

# HUMAN SUPPORT FOR VIRTUAL SIMULATION TRAINING

Grzegorz Gudzbeler  
Mariusz Nepelski  
Andrzej Urban

line 1 (of Affiliation): dept. name of organization  
Police Academy in Szczytno  
Szczytno, Poland

*Games are becoming more popular as a tool for training, due to their promise of increased motivation, context-sensitive presentation of information, immediate feedback and increased sense of immersion. This kind of training should provide proper balance between being fun and engaging, and being informative and effective as a training tool. Supplementing proven training methods by computer simulation tools supported by supervision of experts ensures that the training will suit the demands of the organization. Provides achieve a result which is educate appropriate behavior as a reaction to the proper behavior of the system simulation. This approach will provide the correct data, even in very difficult situations for modeling and simulation. This will allow the use of simplifications in the models which have a positive impact on performance. The system of this type can run on standard computers to simulate large-scale operation without the use of supercomputers and the effect will still be sufficient for the needs of the training. This will allow you to change the scale of the district in a big city, with a group of people for many thousands of crowds, from platoon to force consisting of hundreds of officers. This will allow the transition from the level of interventions on large operations while still maintaining all needed details. Cause the training will be complex and cost effective. This paper presents a study of the design and development of a prototype simulator of police operations in crisis situations.*

**Keywords—** simulation systems, crisis situations, security services, simulation training, virtual games

Virtual simulation training becomes a tool used by most of services responsible for security. The main training value of conducting a simulated exercise is to gain combat experience at a fraction of the cost and risk of live training or actual combat. At a low level, the value comes from the increased individual skills of participants, and insights into specific instances of human, system, and tactic performance. Huge commitment can be seen especially in institutions such as the U.S. Army, or Australian Army. The use of simulation training for an individual soldier, operator of arms or even a military vehicle or airplane fighter is far from the requirements for training of officers for the operations team. The environment in which to place the operation of such services as police or fire department is usually the large agglomerations. The most serious challenges for these services take place precisely in the

heavily urbanized area. Number of persons involved in crisis situations is usually very large. Assuming the maximum value we can speak about 100 thousand people and two thousand police officers and vehicles. Simulation of such a large environment, such a large number of entities using the most popular methods such as high-level programming languages such as LUA would require computing power beyond the capabilities of standard personal computers. Ready solutions available on the market allow the modeling and simulation to a few hundred people. Accurate techniques are highly essential to avoid any fatal results. Especially in such cases. The paper shows how to solve this problem in the construction of a prototype simulator for police action in crisis situations. It presents an assessment of the solution by a group of experts - the commanders of high-level police operations carried out in the Polish capital Warsaw. Test simulations were carried out training in a fully functional system. The test results were to determine the selection of solutions and modifications to the system and answer the question of how exactly the system reflects the reality and what could be the primary or only supplementary training tool. The main aim of constructing the Simulator of Police Operations Commanding in Crisis in the Police Academy in Szczytno was to improve managing process in crisis done by entitled subjects of crisis management, particularly through implementation of decision making games on the tactic and strategic level with the support of multimedia decision making training. We had to consider that major events like football games like those during Euro Cup 2012 are crisis situations in meaning of Polish Police. It consists in preparing training for teams on decision making process (tactic and strategic) during crisis in the police and non-police context. The criterion for assessment during the training was to achieve the aim described in the plan of operation, including the effectiveness of using all available forces and resources, and incurred loss account.

The main idea of the created solution was the ability to conduct an integrated course in which all aspects of police officers' actions in crisis are taken into consideration. Due to use of computer simulation system the costs of such a course should be incomparably smaller than the costs of trainings carried out in real conditions with use of real forces and resources. At the same time, due to proper

modeling all factors existing in the system, it enables all elements to respond in a way similar to the real one. The system is built to answer a specific purpose and usage. Comparison of real actions to any simulation system will certainly be unfavorable to the simulation system.<sup>2</sup> There is no possibility to create such a solution which will correspond to a real world in 100 per cent especially in such complicated area as human behaviors and so many factors interaction within one environment. If we assume at the same time that the system in the required area is characterized by an accurate precision of reproduction we will get incomparably more effective training tool than the solutions used so far. A computer system which fulfills all tasks within both simulating and presenting events in a virtual space will be a created solution.

