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Anticipatory Modeling and Simulation for Inter Regional Security

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Abstract: The idea of anticipatory modeling and simulation with subsequent learning from the outcomes is here applied on inter-regional security work. In this setting, multi-actors have to both cooperate and make coordinated decisions with just partial information about each other. With help of netAgora, a net based environment for simulation, learning, and communication, the goal of training, preparedness and continuous improvement of decisions is met.

Keywords: Inter-Regional Security; Anticipatory Modeling and Simulation; Multi Layered Delayed Systems; Learning; Decision Making

1 Introduction[1]

As manifested in the European FP7 research program[2], Security has lately become a main issue in European Research and Technical Development (RTD). Work on modeling and simulation in order to develop better preparation and training tools for handling of crisis and complex emergencies is one of the topics that, within this broad RTD area, has been pointed out as highly urgent[3].

Inter-regional cooperation is another main issue of European concern[4]. In this context the Cross-border program within the European Territorial Cooperation Objective[5] has as its prime goal to foster cross-border transnational and inter-regional cooperation.

So, by merging those two interests, security in cross-border regions emerges as an urgent research area from at least two European perspectives. The attractiveness, and so the potential for positive economic development, of such regions will increase as a result of better cross-border communication, cooperation, and coordination in security matters.

Focusing down on modeling and simulation, an anticipatory approach has already been demonstrated as a promising approach for handling complex spatial systems with delays (Asproth et al, 2001; Dubois and Holmberg, 2008; Holmberg, 1998). Those approaches, however, still have to be adapted to the EU context of security and cross-border preparation and training.

The purpose of this paper will hence be to increase the potential for applying anticipatory modeling and simulation for better preparation and training tools in successful cross-border inter-regional security work.

The solution put forward here applies systems thinking and a multi modal design methodology (Asproth et al, 2006) in order to solve a practical operational problem. This approach will integrate research insights from both social and engineering (technological) sciences and result in an integrated crisis simulation and training environment – the netAgora tool – for multiactor coordination and decision support.

GSS/netAgora, a cross-border project between Sweden and Norway, at last, will serve both as data source and test bed for verification of results.

2 The Inter-Regional Security Conditions

We start the discussion by introducing the Territorial Concern (TC) as a mental framework for handling inter-regional security. Within that framework security problems and challenges are finally identified.

2.1 The Inter-Regional Territorial Concern

Holmberg (1994; 1998) has proposed The Territorial Concern (TC) as a driving vehicle for handling spatial issues. With some modifications it is here proposed as a base concept also for discussing regional and inter-regional security. A TC, as outlined in figure 1, being a

1 This research is partly founded by the EU Interreg Sverige-Norge IIIA project GSS

2 http://cordis.europa.eu/fp7/dc/index.cfm (2010-10-03)

3 Call identifier: FP7-SEC-2009-1, Date of publication: 3 September 2008

4 http://www.interreg-sverige-norge.com/UserFiles/File/Interreg/Intran%C3%A4t/Programbroschyrer%20Sv-Eng/Interregbroschyr_eng_080917.pdf (2010-10-05)

5 http://ec.europa.eu/regional_policy/sources/docoffic/official/regulation/content/en/02_pdf/00_7_i3_en.pdf (2010-10-05)

community based organisation for the design, construction, and maintenance of order and security within a geographical territory or region (a space). As soon as a critical security variable goes outside of its predetermined limits (an accident) or is threatening to do so (a crisis), the TC activates means to return it to its normal value. In that respect the TC is a homeostatic system, with the responsibility (the concern) to establish and maintain a satisfactory configuration of system components and processes and to keep a set of essential variables within critical levels.

