



3D ANIMATIONS IN EDUCATION OF MEDICAL STUDENTS

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Abstract

Traditional forms of education in the area of human anatomy were supported by the system of 3D virtual projection installed at the Faculty of medicine in Košice. 3D projection system, based on principles of virtual reality, is located in the lecture room with the capacity of 200 students. Using specialized glasses the students feel an existence of 3D space and they are allowed to study human body in more detailed forms. Even if the students' response is very positive, the education using virtual projection is limited to the time schedule of lecture room. Due to this, the teachers asked us to create education materials playable also outside the lecture room and its virtual projection system. To meet these needs we started to prepare so called 2D versions of education movies. These can be equipped by audio and text comments and/or explanations of teachers. At the present, the movies are prepared according to the syllabus for Anatomy guaranteed by Department of anatomy. Database of such materials will be available for the students in the classroom equipped with 10 personal computers as first. Later, we suppose to create also an off-line version in the form of DVD and after completion of all necessary modules the movies will be offered and available in on-line forms as well. Using this way, we expect to reach our primary goal that is to offer students the possibilities of detailed study of human body, its organs and their topographical relations. On the other hand, these materials will be useable repetitively during different education activities.

Key words: virtual projection, 3D movies, anatomy, education

3D virtual projection

The 3D system of virtual projection was installed in the lecture room with the capacity of 200 persons with the aim to make education more effective and more illustrative. Its three main components were continuously tested and improved according to the skills we have reached while preparing first



education materials. 3D camera system is used to record 3D content. Teacher workstation allows to process real captured content as well as digital animations and the large screen projection shows final stereoscopic education movies and/or animations during lectures to the audience even with or without comments of the teacher.

To create a 3D animated material we use model of human body bought together with the 3D system from Slovakia Supercomputers s.r.o. Such model is divided into the several parts, e.g. muscles, bones, nervous system, vascular system etc. The required parts of the human body are loaded into the SuperEngine (software to create scenes and to synchronize individual parts of the system) according to the aim of presentation. User can use the functionalities of the engine to make these parts highlighted, transparent or invisible. Using space mouse it is possible to organize movements, viewing angles and all the necessary effects on the scene. All created scenes can be equipped with texts and audio records and saved as dynamic 3D output for large screen projection.

Basically, using the system capabilities we are able to realize functions as summarized in the Table 1.

Table 1: Summary of 3D virtual projection system functionalities

Function	Description
3D movies projection	presentation of real 3D movies recorded by 3D cameras (surgery interventions, medical treatment procedures, rehabilitation techniques etc.)
3D animated movies projection	presentation of 3D computer animations (usually materials prepared with 3D model of human body)
2D movies projection	presentation of scenes recorded only using one single non 3D camera
projection of 3D content in real time	presentation of 3D model in case when no dynamic material was prepared before the lecture (teacher works with the system and with the 3D content during lecture)
live events 3D projection	presentation of real scenes directly from 3D camera (3D videoconference)



Education needs

The most preferable way of using the system during the lectures is presentation of predisposed materials. It's because the teachers do not want to spend time with managing the scene in real time. However, the major reasons are that they worry to use it as something new and difficult and also there is a need to be skilled in using of space mouse. The limitation of 3D system usage is caused also by the schedule, as the lecture room is often occupied by other teachers to teach students on other subjects.

Therefore, we decided to transform all the created 3D animations into the non-stereoscopic form, i.e. to the forms suitable for use without the large screen projection system and generally playable on common computers with common software players. The disadvantage of this approach is that the 3D information is missing and the visualisation is reduced and worsed a bit. On the other hand, the students are allowed to see it several times and discuss it with their teachers in smaller groups as preparation before practical exercises. Everything is organized in the newly created PC room of Department of anatomy, equipped with 10 personal computers and localized close to the labs and dissecting rooms of department.

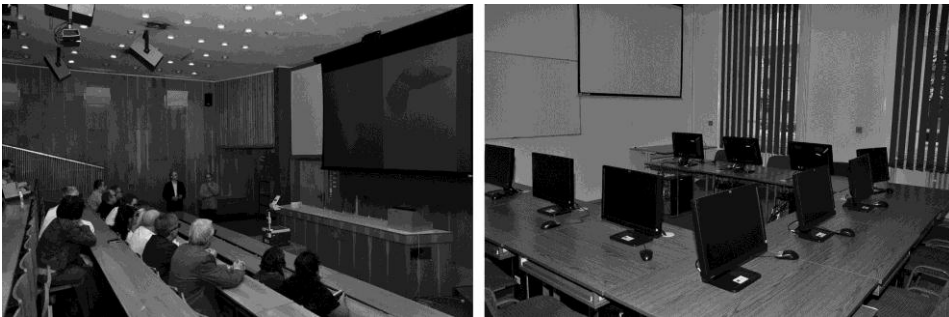


Figure 1: Lecture room with large screen 3D projection (left) and computer classroom with 10 PC at the Department of anatomy (right).

