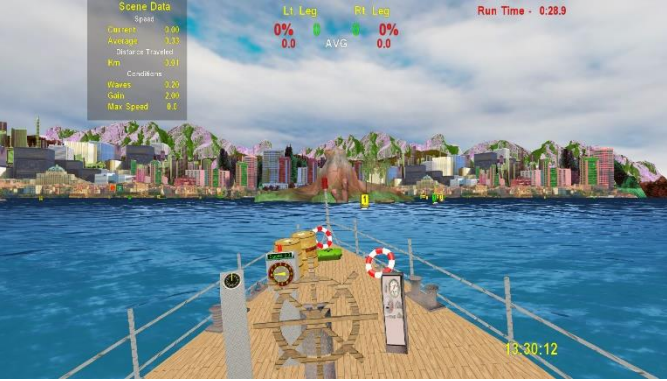




Supplemental Material

Section 1: Description of training VR environments used.

Table e1. Virtual environments and their characteristics.

CAREN setting	Task objective and description	Therapeutic goal	Extrinsic feedback	Task-grade progression
<p style="text-align: center;">Boat</p> 	<p>To sail a boat by moving the body and taking curves according to buoys' signs.</p> <p>The participant should complete the route in the shortest time and avoid to crash into the buoys</p>	<p>Balance (anticipation and reaction) Postural adjustments Motion planning Spatial perception Trunk control</p>	<p>KP: participant's movements control the boat. Information about weight distribution, speed parameters, height of waves, sensitivity, and run time clock. KR: score based on time, speed, route length, height of waves, number of collisions</p>	<p>The speed of the boat. Sensitivity of the patients markers, location of the markers, and heights of the waves</p>

<p style="text-align: center;">Road walk</p> 	<p>To adapt walking pattern on a moving road (platform perturbations).</p> <p>The participant should hit and avoid balls of different colors</p>	<p>Walking adaptations Perturbation training Motor DT Compensatory reactions</p>	<p>KP: Visual flow with virtual hands representing the left and right hand. Information about weight distribution, hits of balls per hand, overall score, average weight bearing, run time clock KR: score based on hits and avoided balls</p>	<p>Treadmill speed. Platform degrees of inclinations. Platform vibrations intensity. Balls parameters (number, type, speed, location)</p>
<p style="text-align: center;">Road obstacle</p> 	<p>To negotiate obstacles while walking on a moving platform</p> <p>The participant should plan and adapt the walking to avoid or surpass obstacles that generate a perturbation following collision</p>	<p>Perturbation training Walking adaptations Motor planning Step clearance</p>	<p>KP: avatar of the shoes. Walking distance and walking speed. Number of collisions. KR: Number and type of obstacles. Number of obstacles collisions. Overall success rate in percentage</p>	<p>Obstacles parameters (Number, height, type). Platform degrees of inclines. Walking speed. Intensity of perturbations while colliding. Cognitive (Stroop, played operations). Lateral perturbations of the platform</p>

Road stand



To keep the balance while standing on a moving road (platform perturbations).

The participant should hit and avoid balls of different colors

Balance (anticipation and reaction)
 Reaction time
 Perturbation training
 Reaching
 Upper limb function
 Visual-spatial training
 Attention function

KP: Visual flow with virtual hands that represent the left and right hand. Information about weight distribution, amount of hits of balls per hand, overall score, average weight bearing, run time clock
 KR: score based on hits and avoided balls

The speed of the environment, platform degrees of inclinations. Platform vibrations intensity. Balls parameters (number, type, speed, location)

Cradle reach



To keep the balance on a moving platform, and to reach the maximum amount of balls.


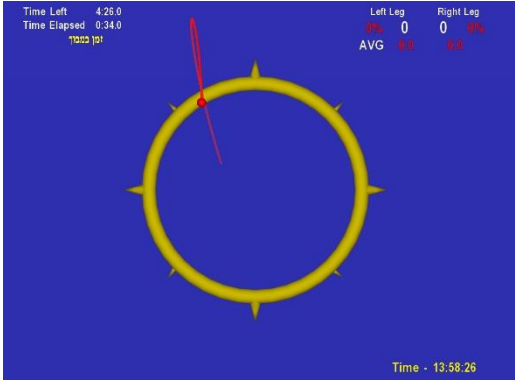
The participant should avoid the ball with horns (that represents the "devil")

Balance control
Reaction time
Attention function
Upper limb function
Visual-spatial training

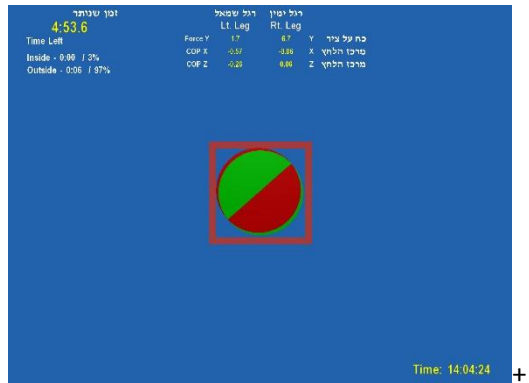
KP: colored balls representing the two hands.
Information about weight distribution, amount of hits of balls per hand, overall score, number of reaches on the "devil", run time clock, remaining time.
KR: score based on number of reached and avoided balls

Frequency, angle and pattern of the platform movement, number, location and distribution of the balls on the screen, display duration of the ball. Sensitivity of the patients' markers