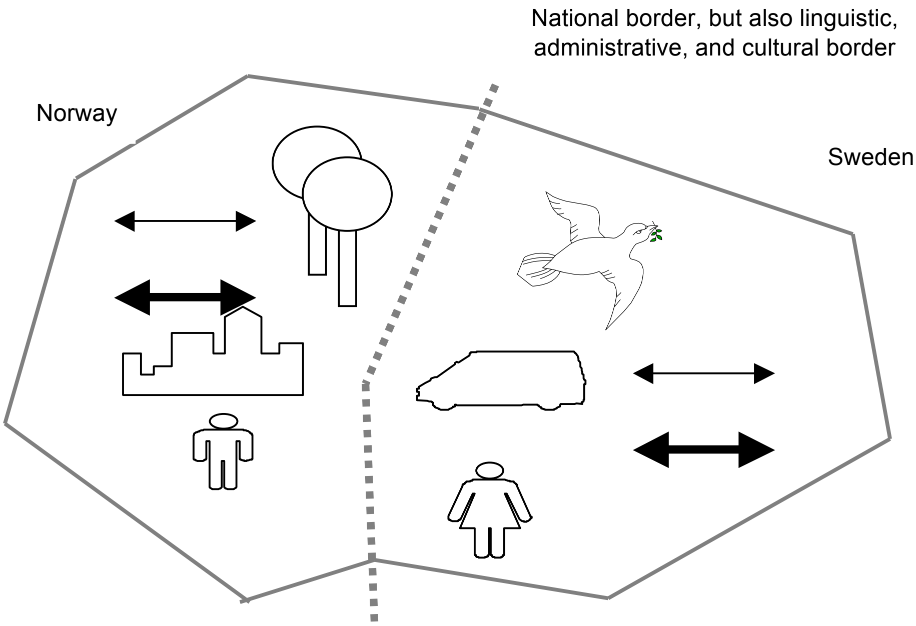

Figure 1. An inter-regional territorial concern (TC) with flows, processes, and living and non-living inhabitants.

2.2 Problems in Inter-Regional Risk and Security Work

As seen in figure 1 however, the inter-regional security work is complicated by the national border cutting the TC into two parts. That border with its administrative and organisational consequences can be identified as a main challenge to the whole TC concept. The following factors are consequently jeopardizing an effective security work in the inter-regional TC:

Different laws, rules and routines for rescue and security work.

The way emergency and rescue work is organized and how responsibility is distributed between organizations differ a lot between countries. That has also an affect on how rules and routines for rescue and security work are formulated.

Differences in organization and distribution of responsibility.

As an example can be mentioned that in Sweden there are only one telephone number to call in emergency situations, but in Norway there are different numbers for police, ambulance and fire brigade. In Norway the police is always leading the work in an emergency situation, while in Sweden who take the leadership depends on type of situation.

Another consequence of this, decisions are made and information is distributed in two separated organisations. Decisions are just partly coordinated and there is just a partly shared picture or understanding of the current situation. All people in this two-headed multi-actor environment do not know each other well and communication channels may be narrow and disturbed.

Differences in resources, for example access to digital maps over the border.

There are differences in how digital maps are available for the organizations involved in rescue work. In Norway all organizations have accessibility to digital maps, while in Sweden each organization has to pay for the access. There is no exchange between the countries when it comes to digital maps.

Differences in education and competence

As the responsibility for rescue and security work is distributed in different ways in the two countries, the competence also is distributed in different ways. It may also vary in what competence is needed for different professions.

Differences in language and culture that can be aggravating circumstances.

The two languages are similar, but there are certain differences, so it may be hard to understand sometimes. Even worse is that the meaning of words and phrases can be different and thereby it is a risk for misunderstanding. Culture may be a greater problem as the two administrative systems involved have different roots and traditions.

Specific problems for the border area at hand in the GSS/netAgora project are:

- Long distances and low density of population.

The border area is very far from any city and just sparsely populated. Rescue services like ambulances and fire brigades, even police service are located relatively far from the area.

- Relatively small resources for rescue and security work.

The resources for rescue and security work emanate from the local communities and as there are few residents in these communities, the resources are also very limited.

- At times many visitors (tourists) that cannot be expected to understand the local languages.

The mountain area between Norway and Sweden is in wintertime visited by thousands of tourists coming from other countries than Sweden and Norway. This will complicate the important communication to the public in an emergence situation.

2.3 Challenges to Inter-Regional Security

A primary challenge will of course be to solve, or at least relieve, the problems listed above. The number and complexity of those, however, are great. It will hence not be possible to solve or remove all of them in a first step but the ambition will be to at least substantially increase the ability to manage them already within the GSS/netAgora project.

On a deeper level, however, there are two more essential challenges. First, while current practical security work is mainly focusing on rescue applying a reactive paradigm we will strive for a shift toward an anticipatory approach. Building on earlier more general works by Dubois and Holmberg (2006, 2008) anticipatory modelling and simulation will here be applied as a tool for the management of TC security. A solid argument for this approach is Ackoff 's (1981) statement that “The future is largely subject to creation”, and “the future depends at least as much on what we and others like us do between now and then as it does on what happened until now”. By this we deduce that it is necessary to develop a model (design) of the desired future and to take measures (actions) in order do attain that desired future, i.e. the design target. In terms of anticipation, this is exactly the same as prescriptive anticipation (PA) according to Holmberg (2002). Anticipation, with other words, is here interpreted according to the etymology of the word, which implies doing or acting in advance.

