Medical Education on an Interactive Surface

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ABSTRACT

We present initial results of SimMed, an ongoing interdisciplinary project for the use of interactive tables in medical education. The project is motivated by the need of combining theoretical knowledge with practice in medical education and the time-consuming task of finding appropriate patients for teaching. Students in medicine are able to interact realistically with a virtual patient displayed on the interactive table to diagnose and cure illnesses. The project is still under development.

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ACM Classification Keywords: H5.2 [Information interfaces and presentation]: User Interfaces. - Graphical user interfaces.

MOTIVATION

Historically, there has been a large gap in medical education between theoretical, lecture-based teaching and practical interaction with patients. Lectures, often presented in front of hundreds of students, present the theoretical knowledge needed, but they do not teach students the necessary skills when it comes to the treatment of real patients.

Efforts to improve the situation include the use of standardized patients (actors trained to act as patients with certain disease patterns), and full scale medical simulators. In both cases, there are limits to the patient conditions – pathological or otherwise – that can be shown. Also, the costs involved are very high.

Virtual patients on interactive surfaces are a viable alternative. They allow realistic portrayal of many pathological conditions. The costs involved are lower. Additionally, tabletops naturally support group interaction between students as teamwork ability is a highly recommended skill.

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THE SIMMED PROJECT

SimMed is an ongoing interdisciplinary research project at Charité - Universitätsmedizin Berlin in partnership with Archimedes Solutions GmbH. The goal of this project is to design a novel game-based learning environment for health professionals and students using multi touch technology on an Archimedes "SessionDesk". The conceptual development of the medical simulation and the integration in a curriculum takes place at Charité, involving medical practitioners, psychologists and sociologists. The technical development and the implementation are realized by Archimedes Solutions GmbH. The first simulation scenarios cover different pediatric case studies. SimMed is intended as a serious game with the goal to train medical skills in a team. These skills include doing the right order of medical examinations, to diagnose and to cure illness under the pressure of time and costs.

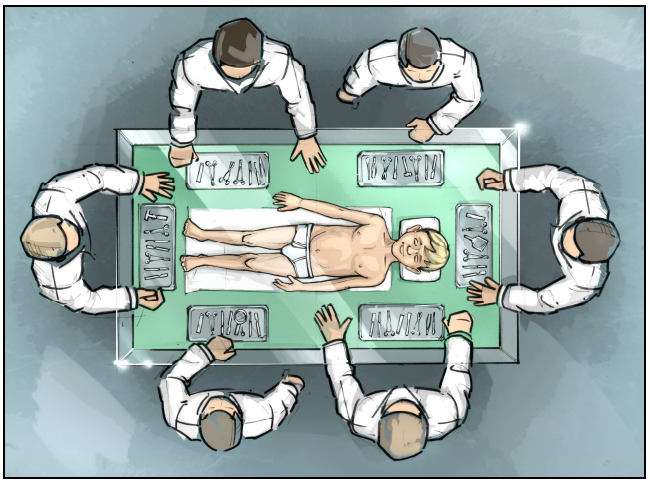

Figure 1: A sketch of the interaction with the virtual patient.

INTEGRATION INTO MEDICAL CURRICULA

In 1999 a new reformed medical studies program was founded at Charité. It was meant to implement new forms of medical education with the objectives to start practicing sooner in medical curriculum and the possibility to learn in small groups. At Charité, the teaching method of problem-oriented-learning (POL/PBL) is currently one of the main components to support this new curriculum: Up to eight

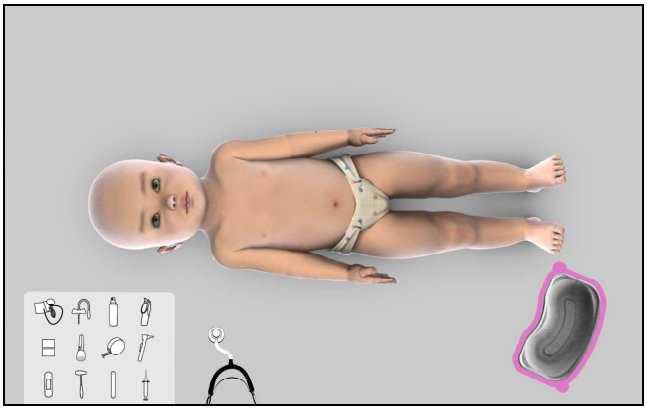

Figure 2: User interface of the prototype application in idle state.

students, supervised by a POL-teacher, treat one medical case study based on data of real life patients. The participants work together to find learning objectives and try to achieve these within one week. The SimMed prototype is intended to support POL or other teaching methods at the Charité within the scope of the new curriculum. On the other hand further and advanced training of health professionals can be improved by SimMed. The simulation provides a realistic scenario in which students or health professionals can refine their medical skills without human assistance of patients or supervisors. Additional information and documentation, such as instructions how to read results from clinical assessments, can be provided by SimMed.

INTERACTION

Interaction with the virtual patient should mimic the interaction with real patients where there is a pedagogical reason and where it is technically possible. The challenge here is to have the student learn to interact with the patient, not with the simulation. We count on regular usability tests and corresponding feedback loops to help find the correct balance here. Much of the interaction with tools will take place using standard selection and drag-and-drop techniques used in traditional WIMP (window, icon, menu, pointing device) interfaces.

On the other hand, interaction with the simulation should feel like interaction with a real patient. To this end, we will be exploring physics-based interaction techniques such as those presented in [2].

FIRST PROTOTYPE

In order to gather initial feedback, we implemented and deployed a first prototype application. The application displays a pediatric patient on the table. A range of medical instruments is available for selection. These instruments can be dragged across the table to simulate interactions with the patient.

To demonstrate the prospects of the medium, auscultation (listening to the internal sounds of the body) with a functioning virtual stethoscope was implemented as a first interactive scenario. The stethoscope can be dragged on the virtual patient and if placed at the right points heart and lung sounds can be heard.

USABILITY FEEDBACK

In order to evaluate the usability, users from the intended audience were asked to answer a short questionnaire and to do the auscultation in a typical usability test setting [4]. All tested users regardless of their age or professional experience did the auscultation without any problems. Most of them didn´t expect any sound and were impressed by the realistic heart tones. We found, that users treat the virtual patient like a real patient, although not all functionality is implemented yet.

FUTURE WORK

The SimMed project is scheduled to run until the beginning of 2012. We expect much work in interaction design and in achieving the pedagogical goals.

We also see many open issues in the rendering of the patient on the tabletop. Tabletops have a much lower resolution than regular displays [1] and there are issues with 3D perspective to be dealt with [3]. Last but not least, the optimal rendering technique is tied to the pedagogical goal: How can we display the patient so that the important details are perceived as relevant [5]? It is possible that photorealistic rendering is not the answer to this issue.

At Charité the project will be monitored with constant usability tests with participation of health professionals, in order to reach the most realistic outcome. A major problem to look at is the judgment of the participants. For instance when they have to decide whether the displayed patient turns pale or this is an artifact of the SessionDesk or the environment, like light shining on the desk.

Furthermore the embedding of SimMed in a teaching method will be developed and evaluated.

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