Multimedia Interfaces VO (188.640 WS23) – Written Exam

18th January 2024, Time: 2 hours

Multimedia interfaces can benefit medical and health applications. A medical research group wants to collaborate with you to integrate multimedia interfaces using immersive technologies for three different applications:

Application 1: Propose an application conceived to train patients who have lost one hand and half of their forearm to learn how to use a prosthesis. The virtual prosthesis should allow the patient to interact with virtual objects by grasping, pushing, or pulling virtual objects. You must define a control scheme for the virtual prosthesis (i.e., how the user, who is missing one hand and half of their forearm, will be able to provide commands to the prosthesis). The user has to be able to move the prosthesis and allow grasping, pulling, or pushing virtual objects. You also must define how the user would be aware of the state of the prosthesis. You can propose different feedback modalities (visual, haptic, acoustic, etc.) to increase the user's awareness. Note that the feedback might be dependent on the control scheme.

Application 2: Propose an application conceived to help new medical students to help users understand (and ultimately practice) medical procedures, stimulating a desire to learn more. We strongly encourage going beyond the limitations of the traditional interaction design to explore innovative multimedia interfaces. We expect the application to address at least one medical procedure you can choose (e.g., surgery, doctor appointments, physiotherapy manipulations). One or multiple potential users should be able to interact with the application. We suggest you propose different feedback modalities (visual, haptic, acoustic, smell,…).

Application 3: Propose an application conceived to help some patients treat their fears through exposure therapy. Exposure therapy is a type of therapy in which you're gradually exposed to the things, situations and activities you fear. You could choose which fear to focus on (e.g., animals, acrophobia, thalassophobia, phonophobia...). The application should present some stimuli to the user related to the fear, or the application can imply the user interact. We suggest you to propose different feedback modalities (visual, haptic, acoustic, smell, …).

Instructions:

You have to design **two** of the three applications. For each application, you will have to propose two versions, one with high immersion (unlimited budget) and another with lower immersion (trying to optimize the tradeoff between the costs and the immersion).

We suggest you start the design with the more complex version and then downgrade several of their components for the more "basic" version, justifying their potential impact on the user's experience.

For each application, you have to provide as many details as possible (e.g., hardware, sensors, control algorithms, interactions, feedback modalities) and your choices' impact on the user's experience.

Consider factors such as immersion, presence, cybersickness, and usability. The multimedia interfaces have to take advantage of multisensory interaction and feedback.

While describing your solutions, structure the discussion based on the perception-action loop presented during the course, answering the following questions: What actions must the user perform? How are these actions translated into commands? What feedback is provided by the system and how does the user perceive it?

Describe the different components of the interfaces with text and drawings in order to increase clarity.

You can assume that the technical aspects of rendering the 3D scenes and the physical simulation are solved and you have unlimited access to multimedia hardware (think big !).

In addition, you could also provide a few metrics to evaluate their performance and usability.

Finish the discussion for each solution by the system's viability and any potential unsolved issues that may remain.