

In crisis situations, policemen and other emergency workers regularly face difficult decision making problems. Even though clear instructions on how to act are usually given, they often have difficulties in making appropriate decisions, due to a combination of factors including time pressure and heavy emotions. Learning to cope with these situations is done with on-the-job training or using role-play where either co-students or professional actors recreate similar scenarios. Although reasonably successful, these types of training have important drawbacks. First, they are very costly, both in terms of money and time. As a result, the frequency by which they are offered is low. And second, there are large differences in the successfulness of role-play-based training: for some students the learning effect is substantial, whereas for others it is minimal.

The project Simulation-based Training of Resilience in Emergencies and Stressful Situations (STRESS) aims at developing a Virtual Reality training as a supplement to these methods. Trainees will be placed in a virtual emergency scenario, in which they have to make difficult decisions while negative emotions are induced. During the scenario, Human Computer Interaction techniques will be applied to measure aspects of their mental state. An important asset of the VR approach is that the system can adapt various aspects of the training (e.g. scenarios or difficulty level) at runtime based on an estimation of the trainees mental state. In this way, by selecting training scenarios with an appropriate context in terms of difficulty level and providing useful feedback, the system can improve the trainee's decision making behavior, and by selecting scenarios with an appropriate context in terms of stress level, the system can improve the trainee's emotion regulation skills.

The research presented in this thesis revolves around these objectives, focused on evoking and measuring negative emotions and using models thereof in a virtual training. In the first part, various experiments are described to investigate the potential for inducing negative emotions with virtual stimuli. Physiological measurements such as heart rate, skin conductance or brain activity are compared with subjective ratings of a participant's mental state. Subsequently, the results acquired using virtual stimuli are compared with those that arise in a real-life setting. A first implementation of a virtual training for aggression de-escalation is evaluated by target users who worked with the system during a period of 4 weeks. The chapters of the second part discuss the use of (cognitive) models in a virtual training as well as methods to include adaptivity and physiological measurements.