Chapter 1
Concepts behind Serious Games and Computer-Based Trainings in Health Care:
Immersion, Presence, Flow

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ABSTRACT

In the area of health care, dynamic changes and improvements of computer-based methods of intervention are more and more observable. This tendency is, amongst other reasons, caused by the implementation of theoretical constructs and psychological phenomena, such as flow, immersion, and presence, because they are able to explain processes and effects of medical interventions and thereby provide helpful hints to the enhancement of rehabilitation technology. This chapter provides an overview of the definitions of constructs related to computer-based technology, how these constructs are related to each other, and how they can be measured. Furthermore, practical aspects of improvement, possible areas of application, and potential benefits of implementing these constructs are discussed.

INTRODUCTION

Regarding the new developments in therapy and health care, the application of software containing virtual reality settings is an observable tendency (Gamberini, Barresi, Majer, & Scarpetta, 2008; Ma & Zheng, 2011). To ease the theory to praxis transfer and understanding of individual processes occurring when persons are interacting with virtual environment interventions, it is necessary to regard theoretically related constructs, especially immersion, presence, and flow. For example, there are individual differences in the fitting and the success of certain clinical interventions because of different levels of immersive tendencies or technology acceptance, so there constructs, which are

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related to technical or personal issues. To explain the individual differences and to improve the effects of technology driven intervention strategies, it should be possible to assess these constructs.

There are different reasons and goals that motivate the improvement of technology used in clinical settings (Reinkensmeyer & Boninger, 2012). Besides the improvement of the rehabilitations' cost-benefit ratio, advances in therapy software may reduce extensive diagnostic and therapeutic processes and, in addition to that, are able to provide helpful hints on clinical decision-making. Furthermore, the assessment of accurate data of the mentioned constructs leads to a better prediction of therapy success and thereby has a positive impact on the motivation of the individual participating in the intervention. In addition to that, the consideration theoretically related constructs might lead to the improvement of already established as well as the creation of new intervention methods.

Literature describing the enhancement of use- and user-dependent adaptability shows technical improvements in virtual reality, robotics, orthotics, computer gaming, computer vision, electrical stimulation and wearable sensors (Adamovich, Fluet, Tunik, & Merians, 2009; Brewer, McDowell, & Worthen-Chandari, 2007; Brochard, Robertson, Médée, & Rémy-Néris, 2010; Burke et al., 2009; Burridge & Hughes, 2010). Within those new technologies, constructs like immersion, presence and flow are directly related to the well-being of the therapies' participants as well as to the effect of the intervention (Zimmerli, Duschau-Wicke, Riener, Mayr, & Lunenburger, 2009). Thus the goal of this paper is to describe how these constructs are defined, how they are related to each other and what kinds of methods are used for measurement.

PRESENCE, IMMERSION, AND FLOW

The term *presence* developed from *telepresence* (Minsky, 1980), which described teleoperators' sense of being physically present at a remote location even if only interacting with the system's human interface. Steuer (1992) redefined presence as "closely related to the phenomenon of distal attribution or externalization, which refers to the referencing of our perceptions to an external space beyond the limits of the sensory organs themselves." He argues that whenever "perception is mediated by a communication technology, one is forced to perceive two separate environments simultaneously", so that one experiences presence in the natural environment and telepresence in the computer-mediated environment.

Nowadays, the terms presence and telepresence are used synonymously, because a cross environment comparison of everyday life and Virtual Environment (VE) seems to be invalid (Usoh, Catena, Arman, & Slater, 2000). Slater (2004) argues that people have varying degrees of attention in different real situations, but do not doubt their presence in these situations. So presence is defined as "the subjective experience of being in one place or environment, even when one is physically situated in another" (Witmer & Singer, 1998). When talking about presence, other related terms like immersion, flow, or involvement are often mentioned. These constructs are related to presence, but do not describe the same phenomenon, so they have to be distinguished in their definitions.

Concerning the term *immersion*, there is a general discussion how to distinguish *presence* and *immersion*. Witmer and Singer (1998) describe immersion as "a psychological state characterized by perceiving oneself enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" and this means as a response to the VE system. This definition seems to be very similar to the concept of presence itself. Other researchers like Schubert, Friedmann, and Regenbrecht (2001) regard presence as a direct function or the outcome of immersion. In contrast to that, Slater (1999) states that immersion is just an objective description of the VE system and its technology. Kawalsky (2000) supports this view and describes