



# CAREN

The World's Most Advanced Rehabilitation System

# Mobility and Quality of Life

In everyday life we are not aware of our balance and locomotion until trauma, disease or natural decline compromises these functions. Daily activities and independent living can become problematic, adversely affecting quality of life. The Computer Assisted Rehabilitation ENvironment (CAREN) is a versatile system enhancing both clinical treatment and research on any aspect of impaired mobility and locomotion. CAREN combines 10 years of experience in rehabilitation technology and therapeutic Virtual Reality applications. CAREN is the world's most advanced system for clinical rehabilitation and research on human performance.



Functional tasks in dynamic environments involve physical, visual and cognitive challenges. These complex interactions demand high-level equipment and technology to target all aspects of balance and locomotion in both clinical treatment and research.

CAREN records patient specific responses to perturbations using the 3D motion capture system and the instrumented dual-belt treadmill which is mounted on a 6 Degrees-of-Freedom motion base. A fully immersive dynamic and interactive Virtual Reality system provides a synchronized visual flow and real-time feedback on any calculated performance measure.



## State-of-the-Art Research

The CAREN is the perfect system for advanced research protocols in order to study impaired balance and locomotion. The patients' environment can be manipulated to study pathology specific responses using physically, visually or cognitively challenging dual-tasks. It's possible to use the treadmill and motion platform to perturb the walking surface in any direction, for example to mimic tripping, slipping, walking uphill or downhill, or sideways pushes.

CAREN supports both fundamental and advanced applied research on gait/movement, balance and human performance. Any parameter of the system and person on it can be influenced and recorded. This will rapidly give insight into the most effective clinical treatment protocols and offers possibilities to investigate new treatment options.

CAREN contains several pre-programmed VR environments, but also enables users to create custom environments for specific target groups or dedicated research questions.

## The Best Clinical Care with Multi-sensory Inputs

Throughout our lives, we constantly prioritize our sensory inputs when we encounter physical obstacles. We process visual information while effectively using our cognitive capacities to guide our movements. Effective rehabilitation includes all these elements. CAREN facilitates this functional approach for patients suffering neurological, orthopedic or musculoskeletal disorders. CAREN offers objective and sensitive assessment possibilities for each aspect of impaired balance and locomotion. Dedicated protocols for real-time **Clinical Gait Analysis** and **instrumented balance assessments** are available. CAREN also includes effective and personalized training options, which will speed up the rehabilitation process towards functional recovery.

High intensity training in challenging conditions benefits clinical treatment in neurology, rehabilitation medicine, orthopedics, physical therapy, sport, and even psychology.

Challenging and effective exercises can be performed using various intuitive therapeutic games, using the immersive interactive and dynamic VR environment.



*"The CAREN enables our lab to perform both fundamental and applied research on every aspect of human movement performance. It also puts us in an advanced position for collaborations and fund raising"*

PROF. DR. PHILIP ROWE, STRATHCLYDE UNIVERSITY,  
GLASGOW, SCOTLAND, UK.



## The CAREN way

A CAREN will put your institute on the map and opens doors for grants, referrals and national and international collaborations with top reference institutes. Join a unique worldwide group with some of the top universities and clinical centers.

## CAREN's Custom Configuration Options.

As an institute, you have specific needs. Motekforce Link's strength is to work with you to advise and develop the most optimal configuration of the CAREN system for your patient group or research challenges. We have been doing this for over 15 years resulting in more than 30 CAREN installations all over the world. VR set-ups can range from flat projection to semi-cylindrical immersive screens, up to a full dome set-up. After installation we train you to use both the available clinical protocols and the D-Flow application development software.

## CAREN fits in your Daily Clinical and Research Practice with:

- A set of clinical protocols based on the latest scientific evidence
- Various protocols for different patient populations
- An intuitive software development platform to create advanced research protocols
- Targeted training for the specific needs of the customer, both clinical and scientific
- A ready-to-use integrated system combining various state-of-the-art technologies

*"The CAREN is an integral part of my therapy for patients with low-back pain, musculoskeletal and neurological disorders. Patients benefit greatly from the CAREN sessions"*

DR. LEV KALIKA, NEW YORK NEUROMUSCULAR  
REHABILITATION & PHYSIOTHERAPY, USA

## Specifications

### Motion base

Degrees of Freedom: 6

Translation limits: Surge  $\pm 24$ cm, Sway  $\pm 23$ cm, Heave  $\pm 19$ cm

Rotation limits: Pitch  $\pm 19^\circ$ , Roll  $\pm 19^\circ$ , Yaw  $\pm 23^\circ$

Trans. Velocity: Surge 0.6m/s, Sway 0.6m/s, Heave 0.5m/s

Rot. Velocity: Pitch  $50^\circ/s$ , Roll  $40^\circ/s$ , Yaw  $50^\circ/s$

Trans. Accel: Surge  $6m/s^2$ , Sway  $6m/s^2$ , Heave  $8m/s^2$

Rot. Accel: Pitch  $300^\circ/s^2$ , Roll  $300^\circ/s^2$ , Yaw  $500^\circ/s^2$

### Virtual Reality and sound system

Circular screen 5m diameter,  $180^\circ$ , 3m height

Options for single flat-screen or Dome setup

Audio: Dolby 5.1

Access to system: electrical access ramp

### Dual-belt instrumented treadmill

Walking surface:  $2 \times 500 \times 1800$ mm

Speed error  $< 1\%$

Speed: 0 – 5 m/s (18km/h), speed stepping of 0,01 m/s

Independent speed setting left/right

6 load components available (Fz, Fx, Fy, Mx, My, Mz) for each belt

Center of pressure (CoP) error  $< 3$ mm

Crosstalk  $< 1\%$

Near zero drift

### Full 3D motion capture system

Optional real-time musculoskeletal Human Body Model software.

All data synchronized with other data streams and available in real-time for application development.



## What The Users Say

Motekforce Link's CAREN clients around the world are enthusiastic about the system and the impact it has on their institute. Upon request we can organize site visits in which other CAREN clients can share their experiences. They recommend the CAREN for a variety of clinical and research applications.

Motekforce Link combines more than fifteen years of experience in high-quality rehabilitation technologies and real-time feedback using virtual reality techniques. Our mission is to contribute to the quality of life for each individual by defining and setting standards for measuring and improving human movement performance, using our network of partners, our technology and our drive to make a difference in this field.



Motek is a proud partner of



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