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Letter to Editor
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VrArSurgery: Virtual and Augmented Reality Kit in Surgical Training

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Letter to Editor

According to The Institute of Medicine, a non-profit organization founded by the U.S. National Academy of Sciences, each year, from 44,000 to 98,000 deaths occur worldwide due to medical errors during patient treatment, within the traditional educational model the surgeon sees an operation, then performs it and finally teaches that operation to another surgeon. That is the way physicians have been taught for generations. This period of training can be as long as 4 to 5 years for brain aneurysm clipping. It all depends on the conscience of the teacher and the skill of the student for the timing of the first solo surgery. If something goes wrong, those patients die!

We are working on a new product (VrArSurgery) that can be an adjunct to surgical education and minimize the risk for patients. The main incentive of this project is to create an open ended simulation working platform based on virtual and augmented reality to initiate the training of neurosurgeons in aneurysm surgery, undoubtedly one of the most dangerous types of surgery within the field. The annual incidence of aneurysmal brain hemorrhage is 10-16 cases per 100.000 population (25/100 000/year in Japan, 22.5/100 000/year in Finland, 6-16/100 000/year in USA). One half of patients with aneurysmal brain hemorrhage die within a month, and roughly half of the survivors are left with some persistent neurological deficit.

The digital simulation will be designed to enable one-to-one practice of this very specific, skill-needing procedure which is cerebral aneurysm surgery. Detached from reality through his headset and pressure sensitive gloves, the surgeon-to-be begins the surgery, performs an incorrect dissection and is given a warning, the correct procedure is shown, the surgeon restarts the last dissection and continues the operation; meanwhile there is no patient who has suffered. The young surgeon has to negotiate numerous critical steps: such as the careful dissection of the subarachnoid space; choosing the right artery which will lead to the aneurysm; meticulously preparing the neck of the aneurysm; and not least the correct and precise placement of the clip, and so on. Each step offers several possible options to the surgeon: the best, the acceptable and the disastrously wrong. As each step is completed, the surgeon is awarded new points or forfeits existing ones. With this project, surgical training will never be the same as it has been for centuries.

In order to make this project happen, first, a visually authentic replica of the brain will be prepared in a digital setting. Second, the digital images of surgical instruments such as aspirator, bipolar forceps and retractor will be added to the digital milieu. These instruments will be animated with smooth, natural movements. The surgeon via his specialized headset and pressure sensitive gloves will perform the surgery. Headset and pressure sensitive gloves that are currently on the market will be modified and machine learning algorithms and software will be created.

This system will also be used in examinations: the candidate will perform a surgery whose level of difficulty is pre-determined by the adjudicator. It will help to standardize surgical practice and its teaching everywhere. It will provide an economic, readily available, and egalitarian process of education in the field. The formation of surgical skill and its subsequent measure (examination/testing) will be systematic and exact, especially so in less privileged parts of the world. This product will be a world's first with all three components: software, headset and gloves. It will be a "portable" and "affordably priced simulation kit" for surgical training, without need for deploying complex infrastructure, hardware or robot. What is available today are Simulation "Centers": rooms with immobile boxes, tables, immovable hardware of limited capacity and without scenario. Surgical simulators today tend to be large and cumbersome devices that run in multi-million-dollar simulation centers.

We are also constructing a working platform, a bearing infrastructure, and we will present this

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to the medical world. This "open-ended" platform will be extended to other surgical branches: cardiovascular surgeons, urologists, gynecologists, and so on. We will provide them with all kinds of help and support. After preparation of the working environment, every surgeon and every specialty will be able to prepare their own surgical scenarios, insert their own anatomical structures and lesions and operate with the instruments of their choice. The project is planned to create new horizons for surgical education and as result contribute to health systems throughout the world.

The consortium to realize this product is being created within the framework of EUREKA ITEA3 funding by Turkish, French, Finnish and Spanish sub-consortiums and hopes to present VrArSurgery to the market in the next 3 years.