A traumatic brain injury (TBI) disrupts the central and executive mechanisms of motor coordination, involving abnormal arm(s) and postural (trunk and legs) interaction, difficulties with arms coupling, lack of agility, and movement precision. To address these issues, we developed a 3D immersive videogame ("Octopus") using the basic principles of videogame design. Unlike many other custom-designed virtual environments, Octopus included an actual gaming component with a system of multiple rewards, making the game challenging, competitive, motivating and fun.

The game was developed using WorldViz software, integrated with the system for motion analysis. Avatars of the participant’s hands precisely reproducing the real-time kinematic patterns were synchronized with the simulated environment, presented in first person 3D view on a 82” DLP screen. During a 1.5-minute gaming trial the participants interacted with computer-generated environment by popping the bubbles blown by the Octopus. Intercepting the bubble trajectory required large-amplitude arm and postural movements in sagittal, frontal, and oblique planes. Successful performance on each trial was rewarded by appearance of an additional virtual character with the overall gaming goal to collect as many characters as possible.

Six participants with mild-to-moderate postural and coordination deficits due to TBI participated in the study. Participants played Octopus ten times during a single session. Kinematic of the whole body was analyzed in terms of arm-postural coordination, and the arm end-point deviation from the line, determining the shortest distance to the bubble.

As a result of short-term practice, the participants improved on game performance, arm movements, and arm-postural coordination. Most participants showed immediate increase in arm reaching distance on the Functional Reach Test, and time of the single-leg stance.

The game developed has been proven to be safe and feasible for the training of coordination abnormalities and can potentially improve the functional mobility in individuals with TBI.