TRANSFER OF GAMING

HOW TO OPTIMIZE, MEASURE AND VALIDATE TRUE LEARNING EFFECTS OF EDUCATIONAL SERIOUS GAMES

THIS WORK PACKAGE HAS PRODUCED THE PRINCIPLES AND METHODOLOGIES CONCERNING OPTIMALIZATION AND MEASUREMENT OF TRANSFER OF TRAINING IN SERIOUS GAMING. IN ADDITION, TRUE TRANSFER OF JOB-SPECIFIC COMPETENCES IS DEMONSTRATED.

In WP 4.4. Transfer of Gaming, methodological knowledge concerning the validity and validation of serious gaming is developed, as well as guidelines, factors, and mechanisms affecting transfer of training of serious games. In addition, experimental research is carried out to verify claims, such as the supposed high learning value of serious games. Also hypotheses are tested concerning the factors that elicit cybersickness. This knowledge on (improvement of) ToG helps game designers and developers to build the right games for the right purposes.

First, a review of the literature has been carried out describing educational, modeling, and motivational aspects of serious gaming as well as methodological aspects of the measurement of transfer. This review includes a taxonomy predicting effects of game characteristics on transfer of gaming and a Stepwise Reference Framework. This latter tool entails an approach for the design, specification and evaluation of serious games from a combined didactical and cost-effectiveness point of view.
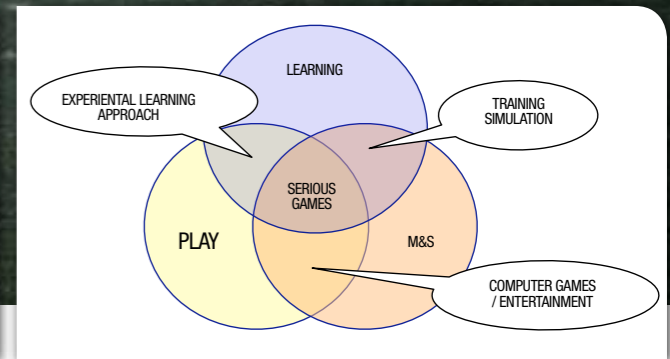
CYBERSICKNESS
Next to this theoretical study, several experimental studies have been carried out. First, cybersickness represents sickness caused by viewing dynamic image content as generated by video games. In order to get more grip on this phenomenon several hypotheses have been formulated and experimentally tested. In addition, an explanatory framework was developed explaining motion sickness in general and cybersickness in particular. Taking the control of body motion as a starting point, according to this framework an essential problem concerns the ambiguity between gravity and inertia. Although visual information can be used to make the distinction between these two phenomena, the visual system is yet too slow for accurate control of active body motion. The result of the apparent unsolvable ambiguity is a conflict between sensory and expected signals in a number of cases, which is highly correlated with sickness severity.

PLAYING MICOSOFT FLIGHTSIM AND FALCON 4.0
In a more practical setting, we have furthermore evaluated training effects of serious gaming (Virtual Battle Space 2) on military tactical competences. Performance evaluations showed that military students performed better after having played several scenario's. Also a transfer of training study was conducted in TNO's high-fidelity F-16 flight simulator. In this experiment three groups of gamers had to perform three typical F16 flight tasks, i.e., Basic flight, Tactical formation flight, and Close formation flight. The results of this experiment show that Falcon 4.0 (a PC based F-16 flight game) gamers performed substantially better on almost all measured performance variables compared to non-flight gamers, and to a lesser degree to Microsoft Flightsim gamers. Whereas, the Falcon 4.0 group showed (near) transfer on almost all flight performance measures, performance of the Microsoft Flightsim gamers even indicated far transfer. This far transfer was shown especially in the less difficult and more generic flight tasks. In conclusion, we have provided real evidence for both near and far transfer of serious job-related competences by playing games.

INTERSECTING KNOWLEDGE DOMAINS
Finally, the knowledge that has been acquired has been described in a chapter of a Handbook on the Psychology of Digital Media at Work. This chapter discusses this topic borrowing from three intersecting knowledge domains, i.e.: Learning, Modeling & Simulation, and Play. From each domain, those issues are presented that are most relevant for serious gaming. In addition, the possibilities and limitations of serious gaming for professional learning and training objectives are indicated. It is shown how gaming can play a serious role in training and education by taking into account the principles and knowledge of the aforementioned knowledge area's.

ENRICHING TRAINING PROGRAMMES
In conclusion, this workpackage provides rules, principles and aimed at measuring transfer of gaming and improving transfer of gaming in educational programs. For developers of serious gaming this knowledge offers various means of support to improve, and substantiate the quality and effectiveness of their serious games. To be complete, in the design and application of serious gaming one has to consider many factors such as training program and instructional features, serious gaming didactics, fidelity, validity, types of tasks and competences, target groups, learning goals, and intrinsic and extrinsic aspects of motivation. Therefore games and play can have a valuable role in schooling and job training; not to fully replace traditional training methods, but to substantially enrich existing training programmes, and to inspire and challenge learners. ◆

SUMMARY
The present workpackage has provided principles and methodologies concerning optimalization and measurement of transfer of training in serious gaming. This knowledge has been produced by literature study on describing educational, modeling, and motivational aspects of serious gaming as well as methodological aspects of ToG measurement. This has a.o. resulted in a stepwise approach for the design, specification and evaluation of serious games from a combined didactical and cost-effectiveness point of view. In addition experimental research has demonstrated factors that enhance cybersickness, beneficial effects of gaming in the training of military tactics, and near- and far transfer-effects of two different flight games on pilot performance.

CONTACT
Dr Hans Korteling is a psychophysiologist and senior scientist at the TNO Department of Training and Performance Innovations with a main focus of interest in cost-effective simulation, cognitive aging (PhD thesis) and design and validation of serious gaming. In the present GATE project Hans collaborates closely with two former TNO researchers, i.e., Ralf Sluimer MSc, working as experimental psychologist and project manager and dr Anne Helsdingen, who is cognitive and educational psychologist at the Effat University in Jeddah (Saudi Arabia).

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