Game research for training and entertainment

Knowledge transfer

The GATE project is now past the half-way point. At the symposium Game Innovation last July, many research projects showed pinnacle results obtained. Two movies were shown. One movie gives a high-speed visual overview of the work done in the GATE project. The other movie gives some further information about the importance and relevance of the GATE project for the serious game research in the Netherlands. See http://gate.gameresearch.nl/index.php?pageID=111 to watch the movies.

Also some initial results from Knowledge Transfer Projects were presented. These KTPs form joint development teams consisting of developers from companies and researchers from GATE research projects that collaborate on making a clearly defined body of knowledge directly accessible to industry. Indeed, knowledge is an essential capital good for companies, needed for the innovation of products and services that give them a competitive edge. There are many SME companies involved in gaming and simulation in the Netherlands. A major problem for these companies is that technology in this domain is developing at an extremely fast pace. New simulations and games must use this technology to be competitive with other products. However, various factors limit the innovative drive of SMEs. They generally don't have the time to scout new technologies world wide and generally don't have the competence to integrate new technologies into their products. An additional complication is that the field of gaming and simulation is very multi-disciplinary.

At this moment there are projects running with Cyclomedia Technology, Noldus Information Technology, VSTEP, Opensa, and Motek Medical, and other projects are on the way; it is expected that each of the thirteen research projects results in a knowledge transfer project. Generally, the companies provide knowledge questions and intended applications. The research center provides new technology. The knowledge transfer projects combine this into practical solutions but also pose new research challenges to the research center. In turn this will focus the research on the mid- and long-term needs from industry. To assure the sustainable transfer of expertise, sometimes a project member is employed both by the company and the knowledge institute, sometimes he moves to the company after the project. Either way, the GATE project creates the knowledge base in the Netherlands that will give these companies a leading edge by helping them to integrate new technology in their future products.

Remco Veltkamp
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KTP with VSTEP

VSTEP earlier has created several procedure and incident training applications. Virtual humans play a central role in these trainings. Current technology limits the variability of their behavior and the range of situations they can cope with. Extending behavior and scope can be very time-consuming. There is much need for more autonomous behavior and the creation of generic models for these virtual humans to increase reusability and efficiency. The use of agent technology can contribute to these problems. This KTP project aims to develop a framework that supports the use of agent technology in building serious games. In order for this goal to succeed we will not just develop some software tools to connect game engines and agent platforms, but will also explicitly support translating the game ontology to the agent ontology and vice versa.

More information can be obtained from the project leader Frank Dignum: dignum@cs.uu.nl

KTP with Cyclomedia

Panoramic images of an environment can give the viewer a great sense of immersion. However, one thing is missing: depth. A 3D reconstruction of the world based on panoramic images opens up many new possibilities and applications. Cyclomedia Technology and Utrecht University collaborate in this KTP to reconstruct urban environments in 3D using panoramic images. A panorama with depth can be viewed on a 3D television, or with simple red-green glasses. In a 3D reconstruction users can easily find the dimensions of a building. It even becomes possible to add virtual objects to the world that interact with the reconstructed environment. However, existing image-based reconstruction techniques often fail when used on a real outdoor environment. This project aims at improving current reconstruction techniques, and to demonstrate some of the possible applications.

More information can be obtained from the project leader Remco Veltkamp (R.C.Veltkamp@uu.nl).



From left to right: Figure 1: The incident in the manipulated version; Figure 2: View on the road in the original version; Figure 3: View on the road in the manipulated version

Experiencing danger on a virtual highway

RESEARCH IN PROGRESS PART 4

Is it possible to experience a feeling of risk in a virtual environment, with non-immersive displays? We experimented with a virtual representation of a highway, used as an examination application for highway patrol officers.

