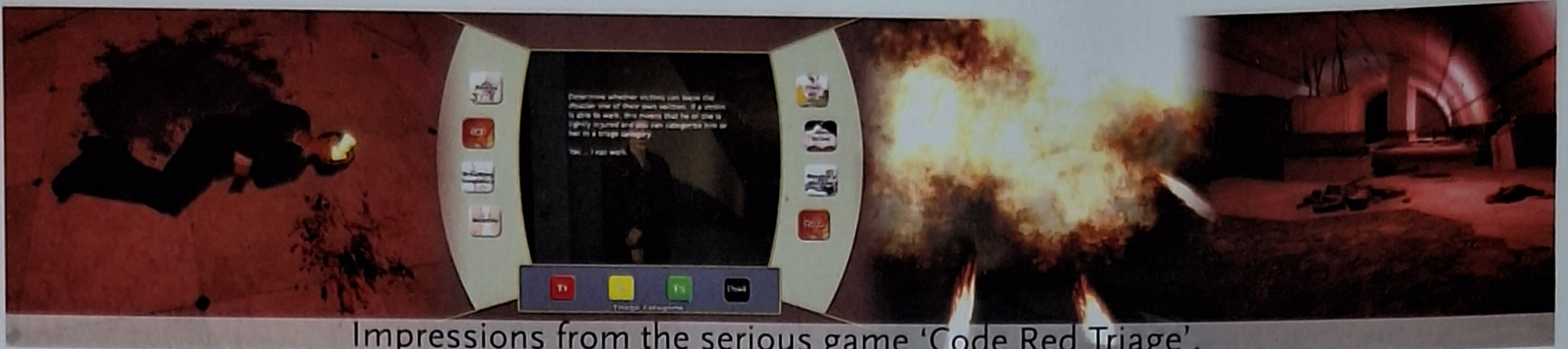




Game research
for training and
entertainment



Impressions from the serious game 'Code Red Triage'.

In the GATE research theme Learning with Simulated Worlds we study how to best create games for learning. We study adaptivity of games, various learning paradigms, design rules for educational games, and how the abilities learned in games transfer to the real world. Indeed, advances in building worlds, populating worlds with virtual characters, and interacting with virtual worlds (other research themes in GATE), cause real and simulated worlds to merge, which opens new ways for education, for both teaching and learning. Gaming is often experienced as fun, and thus may be a vehicle to self-driven and highly motivated learning. These controlled virtual environments can provide decision support and situation awareness support. Combining virtual gaming and real environments into augmented reality takes the potential for learning even further.

For example, we investigate how elements of the game such as virtual characters can adapt themselves in a natural way to the level of the user. We have designed a software framework for the Game Adaptation Model that can be used to orchestrate the adaptation of individual agents within a game. There are a few elements that play a key role in this model. First, all the agents behave according to their role specified in the game model. The role specification puts some limitations on the extent to which agents can adapt their behavior, because the behavior has to comply to the general storyline, interaction norms, etc. of the game. Secondly, the adaptation engine will centrally register the need for adapting the difficulty level of the game and based on the result put out a call for adaptation to the agents. Based on the bids of the agents a suitable combination of adaptation is determined, which is subsequently performed by the agents. An important aspect in this process is that the agents determine the ways they might adapt based on their current status and goal(s). This ensures that agents always adapt in a natural way, fitting with their current and past behavior. In this way the model ensures a balance between global and local control of the adaptation where both local and global consistency is preserved.

We also perform research to establish design rules for learning, specifically on the gaming 'dispositif', the properties of persuasive game design, and the role of narratives in games. We developed a theoretical model that offers an alternative to existing academic approaches to game narratives. The model explicates the logics behind two primary ways in which avatar-based 3D games deal with stories. One of these logics focuses on players as implied authors who guide heroes through challenging trials and tribulations, and intervene in their faith by controlling them. The other logic focuses on players as embodied participants in the story world; players become the hero and have adventures of their own. Drawing on theories from game, film,

theatre and communication studies, the model defines these two logics, presents their characteristics and explains potential problems when the logics co-exist in the design of one and the same game.

We also experimented on how cognitive design principles can be used to improve learning with a serious game. To this end we created a serious game, Code Red Triage (see picture above), and systematically varied elements in the game design to measure the effects on learning and engagement. We investigated the ability of auditory and visual cues to guide the player's attention, the way in which instruction has to be embedded into the game, how curiosity can be engendered; and discovered, among other things, that games can be made significantly more efficient when they adapt to the player's performance and that incorporating surprising events at key moments leads to the player constructing superior knowledge structures. The interaction between game design and the player's cognition can furthermore be described with "GameDNA" (Game Discourse Notation and Analysis), a notation tool we are developing that should benefit game designers in creating better serious games.

Equally important is the transfer of gaming, the rate and efficiency with which learned skills are transferred to practical situations. We conducted an experiment in the F16 flight simulator to determine the amount and kind of transfer of training of two flight games (Falcon 4.0 and Microsoft Flight Simulator) to professional F-16 flight skills. This experiment was aimed at determining the amount and kind of transfer of two flight games and non-flight games to professional F-16 flight skills. The tasks these subjects had to perform in the F-16 simulator were chosen in collaboration with a very experienced ex F-16 test pilot of the Royal Netherlands Air force. The results show that Falcon 4.0 gamers perform significantly better on all the tasks compared to the Microsoft Flight Simulator gamers and the non-flight gamers. It can therefore be concluded that Falcon 4.0 gamers acquire more skills and competences compared to Microsoft Flight simulator gamers for professional F-16 flight skills.

Game adaptation, design rules, cognition-based principles, and transfer of gaming are all aspects that are of paramount importance in game-based education. In all these cases, further innovation is needed. More knowledge and insights are necessary to further increase the effectiveness of game-based learning and teaching.

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