Computer Supported Collaborative Training in Crisis Communication Management

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ABSTRACT

Crisis management requires stakeholders to not only show strategic, organisational preparedness for crisis events (e.g. by systematising and professionalizing coping work), but also to develop skills to deal with unanticipated events and other stakeholders involved in the same crisis. They should not only rely on established information flows and behaviour patterns, but should be able to deal with situational aspects. This usually involves communication work within and between organisations involved in crisis management. We describe the practice of the crisis communication training of a German electricity provider and the prototype we developed, implemented and evaluated. The collaborative training tool targets not only the local practice, but aims at inter-organisational trainings that would also allow improving the mutual understanding for communication practices and information needs of other stakeholders.

Keywords

Crisis Training, Crisis Management, Computer Supported Collaborative Learning

INTRODUCTION

Crisis situations often have extensive consequences on the behaviour of the people affected as well as the actors responsible for crisis management. Organisations are trained to operate along established protocols, but there is a large part of the coordination work that goes along more informal lines, and is based on the individual experience of the crisis managers involved and on the specific characteristics of a crisis. Crisis situations may worsen if inadequate reactions to situations/communications outside the own organisations occur (Hausschildt et al., 2005). These communication competencies need to be trained just like all other competencies in crisis management.

This paper presents how IT can support collaborative training in crisis communication management for an infrastructure providing company using the example of a German electricity provider (GEP). We observed and analysed the existing practice of simulating and practicing crisis situations at the GEP, developed a concept and implemented a prototype that aims at integrating stakeholders also from other organisations. From our experiences, we derive some recommendations for computer-supported training in crisis communication.

TRAINING FOR CRISIS COMMUNICATION MANAGEMENT

Crisis Management and Communication

Corporate crises are caused by a constellation of many external and internal factors (Krystek, 2007). Usually the trigger for the crisis is outside, but the reason for the crisis is the (wrong) reaction of the management

(Hausschildt et al., 2005). In the case of an electric power company a break down of electricity is a trigger, but can be perceived as a crisis.

Emerging crises can be managed actively using crisis prevention, or reactively using coping strategies. Good communication plays an important role in crisis management and consists of a proactive policy (Milis and van de Walle, 2007): If the crisis has achieved an advanced stage, the threats are bigger and the latitude to act is smaller. Defined organizational structures and existing infrastructures are important elements (Jönck, 2006). Beside this, crisis management training is crucial, which has to be prepared like a script for a movie and needs a neutral observer, a logbook and an openness for criticism (Jönck, 2006). Mistakes are often made in the first few hours of a crisis, and it is possible to simulate them well. For infrastructure companies (like GEP) it is also important to have effective information management with state and civil organizations (Murphy and Flournoy, 2002). So, inter-organizational management should also be focused in trainings.

More and more aspects of operative, maintenance and coping work in technological infrastructures are supported with Information Technology. However, IT is currently used very seldom in crisis management. Milis and van de Walle (2007) examined the use of IT in 250 companies from different sectors. They found out that "the level of IT used in crisis management is predominantly related to the presence of a member in the crisis management with an IT background". Neither the size of the company, nor the importance of crisis management within this company have any impact on the use of IT.

Learning and Teaching in Crisis Management

Training situations should resemble crisis situations to reflect and improve participants' procedural knowledge. Among the learning theories, constructivist approaches in our eyes relate best to this context (Duffy and Jonassen, 1992). Socio-cultural approaches which consider learning as a collective process that is situated in a certain area are also very important (Wenger, 1998).

Strohschneider (2000) compared different approaches for crisis management training. *Stress Reduction Training* uses stress immunizations with cognitive restructuring, systematic desensitization or progressive relaxation. *Emergency Skill Training* trains the necessary manual abilities to enable people to use their skills even in stressful situations. It should take place in real processes (Keinan et al., 1990). *Crew Resource Management* reclaims crisis management competences in stressful environments. *General Crisis Management Group Training* is especially suitable for *Low-Risk-Environments*, without any danger awareness.

