuine commitment and enrollment rather than compliance.

"The discipline of **team learning** starts with "**dialogue**", the capacity of members of the team to suspend assumptions and enter into a genuine "thinking together".... "Dialogue differs from the more common "discussion", which has its roots with "percussion" and "concussion", literally a heaving of ideas back and forth and a winner-takes-all competition. The discipline of dialogue also involves learning how to recognize the patterns of interaction that undermine learning. The patterns of defensiveness are often deeply ingrained in how a team operates. If unrecognized, they undermine learning. If recognized and surfaced creatively, they can actually accelerate learning."

There are "**six disciplinary perspectives of organizational learning**: Psychology, Management Science, Sociology and Organizational Theory, Production Management, Strategy and Cultural Anthropology". The psychology and sociology may seem obscure to some, but "... **the trend of learning has shifted from a knowledge management approach to a human process approach.**" ³⁰ Production management may seem to be irrelevant

²⁹ "Leading Learning Organizations, Peter Senge, *Training and Development*, Vol. 50, No. 12, p. 50.

³⁰ "Organizational Learning in a Knowledge Economy", Hoang Van Phuc, http://www.aeaf.minfin.bg/documents/Van_Phuc_Hoang_paper_CMTEA2005.pdf

when thinking about disaster management, but Osterholm³¹ reminds us that we live in a J-I-T economy and that supplies and materiel and its distribution can be affected significantly in widespread and/or long-term events. Sociology is the baseline for the decades of work done at the Disaster Research Center and elsewhere, and psychology is the baseline for extensive work done on attentional behaviors, stress management, decision-making, and situation awareness (all beyond the scope of *this* paper).

Does this mean that the fire-fighters, police officers, EMS staff and others involved in disaster planning and response must become super-generalists while maintaining day-to-day skill proficiency? Not necessarily...

"Three types of learning are particularly interesting from an organizational perspective: communication-based, experience-based, and expectation-based. In **communication-based learning**, individuals learn about tasks, people, organizations, etc. by observing or being told. The information garnered in this way is expected to be new or novel to the learner. **Experiential learning** has its basis in task repetition and feedback. There are several sources for this experience: the communication of previous results, increased familiarity, increased physical skill, prior problem-solving. Finally, **expectation-based learning** occurs when individuals engage in planning, thinking ahead about the future, and then use these expectations as a basis for future reasoning. From a network perspective, learning results in the construction of nodes and relations." ³²

"In theory, learning occurs incrementally. The more [direct] experiences the individual has, the better the performance will be, and consequently, the better the organization's performance will be... In practice, of course, there is a difference between seniority and experience when one is concerned with rare events... The experience that people may have not be the appropriate type of experience... Personnel tend to rise to positions of authority and the basis of experience in non-catastrophic events... Because problems in the disaster response area are not scalable, experience tends to dissipate as the demography of the organization changes. Consequently, **these organizations need to develop ways of transferring information other than through [direct] experience. Possibilities include the use of simulated events...**" ³³

³¹ "Preparing for the Next Pandemic", Michael Osterholm, *Foreign Affairs*, July/August 2005 (<http://www.foreignaffairs.org/20050701faessay84402/michael-t-osterholm/preparing-for-the-next-pandemic.html>).

³² "On The Evolution of Social and Organizational Networks", Kathleen M. Carley, Carnegie Mellon University, in Steven B. Andrews and David Knoke (eds.), Vol. 16 Special Issue of *Research in the Sociology of Organizations* on "Networks In and Around Organizations," JAI Press, Inc, Stamford, CT, pp. 3-20. (http://www.casos.cs.cmu.edu/events/summer_institute/2001/reading_list/pdf/EvolutionofNetworks.pdf).

³³ "Organizational Learning Under Fire", Kathleen Carley and John Harrald, *American Behavioral Scientist*, Vol. 40, No. 3, January 1997, p. 310ff.

What do we know about organizations involved in disaster response?

"If the different entities or jurisdictions are operating at different levels of interest, attention, training, and assessment of vulnerability to hazards, their capacity for coordination is severely impaired.³⁴ Worse, there appears to be a downward spiral in the effort to maintain a common focus. If one organization initiates a strong effort..., but this effort is not matched by the other responsible organizations, the first organization is unable to achieve its goal due to its interdependence with other organizations in the region. Dismayed, it may drop its efforts, just when another organization may begin. If there is not a regular, systematic process to update information, training, equipment and skills by all participating system units within a common timeframe, the effect of "start and stop" efforts to improve capacity for emergency response reduces the motivation for all units and has a strongly negative effect upon the system."

Enrico Quarantelli, director emeritus of the Disaster Research Center, says that **disasters are both quantitatively and qualitatively different**³⁵ from minor emergencies and everyday crises. He notes that:

- "organizations are forced into more and different kinds of interactions with other groups",
- "the greater number of organizations involved, the greater the number of contacts and the more new relationships with other groups that need to be established",
- "during periods of normalcy, new relationships between organizations often develop very slowly" and that, therefore,
- "disasters call for more and different organizational relationships".
- "organizations will lose some of their autonomy",
- "performance standards... change drastically... ",
- "disasters require different types of organizational performance", and
- "boundaries between public and private ... become blurred during disasters".

³⁴ "Coordination in complex systems: increasing efficiency in disaster mitigation and response", Louise K. Comfort, Mark Dunn, David Johnson, Robert Skirtich and Adam Zaorecki, *Int. J. Emergency Management*, Volume 2, Nos. 1-2, pp. 62-80.
(http://www.inderscience.com/search/index.php?mainAction=search&action=record&rec_id=5314)

³⁵ "Research-based Criteria for Evaluating Disaster Planning and Managing", E. L. Quarantelli,
<http://www.udel.edu/DRC/preliminary/246.pdf>.

What do we know about the kinds of events these organizations respond to?
We know they take place across **space** and **time**.

They have **phases** of threat, warning, impact, inventory, rescue, remedy and recovery. Impact can be assessed with indices of extent, severity, duration and scope. They have impact zones or areas, surrounding “filter” areas, community aid **zones**, regional aid areas, and a host of staging areas, triage sites, treatment areas or facilities, holding areas, morgues, command sites, off-site emergency operating centers, manpower and supply pools, press/media sites, family liaison locations, response **routes**, medical evacuation routes, population evacuation routes, etc.

“The actual environment of disaster is extraordinarily complex.... geographic and jurisdictional boundaries are not necessarily congruent... the interaction among agents engaged in disaster response operations and the patterns of communication among their internal components and between the agents and other external systems create the dynamics of the response process.... If even a small part of this interdependent process malfunctions, it can cause serious disruption in performance.... By definition, disaster is an unexpected event that exceeds the normal capacity of a community to respond to adverse events. **Each of these indicators can be measured and included in a dynamic computational model.**”³⁶

There are **deeply-rooted frames of reference which create traps**³⁷ for organizations responding to crises:

- The inability to detect, or search for, “signals”;
- Laborious or hesitant mobilization;
- Divisions, partitions & demarcation lines that isolate [what Marcus calls silos];
- Vertical isolations between layers of bureaucracy;
- Dramatic errors in communication;
- Scape-goating;
- Inadequate mindsets;
- Noisy context;
- Unusual geographical patterns;
- Monitoring difficulties;
- Inadequate data monitoring;
- Unusual data;
- Inadequate focus of attention;
- Stealth problems; and
- Scientific gaps.

³⁶ “Coordination in rapidly evolving disaster response systems: The Role of Information”, Louise K. Comfort, Kilkon Ko, and Adam Zagorecki (University of Pittsburgh), *American Behavioral Scientist*, Vol. 48, No., November 2004. (<http://www.pitt.edu/~kik7/ABS.pdf>).

³⁷ “Understanding the French 2003 Heat Wave Experience: Beyond the Heat, a Multi-Layered Challenge”, Patrick Lagadec, *Journal of Contingencies and Crisis Management* (Volume 12, Number 4, December 2004). (<http://www.blackwell-synergy.com/doi/abs/10.1111/j.0966-0879.2004.00446.x>)

Lagadec says that **crisis situations require**:

- Sharp and wide-open scanning abilities;
- Upgraded monitoring capacity;
- Crisis team-work;
- Data-sharing;
- **An ability to mobilize expertise**;
- **The sharing of leadership through network-based decision-making** (as opposed to top-down command-and-control approaches); and
- Strategic intelligence.

If communications is important within and across organizations, what do we know about communications during disaster?

Quarantelli ³⁸ notes that there are **multiple streams** of information flow during crisis or disaster, including within every responding organization, between them, from citizens to those organizations, and from those organizations to citizens. Furthermore, he adds, "... most problems stem from what is communicated rather than how communication occurs."

There is "... a **"Tower of Babel" effect** ³⁹ where "there are many different disciplinary voices, talking in different languages to different issues and audiences".

Communications interoperability during the response phase has been a driving buzz phrase for some time now, since before and certainly after 9/11, but **sometimes officials from different organizations or jurisdictions simply do not want to talk to one another.** ⁴⁰

What precisely is the critical information? Who has it? How do you get it? Who will you communicate that to? What precisely are you looking for? What is it that you want that information to tell you? In the midst of a crisis, you'll want that information to be available in a timely fashion, to be clear and easily readable, and to allow for its effective analysis.

"**Bureaucracies** are organized and trained to work on stable data, formatted problems. Their culture is more "file-building" oriented. Their basic frameworks of reference are established rules, clear and fixed partitions of

³⁸ "Research-Based Criteria...", op. cit.

³⁹ Paraskevas notes Shrivastava, "Crisis Theory and Practice: Toward a Sustainable Future", *Industrial And Environmental Crisis Quarterly*, 7, p. 33), in "Crisis Response Systems through a Complexity Science Lens", Alexandros Paraskevas (http://www.liv.ac.uk/ccr/2005_conf/subject_areas/mngt_files/papers/CrisisResponseSystemsEtc.pdf).

⁴⁰ Kettl, in "The Worst is Yet to Come: Lessons from September 11 and Hurricane Katrina", cites himself in "The Department of Homeland Security's First Year: A Report Card", The Century Foundation, NY 2004. (see <http://www.disaster-central.com/Worst%20is%20Yet%20to%20come-Kettl.pdf>).

areas of competence and levels of responsibility, top-down dynamics, and a programmed timeframe. This culture is so prevalent that it permeates monitoring, even when obviously incompatible with the task at hand and its timeframe." Yet, in the event, "data and signals were lost in the corridors.... Writing and rewriting, in day-to-day bureaucratic life, can take days.... The primary impulse of officials was not to seek extra information, organize meetings and set up networks, take decisions, and act. This behavior is not strange within administrative culture and not a monopoly of the French." ⁴¹

"The **amount of information** exchange through telephone, wireless phone, satellite phone, mobile e-mail and paging devices, TV, radio, newspaper, and Internet is enormous, and finding effective means of exchanging core information among organizations with central responsibilities in disaster management is essential to improving regional capacity for disaster risk reduction...." ⁴²

"Stress in organizational performance arises when the amount of information surpasses human capacity to absorb and comprehend it, leading to failure in action." ⁴³

Finally, of course, the disaster response organizations and networks get to deal with the public, and talk to them. But "... decision-makers have lost their monopoly on **public information and communication**: in fact, the public is kept permanently informed through a myriad of sources, and is especially made aware of the most dramatic possibilities; this is all the more problematic as experts are now unable to provide decision-makers with such undisputed bold data that would help them "reassure" the public and dismissed criticisms.... Numerous books and checklists have been published to clarify the basic rules of "successful crisis communication". Their advice is certainly valuable, but far from sufficient. In emerging crises, something akin to the "Larson effect" becomes immediately prevalent: **each and every "noise", i.e. item of information, is "recycled" in real-time, and stretched to the limit.** Very rapidly, a mingled bulk of confusing data emerges in the media, combining real facts, false impressions, hypotheses, plausible developments, improbable -- but not impossible -- scenarios, political rifts, public anxiety, plain lies etc., a medley which is all the more inexplicable as

⁴¹ "Understanding the French 2003 Heat Wave Experience: Beyond the Heat, a Multi-Layered Challenge", Patrick Lagadec, *Journal of Contingencies and Crisis Management* (Volume 12, Number 4, December 2004). (<http://www.blackwell-synergy.com/doi/abs/10.1111/j.0966-0879.2004.00446.x>).

⁴² "Coordination in rapidly evolving disaster response systems: The Role of Information", Louise K. Comfort, Killkon Ko, and Adam Zagorecki (University of Pittsburgh), *American Behavioral Scientist*, Vol. 48, No., November 2004. (<http://www.pitt.edu/~kik7/ABS.pdf>).

⁴³ "Modeling fragility and rapidly evolving disaster response systems" (abstract), Louise K. Comfort, Killkon Ko, and Adam Zagorecki, Institute of Governmental Studies (University of California, Berkeley), 2003. (<http://repositories.cdlib.org/igs/2003-2/>).

each **media** outlet recycles the stories of its competitors and echoes (and distorts) the reactions which its own stories provoke -- at the highest speed, and internationally." ⁴⁴

So how can a community effectively manage all of this?

In the first of his ten research-derived principles, Quarantelli ⁴⁵ notes the need to **focus on a planning process rather than the production of a plan**. He speaks of the need to develop techniques for knowledge transfer, and the establishment of informal linkages between involved groups.

Quarantelli's seventh principle argues for both **vertical and horizontal integration** in planning, education and training. "There is not only a need to teach one's own group on what to expect to do, but there is also the necessity of learning how others intend to respond."

"To make sense of crisis situations as they unfold, responding organizations need rapid access to information, which is rendered more likely when organizational boundaries are permeable, barriers to information flow are weakened, and many and diverse actors communicate and coordinate with one another." ⁴⁶

In a disaster environment involving many organizations, this means "networks".

"Over time, social and organizational networks evolve. These networks have a great deal of influence; e.g., they affect the rate of information diffusion among individuals and within organizations, the ability of individuals to acquire and use information, and the speed, quality, and accuracy of organizational decisions....

