

Key features

- Therapy-at-home
- Intuitive, co-adaptive interface
- Fast, easy, exciting to use
- Affordable off-the-shelf components
- Treatment assessment directly in VR

For rehabilitation

- Virtual prosthetics
- Full bilateral upper-limb simulation
- Treatment of phantom limb pain
- Post-stroke rehabilitation
- Familiarisation with myoelectric prostheses

For the gaming industry

- VR games
- Interaction devices
- Fitness games

For the smart world

- Smart appliances
- (Semi-)autonomous cars
- Smart home / Internet of Things (IoT)



DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Goettingen, Hamburg, Jena, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

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VITA - Virtual Therapy Arm



VITA - Virtual Therapy Arm

The world around us is shaped to be manipulated by hands. Cars, smartphones, electric appliances: everything works at the touch of a finger or the grasp of a hand. For this reason, even the partial loss of hand and arm functionality can lead to a degradation in the quality of social and working life, neuropathic pain and depression. In Europe, about 95.000 people suffer from upper-limb amputation, and this figure increases further if we also include stroke survivors and patients of complex regional pain syndrome, paralysis, ALS and spinal atrophy.

Virtual Reality (VR) can help as a tool for rehabilitation: the immersion in a virtual environment promises to have a beneficial effect for upper-limb impaired people, e.g. to alleviate phantom limb pain. The main idea consists of letting users play and get engaged in a world where they can see their missing or impaired limbs in action again.



This is the aim of the VITA project, consisting of an off-the-shelf VR device coupled with an intent-detection system specifically developed by the Adaptive Biointerfaces Group at the Institute of Robotics and Mechatronics of the DLR.

How does VITA work?

VITA uses a Vive VR setup by HTC, requiring a free area of 1.5 m x 2.0 m free space. To detect the actions the user wants to perform in the virtual environment with her impaired limb, an unobtrusive set of sensors is placed on the limb, while a state-of-the-art machine learning system turns the signal patterns into control commands for a virtual replica of the limb. At any time, the user as well as the therapist can "teach" new patterns to the system thus correcting for signal instability or providing adaptation to new actions.

The user controls the interaction from within the VR interface. This fosters trust and ownership of the virtual limb, reciprocal adaptation and feeling of immersion.



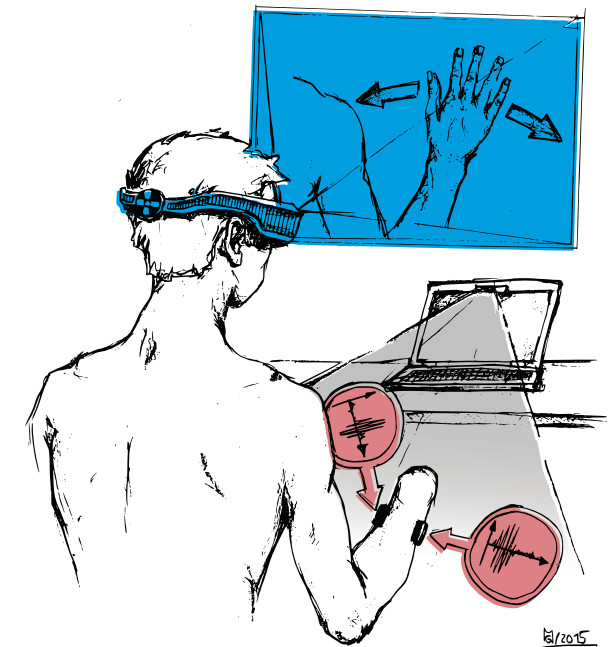
Lightweight, portable, easy to use

In VITA, state-of-the-art VR meets advanced machine learning, enabling co-adaptation of man and machine and helping the users feel completely immersed. Through the VITA framework users can play serious games, undergo prosthetic training programmes and more. Furthermore, the different parts of VITA coexist and communicate with each other via a tightly integrated yet modular architecture.

This means that VITA can also be integrated in other VR applications, environments and devices. It can be used in research labs, in rehabilitation centres, in orthopaedic facilities, in hospitals and even at home. The effectiveness of the administered therapy can be directly assessed, even remotely.

For the gaming industry, too!

VITA enforces intuitive, natural control via muscle activity. It is a modular system based on off-the-shelf components, meaning that it can be integrated into other VR environments or physical devices. This has applications even outside rehabilitation. For instance, people can use the VITA system to interact with VR games, smart appliances, (semi-)autonomous cars and remote controlled devices (e.g. UAVs) through gesture recognition. This can be even integrated in a smartphone app.



The VITA project, equipment, laboratory and setup won the 2015 DLR Idea Award. The team consists of Claudio Castellini, Markus Nowak, Christian Nissler, Zoltán-Csaba Márton and Ingo Kossyk. If you are interested, get in touch with us!