Möhrle and Müller (2005) suggested using the scenario technique. Here, we do not refer to the forecast of a specific situation, but design a spectrum of possible situations. To enhance perceptiveness crisis triggers are created, which are not very likely but have a big impact. One challenge is to simulate the individual psychological processes (Sniezek et al., 2002), therefore we simulate these scenarios. Scenarios are also used in the approach of Benjamins and Rothkrantz (2007), but there in a more technical, not social way.

Computer supported crisis simulations are one possibility to support scenario-based training. In Computer Supported Collaborative Learning (CSCL), simulations, micro worlds, hypermedia and gaming systems have proven to be appropriate software types in this context (Pohl, 1999). Simulation games can be realized as computer supported presence games in which all participants are at the same place at the same time, or as internet based simulation games. In this paper, the focus will be on the second approach, to enable inter-organizational communication.

Computer Based Gaming Simulation

A simulation game is a learning method that helps to gain experience without any negative impact on reality. It enables the learner to carry out actions without fear and risks he could not carry out in reality, because their analysis would be too slow, too fast, too expensive, too complex or too dangerous (Ruohomäki, 1995). A use is suitable where tasks with many factors and variables have to be trained, especially in emergency and business management (Wagner, 2005).

Simulations can be classified into simulations of natural dependencies and dynamics, and social simulations. For collaborative crisis training social simulations fit better to focus the collaboration of different actors with not always qualifiedly decisions. Quanjel et al. (1998) found that crisis management training often lacks realistic interaction, objective evaluation and structured feedback. IT can help to design a realistic learning context using existing resources, processes, networks and structures and can be used as a communication tool and to record all

actions. Recording has benefits and risks: Dron and Bhattacharya (2007) point out privacy issues and the perception of control while Kriz (2005) points out its usefulness for the debriefing.

The process of a simulation game is as follows: In the *preparation*, the reality is modelled by complexity reduction and the participants are introduced to the game. The *gaming phase* includes actions and reactions in a given framework. For the *evaluation* it is important to record the solution steps, decisions and results. Afterwards a comparison of the simulated game experience to the real world has to be made, to just adopt real action patterns, but not malfunctioning patterns, which fit into the game but not into reality (Kriz, 2005).

EMPIRICAL STUDY

Aside from the theory-led consideration above, we aimed to understand the organization and the practice of the agents by conducting an empirical study. Besides explicit requirements, we mainly wanted to explore implicit requirements, like informal information about the process of inter- and intra-organizational crisis management and training, used artefacts requirements for an integrated crisis-training tool, which are usually not formulated by the participants. The development of software for supporting collaborative work or learning requires a good (empirical) understanding of the context (Pankoke-Babatz et al., 2001). According to the *Standish Chaos Reports* the most important reason for a failure within software engineering is a lack in user orientation (Standish, 1995).

Research Field

The field research for this study took place in one of the biggest private electric power companies in Europe (we call it GEP). Experienced members on different levels form the crisis management unit, that operates along an escalation pattern that involves higher hierarchical levels and specialists (e.g. for chemical materials) as a crisis escalates (more people affected, bigger area affected, longer-lasting coping work, etc.) level. The more a crisis escalates, the more actors need to be involved (e.g. police if traffic lights fail, fire-fighters if e.g. chemical plants are affected, public administration and the public depending on the spatial and temporal scope of a crisis).

The crisis situations we concentrated on were different scenarios of a power outage, from planned maintenance-related service interruptions over unplanned local power failures (e.g. caused by construction workers) to large regional power outages in relation to extreme weather conditions (flood, heavy ice rain, etc.). A special challenge is that other infrastructures depend on the infrastructure “energy”. Mobile phones are typically available for 30 minutes, the landline phone is just available for emergency calls, internet and TV are not available at all (Sauter, 2006). Different parties (end users, companies, organizations) have different needs of information, which maybe can not be served because of missing infrastructures.

Empirical Methods

We used qualitative research methods because the criteria and questions were quite open and our aim was to understand the field. We wanted to be open to new cognitions, which could appear during the research process (Randall et al., 2007). We used a document analysis, observations and group discussions. The aim was to enable a *triangulation*, to enlarge the validity and reliability of the study (Flick, 2008).