The **social network** denoting who talks to whom is intertwined with each individual's **cognitive network** (the way in which each individual links ideas) and the **transactive knowledge network** (each individual's perception of the network linking people to their ideas)....

Within organizations, **the authority or reporting network** (who reports to whom) is interlinked with many other networks including **the task structure** (which tasks are connected to which), and **the task access structure** (who is assigned to what task).

⁴⁴ Lagadec, op.cit.

⁴⁵ "Research-Derived Criteria...", op. cit.

⁴⁶ "Networks and Resilience in the World Trade Center Disaster", Kathleen Tierney and Joseph Trainor, Emergency Response and Recovery pp. 157-172.
(http://mceer.buffalo.edu/publications/resaccom/04-SP01/11_Tierney.pdf).

Change in any part of this **ecology of networks** ultimately affects all other parts and the behavior of the entire system is a function of the specific way in which these networks are interlinked."

Each of the agencies or entities within this network are "computational", i.e., they can "acquire, process, store, interpret, or provide information and/or the connections among pieces of information." ⁴⁷

"... **Interaction is the primary defining social act [and is] inherently dynamic...** Interactions and decisions lead to learning and change in mental models which in turn leads to change in interactions and decisions... The emphasis is on mechanism or process. This meta-model is a valuable framework for thinking through the impacts of agency and action on social change. Given the complex dynamic nature of this framework, theorizing about the effects in any specific setting is difficult. Consequently, **computational models** are particularly valuable tools for doing theorizing in this area. Such models, because they capture process, can be used to examine a wide range of phenomena." ⁴⁸

Quarantelli says "**Three common problems** that occur in the middle of disaster response include: a conflict over responsibility regarding new tasks; clashes over organizational domains between established and emergent groups; and the surfacing of organizational jurisdictional differences." ⁴⁹

Is there a way we can surface these issues in advance, and in an ongoing way, so that they do not emerge in the midst of crisis?

"The behavior of the system is determined by its agents' interaction at the local level and **this is the reason why the control of the crisis response system has to be distributed** among its agents. All parts contribute evenly in a crisis situation, perhaps attempting diverse local interventions which will depend on four crisis response constraints: crisis characteristics, local conditions, available resources and prior crisis response experience." ⁵⁰

"Although the management of crises is often described in "command-and-control" terms, suggesting that decision-making and direction of response operations should be vested in a single individual or group of individuals who

⁴⁷ "On The Evolution of Social and Organizational Networks", Kathleen M. Carley, Carnegie Mellon University, in Steven B. Andrews and David Knoke (eds.), Vol. 16 Special Issue of *Research in the Sociology of Organizations* on "Networks In and Around Organizations," JAI Press, Inc, Stamford, CT, pp. 3-20.
(http://www.casos.cs.cmu.edu/events/summer_institute/2001/reading_list/pdf/EvolutionofNetworks.pdf).

⁴⁸ Ibid.

⁴⁹ "Research-Based Criteria...", op. cit.

⁵⁰ "Crisis Response Systems through a Complexity Science Lens", Alexandros Paraskevas
(http://www.liv.ac.uk/ccr/2005_conf/subject_areas/mngt_files/papers/CrisisResponseSystemsEtc.pdf).

are "in charge" of the overall response, analyses of network relationships in the WTC disaster paint a very different picture." ⁵¹ That picture is one of several key nodes functioning within a "decentralized pattern that is "common in post-disaster responses in the US". The requirement for specialized resources facilitates the formation of "semiautonomous task oriented sub-networks". Secondly, relationships between responding entities "involve coordination, rather than direct control over people and resources".

Networks and "Emergent" Networks ⁵²

The disaster environment is "turbulent, ambiguous, and highly demanding, requires organizations to incorporate new information, organizations and resources and alter their response repertoires on a rapid basis."

In major disasters, "the activities of individuals, groups, and organizations begin increasingly to be characterized by emergence, rather than institutional routines. Emergence refers to "social relationships and activities that are new, novel, and non-institutionalized -- in other words, different from routine or expected relationships and activities." These groups include some that have no pre-disaster existence.

"At the group, organizational, and inter-organizational levels, disasters are invariably accompanied by the rapid development of emergent multi-organizational networks (EMONS). Emergence occurs along several dimensions within these networks.... Emergent groups become involved on an as-needed, unplanned basis.... Many of the links are relationships that develop among actors in the network are non-routine and unplanned.... [While] EMONS generally stabilized over time, they are very dynamic, with actors entering and leaving the network and new relationships forming on a continuous basis. **It is thus very common in disasters for network actors to be unfamiliar with one another's roles and capabilities and uncertain about the nature of their relationship with one another, especially during the initial phases of the response. The numerous planning and strategy meetings that take place during disasters are needed in order to facilitate the negotiations that must take place among network actors as they attempt to manage emergence....** Network actors engaged in other response-related tasks actively reached out to partner with organizations and groups they thought possessed needed resources and expertise, even when mechanisms to formalize their participation were not in place."

"The network is a form of organization can be defined as a set of entities that "pursue repeated, joint exchange relationships with one another and, at the

⁵¹ "Networks and Resilience in the World Trade Center Disaster", Kathleen Tierney and Joseph Trainor, Emergency Response and Recovery pp. 157-172. (http://mceer.buffalo.edu/publications/resaccom/04-SP01/11_Tierney.pdf).

⁵² Ibid..

same time, lack a legitimate organizational authority to arbitrate and resolve disputes that may arise during the exchange."

"The emergent networks enhanced resilience because they raise the probability that needed information and resources will become available through network ties and because they empower even and network newcomers within the context of the overall response. Networks are also thought to foster the development and diffusion of innovations -- a key requirement in the crisis environment."

So how do these multi-organizational networks learn to work together, or work to learn together?

There are **10 factors that facilitate or expedite organizational learning** ⁵³:

- **A Scanning Imperative** (awareness of the environment);
- **A Performance Gap** (what Senge calls the "creative tension" between where you are and where you want to be);
- **A Concern for Measurement** (the metrics and quantification of key factors);
- An **Experimental Mind-Set** ("ready, fire, aim", or what the US Marine Corps calls "free play");
- **A Climate of Openness** (or an overall level of transparency, contrasted with a "need to know" mindset);
- **Continuous Education** (and at all levels);
- **Operational Variety** (an appreciation for diversity);
- **Multiple Advocates** (new ideas are advanced by people from all levels and all disciplines);
- An **Involved Leadership**; and
- **A Systems Perspective.**

Within a virtual community, all ten of these factors can come into play. Expanded community involvement, the use of sentinels and sensors (e.g., in biosurveillance), and a heightened awareness and learning engagement all

⁵³ "Understanding Organizations as Learning Systems", E.C. Nevis, A. J. Dibella and J. M. Gould, *Sloan Management Review*, Winter 1995 is cited by Hoang Van Phuc in "Organizational Learning in a Knowledge Economy", http://www.aeaf.minfin.bg/documents/Van_Phuc_Hoang_paper_CMTEA2005.pdf.

feed the “scanning” imperative. The “performance gap” is identified by simulation-based performance, and metrics can be driven by it as well as other means. The experimental mind-set (or “play”), as well as operational variety, are fueled by involvement in simulation gaming. The climate of transparency and continuous education is fostered by expanded involvement as well as the availability of learning linkages. Multiple advocates emerge from the extended involvement of many sectors of a community, as well as its business, community and political leaders.

The process of building connectivity "recognizes and values the distinct qualities and contributions of each constituent, discovers what they can achieve and accomplish working together, explores new ways to enhance their connectivity, and through that learning and problem-solving process, better aligns their working relationship and ultimately their connectivity."

Step two in the four-step process that Marcus outlines, examining "enlarged interests", looks at **the preparedness system as a whole** to grasp the bigger picture of dependence, interdependence, independence and ultimately, connectivity." It asks the questions "What do I expect from you and what do you expect from me?" ⁵⁴

"... "*Autopoiesis*"... is "a powerful driving force for creative self-expression... in individuals that, if extended to social groups and organizations through articulating communications processes, serves as a vital source of creativity, renewal, and regeneration in social systems undergoing change..... Creativity ... is important across the entire spectrum of emergency work, from planning, implementing, responding, and post-event learning." ⁵⁵

What of the technology?

"... coordination [in complex systems] may be achieved more easily with the appropriate design of **a socio-technical system**, that is, a system that supports the exchange of critical information among technical and organizational entities to improve performance in both." ⁵⁶

⁵⁴ "Connectivity and Public Health Preparedness: Resolving Conflicts and Building Collaboration to Enhance System Readiness", Leonard J. Marcus, Ph.D. (Harvard School of Public Health). (http://www.mass.gov/dph/bioterrorism/advisorygrps/pdfs/marcus_connectivity.pdf)

⁵⁵ "Creativity in Emergency Response After the World Trade Center Attack", James Kendra and Tricia Wachtendorf, Disaster Research Center (<http://www.udel.edu/DRC/preliminary/pp321.pdf>).

⁵⁶ "Coordination in complex systems: increasing efficiency in disaster mitigation and response", Louise K. Comfort, Mark Dunn, David Johnson, Robert Skirtich and Adam Zaorecki, Int. J. Emergency Management, Volume 2, Nos. 1-2, pp. 62-80. (http://www.inderscience.com/search/index/php?mainAction=search&action=record&rec_id=5314).

A prototype interactive, intelligent, spatial information system (IISIS) ⁵⁷ links **three types of information technology** to create an event-specific knowledge base that can provide timely, valid information to practicing managers as conditions change and demands for coordinated action increase in a complex, dynamic event.

The three technologies include:

- interactive communication;
- GIS and remote sensing imagery;
- intelligent reasoning by the computer.

“Essential elements of the system include the ability to support:

- real-time communication across departments, agencies and jurisdictions;
- real-time access to distributed databases that can be used to define the nature, scope and potential impact of emergency situations;
- real-time access GIS systems to map critical responses;
- rapid assessment of probable risk to different groups in different sections of the community...;
- calculation of time, cost, and consequences of alternative strategies for action....”

But what about the people, their minds, their capacity for memory, etc.? As a novice firefighter in a college town, I rode in the jump seat on Engine One behind Lt. Homer Cowles. We had few fires in this upscale community, and training often consisted of a simple “talking tour” conducted by this veteran who’d grown up in the town and literally built many of the buildings there. He would describe each building, its construction, the distances to nearby alarm boxes and hydrants, the core fire strategy likely required, and something of the inhabitants. “Old Mrs. Betsy Jones lives up on the third floor in the rear; she’s an invalid, on oxygen.” **Much of the relevant knowledge in a community lies tucked away in the minds of the responder. How can we extract, codify and secure such knowledge?**

“The organization's intelligence, adaptiveness, and computational capability results from the detailed, ongoing interactions among (and the behavior of) its member agents.” ⁵⁸

⁵⁷ Ibid.

⁵⁸ “On The Evolution of Social and Organizational Networks”, Kathleen M. Carley, Carnegie Mellon University, in Steven B. Andrews and David Knoke (eds.), Vol. 16 Special Issue of *Research in the Sociology of Organizations* on “Networks In and Around Organizations,” JAI Press, Inc, Stamford, CT, pp. 3-20.
(http://www.casos.cs.cmu.edu/events/summer_institute/2001/reading_list/pdf/EvolutionofNetworks.pdf).

The situation has to be approached “through **a social vision**. That would require another model of crisis prevention and management – *with the people*, within the most tiny complexities of the social fabric.” ⁵⁹

“Seeing from the “whole” in an organization may seem difficult, but learning to be more attentive and genuinely curious about the cultures we live in and enact is the first step. Edgar Schein, one of the most respected scholars of organizational culture, says ‘**If you want to understand an organization’s culture, go to a meeting.**’ Who speaks and who does not, who is listened to and who is not, which issues are addressed directly and which are ignored or addressed by innuendo are powerful clues to how an organization actually functions. These clues become still more “real” when we also pay attention to our own reactions. Schein believes that we can always learn much more about organizational culture through careful observation and reflective participation than from reading mission or value statements.” ⁶⁰

⁵⁹ “Understanding the French 2003 Heat Wave Experience: Beyond the Heat, a Multi-Layered Challenge”, Patrick Lagadec, *Journal of Contingencies and Crisis Management* (Volume 12, Number 4, December 2004). (<http://www.blackwell-synergy.com/doi/abs/10.1111/j.0966-0879.2004.00446.x>).

⁶⁰ *Presence: An Exploration of Profound Change in People, Organizations, and Society*, Peter Senge, C. Otto Scharmer, Joseph Jaworski, and Betty Sue Flowers, Society for Organizational Learning, Cirrency/Doubleday, Random House, NY 2005.

Simulations, Models and Games, and Other Digital Technologies

"It is the human brain power and the human values, when brought through stages of entry, exploration, integration, commitment and fulfillment by a computer-aided but human-centered process, that will enable the answers to emerge."

-- Anne Branscomb, "Finding One's Way in the Multimedia Society", *Communications in the 21st Century*, John Wiley & Sons, NY 1981.

How can you make the intricacies, complexities and dynamics of a major event across time and space come alive? "The fundamental challenge facing education is to vivify indirect experience with the power of direct experience." ⁶¹

"... **Simulations** consist of four major components: assigned roles; opening scene and/or background information; stimuli to which participants respond; and reactions to participants' actions.... The content, form and sequence of the information are carefully programmed to enhance the crisis atmosphere, introduce specific occasions for decision, and induce particular forms of individual and collective behavior." ⁶²

How do you prepare a complex tapestry of people and organizations to respond to an event that it has never previously experienced?

[The last time something like this happened, few if any of those people were on the job, and their organizations weren't constituted the same way.]

Performance comes before competence ⁶³: You must first do... in order to learn to do. **Meaning is situated in practice**; you get to see it in action, then you get to act it out, and you get to see what it looks like and feels like...

