DERMIS:
Dynamic Emergency Response Management Information Systems

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Joint work with Prof. Murray Turoff (NJIT)
<table>
<thead>
<tr>
<th>Organizational Emergency Situations</th>
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<tbody>
<tr>
<td>• Strike</td>
<td>• Production delay</td>
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<td>• Court Case</td>
<td>• Product malfunction</td>
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<td>• Cost overrun</td>
<td>• Contract Negotiation</td>
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<td>• Delivery delay</td>
<td>• Loss of a key employee</td>
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<td>• New regulation</td>
<td>• Loss of a key customer</td>
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<td>• Terrorist action</td>
<td>• Responding to an RFP</td>
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<td>• Supply shortage</td>
<td>• New Competitive product</td>
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Emergencies – crises - disasters

- Unpredictable:
  - Events
  - Who will be involved
  - What information will be needed
  - What resources will be needed
  - What actions will be taken, when, where, and by who

- No time for training, meeting, or planning

- No contingency plan that fits perfectly

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Emergency Management Requirements

- Obtain data, status, views
- Monitor conditions
- Obtain expertise, liaison, action takers, reporters
- Draft contingencies
- Validate options
- Obtain approvals, delegate authority
- Coordinate actions, take actions, evaluate actions
- Evaluate outcomes
  - Modify scenarios and plans
  - Modify community and operations

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- An emergency system must be regularly used to work in a real emergency
- People are working intense 14-18 hour days and cannot be interrupted
- Timely tacking of what is happening is critical
- Delegation of authority a must and
- Providing related data and information up, down, and laterally is critical
- Plans are in constant modification
Learning and adaptation of response plans from training and real events is a necessity.

In a crisis exceptions and variations to the norm are common.

The critical problem of the moment collects attention and resources.
• Roles are the constant in an emergency and who is in a role may vary unexpectedly

• Training people in multiple roles is very desirable

• Roles and their privileges must be defined in the response system
• Supporting confidence in a decision by the best possible timely information

• Necessary Properties
  > Free exchange of information
  > Delegation of authority
  > Decision accountability
  > Decision oversight
  > Information source identification
  > Information overload reduction
Supporting Wisdom

- Information Overload is typical
- Heterogeneous groups and individuals
- People work together who do not normally do so
- Cannot predict who will be involved
- Community and Public relations is critical (confidence and trust)
### Critical Success Factors

- The priority problem of the moment is the magnet that gathers the data, information, people, and resources to deal with it.
- The integration of qualitative and quantitative information with measures of timeliness, confidence and priority is critical.
- Having pre-established existing communities of people and resources to draw upon.
- Knowing who and what is available in real time.
- Learning from each experience and modifying lore for the future.
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**Objectives**

- Easy to Learn
- High degree of tailoring by users
- Used by trained professionals
- Overcome problem of small screens (PDA)
- Virtual command and control center
- Support use of remote databases in an integrated manner
- Support planning, evaluation, training, updating, maintenance, as well as response
- Communication process independent of content

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Smart Requirements for Emergency Group Communications

- Determine what individuals are looking for and not finding
- Guide individuals to those interested in the same thing at the same time
- Piece relevant data together
- Alert individuals to anything falling in the cracks
- Provide high confidence of a person knowing they have the best information possible at the moment
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Human Computer Challenges

- System is a helper not a boss
- System allows variable problem solving methods
- Reduction of information overload
- Minimization of execution difficulty
- High degree of comprehension
- High degree of tailoring by individual
- Encourage creativity and improvisation
- Support decision confidence
- Monitor performance and effort for possible fatigue
- Multimodal interfaces

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Integration Requirements

- Fire, Police, Public Works
- Public Health, Hospitals, Clinics, Doctors, Community resources (e.g. bulldozers, contractors, boats, generators, etc.)
- Utilities, Contractors, Equipment
- State Agencies, National Guard, State Police, Other local regional Governments
- Federal Agencies, Civil Defense, FEMA, Homeland Security
- Non-Profits, Service Organizations, Professionals, Community Groups
- Forms of communication
Specific Interaction Design Criteria

- Metaphors understood by professionals
- Human roles built in
- Notifications integrated into communications
- Context visibility
- Semantic Hypertext relationships
- List processing at user level
Example: the Emergency Metaphor

- All emergencies have events
- Time logged and archived
- Serves dispatch function
- Used after emergency to understand what took place
- Often separate events on different systems for each agency involved
- Consider dynamic database of events integrated across all agencies
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Summary on DERMIS

- A transaction system integrated with a structured group communication system
- Roles and event templates can be created and modified at any time, e.g. the system can be evolved by the users
- Can be used for all phases of the emergency response process
  - Analyses, Planning, training, evaluation, and recovery
- Can be used for all types of emergencies
- Can be used to support Online Communities
Generating scenarios and evaluating them as a collaborative exercise is quite easy to do in DERMIS.