For the document analysis, we analyzed ten documents of the electric power company about the planning, process and evaluation of the last crisis training and a protocol with observations with an average length of ten pages. Other sources were ten transcribed interviews with members of the company who were responsible for the requirements of crisis management activities. The aim was to understand crisis trainings of the company and existing problems and errors. The analysis focused on the steps preparation, processing and evaluation of crisis trainings.

We also made participatory observations (Randall, 2007) during a two-day workshop about crisis management. The workshop was about 16 hours long, and had 13 participants from infrastructure engineering and management of GEP. The aim of the workshop was the creation of an organizational structure for the crisis and the preparation of crisis training. Our observations aimed at getting a rich picture from the organizational structure, the training context, and the possibilities for interaction and administration.

The group discussions tried to summarize the statements of all group members. Many opinions about social coherence were expressed in social situations (Mayring, 2002). We had two three-hour long group discussions with three members of the company and external consultants. The aim was to create explicit requirements for a

crisis management system. Besides the explicit methods, we conducted an informal, unstructured data collection in about 25 meetings and workshops during an 18-month research project in the same context.

Existing Practice of Crisis Communication Training

When facing a crisis, the company organises a crisis management unit and an adjunct crisis management group for special tasks and assistants. The task of the crisis management group is to make strategic decisions. The adjusted crisis management group consists of members of different departments, who can consult the crisis management group. The task of the assistants is to be an interface for incoming communication and towards the actors at the operative level. Representatives of external organisations are missing, but they are involved if necessary (a list with relevant contacts is maintained). The difficulties for involving actors from other organisations are different crisis vocabularies, different organisational structures and different practices of using communication infrastructures.

Internal as well as external information sources are used. The internal sources are for example screenshots from the local net monitoring system (a highly sophisticated system to visualize the current state of the power grid, including a sensor network, data lines that operate independently, several monitoring stations including large-screen displays which can show geographic as well as grid-related information as device connection plans), different registers of internal and external contacts, different maps and files with organizational procedures. External sources include information from local fire fighting and police departments, and from larger plants that rely on power infrastructures.

The training preparation usually starts with the elaboration on a scenario. It includes different actions at different times. The results are summarized in a PowerPoint presentation. Afterwards, the planned communication ways are designed and put down in an Excel sheet. They also create a catalogue with possible questions. External organizations do not participate. During the training, the scenario is played through successively; new events are submitted via email or fax. Possible questions of external organizations are asked via telephone. The events are recorded in an Excel sheet. Problems with earlier crisis trainings were many calls, which were not part of the evaluation because they could not be logged. The company discussed the training afterwards, but a systematic evaluation did not follow.

Many activities that are actually done without IT, via PowerPoint or Excel can be supported with an integrated system. The main requirement is a system which provides an overview in a crisis. This system should create the information from other operative systems. It should not be used like an expert system but without any precognitions. It should also contain ports to systems of the police and fire brigade. To plan training it should be possible to create a script. Trainers should also able to change the roles and to define alternatives. Interaction is one main component of the system. It should be possible to communicate with all agents, participating or not. The communication should use the same infrastructures as in a real crisis. An automatic log can help to reclaim the evaluation. Trainers should evaluate reactions and insert comments, which enable them to make a better and more specific evaluation at the end. This information should also be shown with statistic tools.

A CONCEPT FOR COMPUTER SUPPORTED COLLABORATIVE TRAINING IN CRISIS COMMUNICATION

We have found both theoretical and practical requirements to collaborative training in crisis communication management. Elements like a proactive policy, a defined organizational structure, infrastructures and crisis simulations are basic requirements. The aim of the training is to achieve the necessary competences. This process should use constructivist methods and can be realized with social simulations, e.g. simulation games integrated in a crisis management system, to use existing data, information, tools and infrastructures. The training can be a combination of different training types, especially Crew Resource Management, to teach non-technical skills. Another aim is the advance of the use of crisis management systems (Emergency Skill Training) and the reduction of stress (Stress Reduction Training). IT should support group interaction, communication and the modelling, processing, logging and evaluation of the training.

