Chapter 25
Rehabilitation and Medical Assistant Technique in Virtual Reality

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ABSTRACT

In the modern world, Virtual Reality (VR) has been accepted by the researcher as a state-of-the-art neuropsychological assessment tool in clinical research. Owing to the two prominent VR attributes i.e. immersivity and interactivity, VR is being used as an assessment tool as well as a training module. Combining cognitive knowledge with existing VR technology can propel VR to achieve a quantum leap in the rehabilitation sector. In addition, it offers potential radical modifications in the traditional way of neuropsychological assessment in the clinical settings, by improving ecological validity of the existing tests. Subsequently, features of VR facilitate customisation of an individual's treatment plan with the informed gradual progression of the challenge. This chapter explains VR as an innovative platform in the sector of medical & others such as military and sports for assessment as well as for training.

INTRODUCTION

Clinical psychologists/cognitive scientists are struggling to keep up with the changing times and the corresponding advancements in technology. The modus operandi followed by a cognitive psychologist is in a dire need for a paradigm shift, involving the re-evaluation of prior trivia and formation of assumptions. For example, in the field of psychology, the changes are observed for mind theory as in mentalist, to behaviourism, and now connectionism frameworks. On the other hand, in the field of psychiatry, understanding of psychiatric disorders and the subsequent investigation in molecular biology paves the way for another "paradigm shift" (Meyer, 1996). Relatively, the growth and transformation of a neuropsychologist with respect to embracing the "paradigm shift" have not been significant. According to Dodrill (1997), clinical neuropsychologists claim to use knowledge of constructs for the paper-pencil tests which were developed a century ago (such as Binet test of Intelligence dated in 1900). This suggests

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that still psychologists are struggling with the old tested methods that might not be applicable to the present generation. On the contrary, development of other streams such as neuroradiology could have been limited to radioisotope brain scans if they had not maintained pace with the technological development. On the same note, Sternberg (1997) sufficed the evidence presented by Dodrill (1997). He explained that present standardised tests slightly differed from tests that were constructed over a century ago. For example, Wechsler Adult Intelligence Scale (WAIS) has created its modification in versions like paper-pencil tests to computerised tests, but not in its constructs. As a consequence, there is a requirement to change in ideas rather than the introduction of new measures.

There are two major limitations faced by psychologist's apprehensions of using modern day technology (Parsons, 2015). First, present neuropsychological assessment procedures corresponds to technology that has hardly changed since the first scales were developed in the early 1900s. Second, the role of neuropsychologist has changed with the progress of other associated streams such as psychiatry, imaging modality and they are more focused towards more ecologically valid predictions.

These limitations can be overcome by embracing current technology and the solution as provided by Bilder (2011). He suggests the evolution of clinical neuropsychology in three ways. In Neuropsychology 1.0 (1950–1979), dysfunction was diagnosed through localisation and this era was pre neuroimaging. It failed to develop ecologically oriented assessments. In Neuropsychology 2.0 (1980-present), the computer automated neuropsychological assessments were invented. These assessments were more affected by neuroimaging advancements and subsequently rather than focusing on differential diagnosis, it characterised cognitive strengths and weaknesses. However, computerised test battery has some advantages over traditional paper-pencil tests such as increased standardisation of administration and accuracy of timing presentation etc. (Sternberg, 1997). The limitation with the Neuropsychology 1.0 and 2.0 is that, the clinical neuropsychologists are required to provide the normative description of everyday functioning. There is limited generalisation of results in approximating real world function; therefore, there is a need to establish ecological validity in the neuropsychological assessment which focuses on either (or both) verisimilitude and veridicality (Chaytor & Schmitter-Edgecombe, 2003). Verisimilitude signifies that method for the data collection should be similar to the real-life task of open environment whereas Veridicality implies that the test results should reflect and predict real-world phenomena (Chaytor & Schmitter-Edgecombe, 2003; Parsons, 2011a). Major challenges faced by administrating paper -pencil tests is that transferring verisimilitude approach from the lab setting to the applied frameworks of the clinical framework would be difficult (Rabin et al., 2007). Furthermore, by adding instruments resembling everyday activities would not suffice the modernisation of computer technology which is the major drawback of the current neuropsychological testing. Thus, progress in such kind of assessment is slower than expected. Although, present psychologist tests have an adequate predictive value but the traditional tests may not replicate the situation of every day. The aforestated limitations are overcome by Neuropsychological Assessment 3.0 which involves the use of virtual environments.

The virtual environments is an advanced computer interface that permits humans to become immersed within a computer-created simulation. It imbibes the concept of Virtual reality (VR) with key properties of immersivity and interactivity. By adding technical values in the existing systems, VR offers opportunities to build test with the ingenious gadgets. Particularly, VR technology adding to its characteristics includes trackers and head mounted displays (HMDs) for immersion as well as data gloves or joysticks for interaction. Integration of different sensors and high-fidelity devices (like trackers, position and motion sensors etc.) makes the virtual environment visually near realistic, thus enabling it to considerably