Chapter 60
Application of Topographical Capture Techniques for Modelling Virtual Reality:
From the Static Object to the Human Figure

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ABSTRACT

Since the dawn of time man has attempted to represent the human figure with techniques ranging from simple drawings to techniques that manage to reflect the movement of body segments. In parallel, cartographic techniques have developed very advanced capture and 3D representation systems, but even though they have been applied in recent years to other sciences, they have not been applied yet to virtual reality. The appearance of the laser acquisition systems has enabled us to acquire data without discrimination on points and to get quick 3D models. This situation allows us to work directly on the concept of surface and to analyze it from the uniqueness of the detail, compared to traditional systems which capture points for, later, imaging surfaces from them. Under this prism, a research group was formed by graduates in Physical Activity and Sport and in Cartography, in order to bring together both sciences and to improve techniques of capture and representation of the human body. The road is not completely gone, but some results have been obtained and are presented in this work.

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INTRODUCTION

Nowadays, the term *"Virtual Reality"* is associated to multiple disciplines, both in research and practical applications, but its ultimate goal in all of them is very similar: to produce an illusion of reality, which can be subject to a practical, technical or conceptual application. Since the 50's, when they were started to nowadays, the capture, processing and representation systems have been varied, evolving in a parallel way to the computers, essential for the mathematical calculations.

Direct applications of virtual reality range from medicine to engineering, from computer games to advertising. In all those fields, simulations provide an effective and efficient support to its technical or practical goals.

If we consider the processing hardware and software, we see that has changed dramatically. In some cases, it is difficult to distinguish between real and fictitious when you see some pieces of work of virtual reality. In a deeper analysis, we can conclude that the problems are in the collection of data, since in many cases much of the work is done through techniques of image designing and processing.

In this report, we propose a new technique to capture the information that is going to by virtualized, basing it in real-world data collection using a 3D scanner. This technique provides us with a virtual model of reality with metric data, which we can say that is a perfect representation of reality. The study develops model tests in laboratory and real environments, trials with static human models, leaving the door open to the modelling of the human figure as a moving object.

Before going further in the work, we would like that you turn the light back with us, so that when you read, you will understand the steps taken since the beginning of the topography until the representation of the human figure by topographic as a result of biomechanical studies.

At present we are working on virtual reality techniques, but it has not always been our goal, as traditionally the development of the topography has focused on modelling and representation of terrain in all its aspects. A few years ago, a group of people considered that topographic techniques and virtual reality had progressed in two parallel but not crossed ways, or, in other words, advancing without looking each other.

Throughout time, topographic and cartographic engineering technologies have been working on the acquisition of data using different equipment and topographic, photogrammetric and geodetic methods in order to represent 2D and 3D objects, buildings, statues and archaeological sites, focusing the research on obtaining and modelling those elements with sufficient metric precision.

It is said that any investigation begins when we are faced with a question or uncertainty that makes us question the situation and initiate a search. And we have the following question: Can our techniques for capturing and modelling to contribute something to the virtual reality and biomechanics?

We believe that one of the fundamentals of virtual reality is three-dimensional interactive computer simulation, so that the user is introduced in an artificial environment that is perceived as real, allowing you to interact in a virtual world that has the ability to maintain a two-way correspondence with the real world. The more closely approximates the information captured to the reality, the better the interrelationships between the virtual and the real. If we apply these concepts to biomechanics, as a multidisciplinary study of the measurements of the human body in movement, we can be at the gates to get almost perfect representations of the reality with virtual models.

In short, we have to understand both the functional and the physical variability in subject's movement, and how these components interact and how they could be improved. The study of the dialectical relationship structure-function, is a basic tool with a strong genetic dependence for the identification of future athletes.