The second fundamental challenge has to do with the complexity and all inclusiveness of the TC. As the TC includes everything within its borders, TC security will not only be a question of human beings. It will also be a question of biological diversity, environmental protection, and resource and energy management. Here we have to do not only with national borders but also with administrative and organizational ones.

Hence, coming to planning and decision making for TC security and crisis management a multi layered system will emerge. First, on the lowest operational level there are direct rescue work aiming at the re establishment of a threatened or disturbed order. On the next tactical level we find maintenance and training actions with the purpose of keep security equipment and procedures in a good state. On the highest strategic level, at last, there are measures and actions for creating and building an as secure environment as possible. An environment there ideally crisis and accidents never will happen. The security management within a TC, however, is heavily complicated by delays and interdependencies between levels. This means that an action on one level will have an impact on the others, but first after some delay.

3 Relevant Research and Steps Beyond

In dealing with a complex issue like TC security nearly every research result will be of potential interest. In this short overview, however, we will focus on just a few main points from the problem identification done above in subsection 2.2.

Simulation and scenarios are found to promote organizational learning and research in security related areas (Burt & Chermack, 2008; Kljajić et al., 2007; Ekker & Eidsmo, 2006). Multi disciplinary based knowledge is, however, critical for accomplishing simulation models and scenarios as usable realistic tools for decision making and intervention in emergence situations. Santos and Aguirre (2004: 44) writes: "…research and theory in the social sciences can have an important effect in grounding the models in realistic assumptions regarding social behaviour in crisis situations, and such modelling in turn could enrich our understanding of collective behaviour in crisis situations". As modeling and simulation will be a central part of our approach a move from prevalent mono disciplinary to multi disciplinary approaches seems to be the big challenge on this point.

Today emergency training and simulation tools assume that involved organizations and individuals have the same image, or view, of the emergency site/situation, although empirical evidence indicate differently (Alvinius et al., 2007; Danielsson et al., 2007; Asproth et al., 2009). Different organizations, as well as individuals within organizations, understand the situation differently depending on their task, position, information, knowledge, organizational culture and preparedness for action. The concept of sense making has proved to be useful for understanding this phenomenon (Weick, 1998; 2005). It can be understood as a process of placing stimuli or phenomena into context or a framework (e.g. organizational culture). Even earlier research of crisis management and organizational learning (e.g. Asproth, 2007; Asproth & Håkansson, 2007; Asproth & Nyström, 2008) is of interest for building trust between organizations. Hence the inter-regional setting seems to be an excellent milieu for bringing those earlier results one-step further.

Published research further indicates that the final result of a disaster is highly dependent on early preparations and training made before the crisis outbreak (Sundelius et al., 2001, Asproth et al., 2010). Boin and 't Hart (2007) here argue that earlier crisis offers a good learning source for feasible planning and preparations for future ones. However, the capability of organizations to adjust to new conditions and policies is limited, and some researchers even claim that collective learning is not possible in complex organizations (Perrow, 1999). Despite those somewhat contradictory results, Asproth et al. (2010) claim that training for emergency situations and an early warning mechanism would make people better prepared and fit to handle emerging crisis. Similar opinions are also expressed by Borglund and Öberg (2010), who for inter-regional security propose a continuous iterative loop consisting of training and practice in order to minimize uncertainty.

Rinaldi (2004) claims that the "national security, economic prosperity, and national well-being are dependent upon a set of highly interdependent critical infrastructures." It is, according to Rinaldi (2004) important to understand the properties and behavior of such infrastructures, particularly when there are threats of different kinds. Modeling and Simulation can bring insights to meet such threats. And there are today a wide range of such models and simulation approached developed. The challenge for the current GSS/netAgora project, hence, seems to be to make a good choice among this broad range of approaches.

Jain & McLean (2003) proposed a framework for integration of modeling, simulation, and visualization tools for emergency response for improve the capability in an emergency response area. They claim that simulation have to be integrated to provide a holistic view to planners, trainers, and responder. The need for a holistic view, to take in the whole situation and have a common picture is also considered in the research conducted by Asproth et al. (2006). Those insights will be overtaken and as far as possible refined in GSS/netAgora.

At last, Thelwall and Stuart (2007) have in their research compared communication technologies within and across crises. According to them, web 2.0 and wiki has an important role in information provision in emergency situations. Even White et al. (2008) present wiki as an important tool for decision making in a crisis situation. In yet another project an international wiki for academics and practitioners has been created for emergency situations[6]. Also the National Research Council (2007) claims that e.g. wikis can provide opportunities for communication in disaster management.