"Simulations can serve as a mechanism for releasing learning that lies dormant in organizations." ⁶⁴

⁶¹ Architect for Learning: Utilizing The Internet as an Effective Educational Environment, Philip J. Palin and Kari Sandhaas, Saint Thomas Didymus Corporation, Ruckersville, VA (Telelogic Learning Company, www.teleologic.net).

⁶² "Individual and Group Learning in Crisis Simulations", Edward Borodzicz and Kees van Haperen, Discussion Papers in Management, University of Southampton, January 2002 (Number M02-5) (ISSN 1356-3548) (<http://www.management.soton.ac.uk/research/publications/documents/M02-5.pdf>)

⁶³ Dr. Gee, in "How Games Are Re-Shaping Business & Learning", Dr. James Paul Gee, Dr. Kurt Squire, and Constance Steinkuehler (<http://www.academiccolab.org/initiatives/accelerate.html>).

⁶⁴ "Microworlds and Simuworlods: Practice Fields for the Learning Organization", J.B. Keys, R.M. Fuller and S.A. Stumpf, *Organizational Dynamics*, Vol. 24, No. 4, Spring 1996

A simulation training system is a **dynamic** and **inter-active** process. It requires the learner to bring **a higher level of emotional and intellectual energy** than is usually required in a more traditional or passive level of learning.

“Research tells us that learning activities that recreate work situations foster better transfer of learning. Industry examples of the use of simulations are plentiful.... When the cost of failure is high and when the performance arena uncertain, simulations are likely to be useful. Educational simulations are simplified versions of the reality that learners interact with on a daily basis. They capture the essential dynamics of a workplace in a way that allows learners to explore different approaches and experience different outcomes... an integrated blend of assessment, coaching, focused lecture presentations, case-study discussions, experiential activities, action learning, and large-scale business simulations.” ⁶⁵

Games make thinking visible in front of peers and experts (designers, planners, trainers and leaders) who are engaged with each other, identify with each other, and give feedback and critique to each other. Games are a space where failure is expected, and you are free to keep trying until you figure out how to make it work. The rules can be tweaked, the roles can be shifted, and different scenarios can be programmed for different player groups. Games make you confront yourself, your knowledge, your skill, and your understanding. Games allow and foster cross-functional collaboration and the integration of expertise. ⁶⁶

Games:

- present well-ordered problems;
- are pleasantly frustrating;
- provide cycles of challenge and learning consolidation;
- are available “on demand” and in “Just-in-Time” formats;
- facilitate systems thinking;
- are “strategic spaces”;
- encourage risk-taking in a safe environment;
- allow players to explore, think laterally, and re-think goals.

James Gee says good simulations are very long, very complex, and very hard. ⁶⁷ Games allow learners to “learn deeply”, to be able to do it, not just talk about it. They allow players “to try on a new self” or identity.

⁶⁵ “Simulation Enhanced Learning: Case Studies in Leadership Development”
Claudia C. Hill (Personnel Decisions International) and Steven W. Semler (Honeywell International)
(http://www.learningsim.com/content/sim_enhanced_learning.pdf)

⁶⁶ Dr. Gee, in “How Games Are Re-Shaping Business & Learning”, Dr. James Paul Gee, Dr. Kurt Squire, and Constance Steinkuehler (<http://www.academiccolab.org/initiatives/accelerate.html>).

⁶⁷ Ibid.

Simulation games let players *inhabit* roles otherwise inaccessible to them. ⁶⁸

"... simulations encourage team risk taking and experimentation because they create an environment characterized by psychological safety. Combining scenario-based training with a simulation technology creates a flexible approach that allows team members to receive immediate, continuous and dynamic feedback regardless of co-location. Team members who participate in simulations benefit from developing more accurate cognitive maps or mental models of the variables that impact team performance and effectiveness." ⁶⁹

Anyone under the age of 35 has already been extensively exposed to simulations and video games. This "**Gamer Generation**" ⁷⁰ embraces:

- de-centralized authority,
- collective intelligence,
- the fact that we are all producers (not just consumers),
- are capable of multi-tasking across multiple information spaces,
- have 'technical chops' (they understand technology and are good at it),
- are comfortable in a world of dynamic and evolving knowledge and practice,
- adapt readily to learning through doing with others (i.e., apprenticeship),
- have an identity with the core project, and
- believe that work/play are a means, not an end.

Simulation games create community that feeds back into the game-based learning. "Even a quick glance at fan communities around games such as *SimCity*, *Dance Dance Revolution*, *Railroad Tycoon*, *Everquest*, or *The Sims* - each of which has dozens of fan web sites where players create and trading game objects, maps, levels, scenarios, and stories - points to **rich relationships** between fans and these games and **complex social structures that mediate the game playing experience.**" ⁷¹

⁶⁸ "Video Games and the future of learning", David Williamson Shaffer, Kurt P. Squire, Richard Halverson, and James P. Gee, University of Wisconsin-Madison and Academic Advanced Distributed Learning Co-Laboratory, December 2004 (<http://www.academiccolab.org/resources/gappspaper1.pdf>).

⁶⁹ "25 Years of Team Effectiveness in Organizations: Research Themes and Emerging Needs", Eduardo Salas, Kevin C. Stagl and C. Shawn Burke, (2/19/03) *International Review of industrial and Organizational Psychology*, Cooper and Robertson (ed.s), John Wiley and Sons, NY, December 2004. (<http://www3.interscience.wiley.com/cgi-bin/summary/109870402/SUMMARY>)

⁷⁰ Constance Steinkuehler, in "How Games Are Re-Shaping Business & Learning", Dr. James Paul Gee, Dr. Kurt Squire, and Constance Steinkuehler (<http://www.academiccolab.org/initiatives/accelerate.html>).

⁷¹ "Cultural Framing of Computer/Video Games", Kurt Squire, *Game Studies: The International Journal of Computer Game Research*, Vol. 2, Issue 1 (July 2002) (<http://www.gamestudies.org/01012/squire/>)

Marine Corps Major Brendan McBreen ⁷², says that **repetition** of simulation-based learning is useful “in order to understand and identify patterns”, “in order to internalize lessons”, such that “the basic lessons become so well known that advanced tactics and experimentation may be attempted”. “Reading the subtle aspects of a tactical situation is a learned skill that requires far more practice than is currently available outside of a simulation”.

The appendix in the *Close Combat Marine Workbook* also has a good discussion about how written and verbal orders are often weak or ineffective because they are too closely linked with plans and the planning process, and a discussion on the value of simulations in addressing and resolving these problems. “A tactical decision is meaningless without the ability to communicate it clearly and rapidly.” The ability to issue a brief, clear, unambiguous order is a difficult but essential skill [whose development] requires guidance, training and practice. When you say “Buy meat, cheese and vegetables”, “your people may not know if they are building a salad, a pizza or a sandwich.”

“Cohesive and well-trained units can operate on concise verbal orders because they have shared experiences and expectations, they know each other’s capabilities, and can operate well under minimal guidance.... When our training ‘enemy’ does not react or willfully attempt to counter our efforts, **we learn the dangerous tendency to precisely script out every move.**”

Your task in an emergency response simulation is to figure out what’s going on, WHERE it’s going on, WHY it’s going on, and **what you collectively are going to do about it**. And every “failure” in a simulation is an invitation to try again.

In that situation, as a leader and communicator ⁷³, what is your **intent**? (Trainees can learn to summarize their intent concisely so that it can be easily understood two steps in any direction within their organizational network.)

In that situation, what are the **specific tasks** you want accomplished? What are the **conditions** you want to establish? What are the **standards** that must be followed? What are your **assumptions**? (and how can you test, confirm or disconfirm these?) What data or **information** will you use to do so? Who has that data or information?

⁷² See “Close Combat Marine Workbook” at <http://www.2ndbn5thmar.com/ccm/ccmtoc.htm>.

⁷³ See *Into the Storm: A Study in Command*, Tom Clancy with General Fred Franks, Jr. (Ret.), Putnam Books, New York 1997. [This is, among other things, a good description of the value of simulation gaming as it applied to leadership, training and strategic/tactical plan development as executed by the US Army during Desert Storm.]

Simulations enable a range of perspectives, including strategic, management, operational and tactical.

It brings together “such tools from various modeling domains such as plume dispersion, traffic movement, communications processes and hospital operations for rapidly building a virtual representation of an emergency response scenario.” **A US Department of Commerce report ⁷⁴ in 2003 details a range of models and simulations used for emergency response.**

“A number of modeling and simulation tools for emergency response related applications are available and more are under development. These includes tools for planning such as virtual representations of city landscapes, human body representations for enhanced medical response, war theatre simulation tools that can be used for homeland security applications, and discrete event simulation tools for planning medical resources to attend to affected population.... Simulation tools for modeling a hazardous plume dispersion under forecasted weather conditions are already available for use for real-time support of response activity....”

The US Department of Justice Office of Domestic Preparedness, with the assistance of the people at ThoughtLink, Inc., developed a “Review of Models, Simulations and Games for Emergency Preparedness”. ⁷⁵

ThoughtLink’s own overview of simulations and games for the national homeland security marketplace is available as a PowerPoint presentation. ⁷⁶

Nationally, a huge investment in money has already been made by the Federal government on behalf of the military. There are scores of models, simulations and games that have already been developed for this marketplace alone. Beyond that, there is a large body of research, infrastructure, design experience, standards development and more by and for the United States Department of Defense. In addition, there are sophisticated tools and software programs emerging by the dozens that address many of the key sub-issues of learning management, planning, team development, the leveraging of social and intellectual capital, and more.

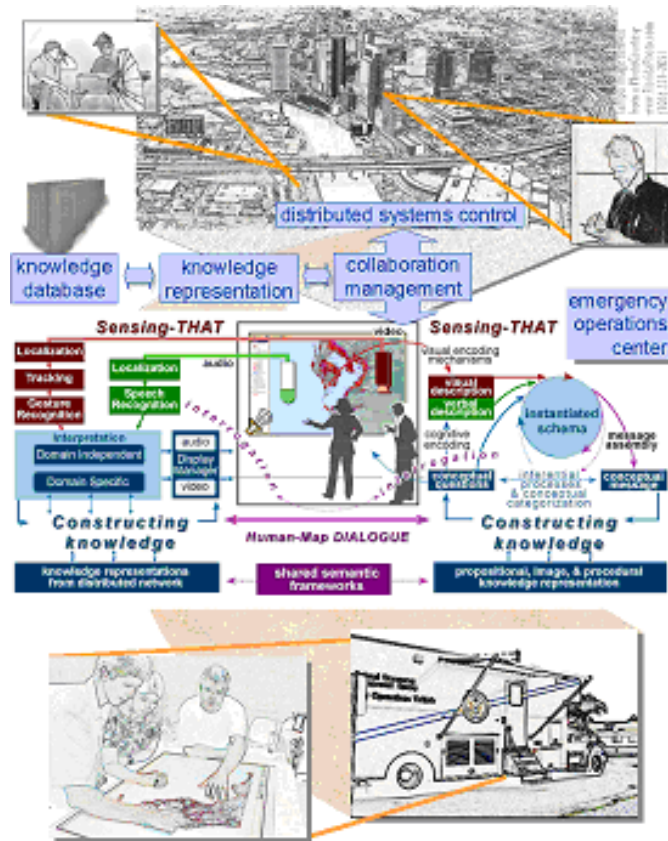
“Hurricane Pam” was an extensive effort linking workshops with a sophisticated computer modeling and simulation system to forecast and prepare for a Category V hurricane hitting New Orleans.

⁷⁴ “Modeling and Simulation for Emergency Response: Workshop Report, Standards and Tools” (NISTIR 7071), Sanjay Jain and Charles McLean, US Department of Commerce (http://securitymanagement.com/library/NIST_Workshop0604.pdf).

⁷⁵ See http://www.ojp.usdoj.gov/odp/docs/Review_of_MSG_Vol3.pdf.

⁷⁶ <http://www.thoughtlink.com/ppt/Serious-Games-Summit-JL-Presentation-10-04.ppt> .

GeoCollaborative Crisis Management ⁷⁷ offers a “human-centered, dialogue-enabled, visually-enabled” approach.



The idea of a **synchronization matrix** ⁷⁸, an outgrowth of military simulation and discussed in the book *Into the Storm* (noted above), has been adopted to civilian emergency response.

Another spreadsheet program has been developed to estimate the time and size of a bioterror attack ⁷⁹.

⁷⁷ See <http://www.geovista.psu.edu/grants/GCCM/Project%20Summary.htm>.

⁷⁸ See “Coordinating, Integrating and Synchronizing Disaster Response: Use of an Emergency Response Synchronization Matrix in Disaster Planning, Response and Operations”, Paul Hewitt, Jacques Mitrani, William Metz, and William Vercellone, http://www.dis.anl.gov/ciep/publications/emergency_management/Hewitt%20etal%20-%20IJMED%20-%20Use%20of%20an%20ERSM%20in%20Emergency%20Planning.pdf **and/or** “The Emergency Management Synchronization Matrix – A Method of Coordinating, Integrating and Synchronizing Disaster Response”, Paul Hewitt, Jacques Mitrani, and William Metz, *International Journal of Mass Emergencies and Disasters*, November 2001, Vol. 19, No. 3, oo. 329-348. http://www.dis.anl.gov/ciep/publications/emergency_management/ERSM%20A%20Method%20of%20Coordinating%20Article.pdf.

One such simulation⁸⁰ models state, city and Department of Health EOC processes executed under the Incident Command System, including the modeling of hospital patient flow and with an embedded **disease** progression algorithm. This and other simulations can certainly be linked to **biosurveillance** systems.

The city of Chicago has budgeted as much as \$500,000 for the development of video games to train over 1,000 public health workers, developed under the direction of epidemiologist Colleen Monahan, director for the Center for the Advancement of Distance Education at the University of Illinois at Chicago. The games are funded by an initiative of the Center for Disease Control and Prevention. The first game is expected to be available by the end of January; workers are required to play the game by the end of the year. Workers can play at least 23 characters in a bio-scenario.⁸¹

ADMS has developed a **virtual reality** system used at a number of airports and other venues; see <http://www.admstraining.com/>. Advanced Interactive Systems is another vendor in the field; see <http://www.ais-sim.com/svs.htm>.

