Robotics, Virtual Reality

According to Authors Joel Stein, MD, Hannah Aura Shoval, MD, Ethan Rand, MD, Robotics and virtual reality are technologies utilized in the field of rehabilitation medicine to facilitate and complement conventional rehabilitation strategies.

A robot can be defined as "a machine that performs various complex acts of a human being" and "automatically performs complicated, often repetitive, tasks." Current robotic systems include therapeutic robots, such as large stationary exercise robots or wearable exoskeletal robots (powered braces). There are also functional robots such as assistant robots for activities of daily living (ADL), and companion robots.



Virtual reality (VR) is defined as a human-computer interface that allows a user to interact with a computer-generated environment, using multiple sensory channels. The virtual environment (VE) can provide users with visual, auditory, or tactile feedback. Current systems vary in size, scope and level of immersion, from cave automatic virtual environments (CAVE), which are room-sized installations containing three-dimensional visual and auditory systems, to head-mounted visual displays (HMD), as well as commercially available interactive gaming consoles (e.g., Nintendo's Wii, or Microsoft's Xbox Kinect). A variety of motion tracking sensors or cameras has been developed in order to incorporate user movement and position.

Robotic and VR systems have primarily been studied for use in patients with motor and sensory disorders of the central nervous system (CNS), including stroke, traumatic brain injury (TBI), multiple sclerosis (MS), spinal cord injury (SCI), and cerebral palsy (CP).

Robotic systems are uniquely suited to also provide functional assistance with mobility and activities of daily living. For example, robotic exoskeletons can allow paraplegic individuals with SCI to walk independently. Brain-computer interfaces, where computers analyze brain signals and use them to control robotic devices are being studied for patients with neuromuscular disorders such as amyotrophic lateral sclerosis. Robotic systems can also serve as companions with sociopsychosoical and physiological benefits.

As technology continues to advance, it has the potential to provide labor and financial savings, however, this is many years away and existing technologies is still in the beginning stages. With that said, there are devices that are available on the market today that can assist with at home rehabilitation.



Rapael Smart Glove by Neofect is a bluetooth glove that's packed with sensors to measure finger and wrist movements. During rehabilitation sessions, patients are prompted to make simple movements, such as extending their fingers or rotating their wrist, in order to accomplish

basic tasks within the game like navigating a submarine or flipping a fried egg. The movements are based on commonly used clinical therapies and a learning schedule algorithm helps adjust difficulty to optimize challenge and motivation.



The Rapael Smart Glove is available to rent for \$99 per month

SaeboVR is a virtual ADL (activities of daily living) rehabilitation system. It is the first system that has been approved by the Food and Drug Administration. The proprietary platform was specifically designed to engage clients in both physical and cognitive challenges involving daily functional activities. In addition to interacting with meaningful every-day tasks, the SaeboVR uses a virtual assistant that appears on the screen to educate and facilitate performance by providing real-time feedback.



SaeboVR's ADL-focused virtual world provides clients with real-life challenges. Users will incorporate their impaired upper limb to perform simulated self-care tasks that involve picking up, transferring and manipulating virtual objects.

- Grocery shopping
- Putting away groceries
- Preparing breakfast
- Pet shopping
- Pet bathing
- Preparing dinner
- Putting away clothes

This system costs upward of \$10,000.

<u>ReWalk Robotics Ltd</u>., the Israeli developer of a robotic exoskeleton system that helps the paralyzed to walk. The <u>**ReWalk**</u>, is the first exoskeleton approved by the FDA, costs between **\$69,000** and **\$85,000** and weighs 51 lbs. Understanding the steep cost of the ReWalk, the company has designed a new exosuit, The ReStore which is to be a versatile, cost-effective gait therapy solution for use in rehabilitation





centers, and is meant to allow therapists to deliver treatment with real time analytics and adjustability.

PHOENIX Medical Exoskeleton the PHOENIX Medical Exoskeleton is the world's lightest and most advanced exoskeleton designed to help people with mobility disorders to be upright and mobile. In the clinic, at home, and in the workplace Phoenix has successfully enabled many individuals to stand up, walk about, and speak to peers eye-to-eye. Phoenix has only two actuators at its hip; the knee joints are designed to allow support during stance and ground clearance during swing. <u>Phoenix is considered an investigational device and currently not available in the United States.</u>