In summary, even if many important insights have been gained several of the quoted results are, at least apparently, contradictory and a great part of them has not yet been field-tested and verified in practical disaster work. With that said, the development in GSS/ netAgora will build on the following conclusions we have drawn from inspected current research insights:

- Final result of a disaster is highly due to preparations and training. Anticipatory modeling and simulation will play an important role in that preparation.
- Many types of actors with different skills and cultures will be involved during rescue and recovery. It is of paramount importance that they have a common understanding of the situation and that they are informed about the decisions of the other actors.
- Communication and Coordination will be more important than Command and Control
- Social media may play an important role in providing a virtual meeting room and a means for coordination of actions.
- The information to the public of different nationalities will be a special challenge.

A last observation of a more epistemological nature may be that most of the cited researchers apply a mono methodological approach, each pricing their specific research approach.

Despite that, the GSS/netAgora endeavor will stick to a systems-based multi methodology.

[6] The emergenciWiki.org project

4 Modeling and Simulation in the Security Learning Loop

Modeling and simulation is here conceived as a driving vehicle in an ongoing learning process toward improved decision making in a multi-actor and inter-regional security context. Our modeling and simulation approach is further based on a constructivist epistemology influenced by von Glasersfeld (1998) and von Foerster (2003).

So, even if our positivistic upbringing may shine through in some details. Hence our Learning Loop Model (LLM) contains three objects and five processes as depicted in figure 2. The objects are:

- the observed phenomenon or the system in focus. In the actual case this is the Territorial Concern (TC) seen from a security perspective.
- the observers / actors, each with a personal informal mental model in their minds. Those models represent at each moment the persons current incomplete knowledge and understanding of the observed phenomenon.
- an explicit formal simulation model of the actors' current common consensus understanding of the observed phenomenon.

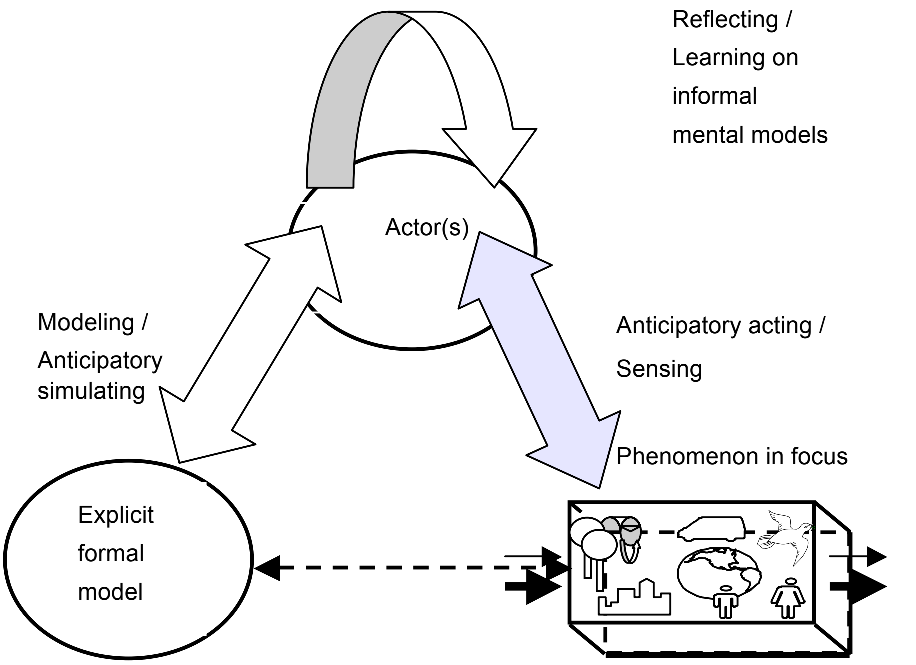

Figure 2. Modeling and simulation as an ongoing learning process.

The five processes are:

- reflecting and learning from observations on the phenomenon (system in focus) and / or the explicit simulation model. Decision making based on understanding and goals.
- sensing data from observing the phenomenon.
- acting on the phenomenon according to taken decisions.
- modeling acts on the explicit model due to new insights and maturing understanding. Setting of simulation parameters and performing simulations.
- sensing data from observing simulations.

All this will result in several positive effects. First, the explicit model will constitute one common and accepted understanding among all the actors. As a main result, this will lead to better coordination in the multiactor setting.

Further, even if the actors / observers always in their minds will have somewhat different and even incomplete and erroneous understandings of the phenomena in focus, that understanding will continuously improve thanks to the explicit formal model and its modeling and simulation acts.