The Purdue University Homeland Security Institute also uses "**synthetic environments**"; see <http://www.purdue.edu/dp/phsi/phsibrochure.pdf>.

The European Master in Disaster Medicine (affiliated with both Yale New Haven and Vanderbilt University here in the US) uses a virtual reality and multimedia based approach for some of its "exercises". See <http://www.dismedmaster.com/>.

Synthetic characters or "virtual humans"⁸² are used in a variety of applications, including law enforcement training and business training. Increasingly these "bots" are recognized as having potential for training in the behavioral dimensions, as tools that can enable responders and medical personnel to recognize less-common patient symptoms. The office worker shown on the next page, courtesy of the UK-based PixelLearning (www.PixelLearning.com), is perfectly healthy (*I think*).

⁷⁹ "Estimating Time and Size of Bioterror Attack", Johan Walden and Edward Kaplan, *Emerging Infectious Disease*, Vol. 10, No. 7, July 2004. (<http://www.cdc.gov/ncidod/eid/vol10no7/03-0632.htm>).

⁸⁰ "Operational Analysis Framework for Emergency Operations Center Preparedness Training", Eytan Pollak, Mark Fallash, Lorie Ingraham, Vivian Gottesman, *Proceedings of the 2004 Winter Simulation Conference*, Ingalls, Rossetti, Smith & Peters, eds., (<http://www.informs-sim.org/wsc04papers/105.pdf>).

⁸¹ "New video game paints a grim scenario", P. J. Huffstutter (Loa Angeles Times), *Boston Globe*, December 22nd, 2005 (A17).

⁸² "Lessons Learned Using Responsive Virtual Humans for Assessing Interaction Skills", Robert Hubal, Diana Fishbein, and Mallie Paschall, Interservice/Industry training, Simulation and Education Conference (ITSEC) 2004 (http://www.rvht.info/pubs%5Ciiitsec_assmt.12.08.04.pdf) [Of note, the paper notes the potential use in training emergency response personnel in the recognition of PTSD.]



Vcom3D (see www.vcom3d.com) creates Web-enabled content and courses that include the magic of characters acting as mentors and as actors in role-playing simulations in which the learner must decide how to respond to different situations. Researchers at the University of Indiana and Carnegie Mellon have shown that interactive mentors can improve student performance by as much as two standard deviations. This means that 95% of students taking courses with such a mentor will learn and retain more than the average student taking a course through conventional e-learning. This technology features and makes available **facial expressions, speech with lip synch, gesture and sub-gesture, expression, gaze and locomotion.**

Real-time, distributed, multi-user immersive synthetic environments to train emergency response personnel linking EMS response and command centers to dispersed medical and physiologic sensors and GPS data might provide real-time geospatial data about both the location and the health status of both casualties and on-scene responders.⁸³

“Computer scientists and robotics engineers have envisioned a future disaster response performed by a “heterogeneous teams of robots, agents, and people”, the “humans performing high level decision-making”, the “intelligent agents coordinating the response”, and “humans and robots performing key physical tasks”. A 3D visualization interface will enable human **virtual omnipresence**⁸⁴ in the environment, improving human situational awareness and [enhancing the] ability to assist agents...” A realistic 3D model of the entire Los Angeles basin⁸⁵ is under development. It will allow the seamless interactive navigation of the entire environment while simultaneously supporting hundreds of users.

⁸³ “Synthetic Environments for Emergency Response Simulation”, Dennis McGrath and Chris Carella, Institute for Security Technology Studies, Dartmouth College (<http://www.ists.dartmouth.edu/library/118.pdf>).

⁸⁴ “The Future of Disaster Response: Humans Working with Multiagents Teams using DEFACTO”, Schurr, Tambe, Scerri, Kasinadhuni and Lewis, (<http://teamcore.usc.edu/papers/2005/SS105SchurrN.pdf>).

⁸⁵ “A Real Time Visualization System for Large Scale Urban Environments”, William Jepson and Scott Friedman, UCLA Urban Simulation Team (<http://www.ust.ucla.edu/~bill/UST.html>).



So these games and tools can be entertaining, yet "... most people who have played *SimCity*⁸⁶ recognize that it can be an excellent resource for understanding urban planning, [but] **most people would not also want to live in a real city designed by someone who is only played *SimCity*.**"

Certainly **table-top exercises** can be considered a form of simulation. They are increasingly used in emergency management and homeland security, with state and Federal agencies offering courses in how to design and execute them. If properly designed, facilitated and de-briefed, and used repeatedly in a progressive manner, they can be a very effective tool. In jurisdictions lacking access to computerized tools or supports, they are a necessity; they can also co-exist with computerized simulations, online learning systems and a virtual community of practice. Creativity and improvisation work here too...; there is a book available that describes a number of low-tech approaches that might be useful. Written by Walter Green III CEM, it is entitled *Exercise Alternatives for Training Emergency Management Command Center Staffs*. All of these also feed into larger, full-scale, walk-through drills.

But, unlike table-tops and computer simulations, **drills** can involve only one scenario, and they enable responders to assume only one role. Drills are enormously expensive, but online games can be conveniently accessed on paid down-time, or off-shift schedules. Drills do not allow learning to be focused on single individuals, and cannot easily be stopped and re-started in order to examine decision path-ways, concepts of situation awareness, or behavioral or inter-personal communications factors. Drills do not allow much opportunity for tinkering or debate about strategies. Drills do not enable "what if..?" thinking about the most effective use of resources. "Such exercises are often instances of play acting walked through by unwilling participants and in which no lessons are or can be learned."⁸⁷

⁸⁶ Doug Church, at the 2002 Electronic Entertainment Exposition, in "Cultural Framing of Computer/Video Games", Kurt Squire.

⁸⁷ Delivery of Emergency Medical Services in Disasters: Assumptions and Realities, E. L. Quarantelli, Irvington Publishers, New York, 1983, p. 121.

One of the values of computerized simulation is that it can track and record inputs. Computer games are capable of tracking a great deal of information about what you are doing inside the game, which then becomes available for de-briefing, as feedback internally and externally to players, designers, planners, trainers and leaders. Games (and their data) can be stopped, re-started, re-cued, saved to memory, re-played for review, and distributed.⁸⁸

The educational value of drills and their critiques is often limited. The "lessons learned" are often not clear, or fully disseminated, to all members of all agencies. On occasion, the "plan" is altered, and then put back on the shelf; it cannot be easily consulted in the midst of a fast-moving event, and may not have the answers for today's incident. As noted by Dr. Quarantelli, "What is lacking are general mechanisms [for sharing] relevant information about problems and solutions.... Assuming that sharing of disaster experiences is worthwhile, the fact is that appropriate social mechanisms and structures for diffusing relevant knowledge do not exist."⁸⁹

"Too often, **after-action reports** are post hoc defenses or justifications of what the agency did rather than a candid assessment of either the problems encountered or the mistakes made."⁹⁰

"...Critical and comprehensive reviews are essential and should be conducted in an environment characterized by **organizational ownership of the problem** and in a no-blame atmosphere."⁹¹ Yet part of the problem is that there are a myriad of organizations with at least some share of the ownership, and some of these organizations have significant political, financial or other power.

The debriefing also provides an opportunity for instructor facilitators to be aware of difficulties that certain group members may have within the simulation because of their inability to shed real-life roles and or hierarchical rank. This may be especially important if a specific individual or agency has a rigid structure or an inflexible agenda. "**The sociology of senior command** makes it difficult for a commander to appear ignorant of anything

⁸⁸ Dr. Gee, in "How Games Are Re-Shaping Business & Learning", Dr. James Paul Gee, Dr. Kurt Squire, and Constance Steinkuehler (<http://www.academiccolab.org/initiatives/accelerate.html>).

⁸⁹ Delivery of Emergency Medical Services in Disasters: Assumptions and Realities, E. L. Quarantelli, Irvington Publishers, New York, 1983, p. 123-124.

⁹⁰ "Research-based criteria for evaluating disaster planning and managing", E. L. Quarantelli, Ph.D., <http://www.udel.edu/DRC/preliminary/246.pdf>.

⁹¹ "Individual and Group Learning in Crisis Simulations", Edward Borodzicz and Kees van Haperen , Discussion Papers in Management, University of Southampton, January 2002 (Number M02-5) (ISSN 1356-3548) (<http://www.management.soton.ac.uk/research/publications/documents/M02-5.pdf>).

or capable of doing something stupid, especially in front of subordinates", as well as peers.⁹²

So the selection and training of the individual(s) handling the de-briefing is of critical importance. "Debriefings must be extensive and performed by experts in the simulation, in the subject matter, and in group processes."⁹³ ... *but expertise in all those areas is not always present in one individual.* "The importance of the **debriefing** session leader or unit leader in promoting learning stands out....[and performing that role] requires some advanced skills as a group session leader." These include "generating focused open questions and providing participative feedback.... A number of factors may influence the outcome of a simulation, which may also influence the learning experience... [including]: instructor behaviors in introducing the simulation; previous experience; the instructor's role; and the debriefing of the simulation experience."⁹⁴

"... debriefing instructors should facilitate **self-discovery and self-critique** by the crew rather than lecture on what they did right and wrong. Self discovery by the crew is believed to provide deeper learning and better retention."⁹⁵

It requires a good deal of work and effort to extract the real and critical lessons. Data gathered from 17 debriefing sessions at the National Training Center and the Joint Readiness Training Center simulation sites, "which offer a fairly uniform, high quality simulation experience considered by the military as being unparalleled in the world, showed that **401 operational problems were identified, and from them 220 solutions were sought, from which only 36 solutions were found, and of those only 4 planned.**"⁹⁶

The fact that simulations and games "sit" within an overall community-oriented learning management system or virtual community of practice will amplify their value. "... The instructional context that envelops gaming is a

⁹² The Complete Wargamers Handbook (revised edition), James F. Dunnigan, Quill Press/William Morrow & Co., New York 1992, page 241.

⁹³ "Microworlds and Simuworlods: Practice Fields for the Learning Organization", J.B. Keys, R.M. Fuller and S. A. Stumpf, *Organizational Dynamics*, Vol. 24, No. 4, Spring 1996.

⁹⁴ Ibid.

⁹⁵ See "LOFT Debriefings: An Analysis of Instructor Techniques and Crew Participation", R. Key Dismukes, Kimberly K. Jobe and Lori K. McDonnell, NASA 1997, NASA Technical Memorandum 110442 DOT/FAA/AR-96/126 http://www.faa.gov/education_research/training/aqp/library/media/Final_LOFT_TM.pdf.

⁹⁶ "Military Simulation Worlds and Organizational Learning", Michael D. Proctor and Justin C. Gubler, *Proceedings of the 1998 Winter Simulation Conference* (Medeiros, Watson, Carson and Manivannan, eds.) (<http://www.informs-sim.org/wsc98papers/103.PDF>)

more important predictor of learning in the game itself. Specifically, **how the game is contextualized, the kinds of cooperative and collaborative learning activities embedded in gameplay, and the quality and nature of debriefing, are all critically important elements of the gaming experience.**" ⁹⁷

"...People don't learn from actual experiences; instead, they learn from reflection on the experience." Thiagarajan "points out that a range of methods can be used, among which are: guided, mediated and video-supported debriefings, debrief games, journal writing, questionnaires, panel discussions, dialogues, etc. It is argued that a structured form of debriefing, using a standard set of questions, appears more effective...." ⁹⁸

How "real" can simulations be? Clearly with the advent of sophisticated computer graphics and engineering, things can *appear* real. But both the game and the event are played within the minds of real human beings.

"'Simulations should display an external simplicity which masks their internal complexity'.... Trainers may place too much emphasis on the need for realism, possibly at the expense of running a good simulation; therefore, 'verisimilitude should be valued more highly than realism'." ⁹⁹

"... the physical fidelity of the simulator environment is of secondary concern to psychological reality or fidelity. **Simulators should serve to trigger psychological processes similar to those experienced in actual operational environments.** Therefore, simulation fidelity should attempt to approximate the level of complexity typically experienced by teams during routine and novel performance." ¹⁰⁰

"A distinction should be made ... between physical and psychological fidelity. The former is often perceived to be more effective as a learning environment – this may even be true for emergency exercises – but for crisis situations it is the latter which provides the best learning environment.... Effective crisis management simulations encourage participants to perceive the scenario as a threat, with time limitations for effective data gathering. Simulations

⁹⁷ "Cultural Framing of Computer/Video Games", Kurt Squire, *Game Studies: The International Journal of Computer Game Research*, Vol. 2, Issue 1 (July 2002) (<http://www.gamestudies.org/01012/squire/>)

⁹⁸ Borodzicz and van Haperen note "Thiagarajan, S. (1994), How I designed a game and discovered the meaning of life, *Simulation and Gaming* 25:529-535".

⁹⁹ "Individual and Group Learning in Crisis Simulations", Edward Borodzicz and Kees van Haperen, Discussion Papers in Management, University of Southampton, January 2002 (Number M02-5) (ISSN 1356-3548) (<http://www.management.soton.ac.uk/research/publications/documents/M02-5.pdf>).

¹⁰⁰ "25 Years of Team Effectiveness in Organizations: Research Themes and Emerging Needs", Eduardo Salas, Kevin C. Stagl and C. Shawn Burke, (2/19/03) *International Review of Industrial and Organizational Psychology*, Cooper and Robertson (ed.s), John Wiley and Sons, NY, December 2004. (<http://www3.interscience.wiley.com/cgi-bin/summary/109870402/SUMMARY>).

should produce the similar reactions and feelings in participants as experienced in real life crisis events, e.g., tension, uncertainty, time pressure, sense of inadequate information, and frustration.... The alleged realism of the exercises may also be a danger for the subjects who may leave a series of exercises thinking that they know what is going to happen when a real crisis occurs.”¹⁰¹

How valid are simulations? And can their results be validated, or the learning from them accredited?

