Adapting the game to the world

LEARNING WITH SIMULATED WORLDS

Keeping the trainee on track

Computer games are frustrating if they are too difficult, but boring if they are too easy. Researchers at Utrecht University are working on computer games that adjust to the skill level of the user on the fly. This way games are just challenging enough for that particular person.

One of the most important factors in making computer games fun is making sure that they have the right difficulty level for the player. Most games can be played at different difficulty levels, which you can chose before you start the game. This way you need to know how good you are at the game before you start playing the game. Different people also increase their skill level at different rates. If the increase in skill level is different than the game designer expected then the game will still become too difficult or too easy for the user.

Continuous matching difficulty of tasks and skill level

We created a framework for creating games that are able to keep track of the skill level of the player and adjust accordingly. We estimate the skill level of the player by dividing the game in small parts and measuring the performance of the player on every part that is finished. Really different tasks are chosen according to the skill level of the user. For example, a game level with lots of aiming tasks if the player needs to improve its aiming skill. Game designers usually create a nice story that the player experiences while he is playing the game. But if different players get different tasks according to their skill level then the ordering of the storyline might change and possibly ruin the experience for the player. The developed system allows games to adjust to the user while making sure that the storyline, created by the game designer, is preserved. For example a character with a broken leg cannot suddenly walk again to make the game easier. They also makes sure that parts of the game that should be more challenging remain more challenging for the player. Beschrijf hier de resultaten. Geef ook eventuele samenwerking met bedrijven aan (voor zover niet binnen een KTP).

"Challenging the user at the right level makes computer games fun"

Proof of concept

At the moment we created a proof of concept of the model and are developing a custom environment in which we can experiment with the theoretical framework developed so far. We plan to submit the progress and gained knowledge from this face to the Agents for Games and Simulations workshop and to AAMAS or a more gaming oriented conference. Journal submissions will also be considered.

Workpackage
4.1 Adapting the game to the world

Partners
Utrecht University

Budget
500.000 euro

Key Publications

Joost Westra,et al (2010). Guiding User Adaptation in Serious Games, Agents for Games and Simulations

Joost Westra,et al (2010). Keeping the Trainee on Track, IEEE Conference on Computational Intelligence and Games

Joost Westra,et al (2009). Adaptive Serious Games Using Agent Organizations, Agents for Games and Simulations (pp. 206-220)

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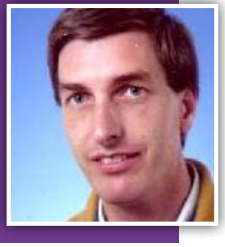

Learning from games

Learning with Simulated Worlds

New models that enable designers to improve specific learning results.

Workpackage
4.2 Design rules for learning through simulated worlds

Partners
Utrecht University

Budget
1.000.000 euro

Key Publications

J. Raessens (2010). A taste of life as a refugee: How serious games frame refugee issues. In: Changes in Museum Practice. New Media, Refugees and Participation, pp. 94-105.

J. Raessens (2009). The gaming dispositif. An analysis of serious games from a humanities perspective. In: Serious Games: Mechanisms and Effects, pp. 486-512.

S. Lammes (2009). Terra incognita: Computer games, cartography and spatial stories. In: Digital Material. Tracing New Media in Everyday Life and Technology, pp. 223-235.

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Serious games can enable players to acquire and improve domain specific knowledge and sharpen cognitive skills such as spatial abilities, media literacy, decision making and problem solving. New models have been developed that can help game designers and developers to discuss and improve the design and learning effects of educational games.

Although serious games have become a very popular medium, developers still require theoretical models that can help them to improve the design and thereby the learning results of serious games. This research wants to fulfill this need by focusing on three specific topics: how meanings are made through games and game play, how narrative structures can be designed to improve learning processes, and how rhetorical strategies can be designed to convince players of certain perspectives (e.g. political games), or behavioural changes (e.g. health games). With the insights gained from this research, we will formulate specific design rules for game-based learning.