Before transformation of 3D animations into the form of common movies we upgrade the content and the design of 3D source. Sometimes we are forced to do completely new scenes as we discovered some mistakes while using previous versions and sometimes there is a need to add and/or remove some parts of the model from the scene. Everything is done with the aim to create as best education and illustrative output as it can be. Also the requirements of teachers with respect to the content of lecture are considered and therefore the final result is discussed and reorganized several times. During



this time consuming work we have been found several mistakes and deficiencies in the original human body model as well. Thanks to the professionals and teachers of anatomy we were able to define precise requests to repair them directly at the side of produces.

Topics and syllabus

Thanks to the MEFANET and its publication portal, the students have access to the presentations of individual subjects taught at the faculty. They can read the slides on-line, wherever they are so they can easily memorize all explained topics. What the teachers were worried about is that the attendance during lectures will be poor, but the time convinced us that it was groundless apprehension as the current attendance is better now and the students attend the lectures prepared and with the questions that can be discussed.

Transformation of existing 3D materials and creation of new ones are now organized in accordance with the syllabus of anatomy. We are working on the systems of head end the neck during this winter term. These cover themes as summarized in the Table 2.

Table 2: Themes of 3D and transformed animations.

Theme	Description
Skull – joints and muscles	bones of neurocranium and splanchnocranium, cranial sutures, cranial synchondroses and temporomandibular joint, main muscles of head and neck
Regional anatomy of the head	regions of the head, bony borders, anatomical structures, temporal fossa, infratemporal fossa, pterygopalatine fossa, parotideomasseteric region, nasal cavity and orbital cavity, cranial (parasympathetic) ganglia, location
Cranial fossae	description of clinically important regions of the skull, characteristics of temporal and infratemporal fossa as parts of temporal region, pterygopalatine fossa, orbital and nasal cavity
Anatomy of cranial nerves I.	review of cranial nerves, main functional characteristics, localization of CN exit places from the brain and entrance to the skull, anatomical features of olfactory n., optic n., oculomotor n., trochlear n., trigeminal n., abducens n., maxillary n., main branches of pterygopalatine ganglion



Anatomy of cranial nerves II.	functional and anatomical description facial n., vestibulocochlear n., glossopharyngeal n., vagus n., accessory n., hypoglossus n., innervation of muscles of the head
Regional anatomy of the neck	review of superficial and deep structures of the neck, description of borders of the neck, innervation of the neck, layers of cervical fascia, anatomical structures of submandibular and carotid triangle, description of structures in the omotracheal and omotrapezium triangle
Vessels of head and neck	review of common carotid and external arteries and their branches, review of blood supply of the head and neck from other sources, description of superficial and deep veins of head and neck, localization of lymph nodes in regions of head and neck

After the movies are created, the teachers can complete their study materials and share them for their students. These will be accessed as combination of presentation (PPT), lecture notes (DOC) and animation (FLV).

Conclusion

Using of 3D virtual projection in the education activities, even if organized in non-periodic terms of all lectures, brought benefits for both the students and the teachers. According to our expectations, these methods increased interest of students in presence forms of study as well as the quality of lecture content. Direct students' response is also reflected by teachers as they prepare more precise and more qualitative education presentations. On the other hand, the students are directed to draw attention on important anatomical structures. To use the animations in more effective way, we decided to transform all the virtual reality outputs to the forms that are applicable in the systems suitable for common personal computers and for on-line distance education.

The teachers demonstrate that the lectures were significantly improved thanks to implementation of 3D virtual models and animations prepared according to the topics to be explained. Visual perception equipped with the comments of teachers brought great didactic benefits, especially in the sense of visualization of organ sections and understanding the space relationships. Separation of themes into the structuralized and smaller standalone monothematic education units brought also possibilities to improve practical self-study and also the knowledge assessment using short quizzes and/or tests.



Except of computers, the classroom is equipped with multimedia presentation technique and videoconferencing tools. These may be used to discuss the topics with the colleagues wherever they are. As the teachers said, the camera system for audio-visual real-time transmission between dissector room and the classroom significantly improved the education of anatomy and brought new dimensions into the pedagogical processes.

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