“Validation [of simulations] may prove particularly problematic because the subjective and dynamic nature of crisis response makes it hard to measure in a scientific way.”¹⁰² Yet relative point values are easy to assign in games, game-based objectives can be quantified, and so on. In a disaster scenario, economic value and productivity can be quantified, lives and ‘life levels’ can be quantified, response times can be quantified, and so on. The grid of space is mathematically quantifiable. In a dynamic system, the concept of capacity defines and quantifies limitation, and the concept of threshold defines and quantifies pending difficulty, breakdown or need to resources that are not immediately available.

“Inside a game, it’s a meritocracy.” “... Expert gaming is developing a set of values – values that highlight enlightened risk-taking, entrepreneurialship and expertise, rather than formal accreditation emphasized by institutional education.”¹⁰³

In military simulations, some of the players are selected and groomed to play the part of the opponent, to think, act and decide like the commander on the other side of the lines. This is known in those circles as “**the red cell**”. **But who can think like a hurricane, or a pandemic?** Nevertheless, there is probable high value, in both simulations and real events, in having multiple levels of ‘kibitzers’: co-players at one level to monitor and/or advise those deeply absorbed in the event and its demands, and theorists, academics, provocateurs, aides-de-camp, experienced “players”, politicians and press on other levels.

¹⁰¹ “Individual and Group Learning in Crisis Simulations”, Edward Borodzicz and Kees van Haperen , Discussion Papers in Management, University of Southampton, January 2002 (Number M02-5) (ISSN 1356-3548) (<http://www.management.soton.ac.uk/research/publications/documents/M02-5.pdf>).

¹⁰² Ibid.

¹⁰³ “Video Games and the future of learning”, David Williamson Shaffer, Kurt P. Squire, Richard Halverson, and James P. Gee, University of Wisconsin-Madison and Academic Advanced Distributed Learning Co-Laboratory, December 2004 (<http://www.academiccolab.org/resources/gappspaper1.pdf>).

In a study of flight crew mishaps, one of the factors that seems to have occurred with some regularity is the failure of the team to monitor individual performance (“The first officer’s main responsibility is to monitor the captain” etc.). The development of team self-monitoring behavior by design, instruction and experience will allow the team to absorb stress and derail degradation of performance.¹⁰⁴

“When a situation is blurred, very unstable, and the stakes are exceptionally high, it is necessary that, besides leaders, some individuals or group should be able to sit back and think, anticipate, and asked the questions that those directly in charge are too overwhelmed to ask: “what if, what next?”.¹⁰⁵

One of the drawbacks of simulation gaming focused on emergency response is that it may be relatively easy for players and trainees to fail to keep in proper focus the true *ethos* and *opothos* of the simulation while engaged in an exciting, absorbing, game-like environment. They can become desensitized to the **realities** of actual response.

The designer of a tabletop war game that re-creates *the Battle of the Bulge* wrote in the rules book notes that often simulations can be *unreal*, and he reminded game-players that, to have a better grasp on the true situation, every time they wanted to “move” a German artillery unit on the board, they should find five friends and push an old automobile around the block.

A football coach can get caught up in X’s and O’s, and fail to see the human psychology or the physical realities behind play execution.

James Der Derian, Director of the Global Security Program at the Watson Institute for International Studies at Brown University, talks of the marriage between the military and Hollywood. “... with the creation of incredibly high fidelity virtual realities, ... **the real thing starts to pale in comparison**. If you have all these virtual environments based on worst-case scenarios..., then all of the human attributes – deliberation, empathy, and experience – become secondary to a machine-like response. Yes, there’s reason to be wary.”¹⁰⁶

It is easy to move people and equipment in a simulation, but “Death in the game-world has very little meaning. When you attach real-world death to a game, it fails to be a game... Instead, you have a system that uses some

¹⁰⁴ “Does Stress Lead to a Loss of Team Perspective?”, James E. Driskell, Eduardo Salas, and Joan Johnston, *Group Dynamics: Theory, Research and Practice*, 1999, Vol. 3, No. 4, 291-302, Educational Publishing Foundation. (<http://www.apa.org/journals/releases/gdn34291.pdf>)

¹⁰⁵ “Understanding the French 2003 Heat Wave Experience: Beyond the Heat, a Multi-Layered Challenge”, Patrick Lagadec, *Journal of Contingencies and Crisis Management* (Volume 12, Number 4, December 2004). (<http://www.blackwell-synergy.com/doi/abs/10.1111/j.0966-0879.2004.00446.x>).

¹⁰⁶ **Massive Change**, Bruce Mau with Jennifer Leonard and the Institute Without Boundaries, Phaidon Press, London and New York, 2004, p. 179.

display and AI routines to simulate a very serious exercise." **It might become easy "to miss the whole damn point."** ¹⁰⁷

Lastly, **several questions** emerge, among them:

To what extent can (or should) simulations be used as a personnel selection tool?

Will the regular use of simulations move disaster response teams from an *ad hoc* status to a more visible, stable team with greater continuity?

¹⁰⁷ "Shall We Play a Game?", April 3, 2003, in *Got Game?: The Future of Play*, Andrew Phelps, Corante Tech News (<http://www.corante.com/gotgame/archives20030401.html#27941>).

Online Learning and Virtual Communities

"Instantaneous communications does not promote and may obscure the judgment and insight that are the hallmarks of information passed by personal contact. The getting of real news – the sort that one can learn from minstrels (and perhaps from teleconferencing) – is not a mechanical act so much as it is a social process, and the social precondition for it is community."

-- Amory B. Lovins and L. Hunter Lovins, "The Writing on the Wall", *Communications in the 21st Century*, John Wiley & Sons, NY 1981.

The development of "the web" (what we now know as the Internet) has its roots in governmental crisis management. Driven by the Defense Advanced Research Projects Agency, computers were linked to other computers as a means of sharing critical information more quickly and effectively. People no longer needed to wait for the mail, the telephone, or travel. Nor did they need to meet face-to-face. The effects of both space and time, and their costs, were shrunken. Back in the early '80's, in the infancy of "interactive communications", Bernard Luskin noted three characteristics for the emerging technologies ¹⁰⁸:

- They are human-centered;
- They allow the energy of transportation to be replaced with communications, and the inconvenience of distance to be replaced by the convenience of access; and
- They allow campus-inclusive learning to be replaced by campus-expansive learning.

So what does this mean for a community emergency preparedness? **"Do you have a meeting with 500 organizations to put together a revised emergency response plan?** Of course not. Not if you want to get anything accomplished. But you do begin to form new networks between these organizations or begin to think about how existing networks can be utilized in the disaster context.... Certainly, these groups may be very willing to become involved and help in a disaster response, but putting organizations in touch in the midst of a crisis can prove quite a challenge. **It is preferable to know the organizations and the people who work with them beforehand.** Indeed, they may have resources and skills to offer that don't immediately come to mind. Knowing each other, keeping organizations informed of emergent needs: these efforts could lead emergency managers to resources they didn't know existed in a timely manner and allow for successful improvisation when established systems are overwhelmed." ¹⁰⁹

¹⁰⁸ "Telecommunications in Education: A Prism of Access", Bernard Luskin, *Technological Horizons in Education*, Vol. 8, No. 1, January 1981.

¹⁰⁹ "Considering Convergence, Coordination and Social Capital in Disasters", Tricia Wachtendorf and James Kendra, *Canadian Risk and Hazards Network (1st Annual Symposium)*, November 19, 2004 (<http://www.crhnet.ca/docs/presentations/T-Wachtendorf.pdf>)

Those organizations can interact through simulation games, and through inter-connected learning management systems, shared Internet bulletin boards, wikis, e-mail links, etc. "Computer-mediated communications can break down hierarchical and departmental barriers, standard operating procedures, and organizational norms." ¹¹⁰

So just exactly what *is* a "virtual community"? ¹¹¹ It is the totality of "social aggregations that emerge from the Internet when enough people carry on public discussions long enough to form personal relationships in cyberspace".

"... the key to establishing community is when communication moves from being entirely information-based to include interpersonal relationships." ¹¹²

But it's far more than just Sally "chatting" with Sam. A "community" is defined as an online group where one's absence will be noted; a "network" is an online group in which one's absence does not matter. ¹¹³

"I think the ultimate possibility of computerized conferencing is to provide a way for human groups to exercise a "collective intelligence" capability. The computer as a device to allow a human group to exhibit collective intelligence is a rather new concept. ¹¹⁴ In principle, a group, if successful, would exhibit an intelligence higher than any member... Attempts to design computerized conferencing structures that allow a group to treat a particular complex problem with a single collective brain may well promise more benefit for mankind than all the artificial intelligence work to date."

Why should a municipality or region create a virtual community of practice around a community's emergency preparedness?

"Under the pressure of an extreme event, decisions will be influenced by social, professional, socioeconomic and political relations, organizational structures, and prior experiences. In other words, decisions, like the extreme events themselves, are highly contextual, and understanding context will be

¹¹⁰ Sara Kiesler, social psychologist, in Harvard Business Review, noted in *The Virtual Community* by Howard Rheingold (<http://www.rheingold.com/vc/book/intro.html>).

¹¹¹ This is Howard Rheingold's definition, found in "Virtual Connections: Community Bonding on the Net, by Stuart Glogoff, *First Monday* (http://www.firstmonday.org/issues/issue6_3/glogoff/).

¹¹² "Ingredients for Successful Online Education: Instructional Design Mixed with the Human Touch", Alison Reynolds, Christchurch Polytechnic Institute of Technology, New Zealand (<http://www.globaled.com/articles/ReynoldsAlison2000.pdf>).

¹¹³ Carole McCulloch, in the *LearningTimes* Virtual Community Working Group at *LearningTimes.net*.

¹¹⁴ Murray Turoff, noted by Howard Rheingold in "The Virtual Community", op. cit.

central to understanding decisions. For example, the willingness of decision makers to act on new information may strongly depend on the level of trust they have for those who deliver the information, which may in turn reflect **a history of prior interaction** [emphasis mine]. And even the concept of a “decision maker” is inherently complex and nuanced. In any organizational context, decisions are usually “made” through complex interactions among a variety of participants, few or none of whom will have a comprehensive view of the entire situation.” ¹¹⁵

“This technology is enabling people to engage in complex, socially contextualized activities in ways not possible before. While it used to be that geography determined the boundaries of a group and the possibilities for collective action — I had to be near you to join you — now technology is revolutionizing our capacity for purposive collective action with geographically remote actors. This evolution toward technology for groups is evident from Meetups, wikis, LiveJournal, peer-to-peer, groupware, virtual worlds, GRID computing, a wide range of so-called “social software” tools.... New social and visual technologies are emerging to facilitate the work of groups. **What was an “information revolution” is becoming a social revolution.**” ¹¹⁶

“**Communities of practice**— collaborative action-learning networks— can combine disciplines, interests, and capabilities across boundaries to take on national priorities.” ¹¹⁷ [Four case studies of communities of practice are detailed by William Snyder and Xavier de Souza Briggs in their very relevant and important paper.] “A “community of practice” is a particular type of network that features peer-to-peer collaborative activities to build member skills as well as organizational and societal capabilities. Education and public safety communities of practice generally involve organizations from the private and nonprofit sectors, even when they are primarily sponsored by public agencies. Organizations and researchers use a variety of terms to describe similar phenomena, such as “learning networks,” “knowledge communities,” “competency networks,” “thematic groups,” and others.”

“Communities of practice also provide a living repository for ideas, information, best practices, directories of experts and resources, and the rest of the requisite repertoire that civic leaders will need. The amount of

¹¹⁵ “Extreme Events: A Research and Policy Framework for Disasters in Context”, Daniel Sarewitz and Roger Pielke, Jr., (<http://www.cspo.org/products/articles/xepaperfinal.pdf>)

¹¹⁶ “A Democracy of Groups”, Beth Simone Noveck, *First Monday*, Volume 10, Number 11, November 2005 (http://www.firstmonday.org/issues/issue10_11/noveck/).

¹¹⁷ “Communities of Practice: A New Tool for Government Managers”, William M. Snyder (Managing Director, Social Capital Group) and Xavier de Souza Briggs, (Assoc. Prof. Of Public Policy, Harvard University), *IBM Center for Business and Government (Collaboration Series)*, November 2003. (http://www.businessofgovernment.org/pdfs/Snyder_report.pdf).

information to absorb just to keep up with an established professional discipline can be overwhelming. Member relationships provide a network for finding out quickly which information is most important to pay attention to and where to get the knowledge you need “on demand,” instead of piling it up on your desk or storing it in an obscure folder somewhere in your computer’s hard drive ‘just in case’.”

Creating a virtual community of practice is like having an extended multi-party conversation. It does not replace face-to-face interaction or meetings, but it can extend their effect, accelerate their value, amplify their impact, and preserve the understandings and agreements that derive from those conversations.

“Conversation is essential.”¹¹⁸ We use conversation as a medium for decision making. It is through conversation that we create, develop, validate, and share knowledge....Conversation is more than simply an intellectual endeavor: it is a fundamentally social process.... The social nature of talk is not an undesirable side effect, but rather the heart of it....

In addition, **conversation within the digital medium, has a property of great importance for our purposes: it *persists*.** Instantiated as text, whether typed in or spoken and recognized, persistence expands conversation beyond those within earshot, rendering it accessible to those in other places and at later times. Thus, digital conversation may be synchronous or asynchronous, and its audience intimate or vast. Its persistence opens the door to a variety of new uses and practices: persistent conversations may be searched, browsed, replayed, annotated, visualized, restructured, and recontextualized, with what are likely to be profound impacts on personal, social, and institutional practices.”

Business guru Rosabeth Moss Kanter¹¹⁹, an expert in management and change, speaks of **the triad of collaboration, initiative and accountability.** Accountability is based on trust and honesty. If we are going to survive and thrive after catastrophe, we’re going to have to hold each other’s feet to the fire. “Without open and frank exchanges, a community will never blossom ... nor will lessons learned or case studies be complete and accurate.”¹²⁰

¹¹⁸ “Social translucence: An Approach to Designing Systems That Support Social Processes”, Thomas Erickson and Wendy Kellogg, IBM T. J. Watson Research Center (http://www.pliant.org/personal/Tom_Erickson/st_TOCHI.html).

