The other city –
Designing a serious game for
crisis training in close protection

Heide Lukosch
Delft University of Technology
H.K.Lukosch@tudelft.nl

Theo van Ruijven
Delft University of Technology
T.W.J.vanRuijven@tudelft.nl

Alexander Verbraeck
Delft University of Technology
A.Verbraeck@tudelft.nl

ABSTRACT

Effective training methods are key to successful crisis management in close protection. This paper discusses the outcomes of a project on the development of a serious game, a virtual training environment for close protection. The aims of the game are to improve situational awareness and communications skills at the individual and team level. Two game designs, developed with two different game engines, are presented and discussed in relation to the project's objectives. Comparison of the two designs shows that several trade-offs are encountered when developing a training game with the available technology. Technological features of the game engines, and differences in time invested in the development of different aspects of the games, make that the two designs meet different project objectives. Simultaneously reaching all project objectives in a single design seems impossible with the two game engines. This paper discusses the different trade-offs that were encountered in the project and presents the major challenges that lie ahead.

Keywords

Authentic urban environments, close protection, serious games, virtual worlds, realism.

INTRODUCTION

This paper presents outcomes from a project on the development of serious games for close protection. Close protection concerns the direct protection of people or objects. Police officers working in close protection form the last line of defense between a protected person (often a public figure) and a possible attacker. Attacks on public figures often lead to crisis in the sense of major public disturbance and have a large impact on society. This impact is not only psychological but also physical in the form of far-reaching security measures. The goal of the project discussed in this paper is to develop a virtual simulation game for training in close protection. The main objectives of the simulation game are to train police officers and private security guards for situational awareness – the recognition of devious behavior – and team communication and coordination. Enhancing these skills of individual police officers and teams should lead to an improved ability to intervene in advance of – and during – attacks as well as to manage a situation once an attack has taken place.

The purpose of this paper is to show how the development of a virtual training for close protection with currently available technology results in several trade-offs between development options and learning objectives. The paper shows what trade-offs are encountered and explains how possible choices affect the outcomes of the project.

In serious games or simulation games, the playing environment or game world plays an important role as supporting means for the game experience, the effectiveness and difficulty of the game play and the feeling of flow. With the increasing possibilities of virtual visualization, the design of computer games has become more and more complex and realistic. For reasons of knowledge transfer from the virtual to the 'real' world, it is of crucial interest to design a serious game that is very much a like the 'real' world, a so-called "there-reality" or real virtuality (Chalmers & Debattista, 2009). Transfer research emphasizes that transfer is effective when the trained skills have similar logical or deep structures in virtual and in real world (Lehman, Lempert & Nisbett, 1988). Failure to achieve the 'right' level of realism holds the risk that the player adopts a 'wrong' or different strategy than needed in real life (Chalmers & Debattista, 2009). This topic is also related to the term of fidelity, which defines the degree to which a game emulates the real world. In this paper, we will not go so far to define every dimension of a game's fidelity, like its physical, functional or

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psychological fidelity (see therefore e.g. Alexander et al. 2005), but we will highlight those dimensions that we experienced as crucial in designing a serious game for crisis training in close protection. These are especially those that are visually and functionally congruent with the real world. In our case, the game's main objective is to raise situational awareness in a close protection mission. Situational awareness is understood as the ability to filter out certain details and highlight and extrapolate others, to better understand and control outcome (Aldrich, 2009). Different people bring in different experiences and expectations, which makes them having a different awareness of a given situation. Serious games with their ability to represent a non-linear, immersive training experience can help to increase situational awareness and understanding of a situation. For this, we aim to develop a game experience that has meaning and is meaningful to the player. Nowadays, simulation games are part of situational and weapon training of police and other security forces (Benjamins & Rothkranz, 2007). Literature shows that police officers who receive realistic training are better prepared for the real scenario, which leads to a more coordinated and appropriate response (Muehl & Novak, 2008). Simulations like *Incident Commander* are recognized as instruments preparing people for responding to natural disasters or crisis situations. Military has a long tradition of using simulations for strategy and combat training, because of the chance to clearly illustrate consequences of actions in a safe environment, without risk of injury or other damage (Macedonia, 2002; Bonk & Dennen, 2005).

The rest of this paper is structured as follows. First, we shortly provide some background information on virtual worlds and the virtual development of urban environments. Second, we describe the design process we went through for this project and compare the two designs that have been developed. Third, we present and discuss the trade-offs that we encountered while trying to meet the project objectives with currently available technology. And last, we draw conclusions for the development of virtual training environments and present the most important challenges remaining.

