Virtual Patient/Eye Simulator – Evolution of a futuristic teaching tool

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Abstract
Virtual simulation is a powerful teaching method that has successfully been used by industries such as pilot training. The use of simulators to assist medical training was first attempted over 40 years ago. With the advancement of technology, better and more realistic patient simulators have evolved. In 1997, we developed an eye simulator to teach medical students basic neurological oculomotor concepts and exam techniques. Based on user feedback, an enhanced simulator evolved last year that added more accurate simulations, a pupillary reflex simulator, neuro-ophthalmology cases, and training demonstrations. This poster describes the development, successes and evolution of these virtual eye simulator applications.

Background
The first known medical simulation application was developed in 1963 by Entwisle[1]. This application simulated patients with six unique diagnoses and provided medical students feedback on their diagnostic skills. With the explosive growth in computer technology during the last 40 years, the invention of the World Wide Web (WWW) and the phenomenal increase in storage technology (CD/DVD) drives, there has been major advances in patient simulation. Current simulation systems include virtual reality surgery simulators, mannequin based simulation system for cardiology teaching (ie.Harvey[2]), simulators for teaching endoscopy, and many case-based multimedia simulations.

Benefits of simulations are numerous and include:
- ability to simulate standardized cases
- ability to easily test competency/comprehension
- ability to protect the safety of patients
- ability to learn new techniques as well as review

Since there were no neuro-ophthalmology simulators, in 1997, we developed the eye simulator EyeSim program (figure 1,2) to teach medical students to understand oculomotor concepts, exam techniques and to recognize cranial nerve palsies. It has been used for the last 5 years by medical students and educators world-wide. Based on user feedback, a second version (EyeSim Ver 2.0) was developed. Both versions are on the WWW at http://cim.ucdavis.edu/eyes

Methods
The first version consists of an eye motion simulator and a quiz section to measure user comprehension. It was developed with the Macromedia Director© animation software, Shockwave© Plugin and is web- based.

The simulator has realistic eyes that follow the mouse cursor. With simple check box control, the eye simulator can simulate any combination of cranial nerve palsies and nerve palsies of the ocular muscles.

The new simulator contains major enhancements including:
- more accurate and realistic oculomotor simulation
- pupillary simulator with virtual flashlight simulating normal and abnormal pupillary reflexes
- neuro-ophthalmology patient cases with discussions
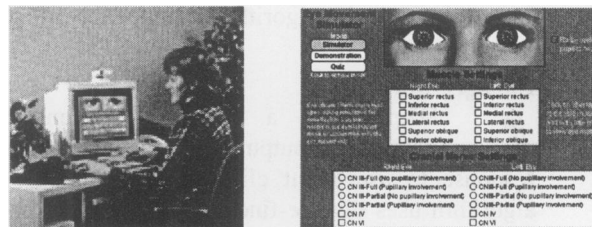- narrated demonstrations of neurological tests

Figure 1 and 2

Results
The first version of the simulator was presented at the World Conference of Educational Multimedia, 1999[3] and has been successfully used by thousands of medical students in medical schools worldwide. The first version has had over 100,000 visits to the website and e-mail messages have been received by hundreds of students and faculty describing its usefulness in the learning process. Many institutions requested the software and mirror sites have been set up in England, Singapore, and Maryland. Many faculty use a video projector to project the simulator during their lectures.

The new eye simulator has been up 9 months. Evaluation by prominent neuro-opthalmologists indicate it is a promising tool for teaching medical students and residents basic neuro-ophthalmlogy techniques. More patient cases are being developed. The next step is to develop a survey that will measure the effectiveness of this technology and how it can be enhanced to improve teaching. Future enhancements will add strabismus concepts and other capabilities. In the future, simulators will be used to simulate the entire patient and be a major part of medical education.

References
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