¹¹⁹ **Confidence: How Winning Streaks and Losing Streaks Begin**, Rosabeth Moss Kanter, Random House/Crown Business, NY, 2004.

¹²⁰ “Crisis Planning and Response (CPR) Web Portal: Opening the Doors between Interagency and Coalition Communities”, Marcy Stahl and Julia Loughran (http://www.thoughtlink.com/publications/publication_ot-01.htm)(MS Word, requires download).

Managing a conversation among hundreds of people and dozens of organizations requires not only some technical systems and expertise, but some human ones as well. "There are a host of problems: addressing; managing threads; bringing other people into the middle of a conversation; keeping a conversation on track; knowing who (or whether) anyone is listening; getting people to respond in a timely manner; finding old messages with crucial information in them; etc. It is difficult to conduct a long-running, productive conversation through the digital medium, especially if there are more than a few people involved." ¹²¹

There is **free software** available to enable the creation of a learning organization. (See <http://moodle.org>.) Moodle allows for facilitated discussion threads, rather than just open posting with some oversight by a moderator. In a "discussion thread", the user can choose to subscribe, so that a notification about each new post is sent by e-mail. In a moderated discussion thread, it's an open dialogue in which a "conversation" has to be generated by the participants. In a facilitated discussion thread, each post is automatically e-mailed to all participants; the participant may choose to respond directly to the poster via e-mail, or to the group as a whole by posting at the web site. Furthermore, and this is critical to any emergency management planning applications, the discussion is guided by a facilitator. Members or participants in such sites are usually provided with a daily e-mail update indicating "what's new". (Another provider of forum software is www.invisionboard.com.)

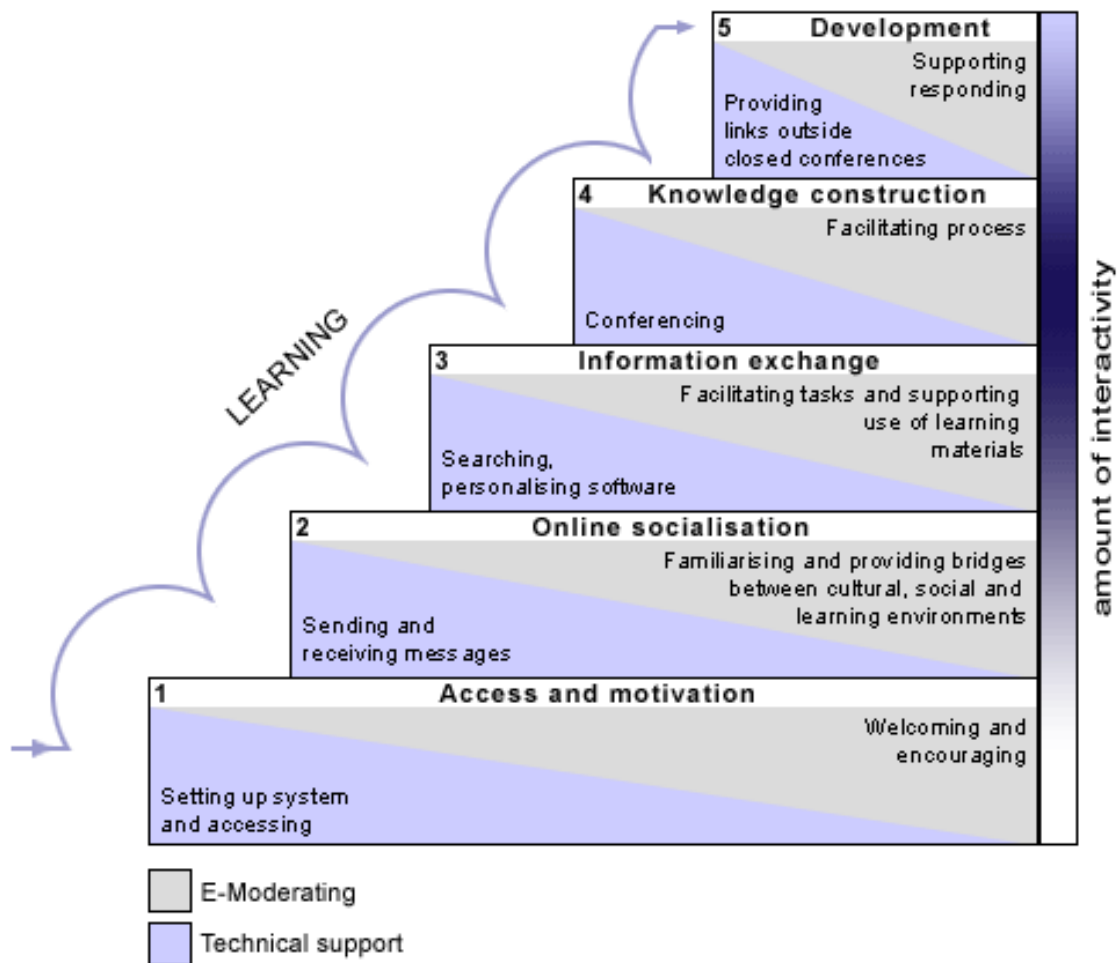
So managing such a complex conversation will require some facilitation. **Nancy White** says that **facilitating online interaction** ¹²² involves:

- enrollment in stages of entry and engagement,
- building sociability, relationship and trust,
- creating norms, agreements and accountability,
- fashioning conversations among people,
- shepherding people towards action and tasks,
- dealing with conflict,
- facilitating intercultural and interdisciplinary awareness,
- harvesting insights, weaving and cross-weaving tapestries,
- fashioning rituals and cycles, and
- bringing people back to entry and engagement at a new level.

¹²¹ "Social translucence: An Approach to Designing Systems That Support Social Processes", Thomas Erickson and Wendy Kellogg, IBM T. J. Watson Research Center (http://www.pliant.org/personal/Tom_Erickson/st_TOCHI.html).

¹²² Nancy White, in the 1st Annual KnowTips online conference held at www.KnowPlace.ca. Nancy holds court at www.fullcirc.com and is recognized as one of the leading experts in online facilitation of communities of practice. Her web site is **loaded** with lots of free and useful information. See also: http://interconnected.org/home/2004/04/28/on_social_software and http://www.corante.com/many/archives/2004/09/30/the_seven_two_pieces_social_software_must_have.ph p.]

Gilly Salmon ¹²³ offers a **five-stage model for moderating online communities of practice**:



Much of the knowledge and skills inherent in community public safety, emergency response, health care, emergency management, NIMS and the Incident Command System and more are already available in an online setting, through either national, state or local efforts and organizations. Indeed, "distance learning" is maturing at a rapid rate; there are, in almost every major community, at least one college or university already engaged in online learning. As part of your community, their resources, experience and knowledge are available to be tapped.

The military has also engaged in a great deal of online learning, including that married with doctrine, simulations, etc., and the US Navy has undertaken an extensive review of what works, and what doesn't.

¹²³ See <http://www.atimod.com/e-moderating/intro.shtml>.

There are **five Critical Dimensions of Distance Learning** ¹²⁴:

- Management Strategies
- Learner Characteristics
- Instructional Strategies
- Multimedia Strategies
- Assessment Strategies

There are **four archetypal models for instruction**:

- Gifted teacher/mentor;
- Instructional systems development;
- Computer-assisted instruction/embedded systems;
- Intelligent tutoring systems.

Within a virtual community of practice, **learning can take place in four overlapping and integrated ways**: The learner can learn from an “instructor”, or resident subject matter expert, as well as from other learners from within the same discipline, or from another discipline. The learner can learn directly from content made available within the community, or from outside resources to which the learning management system has been linked.

Janet Salmons ¹²⁵ says that “collaborative e-learning means mutual engagement of two or more learners in a coordinated effort to construct knowledge, negotiate meanings and/or solve problems using Internet and electronic communications”.

There is a treasure chest of resources on “web learning” here:
<http://www.knowledgeability.biz/weblearning/softwaretools.htm>.

Additional resources:

- Models and Materials: Teams (Wendy Clark)
- <http://www.onepine.info/mod1.htm>
- Teamwork: Skills for Collaborative Work
- <http://www.vta.spcomm.uiuc.edu/>
- Virtual Teams
- <http://www.virtualteams.com>
- Working Together Virtually
- <http://workingvirtually.start4all.com/>

¹²⁴ “What Works in Distance Learning”, Harold F. O’Neil, USC/CRESST, Office of Naval Research (February 28th, 2003) (<http://www.adlnet.org/downloads/124.cfm>)

Or see http://cresst96.cse.ucla.edu/what_works_in_dist.pdf.

¹²⁵ Janet Salmons at KnowTips (www.KnowPlace.ca). See Janet’s web site at www.vision2lead.com.

“The architect of learning ¹²⁶ is principally a creator and organizer of experience [so that]:

- the experience is **engaging** – preferably compelling—because it is perceived as consequential;
- the experience **accommodates multiple learning styles and preferences**;
- the experience is **organized to simulate and refine** analysis, synthesis, and analogical thinking;
- the experience **includes elements of sensory and intellectual novelty**;
- the experience produces some **measurable affect** among most learners, and results in a **motivation** to explain novelty, solve a problem, or otherwise resolve the experience;
- the experience is successful in **achieving an explicit learning outcome** – a new pattern or permutation of an existing pattern – for a substantial number of learners.”

“Learners will embrace repetition, difficulty, failure, persistence, hard discipline, and imposed tasks if they are convinced that the ultimate objective is personally meaningful.”

Learning need not occur in a formalized structure. **Online meeting technologies** abound (see, for example, <http://learningtimes.net>).

Online or virtual conferences (both synchronous and asynchronous) are increasingly available. An online meeting or conference is a way of reducing the travel and time costs of an educational event. iCohere, Inc. [www.icohere.com] held an online conference this past fall on “Collaborative Communities of Practice”, with presentations on building learning networks using social media, and blending COP’s with training.

Frances Long’s website in Vancouver (www.KnowPlace.ca) (which uses Moodle software) annually offers a conference (“KnowTips”) on how to conduct and facilitate online interactions around learning.

¹²⁶ Architect for Learning: Utilizing The Internet as an Effective Educational Environment, Philip J. Palin and Kari Sandhaas, Saint Thomas Didymus Corporation, Ruckersville, VA (Telelogic Learning Company, www.telelogic.net).

Eldis (the International Institute for Communication and Development) has lessons and guidelines on how to organize a virtual conference at <http://www.eldis.org/static/DOC13413.htm>.

See also the IICD Research Report on “Organizing Virtual Conferences” by Anneke Wieman at <http://www.ftpiicd.org/files/research/reports/report2.pdf>.

“Advance organizers ¹²⁷(AO) are another pre-practice tool that helps trainees develop a basic structure—that is, their expectations—for the information that is to be provided during training. This, in turn, aids in the internalization of information learned, easing the integration of new knowledge with existing knowledge. Advanced organizers come in many forms and researchers have offered guidance in terms of the steps required to develop these tools.

Steps include:

- (1) inform trainees of advance organizer purpose,
- (2) identify topics of tasks,
- (3) provide organizing framework,
- (4) clarify action to be taken,
- (5) provide background information,
- (6) state concepts to be learned,
- (7) clarify concepts,
- (8) introduce vocabulary, and
- (9) state the general outcome/goal desired.”

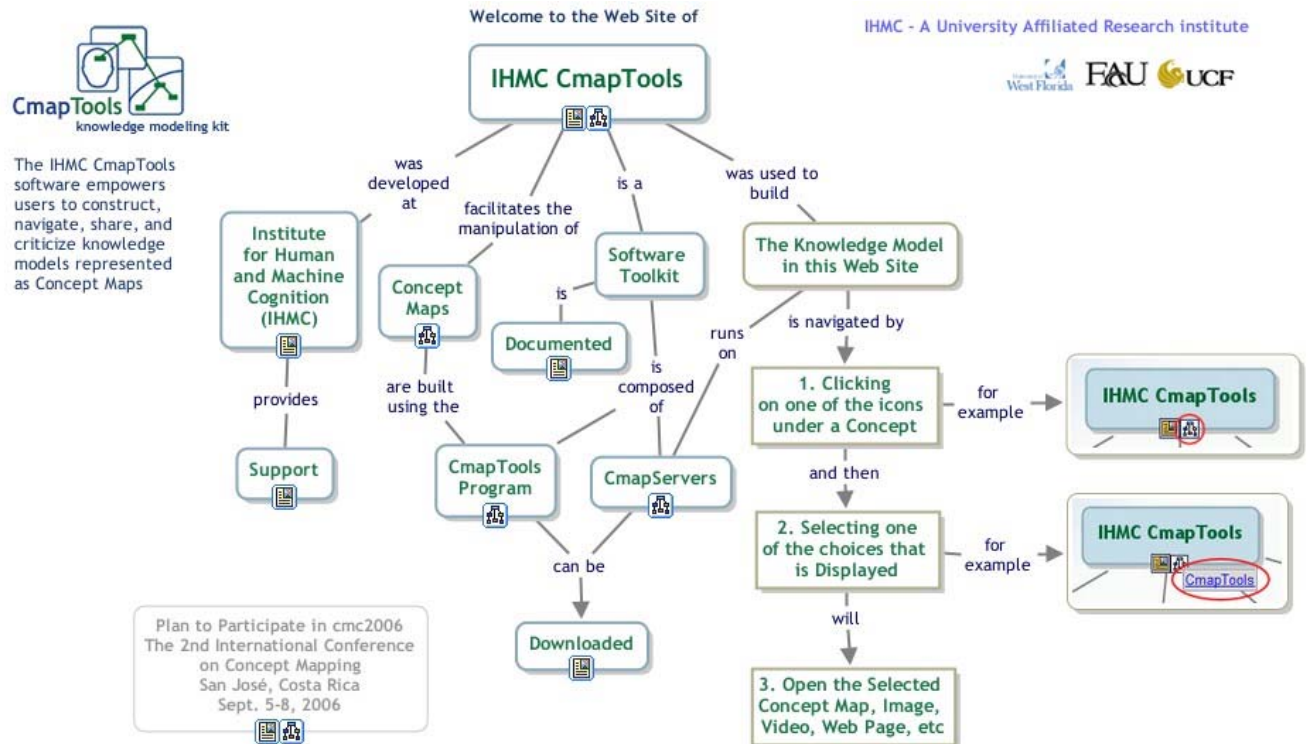
One type of “advance organizer” is a **concept map** ¹²⁸, another digital tool available for free to learning communities. [See the **concept map of concept mapping on the next page.**] As a “map”, it allows the individual learner or learning team to forecast where it is going, chart its progress, and forge an individualized learning path. It combines “... text, graphics, audio, video, links to Web pages, etc., that are associated with concepts.” It is “... essentially a meta-cognitive tool” and “... has significant utility to support just in time learning for performance support.”