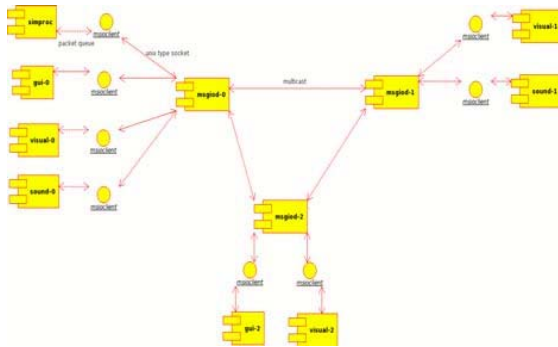


Figure 1. Figure 1 UML components diagram of the system.

Figure no.1 present universal modeling language components diagram of the system. Simproc is module responsible for simulation and placed on separate computer which is standard personal computer with Intel i7-980 processor and 6GB RAM. Other simulation computers have even less capabilities – Intel i7-960 processors. Due to high demands for graphic environment all simulation computers except that for Simproc have strong graphic cards (GeForce 480 1536 MB). Msgiod is module designed for network communication and use multicast frames to synchronize simulation. Such solution need fast and reliable local network. All computers work in separate network build on 1 GB Cisco switches. Gui is graphical user interface and the options are instance number, camera number and role. Number that specifies an instance of gui sets number of user interface while the camera sets the number of instance of the camera to be turned on. Control parameter of the camera number, allows you to configure the system in way that gui is run on one station and the visualization and sound to another. Roles that can be set are: instructor, operator, Commander of Operations, Deputy Commander of Operations, Commander of the sub-operations, Municipal Monitoring, Mobile Monitoring, Surveillance Stadium. We have also visual and sound modules working similar like GUI.

Objects formed in it are built with the use of real objects' parameters. Each object possess predefined features concerning its appearance and abilities to interact with other objects. Such an environment allows us to simulate most of

real events with the ability to observe the consequences of their occurrence.

When a specific event appears in the system all adjacent objects will respond in a way described by algorithms. The objects include both elements of environment such as trees, buildings, vehicles and people. The system is able to simulate actions of services being at the scene as well as outside witnesses and victims. The image generated by the system is based on the most modern solutions and use all capabilities of modern graphics cards. It makes that all presented objects and situations seen by system users are very precise and can be recognized as an image from a real source such as CCTV or city video surveillance. The simulator is an ideal place to run simulation of events which would be difficult to perform in the reality for organizational reasons.

The simulations can be run in the selected area of Warsaw. It is the center of Warsaw with the main emphasis put on objects important for public security and police operations. All elements of the environment which can influence the realism if received message are presented by applying 3D modeling. In the visual context the system is aimed at presenting reality in such a way that the trainees do not focus on graphic elements. All modeled elements can be easily recognized and identified by the trainees. The outsides and interiors of selected buildings, elements of landscape and flora, atmospheric phenomena, police and cooperating services' forces and resources, civilian vehicles, the civilian population, the gatherings including groups of fans, traffic routes, parks and other elements of the city will be displayed. Interactions between elements are modeled too, the buildings can be damaged, the gatherings will change their density, behavior and appearance, according to the situation. In addition, the most characteristic buildings with their interiors such as National Stadium, the Polish Parliament and Central Station will be reproduced very precisely. States of human behavior can be identified in such a way that the situation in the system will be as real as it is possible but at the same time possible to be assessed by the trainees. Such a number of elements, which are reproduced, requires a lot of graphic designers' work. The system makes changes on the weather conditions and time of the day in the real time. As it was mentioned before because of and amount of simulated and presented elements requirements for computers capabilities are really high. Unfortunately to provide proper quality of simulation where trainee is able to take a part in close to real training in so big scale of environment we have to use supercomputers. In that case we are not going to lower one of the most important for security services factors – price. It is always good to allow new possibilities of training, but we have to remember that operational activities are most important.

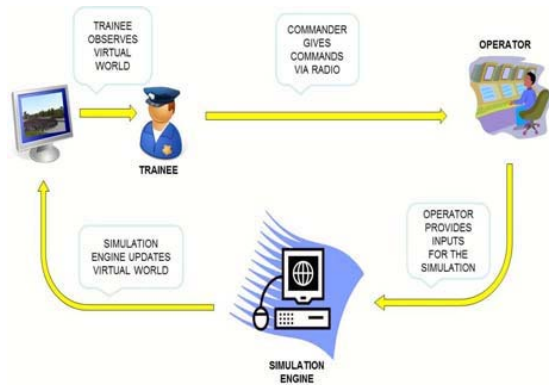


Figure 2. Figure 2. Organizational scheme of system.