One main component is the *role play* to create a collaborative awareness. It is totally adaptable and the organizational structures can be mapped dynamically. Agents can participate as themselves, or can be simulated. It is also possible to communicate with them, but it is more likely that the trainer or an actor will answer. Every agent belongs to one user group and has specific rights. To realize this part of the concept, an agent management has to be created.

To design an authentic training environment the training system has to be included into a crisis management system. This enables the user to learn how to use real systems, tools, infrastructures and data. To enable the

trainer to change some context information (like maps or news), to model the training, to make an evaluation, and to record past real situations and to use them as one component in the training a scenario management is necessary.

The collaboration with other companies and organizations is important for infrastructure companies. In synchronous and asynchronous interaction with internal and external agents the compatibility of the vocabulary and the information systems has to be checked. If all the communication is integrated in one system, the logging and therefore the evaluation is easier. To enable a trainer to play the roles of different actors, patterns for different actors, e.g. fire-fighter, press, or companies, are required.

The training administration plans the scenario and accomplishes the training. To do this, they plan scenarios, in a table and a time bar, which can afterwards be compared to the real actions. This is currently done in Excel sheets. To support this, an automatic log system and time management can help.

Much required and advisable functionality is summarized in table 1:

Module	Description
User Management	Create, change, deactivate and delete agents.
Role Management	Allocates every agent to a specific role (e.g. crisis management, assistant, team member, external).
Right Management	Arranges every agent to the hierarchy (e.g. participant, observer, trainer and administrator) or simulates a user.
Scenario Management	Creates, changes, activates and deletes scenarios for a specific time and displays them in a table and on a time bar.
Event Management	Allocates events like documents, messages and reactions to a scenario.
Message Management	Creates, prepares, sends, receives and deletes messages.
Document Media Management	Displays and administrates documents and media within categories to create a realistic context for specific target groups.
Verbal Communication	Communicates and logs the attributes of the call in the protocol.
Geographical Energy Situation	Gives an overview about current errors.
Time Management	Changes the simulation time in relation to the real time.
Protocol	Logs all communication within the system. Filters it for agents and media.

Table 1: Required functionalities.

DEVELOPMENT OF A PROTOTYPE

To demonstrate the concept we implemented a prototype. This system supports the whole spectrum of preparing, performing and analyzing. With this prototype it was possible to visualize and evaluate the concept. We realized it as web architecture to enable the users to use it from every place without having to install software as required. We used PHP and MySQL as programming languages. To use the system intuitively we chose an iconic representation which eases the finding of functions.

The implementation existed of an *actor and role management*, a *scenario management* to model actions, a *document and media management* to simulate the environment and a *message management* for the written communication. Apart from that, we implemented an automatic protocol of the whole interaction, integrated a *VoIP-System* and a system to display the *geographical energy situation*.

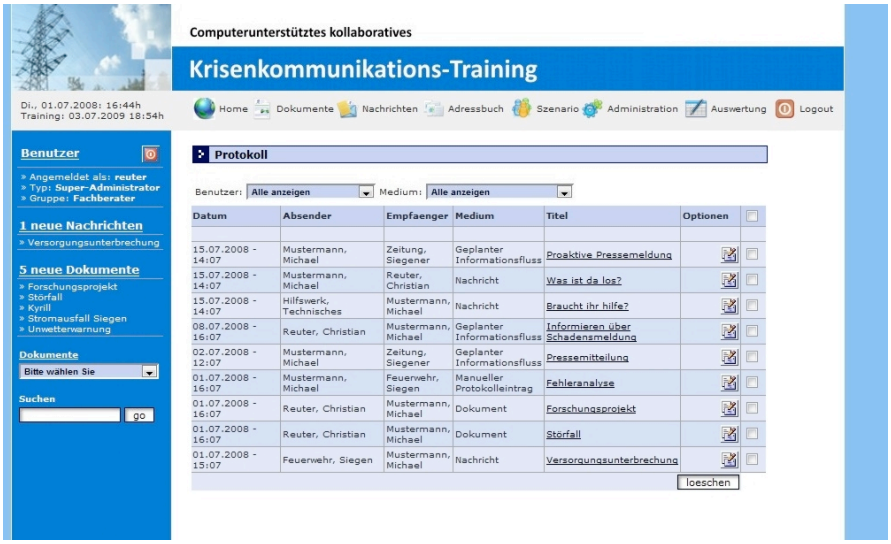

Figure 1: The user interface.