Persuasion and learning

Building on the analysis of the medium specificity of serious games, we created a heuristic tool or model – the gaming dispositif - that takes into account the interplay between technical, textual, contextual, psychological as well as social processes involved in the game-playing situation. This model enables us, for example, to understand how serious games trigger different educational readings, depending on the context in which they are embedded. We also developed a theoretical model that can be used for the analysis and design of emergent narratives in serious games. Breaking with a classical narrative approach, this model focuses on space and spatial exploration, and on how games offer players firsthand narrative experiences in the here-and-now. Finally, we studied the qualities of serious games that enable, promote, limit or impede persuasion. We are using these insights to formulate effective and efficient strategic guidelines for persuasive game design. Taking into account the differences and similarities between persuasion, manipulation and learning, this model can elucidate why and how serious games can be so exceptionally persuasive. Designers can use these models to improve specific learning results.

"Food Force: an educational game that rocks! Informative, and very enjoyable to play"

Social network games

To be able to formulate specific guidelines for designing educational games, we will extend and improve the new models we have developed so far. A specific issue of learning is that it should be accountable and measurable. That's why we want to start with an empirical evaluation of how serious games make use of narrative structures and rhetorical strategies to engage players in learning processes. We will not only summarize the empirical evidence on the effectiveness of existing best practices of serious games (e.g. Food Force), but also participate in the design of new games (e.g. Schiphol SmartGate). The latter will be done in close collaboration with gaming companies in a so-called knowledge transfer project. Furthermore, we also want to include social network games in our research (e.g. FarmVille). We will bring together knowledge on social networking mechanics and serious game design fundamentals to investigate the potential of social networks such as Facebook for game-based learning.

Serious game design

LEARNING WITH SIMULATED WORLDS

Improving the design of serious games from a cognitive standpoint.

Serious games are a fun, but as of yet inefficient way of teaching educational material. In part this is because very little is known scientifically of what makes a well-designed serious game. We are empirically investigating which game design techniques work and which don't.

All games revolve around learning. Much of what makes a game fun in the first place is learning to overcome obstacles, how to defeat difficult enemies and solve complex puzzles. As good games scaffold and regulate this learning process fluidly, inserting serious material in a good game would lead to an effective serious game. This is the theory. In practice however, many serious games struggle to reach their full potential. Games are difficult enough as they are; adding difficult educational content requires a clear notion of the cognitive implications of the game design and finetuning these.

Game Discourse Analysis

To facilitate this clear notion, we created the Game Discourse Analysis, a method and a graphical way of describing the characters, events and implications for the player's cognitive system in the game. With this we were able to discern critical moments in a game narrative that allow evoking curiosity in the player by inserting certain information, and found out that this change in the narrative enhanced curiosity of players and improved recall later on.

Code Red Triage

Different game design techniques can hypothetically be used to finetune the cognitive load imposed by a game and to improve learning from the game. We created a serious game, Code Red Triage, which trains medical first responders in a crisis situation. With this game, we systematically vary techniques such as cueing, the information presentation rate and narrative structure, to determine the effect on learning gains and enjoyment of the game. We already found out that using cues--guiding the attention of the player via auditory or visual hints and often used in entertainment games, may actually be harmful, or at least not effective, in serious games.

Serious serious game design

This begs the question: does good game design actually mean good serious game design? In entertainment games, the complexity of the game progressively builds up, with players receiving new abilities and encountering slightly more difficult enemies as they go along. However, this could also make the player a lazy learner, never being urged to overthink the whole picture. We are now examining what way of increase in complexity works best for serious games. In addition, we are engineering the predictability of the narrative structure of our serious game, to see if this can encourage the player to think actively about the presented information, and thereby boost the learning gains of a serious game.

"Does good game design actually mean good serious game design?"

Workpackage
4.3 Cognition-based learning principles in serious games

Partners
Utrecht University

Budget
500.000 euro

Key Publications

E.D. van der Spek et al. (2010). Code Red Triage, Or COgnition-based DEsign Rules Enhancing Decisionmaking TRaining in A Game Environment. British Journal of Educational Technology.