Solution for that problem can be proper organization of system. To facilitate simulation tasks we can always use human factor. In figure above is operator/instructor role described. The organizer of the training will have appropriate personnel resources, such as instructors responsible for the whole training process, supported by the administrator of the system and operators, who will play the part of the persons fulfilling dispositions during the practice session. Communication will be executed using the appropriate means of communication. The exchange of information between the trained (cooperating forces) will be executed using advanced means of digital (trunking) communication system TETRA. The number of operators in the training will depend on the number of trained persons and the level of difficulty of the implemented scenario. Operators input commands into the system and are responsible for moving police forces and vehicles. They can also add, move, delete and change all factors and states of crowd. It can be used as some kind of safety valve. We don't have to be so afraid about mistakes made by simulation engine, we always can pass some demands on experienced operators. They have to supervise all simulation and correct incorrect reactions. When something is going in different than expected way operator can always adjust proper parameters. All simulated elements in system can be changed by instructor and operator. According to the colloquialism 'All models are wrong and only some are useful' there are not any ideal solutions especially in the context of modeling human behaviors. No model is able to reflect perfectly the nuances of people's emotions, the wide range of human behaviors in the face of stress on different level and its influence on behavior and taken decisions.<sup>3</sup> Many researchers have developed a whole range of methods used for simulations of different aspects of human behaviors. However, most of them need a vast store of computing power to run simulation in the real time. The next problem is a composition of different solutions working in different areas for the need of one system. These techniques cannot always meet the very essential challenge described as variability of human behaviors. We are not able to create effective models when independent factors influence real behaviors. We have hundreds of parameters

impossible to describe with full accuracy, in the words of determinism – only in a way which is represented by distributions of probability. The interactions between factors modeled independently such as groups of people are the next problem. The real challenge is to model human behavior in such a way to convey delicacy of human nature, therefore to achieve a higher level of realism.<sup>4</sup> There are certainly many solutions used for the need of modeling human behavior for military purposes – CGF (Computer Generated Forces). In these systems the application of HBR (Human Behavior Representations) in order to achieve a specific level of realism requires modeling of individual differences and modifying factors such as people's personalities and stress. In the case of our created system the challenges are even more ambitious because we have to try to reflect the behaviors of very different groups of people who are under influence of different external factors such as police actions, weather conditions, interactions with other groups. However, we can try to catalogue in the system all possible factors and point out these whose influence on specific elements of the system can be predicted with proper accuracy. The other elements such as interaction of totally independent variables can be passed over or we can burden the instructor, whose trainee would be able to define the final effect of interaction himself and would immediately run it in the simulation system. Due to such an approach, the issue of right methods of modeling application comes down to standard and easy to implement solutions. It will also allow to focus on other very important elements of the system such as visualization and simulation of many elements' behavior. We have to remember, that the Police use much of their forces in this area so we have to deal with a lot of people in modeled crowds.

The most essential element of the system which has to prevent impossible situation from arising in the reality is a human being, an instructor. Due to very advanced possibilities he/she will be able to influence each element of system functioning. These possibilities can be divided into two groups – the ones are providing current information on the system state and the others are enabling modification of the state of chosen elements. On the training modification of the amount of available forces and resources and other elements such as groups of fans and crowd.

Modification of the status of the system elements such as the level of aggression of the chosen group of fans or crowd with the use of the list of information.

Due to such a solution there will be a possibility to simulate irrational behaviors in the system, which can occur when totally independent and impossible to predict and model with the use of standard methods factors interact with each other. The additional result of such a training will be a better commander's readiness to react in case of unusual situations occurrence.

Due to such an inventive idea the system is open for convergence with other solutions used in crisis management and in police forces commanding including Command Support Systems, any solutions of decision-making support, risk assessment systems or other simple transactional

systems. The created simulation system is simply treated as an external environment, therefore testing the solutions in the environment similar to the real one for the needs of conducted research or implementations is possible. At the same time it makes it possible to prepare an integrated course on their use.

This template, created in MS Word 2000 and saved as “Word 97-2000 & 6.0/95 – RTF” for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

## ***References***

- 
- [1] Khanh Bui „Optimizing Risk and Value in Simulated Training Exercise Design”, Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2011
  - [2] Gudzbeler G., Nepelski M., Urban A. „New Technologies In Training Police Commanders”, SIMTECT2011 Proceedings, ISBN 978-0-9808099-1-6, Melbourne Australia 2011
  - [3] Barry G. Silverman, Michael Johnsy, Jason Cornwellz, Kelvin O’Brien – ‘Human Behaviour Models for Agents In Simulator and Games’ – University of Pennsylvania 2006.
  - [4] Mamadou Seck, Norbert Giambiasi, Claudia Frydman, Lassaad Baati – ‘DEVS for Human Behaviour Modeling In CGFs’ – Universite Paul Cezanne, Marseille, France 2009