

Chapter 1

Virtual Reality in Psychotherapy, Rehabilitation, and Neurological Assessment

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Abstract. This chapter presents a brief overview of advances in the application of virtual reality and related technologies in psychotherapy and healthcare. A summary of the chapters on virtual reality and psychotherapy, virtual reality and rehabilitation, and virtual reality in neurological assessment is presented.

1 Introduction

In the last two decades, not only have technological advancements radically changed the way people communicate and do business but new technologies have also transformed medical practice, bringing yesteryear's science fiction vision of medicine closer to today's standard practice. One such futuristic technology, virtual reality (VR), is now making substantial inroads into medicine, especially in the areas of physical and mental rehabilitation and psychotherapy.

The term *virtual reality* was coined in 1986 by Jaron Lamier to describe a collection of technologies that simulate a computer-generated 3D virtual environment (VE) that users feel they can actually inhabit rather than simply view on a 2D display. Virtual environments immerse users by providing visual, auditory, tactile, and even olfactory sensory stimulation using such devices as head mounted displays and instrumented clothing. As users move and manipulate virtual objects, the VE changes to reflect expected alterations in the environment. Thus, users experience virtual worlds similarly to the way they experience the real world.

McCloy and Stone [1] define VR as any "collection of technologies that allow people to interact efficiently with 3D computerised databases in real time using their natural senses and skills" p. 912. The focus in this definition is on data visualization. Their avoidance in mentioning any specific technologies opens the definition to related areas of human-computer interaction (HCI), such as augmented reality (AR) and mixed reality environments. AR combines the real and virtual in a variety of ways,

oftentimes with the virtual superimposed on the real, as when football broadcasts draw a yellow first-down line across the playing field. Mixed reality refers to any mixture of the virtual with the real. One way to conceptualize the diverse possibilities offered by mixed reality systems is to utilize Milgram's Reality-Virtuality Continuum [2], which spans possible combinations of the real and virtual along the two extremes of the purely real and the purely virtual (VE).

There are many areas in medicine where VR and mixed reality technologies have made a substantial impact. In surgery, for instance, many VR applications have been developed for surgical training, operative planning and strategy, and telesurgery [1, 3-6], for some recent example applications see [7-10]. In diagnostics, current applications include virtual colonoscopy [11] and virtual bronchoscopy [12], and VR has proven particularly beneficial and popular in medical training [13-18].

An opportunity offered by VR is the possibility of finely controlling user interactions and carefully applying therapeutic stimuli. Controlled virtual environments [19] are particularly useful in rehabilitation, psychotherapy and neurological assessment [19-21]. Riva [21] explicitly contrasts McCloy's and Stone's definition of VR above to one offered by Schultheis and Rizzo [22]: VR is an "advanced form of human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion." This definition better suits the behavioral sciences as it is focused on the environment and how incremental changes in the environment can result in changes in behavior. Much evidence, as reported in the chapters of this book, supports the conclusion that what is learned by patients in their controlled interactions in VEs generalizes well when applied in the real world [23].

The chapters presented in this volume serve as an excellent introduction to the state-of-the-art in VR as it is currently being applied in rehabilitation, psychotherapy and assessment. Many of the chapters offer comprehensive reviews of the literature; others provide excellent examples and detailed accounts describing the design and evaluation process of VR in cutting edge therapeutic systems. The chapters also discuss limitations, problems, and ethical concerns using VR in mental and physical therapy.

2 Synopsis of the Chapters in This Book

The chapters in this book are divided into the following three parts:

- Part 1: Virtual Reality and Psychotherapy
- Part 2: Virtual Reality and Rehabilitation
- Part 3: Virtual Reality and Assessment

The first five chapters in Part 1 provide comprehensive literature reviews of the very latest work in VR and psychotherapy. Each chapter covers slightly different aspects of this growing field, and several chapters include discussions of the technologies being employed. This section ends with a paper reviewing the literature on presence that is centered on concerns specific to psychotherapy and a look at using virtual worlds, such as Second Life, to change opinions about psychotherapy and to offer educational resources and some psychological support to veterans.