E.D. van der Spek et al. (2010). Attentional Cueing in Serious Games. Proc. 2nd IEEE conf. on Games and Virtual Worlds for Serious Applications, pp. 119-125.

P. Wouters et al. (2009). Cognition-based learning principles in the design of effective serious games: How to engage learners in genuine learning. 2nd European Conf. on Games Based Learning, pp. 517-524.

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Evidence-based learning in serious gaming

LEARNING WITH SIMULATED WORLDS

How to optimize, measure and validate true learning effects of educational serious games.

Workpackage
4.4 Transfer of Gaming

Partners
TNO-Human Factors

Budget
500.000 euro

Key Publications

Toet, A et al (2008). Cybersickness and desktop simulations: field of view effects and user experience, in: JJ Güell, M Uijt de Haag (Eds.), Enhanced and Synthetic Vision 2008, SPIE-6957. The International Society for Optical Engineering, Bellingham, WA, USA (2008) pp 69570P-1 - 69570P-11.

Bos, J.E. et al (2010). The effect of internal and external field of view on visually induced motion sickness. Applied Ergonomics 41, pp 516-521.

Korteling J.E. et al Report TNO-DV 2010, TNO Human factors (in press).

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Serious gaming may reduce the cost of training, enhance job satisfaction and labor productivity, and thus may be a highly effective and satisfying tool for education. However, to what degree is this possible, what determines learning benefits and how can this be measured and proven?

Transfer of gaming (ToG) of educational games concerns the degree to which skills, knowledge, and attitudes acquired by playing a game can be effectively used in real (practical, professional) situations. In this workpackage, methods for the determinantion of ToG are formulated and developed, as well as tools, guidelines and concepts affecting ToG.. In addition, experimental research is carried out to verify claims (e.g., concerning learning effects) and to test hypotheses (e.g., about cybersickness). This knowledge on (improvement of) ToG helps game designers and developers to build the right games for the right purposes.

Cybersickness, military tactics and F16 pilots

A review of the literature has been carried out describing motivational and educational aspects of serious gaming as well as methodological aspects of ToG measurement. This work includes a taxonomy predicting effects of game characteristics on transfer of gaming and a Stepwise Reference Framework. This latter tool entails a stepwise approach for the design, specification and evaluation of serious games from a combined didactical and cost-effectiveness point of view.

Next to this theoretical study, several experimental studies have been carried out. Cybersickness represents sickness caused by viewing dynamic image content as generated by video games. In order to get more grip on this phenomenon several hypotheses have been formulated and experimentally tested and an explanatory framework was developed. Using a military tactical shooter game (VBS2) for platoons and their commanders, we have furthermore shown that students became more motivated and active learners and performed better, especially in military tactics. Finally, a transfer of training study was conducted in TNO's high-fidelity F-16 flight simulator. The results of this experiment show that Falcon 4.0 (a PC based F-16 flight game) gamers perform substantially better on all measured tasks compared to Microsoft Flight Simulator gamers and to non-flight gamers. The aforementioned results provides rules, principles and tools for an adequate evaluation method aimed at measuring ToG and improving ToG in educational programs.

Flow and engagement

Next to the training of typical perceptual-motor or procedural skills, serious gaming may also be very beneficial for enhancing motivation, engagement and typical professional attitudes. Therefore, after having analyzed the complete set of data of the Falcon 4.0 study, we will further extend on this ToG study. In collaboration with the Open University new tools to measure the performance of the F16 gamers will be developed and applied. These tools measure performance on different behavioral scales, such as flow, situational awareness and engagement. Based on theoretical analyses and previous observations we expect to find that certain (but not all) task aspects of this very complicated professional job, i.e., the execution of coordinated F16 fighter jet missions, will show substantial transfer from the game to "real" task. In addition we will further work on publication and dissemination of the results and conclusions.