The *agent management* defines which agents are participating in the training. Messages sent to a simulated agent will be delivered to a trainer. You can always see, highlighted by colours, how many unread messages each user has which helps the trainer to judge the participants. The *scenario management* is for planning and modelling the training. Messages, documents, media and anticipated reactions can be assigned to scenarios. It is possible to prepare a volume of scenarios and trigger them, depending on the development of the situation. If one scenario is activated, the actions are carried out automatically.

The *message management* enables the participants to send electronic messages. Trainers can prepare messages and assign them to a scenario. The *verbal communication* is realized with an integrated Skype interface. The calls are automatically logged to a protocol.

The *document and media management* contains documents of all standard formats. The categories represent the ports to other systems, like geographical information, media or data from the information platform of the company. Trainers are able to create documents for a specific target group, simulated agents and to allocate them to a scenario. Current accidents like planned abandonments, local, regional or big errors can be displayed in an *integrated map module*, wherefore GoogleMaps is used.

The *communication protocol* is the basis for the evaluation of the training. The whole communication - messages, calls, documents, notes and scenarios - are logged and can be displayed as a time bar. Trainers can review the actions of the participants. Manual protocol entries can fix impressions or anticipated reactions. After the training, the protocol is visible if the communication was done as planned.

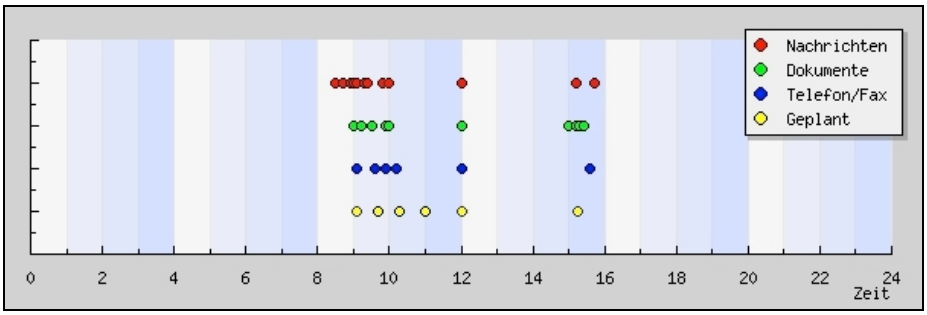

Figure 2: Communication protocol as time bar.

The following figure shows the procedure of the training.