5 Anticipatory Model for Inter Regional Security

Dubois and Holmberg (2006) have presented a multi-level simulation model with anticipation and delay. Though originally envisaged for a management application, the model can easily be adapted to the case of inter regional security handling.

So, according to figure 3 at the current time (t) we have direct actions of rescue (R) on the operational level, preparation, training, maintenance and security planning (P) on the tactical one, and vision (V) of new secure environments and milieus on the strategic one.

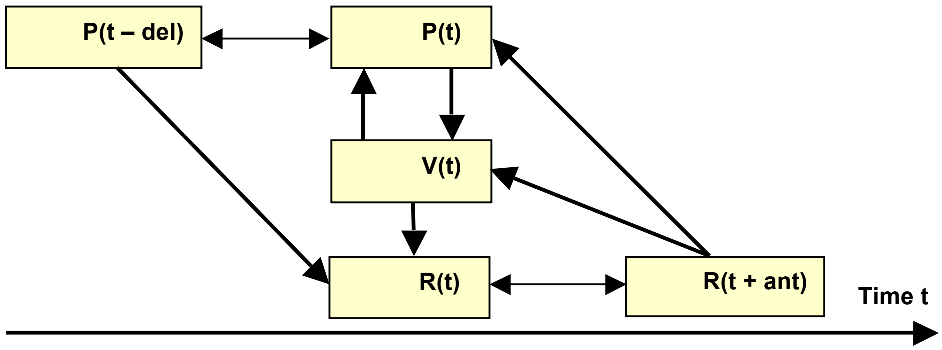

Figure 3. A multi level security system with temporal delay (t – del) and anticipation (t + ant).

Further, as the arrows in figure 3 indicate, the operational, tactical, and strategic actions are mutually interdependent. Energy and resources allocated on one level will be taken from the other two. One crucial security decision will hence be to find a good balance between the three levels. A simulation tool has here the potential of supporting that decision.

The situation, however, is complicated by delays. This, for example, means that an action (P) on the tactical level will not impact the operational one directly but after a certain time delay (del). Hence, the rescue (R) job you have to undertake at time (t) is to a certain degree predetermined by the planning (P) undertaken at time (t – del).

Due to the delay, it is not appropriate to look at current rescue work (R) on the operational level when visualizing (V) new secure environments and making planning (P). That because the current operational situation (R) may never be impacted by current security increasing activities (V) on the strategic level.

Instead it is necessary to look at the target security situation that is wanted at the time anticipation (ant). The actions of rescue (R) at the anticipated time (t + ant), will have their effects on the vision and tactical levels. That means that a future security situation is anticipated by current security actions on the strategic level. Even this decision may be supported by the simulation tool we are aiming at.

Following the approach of Dubois and Holmberg (2006) the graphical model in figure 3 can, for example, be developed into the following set of differential difference equations, as a toy system:

$$dR(t)/dt = [\ c.P(t - del) + e.V(t) - d\ ].R(t) \quad (1a)$$

$$dP(t)/dt = [\ f + b.V(t) - c.R(t + ant)\ ].P(t) \quad (1b)$$

$$dV(t)/dt = [\ a - b.P(t) - e.R(t + ant)\ ].V(t) \quad (1c)$$

In eqs. 1abc, (t) stands for the continuous time, ($del \geq 0$) is a delay time and ($ant \geq 0$) is an anticipation time, and ($a \geq 0$, $b \geq 0$, $c \geq 0$, $d \geq 0$, $e \geq 0$, $f \geq 0$) are control parameters.

In real systems, delays can be reduced but never suppressed, and delays are responsible of instabilities in systems, and the sole issue is to use anticipation for stabilizing such delayed systems. This toy system is based on strong anticipation. Indeed a weak anticipatory system deals with an anticipation that is based on an external model of the system, while in a strong anticipatory system the anticipation is embedded in the system and is based on the system itself (Dubois, 2003). On this point, Dubois (2004) has already demonstrated the strength of anticipatory computing in the Kaldor-Kalecki model of business cycle. The computer simulation of such a toy system given by the differential difference equations 1abc can be performed. An introduction to computing anticipatory systems based on such differential difference equations with delay and anticipation is given in Dubois (2002).

So, the role of anticipation time (ant) is crucial because longer delays, P(t – del), for the planning, tend to increase the instability of the system, with greater fluctuations as a consequence, and longer anticipations, R(t + ant), for the rescue, though, may help to counteract those negative effects in increasing the stability of the system. This may be proven analytically on a simplified set of differential equations, as shown in Dubois and Holmberg (2006).

