Self-referencing virtual reality programs for neurorehabilitation

L Mendes¹, A I Mota², F Barbosa³, R Vaz⁴

¹,³Faculty of Psychology and Educational Sciences, University of Porto (FPCEUP), Portugal Psychosocial Rehabilitation Lab, FPCEUP/ESTSP–IPP, Porto, PORTUGAL
²Neuroscience PhD Student at Medicine Faculty of Porto University, PORTUGAL
³Neurosurgery Department, Faculty of Medicine, University of Porto, Hospital de São João, Alameda Professor Hernâni Monteiro, Porto 4200, PORTUGAL
¹,³www.fpce.up.pt, ²,⁴www.med.up.pt, ²www.anamota.com.pt

ABSTRACT

Virtual Reality (VR) is a recent technology to assist in therapy and neurorehabilitation. In doing so, VR enables a realistic performance, with higher motivation and immersion in the problematic situation. VR increases ecological value and skills generalization; however this technology is still disorder-oriented. Patient’s response to treatment differs from patient to patient. So it is relevant to take into consideration a multitude of aspects, self-referencing VR Programs for Neurorehabilitation. We argue the need to create a variety of scenarios that better adapt to psychological, developmental and ecological characteristics of each patient.

1. INTRODUCTION

Technology-assisted therapeutic approach is an important tool in therapy and neurorehabilitation, with benefits such as increasing access to services for rural individuals, portability, improved self-monitoring, improving efficacy of treatment (Newman, Szkodny, Llera, & Przeworski, 2011).

Virtual Reality (VR) is a recent technology, used in technology-assisted intervention that enables patient’s increased sense of presence and immersion within a computer-generated simulated environment (Bioulac et al., 2012; Parsons, 2004; Tyndiuk et al., 2007; Wuang, Chiang, Su, & Wang, 2011). Besides increasing patient’s motivation towards therapeutic intervention (neuropsychological or psychological), VR enables a more realistic task performance, meaning better ecological value and better skills generalization to other life contexts (Bioulac, et al., 2012).

However, even if VR improves rehabilitation outcomes in different pathologies (e.g., anxiety, ADHD, depression, stroke, traumatic brain injury, dementia), this approach is still disorder-oriented and we are just starting to understand the relevance of factors as the patient’s characteristics and limitations (Tyndiuk, et al., 2007). A more personalized intervention is the next step in the relatively new application of technology to neurorehabilitation.

2. PERSONALIZED VIRTUAL REALITY

In Medicine, general therapeutics are being replaced by a personalized medicine approach. In fact, since the human genome sequencing, in 2003, and the advances in proteomics, pharmacological treatment is heading towards a tailored intervention, attending individual characteristics, thus increasing outcome (Meyer & Ginsburg, 2002).

Disease course and patient’s responses to treatments varies from patient to patient and should be taken into consideration while designing neurorehabilitation programs and materials. But even more important than the patients’ disorders and its general or individual history, are patients’ characteristics in a multitude of aspects may be critical for the outcomes of the intervention. For example, by patients’ characteristics we don’t just mean the previous task experience, or VR experience, or any other isolated feature, such as cognitive capacity (Tyndiuk, et al., 2007). We also mean the patient as a whole person, with interests, values, expectations, fears, personality, a particular family and social environment, etc. In fact, we argue that these
later factors and the way they interact are even more relevant for the success of VR Neurorehabilitation Programs.

While a neuropsychological evaluation is crucial for the outcome prediction of Neurorehabilitation VR Programs, as they determine baseline and prognosis, individual characteristics are of the upmost importance for patient’s motivation towards the intervention and for maximizing outcome (Santos, 2005; Wilson, Gracey, Evans, & Bateman, 2009). Therefore we argue that we manage to develop more personalized VR Programs, creating different scenarios for the same task, and allowing each patient to extract a self-referenced meaning from these scenarios, we will raise the odds of success. We do not argue about a different scenario available for each patient, as it wouldn’t be financially possible, but a different scenario tailored for a group of patients with similar individual characteristics, including life experiences. We argue about the need for user-profile typologies as the psychological, developmental and systemic profile of each patient and the acknowledgment of their individual references.

