Amputee puts limb system through its paces

19 December 2014, by Nancy Owano

APL prosthetist Courtney Moran looks on as Les Baugh tests out the Modular Prosthetic Limbs. Credit: Johns Hopkins University Applied Physics Laboratory

"Amputee Makes History with APL's Modular Prosthetic Limb" is the headline from Johns Hopkins Applied Physics Laboratory, where a team working on prosthetics observed a milestone when a double amputee showed he can control two robotic hands with his mind. Les Baugh of Colorado lost both limbs after an electrical accident over 40 years ago; the team gave him two bionic arms attached from shoulder-level. The rest is the story of what happened when this robotic limb performed functions controlled by his thoughts. Baugh received two Modular Prosthetic Limbs (MPL) as part of a test run at the Johns Hopkins APL. A team there has been at work on a neurally controlled artificial limb that can restore near-natural motor and sensory capability to upper-extremity amputee patients. Baugh is a noteworthy case of a shoulder-level amputee who wore two MPLs at the same time.

How it was done: Baugh had to undergo surgery at Johns Hopkins Hospital known as targeted muscle reinnervation, which reassigned the nerves that once controlled his arms and hands, reassigning those nerves to control the prosthetic devices by thinking about the action they want to perform. After that, Baugh visited the Laboratory for training on the use of the MPLs. Dr Albert Chi, medical director, Targeted Muscle Reinnervation Program and assistant professor of surgery, said "it started really with intensive training with a pattern recognition system." The latter involves advanced algorithms to identify individual muscles that are contracting, how well they communicate with each other, and their amplitude and frequency. Information is translated into actual movements within a prosthetic. (Chi is a trauma surgeon. His practice includes critical care, trauma and acute care surgery. His background includes biomedical engineering and clinical research, focused on improving the lives of individuals with traumatic injuries, with an emphasis on motor control.)

Baugh was fitted for a custom socket to support the prosthetic limbs and they had him work first on a virtual reality version of the MPL, called the Virtual Integration Environment (VIE). The VIE is one of the important features of the research activities, used to test novel neural interface methods and study phantom limb pain. The VIE is a simplified, platform-independent communication interface to the MPL. It is credited as having revolutionized neuroscience and prosthetics research and development by creating a common playing field for researchers and developers around the world, to use to simulate and test new ideas.

Once the training sessions were complete, Baugh said, "They released me and let me be the computer." After ten days of training, he was able to move objects, including an empty cup from a counter-shelf height to a higher shelf, a task that required him to coordinate the control of eight separate motions to complete. A prosthetist working with Baugh said the team was floored by what he had been able to accomplish. They were

surprised by the speed with which he learned motions and they were also surprised by the number of motions he was able to control in a short period of time.

One of the milestones regarding Baugh is that he became the first bilateral shoulder-level amputee to wear and simultaneously control two of the Laboratory's Modular Prosthetic Limbs. As a next step, the team hopes to send Baugh home with a pair of limb systems so he can see how they integrate with his daily life.

Baugh completes a task showcasing his control of the MPL. Credit: Johns Hopkins University Applied Physics Laboratory

More information:
www.jhuapl.edu/prosthetics/scientists/mpl.asp
www.jhuapl.edu/newscenter/pres …
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APA citation: Amputee puts limb system through its paces (2014, December 19) retrieved 26 January 2022 from https://techxplore.com/news/2014-12-amputee-limb-paces.html