Additional need of voting and scaling aids to allow determining disagreements and focus discussion.

Generate new event types and roles to deal with new risks.
• Easy to establish training exercises based upon role-event structure

• Simulation driven by a sequence of timed events in real time tied to the clock or can be speeded up for some types of training

• Players can easily be simulated with respect to actions and generated events

• Small teams can participate with a much larger groups of simulated players
DERMIS

- Examine log file of events and actions by roles
- Develop appropriate analysis tools to aid this process
- Discover and correct problems by improving system and/or improving training
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- Can be used to direct and coordinate the recovery activity
- Can involve any diversity organizations and agencies involved
- Provides a complete record and accountability for the recovery process

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- Can be used for all phases of the emergency response process
- Can be used for “little” emergencies which are quite common in any type of organizations
- Can be used to support Online Communities
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- Tend to be top down
- Follow designs done for single agencies or organizations
- Somewhat bureaucratic
- Assume largely verbal interaction
- Pre-segments groups to “manageable” size
- Tend to encourage rule following and often promotes rigidity
- Can work for single homogenous group
<table>
<thead>
<tr>
<th>DERMIS Type</th>
<th>Systems</th>
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<tr>
<td>• Heterogeneous very large communities</td>
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<tr>
<td>• Allows group formation to be dynamic</td>
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<td>• Allows for quick delegation of authority by role assignment</td>
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<td>• Provides for timely oversight and accountability</td>
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<td>• Encourages flexibility of response</td>
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<td>• Encourages strong personal ties among responders and resulting cohesive groups.</td>
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<tr>
<td>• Provides support for all phases of the emergency response process as well as everyday use for other regular functions</td>
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Change and disruption is more common than we think, even in commerce, and getting more frequent

The technology exists to do it

However, does the organizational motivation and understanding exists to do it?

> The issue is designing new virtual organizations and communities that will change existing organizations and the way things are done.
Research topics in ER I

- Decision models (‘fast and frugal’ heuristics?)
- Requirements and design of Virtual Command and Control Centers
- How to design human computer interactions to stimulate creativity or improvising by both individuals and groups
Research topics in ER II

• How to reduce information overload and its negative effects when it occurs

• Design of training scenarios to encourage flexibility of response and reduce rigidity
Research topics in ER III

• Design and development of systems to support local, regional, and national virtual communities of experts and professionals in ER

• Lightweight integration of resource databases

• Design and utilization of collaborative knowledge systems for professional communities
Research topics in ER IV

• Development of Emergency Prevention & Response audit controls in a continuous auditing environment

• Integrating Emergency Response Systems into day to day processes in organizations
Research topics in ER V

- Multimedia information capturing of information in training and real crisis situations
- Development of realistic training games for large groups utilizing the actual response IS system
- Investigations of decision processes in the full cycle of emergency response functions:
  > Analysis, planning, preparation, training, response, and evaluation
  > Development of improved support tools for all the phases
Research topic: Virtual teams and communities

- Large numbers of on call advisors did exist in OEP for obtaining information in an emergency

- Today the Web makes this a very economical approach and can encourage local, regional and national communities of volunteer experts
Virtual teams and communities

Virtual Communities

- Use ERMIS software for virtual communities and people will be trained to join given the right emergency situation.

- Allow communities to build a knowledge system in their area.

- In organizations employ ERMIS for all teams and committees dealing with problems that cut across the organization.
ERMIS is an Interdisciplinary Effort

- Information System Designers and Researchers
- Software Engineers and Developers
- Emergency Preparedness Professionals and Managers
- Local and Regional Government Professionals and Administrators
References


• Special Issue of JITTA, forthcoming spring 2005
• Special issue of Journal of Homeland Security and Emergency Management, vol 2 issue 1, 2005

All ER presentations from ISCRAM2004 and AMCIS2004 are available at ISCRAM website

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