In fact, an accurate neuropsychological and psychological evaluation will enable the professionals to determine the individual characteristics, and then patient’s insertion in smaller groups, more homogeneous in their user-styles and needs. For instance, if the patient is a boy, he might like football but also he could prefer martial arts or an action figure’s animation series. Simulating tasks in such environments, according to each child’s interests, would increase outcome and improve generalization, as the situation is much more self-referenced and meaningful. However, if the patient is a sexagenarian woman, she could respond better towards playing with children, shopping for groceries or even a walk in the park, depending on her individual characteristics.

Next step in Neurorehabilitation VR Programs should be having different scenarios available, in order to better adjust to patient’s real needs and expectation, thus increasing patient’s motivation, participation, generalization and overall outcome maximization.

3. DEVELOPMENTAL APPROACH

As important as the ecological approach (simulation of daily life situations), patient’s developmental stage should be determined as people of the same age often have different life experiences and different perceptions of the world.

Determining patient’s perception enables the professionals to better understand how to reach to each patient. Without forgetting the work of Freud, Piaget, Erikson, and many others, it seems also relevant to integrate the notion from Robert Kegan’s developmental theory of the evolving self. According to this author (Kegan, 1982) the human self oscillates from psychologies favouring inclusion and psychologies favouring independence along lifespan (Figure 1).

![Figure 1. Kegan’s helix model of the evolving self.](image)
Knowing in which developmental stage the patient is will allow the rehab professionals to motivate and promote generalization to other life contexts, as the simulation and the story behind the simulation becomes more significant for that patient. This would presumably enable the patients to upgrade their inner speech and perceive themselves as capable of performing the rehabilitation tasks not only in a VR environment, but also in real life situations.

4. HOLISTIC MODEL OF INTERVENTION

Along with user-styles and needs as the individual’s psychological, developmental and systemic profile, a comprehensive model of neurorehabilitation is also needed. Health professionals, families and patients should meet and agree on appropriate neurorehabilitation goals (Wilson, et al., 2009) and involve family as much as possible in VR Neurorehabilitation Programs as their understanding of it is crucial for patient’s generalization.

The Holistic Approach first appeared in the 1970’s (Santos, 2005). This approach offers integrated multimodal treatment attempting patients acceptance of altered life status and self-awareness of impairment, by teaching compensatory strategies for coping with residual deficits (Diller & Ben-Yishay, 2003). VR Neurorehabilitation Programs can be far more comprehensive than other computer-based tasks for cognitive training, or even other computer-generated simulation programs. Nevertheless, it is necessary to combine technology with a multidisciplinary team of professionals pairing with the patients’ physical and psychological needs, their families, significant others, etc. Thus, such holistic Neurorehabilitation VR Program comprehends three major modalities of treatment: therapeutic milieu, cognitive remediation (VR sessions included) and psychotherapy (Diller & Ben-Yishay, 2003). Always adapted to each patient’s individual characteristics, development stage, personal history, life experiences, and social context. Always considering user’s styles and needs.

5. CONCLUSIONS

Each patient lives in a different context, in a different cultural environment, conducting to even more different personalities and individual aspects. Each disorder has different stages and could affect patients in different developmental stages.

Health professionals must be aware of this and respect patient’s individuality. A self-referencing approach to VR programs will increase patient’s motivation and skills generalization, better aiding psychotherapy and neurorehabilitation. Therefore, while programming, professionals should create a group of possible scenarios and the possibility of creating a new one, based in patient’s preferences. In doing so, patient’s outcome should be even better than in normal VR neurorehabilitation programs, as it better suits each patient’s needs. A change of paradigm is in order with further research necessary.

6. REFERENCES


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