EMCSR: pp-pp, year
ISSN xxxx-xxxx
http://conference.emcsr.net

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, multiactors 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. Extended Abstract

As manifested in the European FP7 research program, 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 .

Inter regional cooperation is another main issue of European concern. In this context the Cross-border program within the European Territorial Cooperation Objective 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.

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 1 at the current time (t) we have direct rescue actions (r) on the operational level, preparation, training, and maintenance (p) on the tactical one, and creation (c) of new secure environments and milieus on the strategic one. Further, as the arrows in figure y 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.

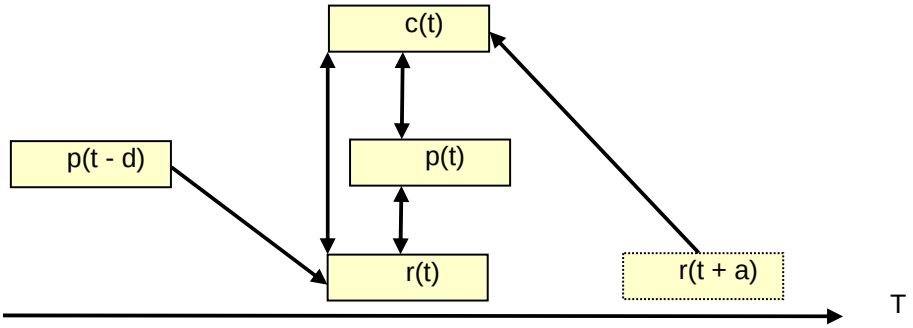

Figure 1: A multi level security system with anticipation and delay.

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

At last, due to delays it is not appropriate to look at current rescue work (r) on the operational level when creating (c) new secure environments. That because the current operational situation (r) may never be impacted by current security increasing activities (c) on the strategic level. Instead it is necessary to look at the target security situation that is wanted at the time (t + a) the actions will have their effects on the tactical level. 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.

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.

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.

Main components in netAgora are given as follows. 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 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.

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

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Daniel M. Dubois is Professor, Applied Informatics and Artificial Intelligence, at the HEC – Management School of the University of Liege, Belgium. He holds a Physicist Engineer degree and an Applied Sciences Doctorate at the University of Liege, Belgium. He is the Founder, in 1996, and Director of the non-profit association CHAOS : Centre for Hyperincursion and Anticipation in Ordered Systems, Institute of Mathematics of the University of Liege. ASBL CHAOS is a member of the IFSR, International Federation for Systems Research. Daniel Dubois is editor of CASYS : International Journal of Computing Anticipatory Systems, ISSN 1373-5411. Daniel Dubois received the insignia of Doctor Honoris Causa, in 1999, at the University of Petrosany in Romania.

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Stig C Holmberg is a professor emeritus at Mid Sweden University. He holds a master and doctor degree from the Royal Institute of Technology in Stockholm. His main research interests include modeling and design methods and applications of fuzzy, anticipatory, and spatial information systems. Professor Holmberg is one of the initiators of GSS, an EU-funded development project aiming at effective procedures for inter regional risk management.

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