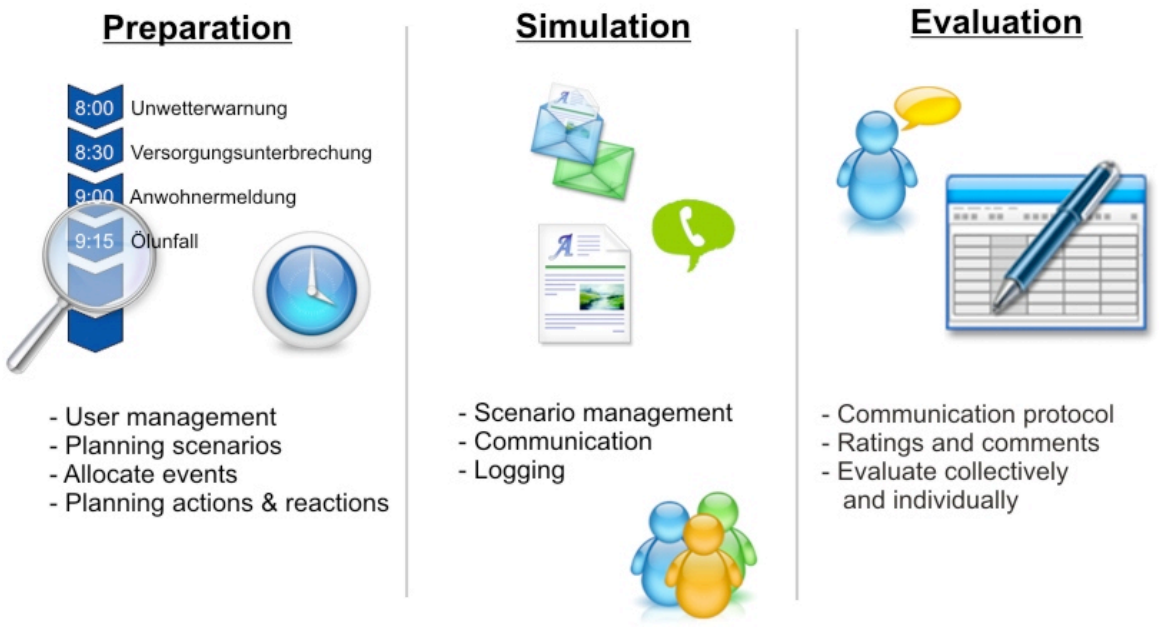

Figure 3: Procedure of Computer Supported Collaborative Training

EVALUATION

We did an implicit formative evaluation during the iterative developmental process. We used qualitative methods and integrated the results to the evolutionary process of software development (Cremers et al., 1998). Furthermore, we made a summative evaluation to analyze the system with a scenario-based walkthrough, a technique that directs the user with tasks through the system. To do this, both concept and prototype were presented to three potential users and we simulated a whole crisis communication management training in about three hours. Therefore, we created the users in the system and assigned roles to them. Then we designed scenarios with messages, documents and anticipated reactions. The execution of the training contained activating activities, to write messages, to simulate the environment with documents, calls and notes. They were all listed automatically in the protocol. During the whole evaluation the users were asked to state their impressions while interacting with the system, by thinking aloud.

The users were very satisfied and liked to prepare, process and evaluate the whole training within one system, instead of many local documents. The possibility to design the scenarios collaboratively without the explicit exchange of documents improved the awareness and the usability. The adaptability to different organizational structures and the possibility to model the environment was considered to be very important. The control about the whole scenario at every time was another important factor. Not clear was how it is recognizable how many documents and messages are allocated to a scenario: "How can I see, whether documents belong to a scenario". The possibility to open a scenario and then to see the documents was easy to understand. The automatic log and further manual protocol entries and comments can create a better basis for an evaluation. Explicit critics are not welcome within this context: „We can not implement that … we don't want critic of colleagues". This was a surprising finding because progress is not possible without critic. Another possibility could be to not criticize the colleagues directly in the system, but to criticize their role names.

Inter-organisational Aspects

The original idea and goal of our research is to develop a system that allows different organizations, who need to collaborate in the event of a crisis, to practice collaboratively the communication flows that reflect particularly situational (i.e. unforeseeable) aspects of a crisis. The training would not only improve the local processes and information flows, but could also contribute to an increased awareness of the information necessities of other organizations that are involved in crisis management. We used GEP as the nucleus of our first experiment, but aimed at a platform that would work independent of the local IT infrastructure. Nevertheless, it would be interesting to closer integrate the system for practicing crisis communication into the

GEP infrastructure management systems itself. As this claim would also apply to the systems that e.g. fire-fighters, police and other civil organisations would use the platform, it needs to provide clear interfaces to these systems. It still requires a significant effort to include also the actors of these organizations, but based on our approach to provide a distributed CSCL platform, the participation costs of each individual organisation may be lowered. The experiences within GEP also show that an inter organizational approach would require sophisticated ways of dealing with event logs and debriefing processes, as critique resulting from training is considered highly political information.

