Caserman, P., Cornel, M., Dieter, M., & Göbel, S. (2018, November). A Concept of a Training Environment for Police Using VR Game Technology. In Joint International Conference on Serious Games (pp. 175-181). Springer, Cham.

A concept of a training environment for police using VR game technology

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Abstract. Serious games and simulations can be used to support or supplement training, especially when training scenarios are too complex. With the novel Virtual Reality technology, training can be partially replaced and complemented by a virtual environment. This paper focuses primarily on the design of the police training. The requirements for the serious game were raised in cooperation with policemen. A virtual training environment for traffic control was developed. The initial user evaluation revealed importance of full-body tracking and intelligent virtual agents. Due to the variability of the training scenario, the effectiveness can be increased and the skills learned within the serious games are transferable to the real work tasks.

Keywords:

1 Introduction

Traditional emergency training is complex, costly, and often includes only a small variety of scenarios [1]. With the novel Virtual Reality (VR) technologies, new possibilities arise to train certain action sequences and procedures in the virtual environment, that are not always possible in the current existing training. Head-Mounted Displays (HMDs), such as HTC Vive or Oculus Rift enable external tracking, creating a full 360° immersion and allowing the user to physically move in a large area. Recent studies provide significant evidence that room-scale VR games lead to a higher immersion [9].

Due to recent improvements in VR, not only game industry but also the government and corporate organizations can benefit from the training environment that serious games provide [10]. Serious games are digital games that are designed to entertain and have an additional characterizing goal (e.g., a learning/training effect) [4]. Safe VR-based training environments allow making mistakes without serious consequences in order to gather experiences, that help to avoid bad decisions in the future [3, 6]. In comparison with the traditional training, virtual environments have various advantages, e.g., they are less expensive, can be easily set up and training sessions can be performed even when the team members are geographically far apart [3]. Playful training and simulations are a major field of

The final authenticated version is available online at https://doi.org/10.1007/978-3-030-02762-9_18.

serious games, mainly used for collaborative training, e.g., military training [10], police training [1,6], and crime scene investigation [3,5]. Moreover, previous studies reported that intelligent virtual agents in training environments are helpful, e.g., for leadership training and decision making in stressful situations [8] or to reduce the chances of accidents and failures [2]. A positive impact on training results in serious games could be proven in some studies [6]. However, the context must always be considered and it is difficult to make general statements about the effects of serious games.

In this paper, we present a concept of an immersive, virtual training environment for traffic control. A demo can be seen here[1]. The requirements analysis for the training and the initial user evaluation were done in cooperation with the policemen. We want to show how the VR technology could be used for the police training in the future. Due to the variability of the scenario, the quality of training can be increased. In particular, trainees can be supported in their individual training and can receive immediate feedback on completed activities.

2 Concept

Training in a virtual environment can be effective to learn particular behaviors and strategies. We raised requirements for the training in cooperation with ten policemen (eight men, average age of 27). A police training is usually practiced in a team. In the traditional training settings, scenes of everyday police work life are recreated and the behavior of the policemen in these situations is then evaluated. Such a training requires at least two participants and must be additionally assessed by an expert. Frequent training of different situations is thus often not possible.

We identified various scenarios, e.g. routine activities such as traffic control, shoplifting, and search of a person. Further examples include situations where the policemen themselves are in danger, such as knife attach and domestic violence. Some complex situations were named, e.g., accidents with many persons involved, demonstrations, rampaging football fans, and bank robberies.

2.1 Virtual training for the police traffic control

We focus on general police traffic control because this is a common situation in the daily routine of a policeman and it requires from the policeman to follow a certain procedure. Nevertheless, the work processes have to be trained regularly, as new situations may occur.

The following scenarios should not be considered as complete. Each federal state and country can provide a different approach. In the scenario, the vehicle already stopped and the policeman stands next to the car. The player must inspect the driver's license, the vehicle registration, the first-aid kit, the warning triangle and the safety vest. To increase the quality of the training and to train