<p style="text-align: center;">Surf</p> 	<p>To sail a surfboard by moving the body and taking curves according to buoys' signs.</p> <p>The participant is 90° oriented to the screen and should complete the route in the shortest time and avoid to crash into the buoys</p>	<p>Balance (anticipation and reaction) Weight bearing on the front leg Postural adjustments Motion planning Spatial perception Trunk rotation Executive function</p>	<p>KP: the surfboard controlled by the participant's movements. Speed parameters, height of waves, markers sensitivity, and run time clock. KR: score based on time, speed, length of the route, height of waves, number of collisions</p>	<p>The speed of the surfboard. Sensitivity of the patients' markers. heights of the waves</p>
<p style="text-align: center;">Cradle balls</p> 	<p>To keep balance while standing on a moving platform, and hitting and avoided colored balls.</p> <p>There are balls in different colors and trajectories, the participant should hit and avoid balls with specific color</p>	<p>Weight shifting Balance reaction Upper limbs training Attention function Visual-spatial training</p>	<p>KP: balls representing the (two) hand(s). Information about weight distribution, amount of hits of balls per hand, overall score, average weight bearing, run time clock KR: score based on hits and avoided balls</p>	<p>Frequency angle and pattern of the platform movement, and number, location , type and speed of balls</p>

<p style="text-align: center;">Forest</p> 	<p>To walk on a moving platform while hitting moving objects (birds/butterflies).</p> <p>The participant should plan ahead and to accurately hit the virtual objects</p>	<p>Visual perception Motor DT Upper limb function Perturbation training</p>	<p>KP: balls representing the (two) hand(s) amount of hits of birds and/or butterflies. run time clock. Treadmill left / right speed. KR: number of hits</p>	<p>The speed of the environment, platform degrees of inclinations. Birds/butterflies position on the screen. Controlled perturbation induced manually by the operator</p>
<p style="text-align: center;">Active balance</p> 	<p>To control the body movements over a moving platform, while manipulating a changing projected shape.</p> <p>Body movements control the motion of the platform, and the dot on the screen</p>	<p>Weight shifting Balance reaction Trunk and pelvis control</p>	<p>KP: a dot represents the location of the body. A line depicts the trajectory of the body movement. Information about weight distribution and run time clock. KR: weight distribution and performance time</p>	<p>Parameters of the shape (e.g., type, location, size)</p>

Counter balance



To keep balance without body movements on a moving platform, in order to keep an overlap between two circles.

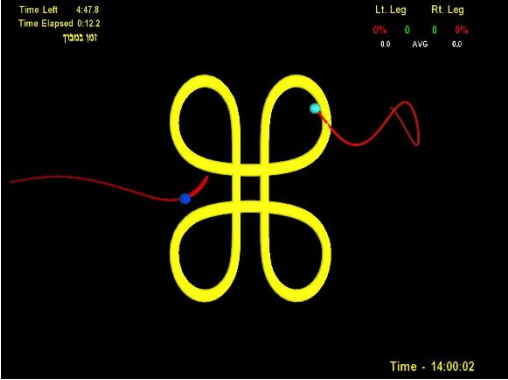
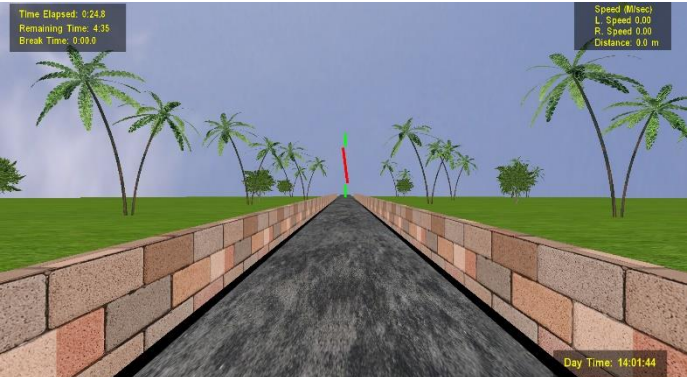
The participant should try to keep static, aiming to maintain an overlap between a circle that represent the body movement, and a system-defined circle

Postural and balance Over-stationary base of support

KP: a circle that represent the body movement in relation to a fixed centered circle surrounded by a square. Information about weight distribution and center of pressure, run time clock

KR: performance time, success rate in percentage (time maintaining accurate overlap divided by the total time)

Practice time, sensitivity of the platform to body movement

<p style="text-align: center;">Cradle shapes</p> 	<p>To keep balance while standing on a moving platform, and to keep the hands on the line of a changing projected shape.</p> <p>The participant is standing in a moving platform and should follow the shapes by moving his/her hands</p>	<p>Weight shifting Balance reaction Upper limbs training</p>	<p>KP: balls representing the two hands. A line depicts the trajectory of the hand(s) movement. The line is green when the patient is on the shape and red when outside. Information about weight distribution and run time clock. KR: weight distribution and performance time</p>	<p>Frequency angle and pattern of the platform movement, parameters of the shape (e.g., type, location, size). Sensitivity of the patients' markers</p>
<p style="text-align: center;">Endless road</p> 	<p>To walk on a platform and keep upright position while dealing with perturbations and cognitive dual tasks.</p> <p>The participant is walking in a treadmill either in self-pace or fixed speed mode</p>	<p>Cognitive DT Decreasing festination Shuffling gait Gait adjustments</p>	<p>KP: Visual flow. Optional: sound cue. Speed, 3 vertical bars that indicated the alignment of the patient's body. Distance walked. Time. KR: Distance walked</p>	<p>Platform degrees of inclinations. Walking speed. Cognitive (Stroop and arithmetic operations). Perturbations of the platform</p>

KP: knowledge of performance, KR: knowledge of results, DT: dual-task