“CmapTools is a software suite that is in ongoing development at the [Institute for Human and Machine Cognition \(IHMC\)](#), The University of West Florida. This tool is built as a distributed knowledge modeling system that enables learning and collaboration over the Internet.... [It] has been used to acquire knowledge for expert systems, for institutional memory preservation,

¹²⁷ “How to turn a team of experts into an expert medical team: guidance from the aviation and military communities”, C. S. Burke, E. Salas, K. Wilson-Donnelly and H. Priest, *Qual. Saf. Health Care* 2004:13-96-104 (http://qhc.bmjournals.com/cgi/reprint/13/suppl_1/i96)

¹²⁸ “LEO: A Learning Environment Organizer to Support Computer-Mediated Instruction”, John W. Coffey and Alberto J. Canas, *Journal for Educational Technology Systems* 31(3), pp. 275-290 (2003). (<http://cmap.ihmc.us/Publications/ResearchPapers/LEO-A%20Learning%20Environment%20Organizer%20to%20Support%20Computer%20Mediated%20Learning.pdf>)

performance support, and potentially, as content for instruction in a course.”
 [For further information, see www.ihmc.us and <http://cmap.ihmc.us/>]



The advent of “podcasting”, and the increasing available of “wearable” computers, along with a host of other technologies, all present both problem and solution; “listservs” are used to communicate with Medical Reserve Corps and CERT teams in the Merrimack Valley and elsewhere. Wikis, a collaborative editing tool for creating Web pages that can be openly edited by more than one person, are becoming ubiquitous. Voice-over-Internet-protocol (VOIP) (available free at www.skype.com), a raft of wireless or Bluetooth devices, video chat, camera-equipped cell phones, PDA’s with instant messaging and walkie-talkie-like push to chat and push-to-video features, all seamlessly jumping from wireless to cellular to corporate networks, enable immense mobility and immense capability to communicate.

“Today’s technologies make the world’s libraries accessible to anyone with a wireless PDA. A vast social network is literally at the fingertips of anyone

with a cell phone. As a result, people have unprecedented freedom to bring resources together to create their own learning trajectories.”¹²⁹

“ ‘We’re seeing an increase [in the number of people looking for help online]. In fact, if anything, I have a feeling this time that we’re starting to fall over each other [in that] there are too many ways to get information, too many possibilities, too many options as opposed to one authorized place,’ said Claire Rubin, a Virginia-based emergency management/homeland security researcher and consultant. [See her portal at www.disaster-central.com.]

“Michael Brown, chief technology officer at Prepared Response, a Seattle-based technology company that develops and implements crisis management planning and response systems, said the use of e-mail, instant messaging services and the Internet during disaster response efforts has increased since the 2001 terrorist attacks. The Internet allows multiple people to access a system simultaneously.

‘In addition, one of the huge values of the Internet is the way it presents information,’ said Brown, who is not related to former Federal Emergency Management Agency Administrator Michael Brown. ‘It’s not just a scribbled piece of information. You can get data formatted in a way most [people] can understand, such as graphs or text, and get data that’s archivable, and you can update that pretty rapidly. It amplifies the value of that information.’...”

“Rubin, a visiting scholar at the George Washington University’s Institute for Crisis, Disaster and Risk Management, said she doesn’t think researchers have studied much about using the Internet during disasters. But she said there’s a greater chance of fraud and error as more sites offer information.

‘Disaster people use a term -- convergence,’ she said. ‘You get convergence of too many donated goods, which clogs up the roadway, too many self-deployed firemen. You may now have a convergence of too many freestyle bloggers and wiki types and whatever. So one of the issues would be: **How do you sort out charlatans from the real, and how do you give primary attention to the ones who are authentic and credible?**’”¹³⁰

¹²⁹ “Video Games and the future of learning”, David Williamson Shaffer, Kurt P. Squire, Richard Halverson, and James P. Gee, University of Wisconsin-Madison and Academic Advanced Distributed Learning Co-Laboratory, December 2004 (<http://www.academiccolab.org/resources/gappspaper1.pdf>).

¹³⁰ “Disasters in the Internet Age”, Dibya Sarkar, *Federal Computer Week*, 10/31/2005 (<http://www.fcw.com/article91254-10-31-05/>)

Fernanda Ibarra ¹³¹ suggests the following **success criteria** for **virtual communities of practice**:

- Sustained mutual relationships
- Quick mobilization for discussion
- Shared Methodology
- Rapid Flow of Information and Fostering of Innovation
- Acknowledged participant base
- Knowledge of what others know, what they do, & how they contribute
- Mutually defined identities
- Ability to assess appropriateness of actions and products
- CoP developed (or sustained) tools, language, and definitions
- Open communication channels
- Satisfaction of specific knowledge goals
- Reduction in hours needed to solve problems
- Drop in rework
- Number of innovative/breakthrough ideas
- Transfer of best practices from one member to another
- Adoption of best practices or innovations that were not invented here
- Less redundancy of effort among members
- Avoidance of costly mistakes
- Quantitative measures
- Success stories

Online learning and a virtual community of practice enables and co-exists within a functional portal.

“A robust **CPR [crisis planning and response] portal** ¹³² will serve as an information resource, support collaboration among multiple distributed users, and provide just-in-time training and education ranging from passive to active to experiential via access to simulation and role-playing.... [It will] promote a sense of community among users. In addition to having content focused at a particular population, portals typically include collaboration tools to help users identify and interact with each other through text chat, bulletin boards of archived email, and ratings or evaluations of users (also known as reputation managers).”

One example of a CPR portal is the prototype Internet-enabled emergency response system for the Kentucky Chemical Stockpile Preparedness Program (CSEPP) and a 10-county region surrounding the Blue Grass Army Depot in Madison County, Ky. ¹³³ The completed portal fully integrates interactive

¹³¹ Fernanda is member of the *LearningTimes* Virtual Communities Working Group at LearningTimes.net.

¹³² “Crisis Planning and Response (CPR) Web Portal: Opening the Doors between Interagency and Coalition Communities”, Marcy Stahl and Julia Loughran (http://www.thoughtlink.com/publications/publication_ot-01.htm).

¹³³ For further information, see www.plangraphics.com and <http://www.plangraphics.com/publications/SF%20Antenucci.pdf>.]

mapping, weather information and plume models, 3-D visualization and fly-throughs, traffic surveillance video, census and socio-economic models, incident logging, alert notification, and response documentation that had previously only existed as separate computer applications that did not work together.

One way in which a portal functions is to have links to key **nodes**. There are a host of these, too numerous to mention or characterize them all. Such nodes exist largely through the efforts of government agencies and non-profit organizations; undoubtedly these would include web sites run by key governmental agencies such as FEMA, state emergency management agencies, the CDC, etc.

One web site (<http://www.semp.us/>), headed by an emergency physician with an MBA, is a model of what can be accomplished on a local and regional level, as deep background, and as a window to "the field". There are a number of resources there.

Another useful web site is <http://www.all-hands.net> operated by DavisLogic, a DC-based consulting firm in emergency management and business continuity. Operated in a user-driven forum/bulletin board/newsletter format, it has useful news, web links, and other types of resources. It's free to approved registrants. It has a very wide range of resources on the topics of NIMS and the Incident Command System, as well as the operation of EOCs (including some really provocative ideas on "**virtual**" EOCs). You may be, of course, already familiar with Web EOC.

Major acute health care institutions and primary care organizations in Eastern Mass. are probably aware of and even tied in with Ross Lazarus' program at Brigham and Women's (<http://www.biosurveillance.org>) (*because of HIPAA and related confidentiality and security concerns, some segments of this site are **strictly secured** and require formal approval for registration*).

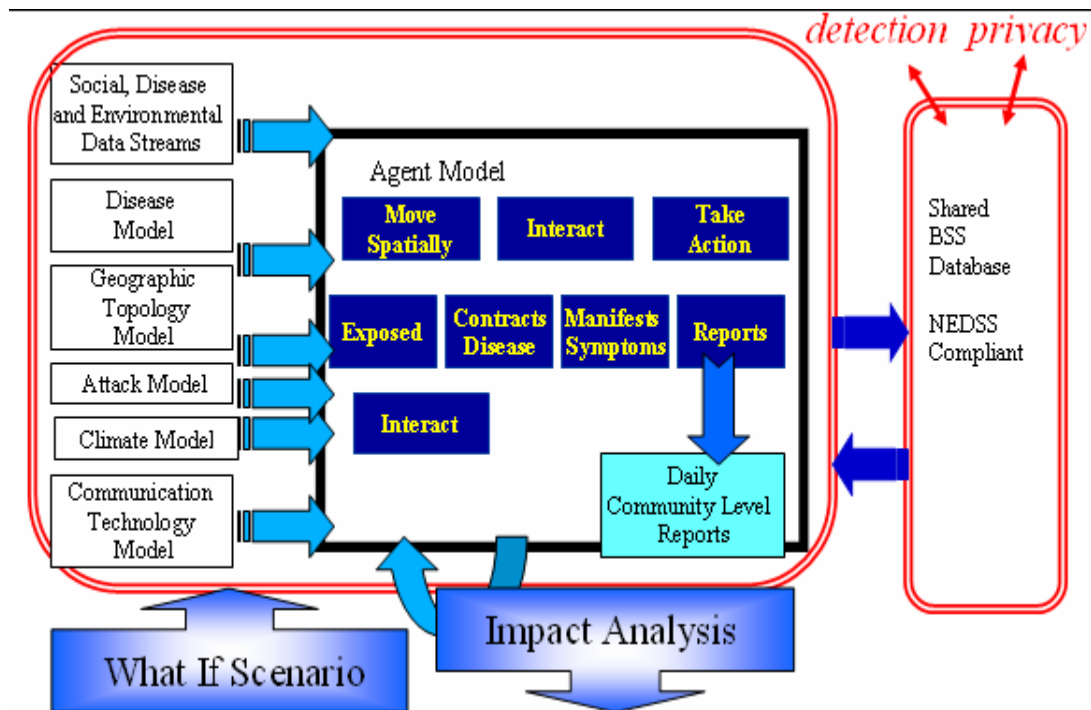
Also, you can find further information on the FirstWatch program, a 911 and GIS-based **biosurveillance** program now up and running within the Richmond, VA Ambulance Authority. See <http://www.stoutsolutions.com> or type FirstWatch in your browser.

If key clinicians in your community are not on the clinicians' listserv mechanism for the **CDC's** alert and update system, they can register at <http://www.bt.cdc.gov/clinregistry/>. See also www.cidrap.umn.edu, a web site updated every day at the University of Minnesota's Center for Infectious Disease, Research and Policy.

A syndromic surveillance approach based on Microsoft Access database tables and a Microsoft Excel worksheet is available through the CDC. See <http://www.bt.cdc.gov/surveillance/ears/setup.asp>.

The CDC's online journal *Emerging Infectious Disease* (Vol. 9, No. 6, June 2003) has a very interesting article about **communicating risk effectively**; entitled "Community reaction to bioterrorism: prospective study of a simulated outbreak".¹³⁴ The article notes that "Journalists and other **media** specialists should participate actively in scenarios and other similar exercises to gain insight into the complexity of information management in a bioterrorism-related crisis."

Perhaps one of the most conceptually-advanced marriages of computer technologies to community crisis planning and response is **BioWar**¹³⁵:



"... combining state-of-the-art computational models of social networks, communication media, disease models, demographically accurate agent models, wind dispersion models, and a diagnostic error model into a single integrated model of the impact.... The analyst can examine real cities using census, school track, and other publicly available information. Moreover, rather than just providing information on the number of infections, BioWar models the agents as they go about their lives – both the healthy and the infected. This enables the analyst to observe the repercussions of various attacks and containment policies on factors such as absenteeism, medical

¹³⁴ It's available at <http://www.cdc/ncidod/EID/vol9no6/02-0769.htm>.

¹³⁵ "BioWar: Scalable Multi-Agent Social and Epidemiological Simulation of Bioterrorism Events", Kathleen Carley et al, Carnegie Mellon University (<http://www.sandia.gov/ACG/documents/papers/carley-2003-biowar.pdf>).

web hits, medical phone calls, insurance claims, death rate, and over-the-counter pharmacy purchases.... Among the data that can be represented as graphs are interaction or communication networks, monetary networks, inter-organizational alliances, mental models, texts, web pages, who was present at what event, story lines. The combination of these techniques with machine learning is likely to be especially powerful for locating anomalies, assessing coherence, and locating underlying fundamental patterns.... it will serve to help researchers understand, predict, and analyze weaponized biological attacks at the city level and engage in "what-if" analyses to help inform decision-making in this complex socio-technical policy domain."

