Chapter 9
Implementing Virtual Reality in the Healthcare Sector

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ABSTRACT

This chapter will concentrate on the advantages that VR can offer to the Healthcare Sector. After a brief introduction, the second section will present an analysis of the areas where VR techniques can be successfully applied. Next section will describe some existing VR applications in healthcare. The development of a VR surgery simulator, with all the aspects that make this process challenging, will be presented on the following section. An analysis of the difficulties specific to healthcare environments while dealing with the design and development of VR applications will be covered in the next section. The last section will be devoted to conclusions and future perspectives of VR in the Healthcare Sector.

INTRODUCTION

The last decades have seen a remarkable growth of the Healthcare Sector in most societies, fuelled by advances in Medicine and an increased availability of resources. As a result, many societies present nowadays longer life expectancies and aging populations, which are more aware of health issues, in terms of demanding advanced treatments for health problems that would remain untreated just some decades ago. This places stronger demands on professionals, which have ever-increasing needs for continuous education on aspects such as learning new techniques, acquiring
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new dexterities, understanding data provided by new, complex instruments, etc.

Virtual Reality (VR) has an important role to play in this scenario. VR systems can be used for learning, training, planning and assessing techniques and interventions. The can also be helpful by facilitating the analysis and understanding of complex data. And they can even help motivate, distract and provide extra support for patients with specific some times overwhelming injuries, pain or sicknesses, such as severe burns (Hoffman, 2004).

Even though VR has a lot to offer to these domains, the Healthcare Sector is peculiar, presenting specific features that depend on its very nature. This chapter analyses the problem of designing and implementing VR applications in this sector, departing from an example of an area that has achieved a remarkable success: surgery simulation. The conclusions reached during the development of these systems can be used to cast some light on the problems associated to the development of a new VR application for the Healthcare Sector.

Regarding the case of surgical simulation, a lot of surgical procedures have a long learning curve, since they are complex to perform and require specialized training in order to obtain proficiency. Therefore, there is a strong need for learning and training the surgical skills.

During their instruction, surgeons, after a period of theoretical education, must acquire practical proficiency before being allowed to perform surgical procedures. This practical training-by-opportunity period usually consists of the observation of a number of operations performed in real patients and the gradual incorporation to auxiliary tasks, executed under strict expert supervision. This traditional training entails several disadvantages. First, the presence of beginners increases the risks involved in these procedures. Second, patients are frequently not pleased with being examined by non-experts. Third, those practical sessions constitute a bottleneck in the learning process, given the restrictions in the number of trainees admitted to each operation. Other alternatives, such as using animals or plastic models, present problems too. For example, experimenting with animals involve legal and ethical restrictions. Additionally, they are of limited use given the anatomical differences and the expenses associated to animal maintenance. Plastic models can be quite realistic. Nevertheless, they are expensive to build, and once an incision has been made during a training session, it cannot be removed (unless the model provides extra exchangeable pieces, with its associated cost). This limits the lifespan of a plastic model before it turns into a non-realistic environment. Another limitation is that plastic models have in general a reduced number of different cases or configurations and they do not allow performing a patient specific training. Specialized courses involving cadavers are often expensive, restricted by the availability of cadavers and necessarily short. They do not suffice to achieve competency.

Simulation using Virtual Reality techniques offers a strong potential and makes it possible to conceive new solutions. Nevertheless, when designing Virtual Reality simulators, a lot of different aspects need to be considered: the interface that the surgeon will use; how to provide faithful and realistic feedback; the learning method to be applied; the process of practitioners’ evaluation and, last but not least, cost. These issues support the fact that surgical simulators involve and should take into account different research lines and multiple disciplines:

- **Medicine and surgery**: it is essential to know which are the surgeons’ problems and needs depending on each specialty. Surgical skills and techniques must be studied to understand how they are acquired so that learning and training deficiencies can be avoided.
- **Psychology**: task analysis is necessary to define a coherent and reliable learning program, which contains useful and effective