Indeed, let us consider that vision is omitted (V = 0), so eqs. 1abc become

$$dR(t)/dt = [\ c.P(t - del) - d\ ].R(t) \quad (2a)$$

$$dP(t)/dt = [\ f - c.R(t + ant)\ ].P(t) \quad (2b)$$

The stationary states are given by

$$[\ c.P0 - d\ ].R0 = 0$$

$$[\ f - c.R0\ ].P0 = 0$$

for which the nontrivial stationary states are

$$P0 = d/c$$

$$R0 = f/c.$$

In introducing the reduced variables, r(t) and p(t), from the stationary states

$$R(t) = R0 + r(t) = (f/c) + r(t)$$

$$P(t) = P0 + p(t) = (d/c) + p(t)$$

in eqs. 2ab we obtain, in taking only the linear terms,

$$dr(t)/dt = [\ d + c.p(t - del) - d\ ].[\ (f/c) + r(t)\ ] = f.p(t - del) \quad (3a)$$

$$dp(t)/dt = [\ f - f - c.r(t + ant)\ ].[\ (d/c) + p(t)\ ] = - d.r(t + ant) \quad (3b)$$

In taking the first order Taylor development of the delayed p(t − del) and the anticipated r(t + ant) functions as

$$p(t - del) = p(t) - del.dp(t)/dt$$

$$r(t + ant) = r(t) + ant.dr(t)/dt$$

these functions are transformed to current time functions, so eqs. 3ab become

$$dr(t)/dt = f.p(t) - f.del.dp(t)/dt \quad (4a)$$

$$dp(t)/dt = - d.r(t) - d.ant.dr(t)/dt \quad (4b)$$

The effects of the delay and anticipation on these functions can be more precise in taking the second order Taylor development as shown in Dubois and Holmberg (2006).

But for the purpose of our demonstration, the first order gives similar effects of the delay and anticipation on the stability.

Now, let us introduce eq. 4b and its derivative into the derivative of the first eq. 4a

$$d[dr(t)/dt]/dt = - f.d.r(t) - f.d.ant.dr(t)/dt + f.d.del.[\ dr(t)/dt + ant.d[dr(t)/dt]/dt\ ]$$

After regrouping the terms, one obtains

$$d[dr(t)/dt]/dt + \{f.d.[ant-del]/[1-f.d.del.ant]\}.dr(t)/dt = - \{f.d/[1-f.d.del.ant]\}.r(t) \quad (5)$$

This is a harmonic oscillator whose amplitudes increase or decrease depending on the values of the delay (del) and anticipation (ant) factors.

The frequency ω of the oscillations is given by

$$\omega = \sqrt{\{ f.d/[\ 1 - f.d.del.ant\ ] \}}$$

with the condition

$$f.d.del.ant < 1$$

which limits the values of the delay and anticipation factors. The frequency increases with the delay and the anticipation factors, so the period of oscillations decreases.

On one hand, when the delay and the anticipation factors are equal, del = ant, eq. 5 becomes

$$d[dr(t)/dt]/dt = - \{ f.d/[\ 1 - f.d.del.ant\ ] \}.r(t) \quad (5a)$$

the solution of which is an harmonic oscillator, so the value of the rescue r(t) around its stationary state R0, and the rescue R(t) are given by

$$r(t) = A.\sin(\omega.t+ \varphi) \quad (6a)$$

$$R(t) = R0 + r(t) = (f/c) + A.\sin(\omega.t+ \varphi) \quad (6b)$$

where the amplitude A and the phase φ are defined by the initial conditions at the initial time t = 0. This case corresponds to an orbital stability, which is at the border between a stable solution and an unstable solution. Let us remark that without delay and anticipation factors, del = ant = 0, the solution is also given by an oscillatory system given by the equations 6ab, with a frequency equal to $\omega = \sqrt{\{ f.d \}}$. For a rescue system, an orbital stability is not really a good solution, because any perturbations will drive the rescue system out of control. So the sole issue consists in reducing delay and increasing anticipation.

On the other hand, when the delay and the anticipation factors are not equal, there are two cases, an unstable system and a stable system.

Firstly, when the anticipation factor is smaller than the delay factor, ant < del, the rescue R(t) oscillates with an increasing amplitude and is thus unstable. For a system with a delay factor and without anticipation, ant = 0, the rescue R(t) is also unstable, in oscillating with an increasing amplitude for $del < 2/\sqrt{\{ f.d \}}$ with the frequency $\omega = \sqrt{\{ f.d \}}$.