[1] https://youtu.be/H8AP_S8x6A0, last visited on May 31st, 2018

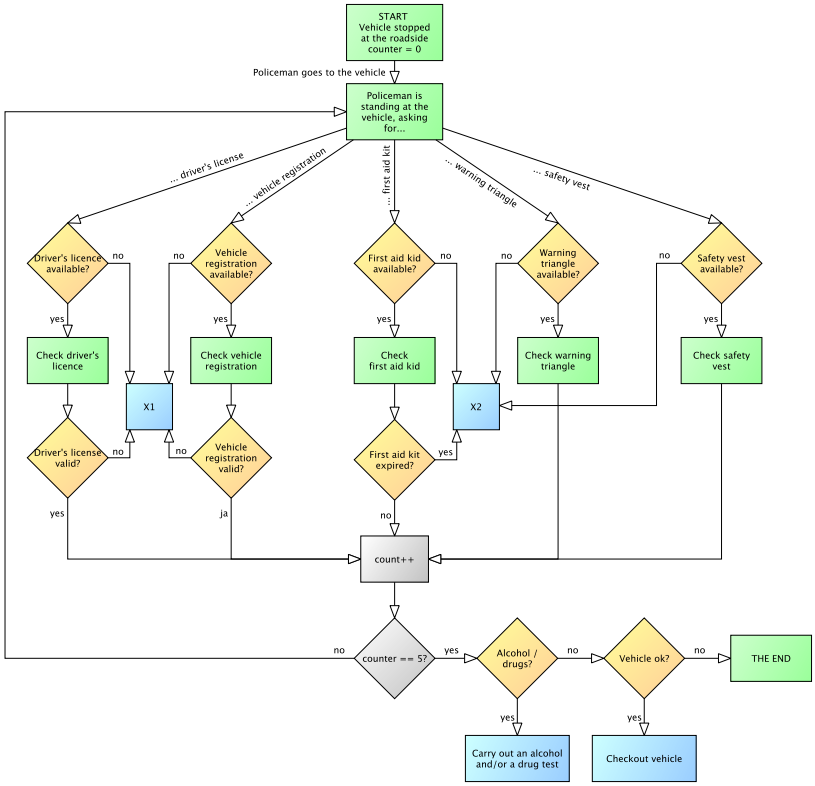

Fig. 1: Flowchart of the general traffic control

varied situations, the items which have to be inspected vary. Fig. 1 shows the flowchart of the general traffic control. In addition, the general condition of the driver (e.g., an influence of alcohol or drugs) and the vehicle (e.g., the lights and tire condition) must be examined. The states marked with "X" serve as placeholders for special cases, e.g., situations that involve a warning or even an arrest. Parallel, the policemen have to ensure their own safety, e.g., look for a weapon and other dangerous items.

3 Implementation

The virtual environment, as it can be seen in Fig. 2a, was built using the Unity3D game engine. To facilitate integrating the device and controller interaction, the SteamVR Plugin and SteamVR Unity Toolkit plugins were used. We used free 3D models from the Unity Asset Store to create a city, e.g., streets with bushes and trees at the roadside as well as houses. For the traffic control, two vehicles are included: a police car and an additional vehicle with a driver, a weapon (PM-40) on the passenger seat and a cat on the back seat.

(a) The virtual scene top-down layout (b) First-person view

Fig. 2: Virtual environment

The serious game utilizes a first-person view using a HMD, as shown in Fig. 2b. The player can move within the virtual environment by physically walking in the real world. Since the physical space is limited, a teleportation mechanic can be used for larger distances.

3.1 Gameplay

The player can interact with the driver through a game menu (see Fig. 3a). It contains several buttons to require the driver's license, vehicle registration, warning triangle, safety vest and first aid kit. To specify the items as "OK" or "Not OK", the player can drag the items to the green checkmark or the red cross. To increase the variability, the items are randomly created, e.g., the driver will either have the permission to drive a car or only a scooter, the car color in the vehicle registration will change, and the first aid kit will either expired or not. When the quit button is pressed, the feedback for the player appears (see Fig. 3b). The feedback system consists of a "thumbs up" or "thumbs down" icon for each interaction item.

In the car, dangerous or unsecured items are hidden. To increase the training effect, these items are generated randomly. A dangerous item can be weapon lying on the passenger seat (see Fig. 3c). An unsecured item can be a cat in the footwell of the rear seats.

4 Evaluation

An evaluation was conducted to review the game concept and to collect ideas for future developments. Three policemen (aged between 27 and 34) participated in the evaluation. First, the game concept was explained briefly. This was followed by an introduction of the interaction possibilities (teleportation, assignment of the items). HTC Vive HMD with two associated controllers were used to gain the first-person view of the virtual environment. During the evaluation, the policemen were encouraged to express their thoughts (think-aloud method). Two observers were asked to take notes of what participants say and do.

(a) Game menu (b) Feedback (c) The hidden weapon

Fig. 3: Game design

The impression of the VR was consistently positive. None of the subjects experienced cybersickness. The controls were perceived as simple and intuitive. The participants also liked the fact that the cat and the weapon are not immediately visible. Only the resolution rate of the headset was perceived as too low and too blurry, which caused some details to be hard to read, e.g., text on the driver's license and vehicle registration.