VIRTUAL WORLDS AND VIRTUAL CITIES

Our minds are capable of re-creating an environment we have ever experienced in more or less detail. Serious games can trigger many of the same sensory responses that result from imagined or participated environments (Muehl & Novak, 2008). One of the prepositions to do so is the realistic imagery, which transports players into a virtual world. This process is called immersion, the feeling of "being in there", which can also be evoked by relatively poor graphics, but works much better with recent interactive 3D-environments. Furthermore, sound can help to immerse players in the game, especially when sound effects are designed in a high quality, 3D- or surround-sound manner. To convey the look and feel of a real-world situation, serious games have to rely on high-definition graphics. In the last decades, artificial intelligence has significantly improved, so it is possible to also enrich virtual environments with intelligent objects and characters supporting the interaction with the user (Muehl & Novak, 2008). Immersion may contribute to the amount of information acquired, skills developed, and subsequent transfer of knowledge to real environments (Alexander et al., 2005). Virtual worlds are more and more increasing in detail and size, which makes their design more complex. As an answer, procedural methods of design are used, such as textures or complete virtual cities (Smelik et al., 2010).

When designing virtual cities, it is important to avoid disorientation of the player moving through the streets, alongside more or less varied buildings. Clear primary paths and numerous sub-paths seem to be the best way to provide both orientation and variation and encourage experimentation within the virtual environment (Muehl & Novak, 2008). In our case, we developed a virtual model of the city of The Hague, the working environment of the games' target group. To achieve a highly authentic experience, streets of The Hague were re-built as realistic as possible, with authentic positions, heights and textures of buildings, streets and objects like plants, tram lines and dust bins.

DESIGN: GAME DEVELOPMENT FOR CLOSE PROTECTION TRAINING

Following Muehl and Novak (2008), when serious games are used for learning and training purposes, the model of the simulation should be as realistic as possible to get the best results in preparing the trainees for real-life situations. In our case, the purpose of the game is to train police officers who are working in the field of close protection. This includes officers who investigate a specific area on safety issues, as well as police agents escorting a VIP and team leaders within the police force. The overall learning objectives are to increase situational awareness competencies of the police agents and to raise their communication skills. The participating parties in the design process are two groups of end-users, the Dutch police force and a private security organization. These groups deliver input in the sense of scenario building, learning objectives and usability testing. Furthermore, a training company with extensive experience in police and military training delivers input on the didactical model of the scenarios. A well-known game developer with many years of experience in the field of virtual safety training supports the design process at the gaming level. The first simulation game was developed within the XVR™ software environment, which is built on top of the

Quest3D™ Virtual Reality engine. In the remainder of this paper we will refer to this game as the Quest3D™ design. The design of the first scenario followed the design process as described by Roozenburg and Eekels (1995). As a first step, we defined the function of the game scenario in line with the project objectives; to enhance situational awareness and (inter-)organizational communication skills of security personnel. Following the crucial criteria of the project description, the virtual training must be authentic – taking place in the city of The Hague – realistic, vivid, adaptable and multiplayer. The vivacity demand has been separated into a demand for a sufficiently busy environment and a demand for genuine motion mechanics. The first provisional design took place in the Quest3D™ environment. The design has been evaluated by a focus group of game developers. This group valued the design of the first scenario as:

- Authentic (++)

- Realistic (+/-)

- Vivid – busy environment (-)

- Vivid – motion mechanics (+/-)

- Adaptable (++)

- Multiplayer (++)

With this result, we decided to reiterate with an alternative game engine for which we knew that the level of realism and vividness could be expanded compared to Quest3D™. The second provisional design of the simulation game was made within the UDK™ game engine. We will refer to this game as the UDK™ design. The result was again evaluated by the focus group of game developers. They valued the second design as:

- Authentic (++)

- Realistic (++)

- Vivid – busy environment (++)

- Vivid – motion mechanics (+)

- Adaptable (-)

- Multiplayer (++)

The two iterations of the design process result in two comparable designs for a training environment for close protection. Both designs have (dis-)advantages that are discussed in the following paragraph.

Comparison of the Quest3D™ vs. the UDK™ design

Table 1 shows the scores of the two designs for each of the design criteria we briefly introduced above. The scores are briefly discussed with a focus on the differences between the two designs.