Secondly, when the anticipation factor is greater than the delay factor, ant > del, the rescue oscillates with a decreasing amplitude to reach the stationary state R(t) = R0 = f/c. For a system with an anticipation factor without delay, del = 0, the rescue is also stable, and the solution is given by an oscillator with a decreasing amplitude for $ant < 2/\sqrt{\{ f.d \}}$ with the frequency $\omega = \sqrt{\{ f.d \}}$.

Further, the qualitative behaviour of an inter-regional TC security system may be simulated in a computer model. Indeed the toy system given by the differential equations 1abc can be simulated after having transformed these differential equations to discrete difference equations, as a computing anticipatory system.

By making associations between the control variables and concrete security decisions it will be possible for responsible security actors to transform their decisions into simulation parameters and to simulate the outcome of their decisions in the simulation model.

Hence the simulation model becomes a learning tool. This is a tool both for improving the model itself and for making better decisions and actions in the real TC.

6 Designing the netAgora Security Environment

In trying both to take care of current research insights and meet the challenges in practicing rescue and security work we will develop the netAgora environment. Hence, within the project a computer and net based integrated environment for mutual preparation and training for disasters and complex emergency situations will be developed. The netAgora environment will be all comprehensive with a disaster simulator, a scenario editor, and an assessment kit included in its core. It will support cooperation, coordination, training, preparation, and learning on individual, group, and organisational levels. The netAgora will further include support for an exchange of experiences, tools, and models of response to emergence situations within and between the countries involved including the handling the cultural differences that may impede the emergence response.

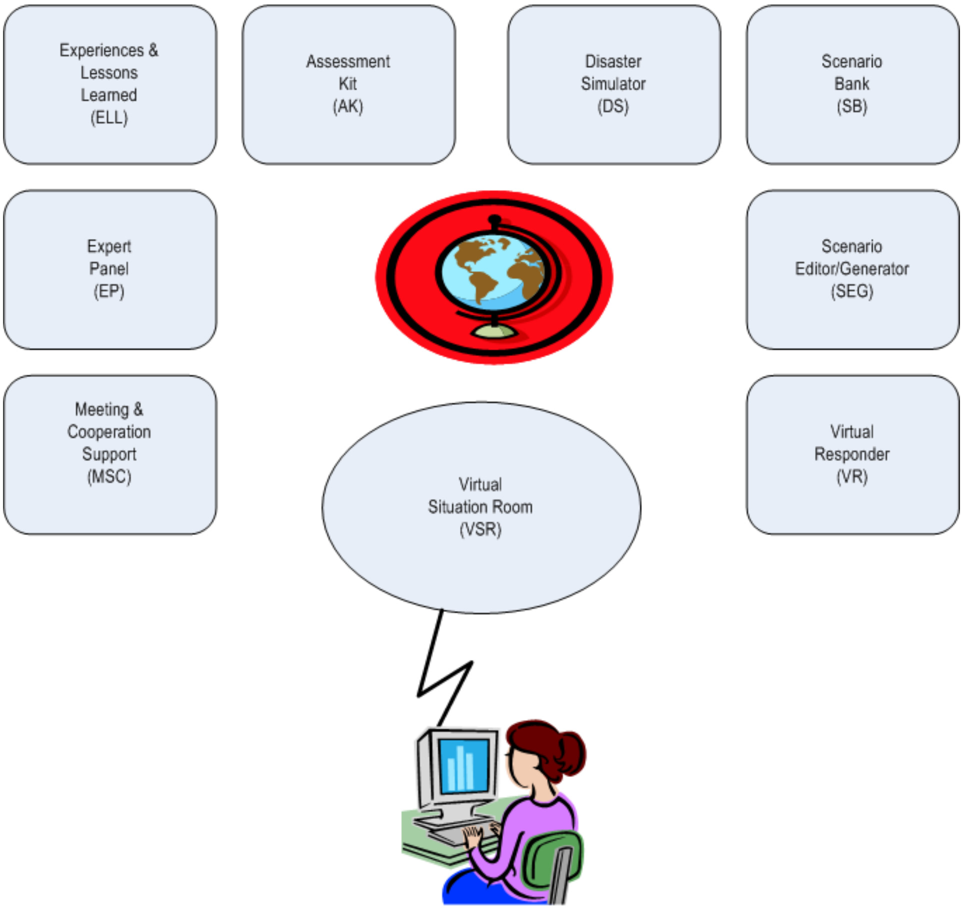

Figure 4: The netAgora communication, learning, and simulation environment.