The analysis has revealed the importance of full-body tracking in VR. The visualization of only Vive controllers was irritating and the participants were missing the representation of the own body. This finding corresponds with the recent work, showing that visualizing of a controller or floating hands will break the immersion [7].

The current implementation supports only a single-player. However, in the real life the policemen (in Germany) usually always work in pairs (or teams). The participants suggested a multiplayer mode so that the second player can secure the vehicle on the passenger side as in a real control situation. In such a virtual team training, the players can inhabit the same virtual world and learn to perform tasks as a team. To still enable single-player mode, an intelligent virtual agent could provide feedback and help. Non-player characters could furthermore simulate additional characters, e.g. a passenger. Moreover, traffic can be simulated so that the player must be careful not to be hit by a car.

To improve the level of immersion, sound effects, such as engine noise should be created. Speech control would furthermore improve training efficiency, e.g., to show the driver's license and the vehicle documents.

However, our study has some limitations. The current implementation includes only a small scenario for the general traffic control. The current implementation can be easily expanded by creating additional interfaces for the interaction items, e.g. a stolen license plate. Furthermore, the total number of three participants is too low for any statistical conclusions. A significantly greater evaluation should be carried out in a future work.

5 Conclusion

We developed a serious game in order to show how VR technology could be a part of the police training in the future. We raised the requirements for the training scenario in cooperation with the policemen. We evaluated the game with policemen to review the game concept and to identify the limitations. Our results are promising and show that immersive VR can be used for the effective training. The evaluation results showed that our game is fun, motivating and could be used in police training in the future.

Further research will focus on body tracking since this would improve the presence in VR. To increase the effectiveness of the training and to support complex collaborative tasks, a multiplayer mode is needed. Furthermore, in the future work, we also want to support speech recognition. For a more advanced training scenario, intelligent virtual agents should be incorporated.

References

1. Bertram, J., Moskaliuk, J., Cress, U.: Virtual Training: Making Reality Work? Computers in Human Behavior **43**, 284 – 292 (2015)
2. Brasil, I.S., Neto, F.M.M., Chagas, J.F.S., d. Lima, R.M., Souza, D.F.L., Bonates, M.F., Dantas, A.: An Inteligent Agent-Based Virtual Game for Oil Drilling Operators Training. In: 2011 XIII Symposium on Virtual Reality. pp. 9–17 (2011)
3. Conway, A., James, J.I., Gladyshev, P.: Development and Initial User Evaluation of a Virtual Crime Scene Simulator Including Digital Evidence. In: James, J.I., Breitinger, F. (eds.) Digital Forensics and Cyber Crime. pp. 16–26. Springer International Publishing (2015)
4. Dörner, R., Göbel, S., Effelsberg, W., Wiemeyer, J.: Serious Games: Foundations, Concepts and Practice. Springer (2016)
5. Ebert, L.C., Nguyen, T.T., Breitbeck, R., Braun, M., Thali, M.J., Ross, S.: The Forensic Holodeck: an Immersive Display for Dorensic Crime Scene Reconstructions. Forensic Science, Medicine, and Pathology **10**(4), 623–626 (2014)
6. Lukosch, H., van Ruijven, T., Verbraeck, A.: The Participatory Design of a Simulation Training Game. In: Proceedings of the 2012 Winter Simulation Conference (WSC). pp. 1–11 (2012)
7. Mendes, D., Medeiros, D., Sousa, M., Ferreira, R., Raposo, A., Ferreira, A., Jorge, J.: Mid-air Modeling with Boolean Operations in VR. In: 2017 IEEE Symposium on 3D User Interfaces (3DUI). pp. 154–157 (2017)
8. Rickel, J.: Intelligent Virtual Agents for Education and Training: Opportunities and Challenges. In: de Antonio, A., Aylett, R., Ballin, D. (eds.) Intelligent Virtual Agents. pp. 15–22. Springer Berlin Heidelberg, Berlin, Heidelberg (2001)
9. Shewaga, R., Uribe-Quevedo, A., Kapralos, B., Alam, F.: A Comparison of Seated and Room-Scale Virtual Reality in a Serious Game for Epidural Preparation. IEEE Transactions on Emerging Topics in Computing pp. 1–14 (2017)
10. Zyda, M.: From Visual Simulation to Virtual Reality to Games. Computer **38**(9), 25–32 (2005)