CONCLUSION

In this contribution we described the development of a collaborative crisis communication training concept and tool for an infrastructure providing company. In addition to skills and knowledge about coping and recovery work in an actual crisis, crisis managers also need to train communication skills and the management of information chains – particularly for crisis of a size that requires inter-organisational coordination. The training can be supported by simulation and role-playing games. A central element is "interaction". IT can support the communication itself and the logging of game events and reactions. Our empirical research tried to answer the question how crisis management and communication work in the context of a German electric power company and what the specific requirements and the potential of IT support are.

Crisis management training should contain collaborative communication oriented elements and scenarios to model the context in advance, but with the opportunity to decide which scenario should arise in the training. An automatic log helps to monitor and evaluate the process.

Our approach remains more general than the approach of Gomez (2008), which focuses on SMS-based communication and uses speech act theory. Our concept focuses on improving communication competencies of the actors involved as well as improving inter organisational information flows. We also do not aim at an improved 'communication efficiency' through standardization (e.g. using speech acts), as this makes most sense in repeating situations while in our considerations communication becomes particularly valuable with regard to unforeseeable, situational aspects of crisis management. This also distinguishes our approach from Benjamins and Rothkrantz (2007) who also focus on pre-modelled information in their platform for crisis simulation. Nevertheless, it would be highly interesting to include these technologies and approaches also in a system that aims at practicing and building up communication competencies. We also found that our system should be integrated into crisis management systems, to enable realistic inter- and intra-organizational communication that may even allow training participants to see what others see in the IT systems they use. Another particularity of crisis scenarios is that the availability of information and communication systems may not be given in the event of a crisis involving infrastructure providers. Crisis scenarios practice should also reflect this type of failure.

In being better prepared for crisis management, there are many directions to go. While it is important to improve the strategic preparedness of actors in crisis management e.g. using process modelling and improvement techniques, there will always be situational aspects that the actors need to respond to, and that require in-situ coordination and communication, and skills to interact appropriately with others. In further research, we will extend our system with regard to inter organisational requirements and towards a stronger integration with crisis management tools. The concept as a whole will also be evaluated for other crisis situations.

REFERENCES

Benjamins, T. and Rothkrantz, L. J. M. (2007) Interactive Simulation in Crisis Management. In *Proceedings of the 4th International Conference on Information Systems for Crisis Response and Management ISCRAM2007* (Eds, Van de Walle, B., Burghardt, P. and Nieuwenhuis, C.), 571-580.

Cremers, A. B., Kahler, H., Pfeifer, A., Stiemerling, O. and Wulf, V. (1998) PoliTeam - Kokonstruktive und evolutionäre Entwicklung einer Groupware. *Informatik-Spektrum,* **21,** 194-202.

Dron, J. and Bhattacharya, M. (2007) Lost in the web 2.0 jungle. In *7th IEEE International Conference on Advanced Learning Technologies (ICALT)*, Vol. 7 (Eds, Spector, J. M., Sampson, D. G., Kinshuk, T. O., Cerri, S. A., Ueno, M. and Kashihara, A.) IEEE Computer Society, Niigata, Japan, 895-896.

Duffy, T. M. and Jonassen, D. H. (1992) *Constructivism and the Technology of Instruction: A Conversation.* Lawrence Erlbaum Associates, Hillsdale.

Flick, U. (2008) *Triangulation: Eine Einführung.* VS Verlag für Sozialwissenschaften, Wiesbaden.

Gomez, E. A. (2008) Crisis Response Communication Management: Increasing Message Clarity with Training over Time. In *Proceedings of the 5th International Conference on Information Systems for Crisis Response and Management ISCRAM2008* (Eds, Fiedrich, F. and Van de Walle, B.), 368-375.

Hausschildt, J., Grape, C. and Schindler, M. (2005) Typologien von Unternehmenskrisen im Wandel. *Schriftenreihe aus den Instituten für Betriebswirtschaftslehre der Universität Kiel (CAU),* **588**.

Jönck, U. (2006) Krisenkommunikation. In *Krisenmanagement. Grundlagen – Strategien – Instrumente* (Eds, Hutzschenreuter, T. and Griess-Nega, T.) Gabler, Wiesbaden, 447-462.

