A SWOT Analysis of the Field of Virtual Rehabilitation

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Virtual Reality (VR) has now emerged as a promising tool in many domains of therapy and rehabilitation (Rizzo, Schultheis, Kerns & Mateer, in press; Weiss & Jessel, 1998; Zimand, Anderson, Gershon, Graap, Hodges, & Rothbaum, 2002). Continuing advances in VR technology along with concomitant system cost reductions have supported the development of more usable, useful, and accessible VR systems that can uniquely target a wide range of physical, psychological, and cognitive rehabilitation concerns and research questions. What makes VR application development in the therapy and rehabilitation sciences so distinctively important is that it represents more than a simple linear extension of existing computer technology for human use. VR offers the potential to create systematic human testing, training and treatment environments that allow for the precise control of complex dynamic 3D stimulus presentations, within which sophisticated interaction, behavioral tracking and performance recording is possible. Much like an aircraft simulator serves to test and train piloting ability, virtual environments can be developed to present simulations that assess and rehabilitate human functional performance under a range of stimulus conditions that are not easily deliverable and controllable in the real world. When combining these assets within the context of functionally relevant, ecologically valid VEs, a fundamental advancement could emerge in how human functioning can be addressed in many rehabilitation disciplines.

But we know that already.

What we don't know is: What place will VR occupy in the future of rehabilitation?

Depending on who you ask, you're likely to hear a variety of responses to that question that might include such words as: "visionary!", "too expensive", "just what the field needs!", "but how will that impact the therapist's role?", "sounds like the Holodeck", "need better interfaces", "hmm…interesting possibilities", "can they really do that?", etc. In essence, the view that one takes of VR and its potential to add value over existing rehabilitation tools and methods, is often influenced by such factors as one's faith in technology, economic concerns, frustration with the existing limitations of traditional tools, fear of technology, popular media influences, pragmatic awareness of current hardware limitations, curiosity and healthy skepticism.

For those working in the "trenches" trying to employ VR in a meaningful way for rehabilitation purposes (or for those just getting their feet wet), a more systematic strategy for evaluating the state of the field could be of value for informing one's judgment, decision-making and guesses as to what's possible now and what lies ahead in the future. Without applying a structured framework to aid one's thinking about the current status and future of VR and rehabilitation, it is quite easy to regularly oscillate between flights of wishful thinking and bouts of abject discouragement, depending on the daily ebb and flow of provocative data and system crashes. Perhaps our susceptibility to this sort of bi-polar "second-guessing" of VR could be reduced if one is armed with a comprehensive, yet intuitive method for organizing the myriad factors that will serve to both enable and limit how well we can successfully translate our VR/rehabilitation vision into actual reality! Such a strategy may also help us to identify realistic goals and establish priorities regarding which clients are the most appropriate candidates for VR and which technologies are best suited to create applications to meet their needs. Although a high capacity to live with ambiguity is a requirement for those who explore novel emerging approaches in any discipline, a focused approach for guiding our expectations could make that process more manageable and productive in the long run.

With that said, this keynote address will present a SWOT analysis for the field of VR and the Rehabilitation Sciences. SWOT is actually an acronym that stands for Strengths, Weaknesses, Opportunities and Threats and is a commonly employed framework in the business world for analyzing the factors that influence a company's competitive position in the marketplace with an eye to the future. A classic success story for the value of a SWOT analysis is Dell Computer Corporation's use of the framework to make the strategic decision to implement mass customization, just-in-time manufacturing and direct internet sales. However, the SWOT framework can also be

usefully applied outside of the pure business domain. A quick check on the internet will turn up SWOT analyses for urban renewal projects, career planning, website design, youth sports programs, evaluation of academic research centers and it becomes obvious that it can be usefully applied to guide any organized human endeavor designed to accomplish a mission.

Generally, a SWOT analysis serves to uncover the optimal match between environmental trends (opportunities and threats) and the internal strengths of a given entity.

- A **strength** can be viewed as a resource, a unique approach or capacity that allows an entity to achieve its defined goals (e.g., VR can allow for precise control of stimulus delivery within a realistic training simulation).

- A **weakness** is a limitation, fault, or defect in the entity that impedes progress towards defined goals (e.g., The limited FOV and resolution in a head mounted display can limit perceptual realism).

- An **opportunity** pertains to internal or external situations or forces in the entity's operating environment such as a trend that increases demand for what the entity can provide or allows the entity to provide it more effectively (e.g., Tremendous growth in the interactive digital gaming area has driven development of the high quality, yet low-cost graphics cards needed to make VR deliverable on a basic PC).

- A **threat** can be any unfavorable situation in the entity's environment that impedes its strategy by presenting a barrier or constraint that limits achievement of goals (e.g., Clinical administrators and financial officers belief that VR equipment is too expensive to incorporate into mainstream practice).

What has typically been found to be effective based on SWOT input, is a strategy that takes advantage of the entity's **opportunities** by employing its **strengths** and by proactively addressing **threats** by correcting or compensating for **weaknesses**. In view of this, my address will begin by quickly reviewing the oft-discussed topics relating to VR strengths and weaknesses with illustrations from existing work in the fields of rehabilitation and therapy. The more challenging analysis of opportunities and threats will require an examination of scientific, medical, marketing and attitudinal trends that may well be open to varied interpretations by members of the audience. This structured examination of the factors relevant to the current status and future of VR Rehabilitation will unlikely produce a final answer that members of the audience will consensually agree upon. But I do hope to stir the visionary pot enough to stimulate some creative pondering of these issues that will set the stage for how we listen to the research presentations that will follow at the conference and perhaps will linger on a bit afterwards!