

Chapter 1

Learning in Virtual Environments: What About Paradigms and Metamodels? An Illustration Through Enaction and Trinologic

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ABSTRACT

This chapter addresses the questions of why, when, and how to use virtual reality to support learning processes for human beings. It focuses therefore on what can and cannot be done in a real environment versus what can and cannot be done in a virtual environment, as well as on how using virtual reality can make some types of learning easier as long as certain conditions are fulfilled. These conditions include the shifting of some inner beliefs and the choice of an accurate paradigm. The paradigm of enaction will be presented as an example of an accurate paradigm for virtual reality. Some conceptual keys and landmarks for design will be proposed in the context of the Trinologic metamodel developed by the author. Such metamodels should facilitate the connection between human actions, learning, and the characteristics of the outer world, whether this world is real or virtual.

FOREWORD

This chapter addresses the topic of *learning in virtual environments* and *virtual environment for learning (VEL)*. It will therefore address the field of education, among other subjects. It will focus on how virtual reality can support and facilitate learning processes. Terms such as *virtual reality (VR)* or *virtual environment (VE)* will be used in a very generic way, encompassing the whole family of associated technologies such as *mixed reality*, *augmented reality*, *full-scale simulation*, *serious games* and so on.

The focus of this chapter will not be on the state of the art, nor on recent developments in the sector, nor on technologies, nor on pedagogy. It will focus on timeless issues that might be relevant for

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the conception and the design of VEs for learning. Therefore, in order to think out of the box, it might challenge some of the reader's deep beliefs. Using a new media requires thinking that is consistent with the characteristics of this media. Transposition may work but could produce poor results. One cannot produce novelties with old ways of thinking. And switching from a real environment to a VE is quite a radical change as far as learning is concerned. It is important to recognize that although most of what can be done in real environments can also be done in VEs, certain things that can be done in real environments are not possible in virtual ones. It is therefore fundamental to emphasize the things that cannot be done in real environments but can be done in VEs. This is a key point in rethinking learning approaches using VEs.

Although pedagogical issues are crucial, they will not be addressed in this chapter either. As shown by Fowler (2015), there is an important need for pedagogy in the field of VELs. Radiantia et al. (2020) point out that a lack of explicit learning theories becomes evident through reviews of existing applications. They call for a theory on VR for educational applications and the clarification of ambiguity, and for a taxonomy of learning theories. Holopainen et al. (2020) claim that completely new pedagogical approaches, including objectives, contents, methods and assessments, are required for learning environments. As a minimum, it will be taken as a given that the use of virtual reality can be correlated to active and embodied pedagogies as *learning by doing* or *hands-on learning* as a basic approach and provide the learner with first-hand experiences (Martín-Gutiérrez, et al., 2017). Some other general rules will be found in the *Necessary Nine* (Johnson-Glenberg, 2019). Of course, some other educational issues could be considered, for example: How to handle and address errors? In what situations are feedback or corrections necessary and how should they be provided? How should theoretical content be provided? What is the exact place and role of educators, teachers and trainers when VEs are used? How can activities be articulated in virtual and in real environments? How are progress and learning to be assessed? Is an Intelligent Tutorial System necessary? Such questions will have to be discussed and answered elsewhere.

INTRODUCTION

Learning in a virtual environment presents certain specificities. This chapter will use different perspectives and viewpoints to present arguments showing how learning experiences might be renewed by using virtual reality thus making learning a much easier experience. The properties of the medium will be analyzed, considering whether they support learning processes or not. Regarding the design and the conception of a VEL, this chapter will emphasize the importance of choosing and/or making explicit the choice of a paradigm to guide the entire development of a project. Finally, it will explain and illustrate how an interdisciplinary metamodel can support and facilitate project development.

ISSUES AROUND VR AS A MEDIUM

How to build an efficient and supportive VEL is a question that has not yet been fully answered. This chapter will consider any situation that involves learning processes. It will focus on how to create a more varied and easier learning experience for the learner by means of virtual reality. Hands-on learning can already be provided in VEs and it might also be possible to teach abstract content hands-on in a VE.

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