VIRTUAL REALITY IN ADVANCED SIMULATIONS OF INTENSIVE CARE SCENARIOS

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D2.1 TECHNOLOGY-ENHANCED LEARNING AND TEACHING IN ACUTE MEDICINE

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Truly immersive virtual reality where medical students could acquire professional knowledge and skills, while no real patient is in danger, is the Holy Grail of medical e-learning.

This presentation will briefly tell the story of our recent development towards this Holy Grail. We will share our experience with the transformation of one example problem-based scenario in acute medicine, Surviving Sepsis, into a virtual reality simulator. The simulator combines 3D graphics for the virtual reality context, nodal structuring for problem-based learning context and physiological models for simulation-based game component.

The core approach to e-learning in our laboratory is physiological modeling and simulation. For the modeling we use industrial strength tools based on Modelica language, which is an equation based language to model physical systems. For the simulation part we have created a custom tool chain which allows us to embed the Modelica models into simulators. The simulators are then used as learning objects for medical education, with or without the assistance of teachers.

Virtual reality is commonly referred in the context of 3D media. Modern 3D game engines has lowered the bar enough to make it feasible even for small teams, as we are, to actually start using 3D. Using Unity3D game engine, we have added 3D virtual patient visualizations to provide more immersive learning context to our serious games.

Recently, we have been in close cooperation with several intensive care practitioners and educators, namely from Military University Hospital Prague and AKUTNE.CZ, which had lead us into the area of problem-based learning in intensive care medicine. Node-based scenario description is often used to capture essential situations in acute medicine scenarios. We have combined the nodal-based approach with our physiological simulation-based approach to get the most out of both.

Creation of physiological models and simulation based games is a demanding task. We have mastered it to a great extent. One of our greatest achievements in this area is the translation of HumMod model into Modelica language while further enhancing it; HumMod is perhaps the most complex and largest physiological model ever created. Now, we can use this model to simulate complex states of virtual patients during simulated clinical scenarios.

However, presentation layer of our simulation games were made of 2D graphics exclusively, and we must admit, our e-learning applications were more or less of technocratic nature. Our recent addition of 3D media is moving us to the area of immersive virtual reality.

Then, the combination of physiological simulations and nodal-based clinical scenarios proves to be mutually beneficial. We have tested all this together on one example intensive care scenario: Surviving Sepsis.

Our laboratory has reached a new milestone on the way towards the use of true virtual reality in medical education and training. Now, we can combine complex physiological simulations, nodal-based clinical scenarios, 2D and 3D graphics in one learning object.

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