Day and night, highway patrol officers inspect the Dutch highways. Their job is helping to ensure the safety of road users and to restore the traffic flow in case of accidents. In the qualification exam of the highway patrol officers, Rijkswaterstaat uses a virtual environment including traffic incidents, developed by the simulation software company E-Semble. It is important that the officers can assess the danger for themselves and other road users at any time during the examination, as in real life. However, on the flat projection screen that is used in the exams, it is difficult to judge and experience the speed and proximity of vehicles and feel the danger when standing close to highway traffic.

During the exam, the candidates stand in front of a projection screen, and handle a joystick to navigate through the environment, which they see from a first person point-of-view. In the virtual environment they can either sit in their car, or walk along the road. Confronted with a simulated highway incident, they should take actions to resolve the problem and to restore normal traffic flow, while minimizing the risk for other road users and themselves. An instructor assesses the candidates' procedural knowledge in several scenarios.
The scenario we investigated simulates an accident that has occured on the left lane of a highway, with a driver standing next to his vehicle, not knowing what to do. (Fig 1)
In a corresponding real life situation, the feeling of risk causes anxiety, which may affect decision making. In our simulation, many factors that contribute to the awareness of danger and create a feeling of risk, are missing. In real life one sees for instance upcoming traffic in the peripheral view, hears loud traffic noise, and feels strong gusts of wind when trucks are passing closely. The virtual environment only occupies a small part of the field of view, and the volume of the soundtrack is kept low to allow communication during the exam.

Cues for depth and motion

In a real environment, viewers have access to many cues that often provide redundant information on the depth and motion of objects. When estimating depth and motion from a VE represented on a 2D display, viewers have to rely on a restricted set of pictorial cues, which are automatically generated by the 3D rendering software, and on elements added or enhanced by the developers. In an attempt to provide viewers a more compelling impression, we enhanced and added several visual and auditory depth and speed cues in the VE, and added variability to traffic behavior.
We added lines of trees along the road to improve the effect of motion parallax, a cue for depth perception. The first person perspective was changed to an over-the-shoulder view. The larger simulated field of view used in the third person perspective, in combination with the reference provided by the avatars head, helps users to more accurately estimate distances, and to better anticipate the speed and trajectory of vehicles. Aerial perspective was introduced in the simulation by adding a distant haze, which gradually reduces environmental contrast with viewing distance. Traffic behaviour was made more irregular and unpredictable, and the number of trucks was increased. Also the shadows of the vehicles were improved.
We replaced the original soundtrack by one that more closely resembles ambient highway sounds. Car sounds were synchronized with vehicles, and included the Doppler-effect. In the enhanced simulation, one in ten trucks passing sounds its horn. The horn's high volume and its unpredictability is expected to draw the attention of the user and signal a possibly dangerous situation. All these visual and auditory cues can easily be implemented in standard desktop environments.

28 highway patrol officers took part in an experiment, in which we measured the effects of the manipulations on their perception of speed, distances, and their assessment of the danger. They were either shown the original or the manipulated environment. The results show an interesting effect: the participants seemed to judge distances to other cars in the original version smaller, and the speed of the vehicles higher, than in the manipulated version. In reality, this would decrease the safety for the road users. However, the participants that used the manipulated version felt the situation was more dangerous to themselves than those in the original environment. We assume that the sounds and extra visual information created a more convincing and vivid representation of the situation and events. This is supposed to stimulate mental images and associations, which induce a feeling of risk.
Although non-immersive systems like the one used in this experiment lack some of the (e.g. stereoscopic) cues and the wide field of view offered by more immersive systems (e.g. head-mounted displays), they can still be valuable tools for training and evaluation of skills. Our results show that relatively minor modifications tuned to the purpose of the VE can significantly influence the experience of the user, also on 2D displays.

Joske Houtkamp is workpackage leader of GATE workpackage 1.3, Affective appraisal of virtual environments. Together with Lex Toet (TNO) and many master students of Utrecht University, she has conducted experiments to investigate the effects of virtual environments on the emotional response of viewers. Together with VSTEP, Joske is now involved in the Knowledge Transfer Project 'Sound Design in Serious Games'.

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