Keinan, G., Friedland, N. and Sarig-Naor, V. (1990) Training for task-performance under stress: The effectiveness of phased training methods. *Journal of Applied Social Psychology,* **20,** 1514-1529.

Kriz, W. C. (2005) Gaming Simulation - State of the Art. In *Planspiele in der beruflichen Bildung*, Vol. 4 (Ed, Blötz, U.) Bertelsmann, Bielefeld, 247-256.

Krystek, U. (2007) *Handbuch Krisen- und Restrukturierungsmanagement. Generelle Konzepte, Spezialprobleme, Praxisberichte.* Kohlhammer.

Mayring, P. (2002) *Einführung in die Qualitative Sozialforschung.* Beltz Verlag, Weinheim und Basel.

Milis, K. and van de Walle, B. (2007) IT for Corporate Crisis Management: Findings from a Survey in 6 different Industries on Management Attention, Intention and Actual Use. In *HICSS 2007*, 24.

Möhrle, M. G. and Müller, S. (2005) Frühzeitige Krisenwahrnehmung durch Szenarien und anknüpfende Methoden. In *Management von Ad-hoc-Krisen: Grundlagen- Strategien- Erfolgsfaktoren* (Eds, Burmann, C., Freiling, J. and Hülsmann, M.) Gabler Verlag.

Murphy Jr., W. S. and Flournoy, M. A. (2002) Weapon and communication systems: simulating crisis communications. In *Winter Simulation Conference 2002*, 954-959

Pankoke-Babatz, U., Prinz, W., Wulf, V. and Rohde, M. (2001) Spezifika des CSCW-Designs. In *CSCW-Kompendium. Lehr- und Handbuch zum computerunterstützten kooperativen Arbeiten*(Eds, Schwabe, G., Streitz, N. and Unland, R.) Springer, Berlin, 373-393.

Pohl, C. (1999) *Methodik und Realisation von Systemen zur effizienten Wissensvermittlung durch Hypermedia.* Peter Lang Verlag, Frankfurt am Main.

Prenzel, M. and Mandl, H. (1993) Transfer of Learning from a Constructivist Perspective. In *Designing Environments for Constructive Learning* (Eds, Duffy, T. M., Lowyck, J. and Jonassen, D. H.) Springer, Berlin, Heidelberg, 315-329.

Quanjel, M. M. H., Willems, A. J. and Talen, A. N. (1998) CRISISLAB: Evaluation and Improvement of Crisis Management Through Simulation/Gaming. *Simulation Gaming,* **29,** 450-455.

Randall, D. W., Harper, R. H. R. and Rouncefield, M. (2007) *Fieldwork for Design: Theory and Practice.* Springer, London.

Ruohomäki, V. (1995) Viewpoints on Learning and Education with Simulation Games. In *Simulation Games and Learning in Production Management* (Ed, Riis, J. O.) London.

Sauter, M. (2006) *Grundkurs Mobile Kommunikationssysteme: Von UMTS und HSDPA, GSM und GPRS zu Wireless LAN und Bluetooth Piconetzen.* Vieweg+Teubner.

Sniezek, J. A., Wilkins, D. C., Wadlington, P. L. and Baumann, M. R. (2002) Training for Crisis Decision-Making: Psychological Issues and Computer-Based Solutions. *Journal of Management Information Systems archive,* **18,** 147-168.

Standish Group (1995). The Standish Group Report. http://www.educause.edu/ir/library/pdf/NCP08083B.pdf.

Strohschneider, S. (2000) *Handeln in Krisensituationen - Anforderungen, Fehler, Trainingsansätze.* Institut für Theoretische Psychologie. Otto-Friedrich-Universität Bamberg, Bamberg.

Wagner, I. (2005) *Einsatz und Evaluation eines nutzergerechten Autorensystems für webbasierte Planspiele.* Kassel University Press, Kassel.

Wenger, E. (1998) *Communities of Practice: Learning, Meaning, and Identity.* Cambridge University Press., Cambridge.