Objective 1: The Lung Experience

3D Virtual Environment

This objective describes an interactive education tool for the study of bronchoscropy, bronchial anatomy, and cystic fibrosis which is targeted at trainee respiratory doctors, medical students and non-cystic broncho-epithelial cells. For wide accessibility, the tool is deployed on multiple platforms, including Windows, Mac and Web through various browsers. Below presents scenarios where the tool can be used and its respective target audience.

Stage 1: A 3D interactive web based educational system to help teach medical students lung anatomy.

Target Audience: Novice Bronchoscopists and Medical Students.

Features: A 3D simulator for exploring the internal structure of the lungs with interest points with both learning and quiz environments.

Platform: Standalone executable for Mac/Windows and for Web.

Research Question: Can the use of a web based bronchoscopic simulator improve student and practitioner knowledge and confidence?

Aim: To benefit bronchoscopist orientation and navigation knowledge within the lung and to ultimately improve user confidence.

Stage 2: A 3D interactive CF lung to disseminate Cystic Fibrosis specific Pedagogy.

Target Audience: Medical students - primarily final year.

Features: A 3D simulator for exploring a CF lung with associated interest points with CF content.

Platform: Stand alone executable for Windows and Mac.

Research Question: Can an interactive 3D environment aid in medical students' visualisation of characteristics of Cystic Fibrosis in a patient's lungs?

Aim: To create an interactive simulation for cystic-fibrosis specific pedagogical concepts based on the system developed in stage 1.

Stage 3: A Virtual Reality 3D exploration of the Cystic Fibrosis Lung for 4th and final year medical students and a system to raise awareness of Cystic Fibrosis in an outreach setting.

Target Audience: Medical students, primarily final years. This can also be used in an outreach setting.

Features: A 3D simulator for exploring a CF lung with associated interest points with CF content.

Platform: Stand alone Windows executable that also uses a Head mounted display unit and gloves.

Research Question: Can virtual reality be used to engage with students and simultaneously raise awareness of CF?

Aim: To create an novel and engaging tool based on stage 2 to improve CF knowledge in an outreach setting.

Future Work:

- Objective 1: Evaluation of the learning utility of these tools with final year medical students will be conducted shortly.

- Objective 2: Complete patient stress testing and analyse the recorded data for clinical significance before publishing findings.

Future directions of this research include Patient Education and Airflow Modelling:

Patient Education:

To develop CF patient education tools with a tracker to research its effectiveness in various environments. It is known that visualising visuals for CF through the 3D modelling of airflows the objectives are as follows: 1. To create interactive learning tools and content for third level medical students for the study of lung anatomy, and CF. 2. Using serious games on mobile device for CF patients breathing physiotherapy, that can also record imperative data to enhance patient experience. 3. To develop CF patient education tools with a tracker to research its effectiveness in various environments. 4. To advance 3D visuals for CF through the modelling of airflows in the human lung which is subject to treatment and run treatment. The resulting work is intended to aid in both the education and communication of Cystic Fibrosis research, and in other medical areas that could also benefit from the tools, games and visuals being studied.

Games have increasingly become more popular for training and learning within the medical and health industry. Previously, serious games for children with Cystic Fibrosis (CF) have been developed with promising results. However such serious games for CF adults has yet to be investigated. This article, presents a mobile based continuous game for Android devices which is inspired by the game Flappy Bird, however the user must blow into the microphone to control the sprite movements as opposed to tapping. The game also encompasses a questionnaire and web-based data tracking system. The questionnaire and performance data is stored on a external database and saved under a user's profile, which includes weight, height, age, gender, ethnicity and physiotherapy technique. The data is then analysed by the web tool and a SMS message is sent to a patient based on default alert criteria (i.e. consecutive recordings of reduced game performance, or increase in spoutum, or decline in baseline). This default criteria was agreed upon by the healthcare team as this time frame may be indicative of an exacerbation. However the time frame for this criteria can also be altered on a patient to patient basis to allow for a more targeted analysis. The game performance data, questionnaire data, alert criteria and alert history are also viewable through the web tool once the health care team member is logged in.

Platform: Android

Research Question: Can serious games enhance physiotherapy and patient well-being through gameplay and the recording and analysis of data?

Aim: To improve CF patient well-being through gameplay and also tracking questionnaire data on a smartphone. This data will then be analysed and patients will be notified based on certain alert criteria.

The complete system was presented at the CF medical multi-disciplinary team for review and feedback and is currently undergoing stress testing with a small patient cohort. It is anticipated, that this framework will have a positive effect to the health care experience of adult CF patients after passing the clinical testing.