		Quest3D™ design	*UDK™ design*
Authentic urban environment		++	++
Realistic (detailed) environment		+/-	++
Vivid	*Busy environment*	-	++
	Motion mechanics	+/-	+
Scenario adaptation		++	-
Multiplayer option		++	++

Table 1. Scores of the different criteria given by the focus group

It is possible to develop an authentic environment for the entire city center of The Hague in both Quest3D™ and UDK™. For both engines, a point cloud serves as a framework for building heights and distances between objects. Pictures are used to texture buildings and objects. Being familiar with the environment helps, or is even necessary in creating the right atmosphere in the virtual environment. Environmental details are mainly created

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through the textures of buildings and objects. The Quest3D™ design makes use of two-dimensional textures while the UDK™ design allows three-dimensional texturing (normal mapping) through several parameters. Because of this ability, the UDK™ design can present a considerably more detailed environment than the Quest3D™ design. The Quest3D™ design cannot hold more than 200 objects on a normal PC without slowing down significantly while the UDK™ design can hold a virtually infinite amount of objects. Creating the true vivacity of an urban environment requires the simultaneous presence and movement of many different objects. The first technological tests showed as well that the UDK™ design holds a considerable advantage over the Quest3D™ design in this respect. Motion mechanics in Quest3D™ are relatively poor. Object movement is based on single mechanics. In the UDK™ design, motion mechanics can be borrowed from a wide range of sources, making it possible to create variation between the movements of different objects. Scenario adaptation is quick and straightforward in the Quest3D™ design. Through a drag-and-drop function, objects from a library can be placed in the virtual environment. The XVR™ environment comes with a comprehensive library of emergency management objects. UDK™ does not hold such a library, which makes scenario development a time consuming process. Both the Quest3D™ and the UDK™ design have a multiplayer option.

DISCUSSION

The literature states that serious games have the capacity to emulate the real world, and so provide opportunities to train with some realism and without risk for the trainee. We understand the learning and training context of a game as its meaningful context. Elements in the game become meaningful when serving for this purpose. To understand the relation between reality and meaning of a serious game, we can order the game world in systems of signs, like elements of the landscape. In our case, systems of signs represent buildings, plants, streets and static or moving objects. All these systems together represent the world of the game to the player (Salen & Zimmerman, 2005). The main aim of this project is to develop an environment that is sufficiently realistic to support the training of close protection. To achieve this, we tried to use available game design software as effectively as possible for designing as many meaningful game elements as possible to reach a high level of physical fidelity.

During the design process, we experienced some crucial steps that foster a collaborative development process of a serious game for training purposes. We faced some problems like the limited capacity for moving elements within the Quest3D™ environment. We solved this problem by limiting the game world to a much smaller piece of the city than intended in the didactical concept, with all consequences for gameplay and learning effect, thus for functional fidelity. Comparing properties of the Quest3D™ with the UDK™ designs shows the value of the two engines for the development of a simulation game and our project. Both engines have their drawbacks and advantages. From the comparison of the two designs, several trade-offs that must be made during the development of a virtual training can be derived. These trade-offs are:

- Investing in authenticity vs. investing in realism
- Investing in authenticity vs. investing in detailed texturing
- Adaptability of the scenario vs. advanced motion mechanics
- Adaptability of the scenario vs. vivacity of the environment

Authenticity is not the same as realism. Time invested in creating a true city outline cannot be spend on the development of realistic game mechanics and a realistic 'experience'. Authenticity requires the unique modeling of each individual object. Time invested in the modeling of objects cannot be spend on the graphical enhancement of object details. The repetitive use of similar objects would make it possible to save time that can be spend on the enhancement of graphical details. Quickly setting up and adapting scenarios can only be done with a pre-established object library. The motion mechanics of such a library are often poorly developed. Developing advanced motion mechanics is time consuming, which makes it difficult to create an extensive library. A vivid environment requires a large amount of moving objects. The Quest3D™ design that allows for drag-and-drop scenario development, cannot handle more than 200 objects at the same time. The UDK™ design cannot easily be adapted but is able to host a large amount of objects.

CONCLUSIONS

In the light of the two main objectives of the project – enhancing situational awareness and communication skills – the four trade-offs presented above boil down to one explicit challenge. Enhancing communication skills requires an authentic and adaptable environment but details and vividness are not important to reach this objective. Enhancing situational awareness requires a detailed, vivid, adaptable and preferably authentic environment. With currently available technology, the environmental requirements for communication training can be reached. The technological requirements for enhancing situational awareness, however, pose a challenge.

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Authenticity becomes an issue in this respect because creating an authentic training takes up much time that cannot be invested in the development of a realistic experience or detailed texturing, aspects that seem more important for the training of situational awareness than authenticity. The requirements that pose the main challenge, therefore, are vivacity and adaptability. Current game engines do not support environments that are both detailed and vivid and come with a library and drag-and-drop function to instantly create new scenarios at the same time. The first would serve the physical fidelity of a game, while the second would support functional fidelity of a game. The explicit challenge that lies ahead is therefore either to make adaptable worlds more vivid or to make vivid worlds more adaptable. Next steps in our project will be to validate in how far the "reality" or "fidelity" level of the game improves the learning process and increases training outcomes.

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