One result of the establishment of a virtual community of practice is the **"double-knit" composition** that allows flexibility and stretching across multiple inter-connected organizations. Shared information and insight and cross-functional collaboration generate new ideas. Community preserves discipline and technical focus, and teams unite multiple disciplines around a common focus. "Teams weave the organization together in one direction. Communities weave it together in the other." ¹³⁶

One of the new tools available for the creation of **social capital** is the web site **i-neighbors**. [See <http://i-neighbors.org/index.php>.] "The idea of combining a way to support the people around me and link to local government while developing a platform for people to do some basic sharing of opinions, knowledge and giving them a way to communicate..." has arrived in the US. ¹³⁷

Readers interested in the issue of **social and intellectual capital leveraged through networks** should download **"The Changing Business Model: The 21st Century Enterprise Dynamics of People, Business & Society in a Networked Economy"** by Colby Stuart, Ph.D. at the Institute for Collaboration, Creativity and Culture at www.ifccc.org.

In a meeting in Virginia called to discuss avian influenza, one community health director asked a question that "hung in the air for a long time": "Are we going to do our best to save the next generation, or are we going to do our best to prevent deaths?" ¹³⁸

Who needs to be involved in this important discussion?

¹³⁶ "The Role of Communities of Practice in Team Organizations", Richard McDermott, *Knowledge Management Review*, May/June, 1999 (<http://www.co-i-l.com/coil/knowledge-garden/cop/learning.shtml>).

¹³⁷ See the blog by James Burke at www.ifccc.org.

¹³⁸ "Leaders Share Flu Pandemic Concerns", Susan Levine, *Washington Post*, November 21, 2005.

“Pandemic influenza requires a different preparedness strategy ¹³⁹,” said Dorothy Teeter, Interim Director and Health Officer for Public Health, Seattle & King County. “Buildings are left standing, and the roads remain open, but the tremendous impact on human health will change how everyone will do business when a pandemic influenza comes.” Basic services such as health care, law enforcement, fire, emergency response, communications, transportation, and utilities, could be disrupted during a pandemic. Unlike many other emergency events, a pandemic influenza could last for many weeks, if not months.”

“... What is needed is a detailed operational blueprint for how to get a population through one to three years of a pandemic. **Such a plan must involve all the key components of society.** ¹⁴⁰ In the private sector, the plan must coordinate the responses of the medical community, medical suppliers, food providers, and the transportation system. In the government sector, the plan should take into account officials from public health, law enforcement, and emergency management at the international, federal, state, and local levels.

And **the media**..., which : “... often plays a formative role in both bringing public attention to, and influencing the evolution of, extreme events.” ¹⁴¹

Given the extent to which modern commerce relies on the precise and readily available international trade of goods and services, a shutdown of the global economic system would dramatically harm the world's ability to meet the surging demand for essential commodities such as food and medicine during a crisis. **The business community can no longer afford to play a minor role in planning the response to a pandemic.** For the world to have critical goods and services during a pandemic, industry heads must stockpile raw materials for production and preplan distribution and transportation support. Every company's senior managers need to be ready to respond rapidly to changes in the availability, production, distribution, and inventory management of their products. “

“We need to think about bottom up processes as well as top down planning in order to effectively galvanize community efforts around a variety of

¹³⁹ “Businesses prepare with King County for pandemic influenza” (Mon. 10/3/05), King County Public Health (<http://www.metrokc.gov/health/news/05100301.htm>).

¹⁴⁰ “Preparing for the Next Pandemic”, Michael Osterholm, *Foreign Affairs*, July/August 2005 (<http://www.foreignaffairs.org/20050701faessay84402/michael-t-osterholm/preparing-for-the-next-pandemic.html>).

¹⁴¹ “Extreme Events: A Research and Policy Framework for Disasters in Context”, Daniel Sarewitz and Roger Pielke, Jr., (<http://www.cspo.org/products/articles/xepaperfinal.pdf>).

partnership-building and partnership-knowing activities that will benefit the community during and outside of disaster episodes.”¹⁴²

What may be of supreme benefit, then, is to utilize new kinds of software that will allow large groups of experts, community leaders and others to engage in “**cascade thinking**”. (Such “**strategic exploration**” processes and software can be found here: <http://www.strategicexploration.com/i-wheel/index.htm>.) This tool and its associated process allows a detailed examination of **second-generation** and **third-generation consequences** of decisions, policies and actions.

As Joel Barker suggests, the community needs to send out its scouts to examine the trail ahead, in order to know what lies ahead.

¹⁴² “Considering Convergence, Coordination and Social Capital in Disasters”, Tricia Wachtendorf and James Kendra, *Canadian Risk and Hazards Network (1st Annual Symposium)*, November 19, 2004 (<http://www.crhnet.ca/docs/presentations/T-Wachtendorf.pdf>).

Conclusion

The true value of serious simulation games and the range of other digital learning tools can best be judged by the extent to which they bring people to a higher level of dialogue, discovery, research, learning and collaboration after the game or learning encounter has ended. ¹⁴³

“Robert Fried, associate professor of education at Northeastern University ¹⁴⁴, suggests that **passionate learning is mostly a function of relationships, largely a social and interactional activity.**

Leaders in organizational learning tell us that “When somebody asks us to talk about ourselves, we talk about family, work, academic background, sports affiliations, etc. The self is not a thing, but a point of view that unifies the flow of experience into a coherent narrative --a narrative striving to connect with other narratives and become richer. **The constitution of the self happens only in a community....**” ¹⁴⁵

Linking people and groups together empowers them by providing information, resources, perspectives and insights they might not otherwise have, and by building **a luminescent connectedness** that did not previously exist.

In learning communities, the challenge is to build local capability quickly, to leverage the best capabilities available with government, industry, academic institutions, and the community at large, to create tools that will foster innovation, facilitate knowledge-sharing, and accelerate collaboration among organizations and people and within and across jurisdictions, hierarchies, neighborhoods, cultures and both organizational and social networks. ¹⁴⁶

If the efforts suggested within this paper are going to be undertaken, **who is going to do it?** This kind of effort requires change, and to get any community to change requires a group of “change agents”: a “prophet” who envisions; an “entrepreneur” who invents, integrates and seeks opportunity; a “missionary” to gain acceptance for the effort; a “catalyst” to forge

¹⁴³ Posted previously in Internet blogs by the author.

¹⁴⁴ See his book The passionate learner: how teachers and parents can help children reclaim the joy of discovery, Beacon Press, 2001.

¹⁴⁵ Fred Kofman & Peter M. Senge, "Communities of Commitment: The Heart of Learning Organizations," in *Learning Organizations: Developing Cultures for Tomorrow's Workplaces*, Chawla and Renesch (eds.), Productivity Press, Portland, Oregon 1995), pp. 14-43. Found at http://home.nycap.rr.com/klarsen/learnorg/kof_sen.html.

¹⁴⁶ “Communities of Practice: A New Tool for Government Managers”, William M. Snyder (Managing Director, Social Capital Group) and Xavier de Souza Briggs, (Assoc. Prof. Of Public Policy, Harvard University), *IBM Center for Business and Government (Collaboration Series)*, November 2003. (http://www.businessofgovernment.org/pdfs/Snyder_report.pdf)

alliances that enable it; a manager to “shepherd” the project and focus on efficiency and effectiveness; and a “sponsor” who ensures the necessary support and resources.

At the community level, it will require a project initiator, some experts, some general contributors, a nurturer or two, a communicator, a good deal of technical support, several with skills in the facilitation of discussion (both face-to-face and online), and a mix of participants and “lurkers”.¹⁴⁷

This implies people... a lot of them. As noted, there are debates about the value of a command-and-control approach versus open and adaptive systems, incident command approaches and a closed organizational structure versus wikis, electronic bulletin boards, an open Internet approach, and participatory democracy. And entering into this fray is some awareness of the extent to which “emergencies”, whether terrorism, hurricane, or avian flu, have been politicized... and some awareness that “we” collectively precipitate or set the table for disasters and crises through policy, regulation, the marketplace, and other means.

Madhu Beriwal, CEO of Innovative Emergency Management, Inc., said recently “We need to more completely integrate modeling and simulation technology to calculate the consequences of various actions. These outcomes are what allow us to engage better with political leaders.... We have to work to show the effects of various interventions on the outcomes.”¹⁴⁸

Can we indeed predict consequences of actions and policies?

When a community faces the potential of a Category V hurricane or a looming pandemic, there will be a host of difficult and interlocking questions, each with an answer that will affect the other answers. What may be required is that that community tap into its social and organizational networks to engage “the wisdom of the crowd”.

“One purpose for engaging in a team decision process is to pool expertise [knowledge, social network and experience] from multiple sources and thereby generate ideas that no individual could develop alone. In this way, leaders may anticipate capturing synergistic benefits from teamwork. Such benefits often remain elusive, however. Asymmetrical information in groups is associated with a notable failure to discuss all relevant information... Group discussion tends to focus on common information held by all members, such that information privately held by various members fails to

¹⁴⁷ “What is Community” by David Coleman, in *Collaborative Strategies (Strategies for Electronic Collaboration and Knowledge Management)*, August 2002; see http://www.collaborate.com/newsletter/publications_newsletter_august02.html.

¹⁴⁸ “Hurricane Pam and Hurricane Katrina: Pre-Event “Lessons Learned”, EIP Virtual Forum Presentation, December 14th, 2005 (see the transcript at <http://www.emforum.org/vforum/lc051214.htm>).

surface.... Private information may remain unshared when individuals—deeply engaged in the discussion at hand—fail to recognize its salience for the issue under consideration. Members also may fail to share private information because they take it for granted and implicitly assume that others know what they know, or because they are reluctant to jump into an already active discussion.

Failure to share situation-relevant information is likely to decrease team effectiveness. By not discussing all pertinent information, teams may overlook plausible options, fail to examine the full consequences of each alternative, or underestimate the risks associated with a proposal. In addition, members' awareness that relevant information did not surface is likely to erode commitment to implementing the group's decision, especially if they feel they did not contribute fully to it." ¹⁴⁹

"We know the rules of community; we know the healing effect of community in terms of individual lives. If we could somehow find a way across the bridge of our knowledge, would not these same rules have a healing effect upon our world? We human beings have often been referred to as social animals. But we are not yet community creatures. **We are impelled to relate with each other for our survival. But we do not yet relate with the inclusivity, realism, self-awareness, vulnerability, commitment, openness, freedom, equality, and love of genuine community.** It is clearly no longer enough to be simply social animals, babbling together at cocktail parties and brawling with each other in business and over boundaries. It is our task – our essential, central, crucial task – to transform ourselves from mere social creatures into community creatures. It is the only way human evolution will be able to proceed." ¹⁵⁰

"Evolution gave us culture (**a context of space, people and time**) as the means with which to profoundly increase the complexity of the brain-world interaction that builds the mind. Culture is where we build and teach the use of tools, how we transmit socially-acceptable behaviors, where we use symbol and language, and how we develop rituals and institutions. Human culture is **a "cognitive web"** that frees the mind from its individual isolation to partake in a widely-distributed system of knowledge shared across many nervous systems." ¹⁵¹

¹⁴⁹ "A Dynamic Model of Top Management Team Effectiveness: Managing Unstructured Task Teams", Amy Edmondson, Michael Roberto and Michael Watkins, Harvard Business School (<http://www.hbs.edu/research/facpubs/workingpapers/papers2/0001/01-048.pdf>).

¹⁵⁰ M. Scott Peck, "The Different Drum: Community-Making and Peace", in *The Virtual Community: Homesteading on the Electronic Frontier*, Howard Rheingold (<http://www.rheingold.com/vc/book/intro.html>)

¹⁵¹ Canadian psychologist Merlin Donald is credited with the phrase "cognitive web" in *Liars, Lovers and Heroes: What the New Brain Science Reveals About How We Become Who We Are*, Steven R. Quartz, Ph.D. and Terrence J. Sejnowski, Ph.D., HarperCollins/Wm. Morrow, New York 2002.

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About the Author

Ed Jewett's professional career includes over a decade in the field of emergency medical services as an EMT, instructor, systems planner at area, regional and state levels, and regional systems administrator. He has a particularly strong interest in disaster and mass casualty incident management, and circulated and published a proposal for the development of simulation gaming as a planning and training tool in that field. He wrote "**Mass Casualty Simulations: Tomorrow's Disaster Drill?**", published in the March-April 1990 issue of *Rescue* magazine. He has been a hobbyist in tabletop simulation gaming, and has read widely in military history, strategy and tactics. He is a member of NASAGA.

He has also been an association executive for groups of emergency physicians, purchasing managers and community health center executives, and has planned and executed a wide range of educational programs. He has a bachelor's degree in communications studies and media production, and has written and co-produced public information, corporate marketing, and pediatric continuing education video programs.

He drafted the first statewide EMS plan for Massachusetts, and wrote the first mass casualty incident plan for the Merrimack Valley and developed corollary educational programs and community level planning templates, a planning effort described by the New England Council for EMS as "clearly ahead of any other EMS region in New England at this time". That plan was tested by an explosion and fire at Malden Mills in which 27 burn/trauma victims were successfully placed in definitive care status in under an hour with no loss of life.

The parent of two elite athletes, he compiled and edited an e-book, a large collection of excerpts, guidelines and exercises for high school and college athletes on a variety of topics in sports psychology and performance enhancement (including stress and attention management), called *Summon The Magic: How To Use Your Mind to be a better athlete (or anything else you want to be)*.

He consulted on the design of a simulation training system (a "virtual tabletop exercise") focused on a unique homeland security scenario (the outbreak of a pathological animal disease) for a leading developer of military multi-player simulation training systems distributed to desktop PC's anywhere on the globe.

He wrote and posted several articles at *all-hands.net*, including "**Situation Awareness and the OODA Loop**" and "**Needed Change in Emergency Management: Accelerated Learning for Community Response Teams**".

He was a volunteer in the early stages of development of a three-site, 36-hour full-scale exercise. He is certified in incident management and exercise design, a member of a CERT team, and a member of a Medical Reserve Corps.

He was a member of the Virtual Community Working Group at *learningtimes.net*, was one of six *beta*-testers of the inaugural Internet-based "Game of Games", and has attended several online conferences on appreciative inquiry, facilitating in an online world, and other topics. He is a contributing member in six online communities.

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