Main components in netAgora are shown in figure 4. The Virtual Situation Room (VSR) is the interaction surface toward the user. Through this surface (GUI) the user has access to all the other resources of netAgora. VSR may be freely adopted to meet the specific requirements of different user categories. There is no theoretical limit to the number of users that may simultaneously be connected to netAgora.

The Virtual Responder (VR) is a system component, which simulate the behaviour of other responders. From the point of view of the player there is no difference between a virtual actor and a real actor. This means that in netAgora there are always several actors, real or virtual ones, which you as user have to coordinate and communicate with. The one person in figure 4 represents any number of real responders who can interact via the netAgora system.

The Disaster Simulator (DS) is the core of netAgora. DS can calculate (simulate) the dynamic evolution of a set of crucial disaster variables and react on different user decisions and actions. The ability to handle geographical or spatial information (GIS) is a crucial faculty of the Disaster simulator. The user can select a scenario, i.e. disaster, from the Scenario Bank (SB) or set up a new one, or change an existing one, with help of the Scenario Editor/Generator (SEG). The Assessment Kit (AK) helps the user to evaluate the decisions and actions taken during the playing of a scenario.

Experiences and Lessons Learned (ELL), at last, is a knowledge bank with tested and verified disaster and crisis knowledge. Via the Meeting and Cooperation Support (MSC) the user can interact and discuss with other disaster responders and via the Expert Panel (EP) she or he can put disaster related questions to a group of disaster experts and disaster researchers.

In short, the main objective of netAgora Environment is to provide, in one place, all the necessary resources and functions for best possible preparation, training, and learning in relation to crisis and complex emergency situations in a regional context.

7 Steps of Verification and Refinement

The plan of the verification and refinement of the anticipation and simulation model is based on two main activities namely scenarios and table top exercises. Three table top exercises will be performed during the project and the scenarios will be based on the same story but the complexity will increase for each exercise. This means that the first exercise will be a rather simple emergency situation meanwhile the third exercise will involve more actors and bring larger consequences.

To be able to create the scenarios data from previous disasters will be collected and will involve representatives from inter-regional organizations and actors. Differences between the organization and structure of rescue work between the two countries will be taken into consideration. The focus in the scenarios will be put in involved actors, decision making, cooperation and management communication.

The scenario will then be tested in the table top exercise where concerned security officers will lead and cooperate in order to reach their mission this will be made from their regular working offices and with their regular resources. The exercises will be evaluated both in a qualitative and a quantitative manner during and after the exercises. The aim with the evaluation is two folded. First of all it is a possibility for all participators to reflect and learn from the exercise and second it is an important feedback to the group that will design the next scenario. The qualitative evaluation will be performed by evaluation of the simulation process. The quantitative evaluation of communication patterns and learning outcomes will be performed with surveys. The surveys will be used to both capture the state before the simulation and after the simulation.

As described three exercises will be performed during the project. The general process follows figure 2 where modeling and simulation is described as an ongoing learning process. The model should in this sense be understood as a simulation tool.

8 Conclusions

In this paper we have identified and penetrated the area of inter-regional security. Further, we have proposed a coherent set of concepts, methods, and measures in order to ameliorate the current situation. In so doing it has been possible to draw the following preliminary conclusions:

- Inter-regional security is not just rescue work. Preparations and training, as well as strategic measures, have a great impact on the total security level in the TC in focus.
- Anticipation is important in order to counteract the negative effects of delays in this type of multi layered and multi actor complex systems.
- The realism and truthfulness of the model, however, will be of crucial importance in order to get it accepted by the regional security decision makers. Hence, great effort has to be put into the work of capturing scenarios and events from the real world and incorporating them into the simulation tool.
- From our critical review of current research results it has further become evident that preparation and training are the most crucial parts in any system for crisis and disasters management.
- The netAgora design will meet most inter-regional amd multi actor needs for an integrated learning, training, preparation, coordination and communication environment.
- The realism and truthfulness of netAgora, however, will be of crucial importance. Hence, great effort has to be put into the work of capturing scenarios and events from the real world and incorporating them into the netAgora tool.
- It has also become evident that disaster situations will change all the time. New threats will emerge and at the same time inter-regional differences between different nations will remain. Hence, a system for feedback and continuous learning will also be a most important part of the netAgora environment.
- In using Internet and the web as a main vehicle for netAgora many practical problems have been solved automatically and the training tool will be available for everyone who needs it, all over Europe.
- The combination of technical and social research competence in the project team has turned out as being of paramount importance.

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