

Use of Robotics to Promote Neurorehabilitation

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Abstract: My laboratory focuses on upper extremity rehabilitation for neuromuscular impairment. Toward that end, we are investigating human sensorimotor control, identifying the changes that occur from injury or disease, and developing new interventions to restore function through therapy or assistance. Damage to the nervous system is the primary cause of major long-term disability in the U.S., with impacts on self-care, employment, and social engagement. Robotic technology has the potential to improve outcomes for individuals with impairment, whether through therapy or assistance, but the close interactions between the user and the device present challenges that must be overcome to realize benefits.

I will focus on two areas of human-machine interaction: the mechanical interface and communication. The physical connection between the wearer and the device is crucial to proper function. We have developed different types of exoskeletons (soft, hybrid hard-soft) to best interface with the user depending on intended purpose. Recently, we have concentrated on ease of donning and doffing through the generation of custom 3D-printed components that attached both to the user's digits and the exoskeleton. Communication is vital for sharing control between the user and the device and cumbersome conveyance of intent may dissuade usage of the device. We have been exploring means of using electromyography to discern user intent. High-density electromyographic arrays hold promise for continuous, parallel control of multiple degrees-of-freedom.

Bio: Dr. Kamper is currently a Professor in the Lampe Joint Department of Biomedical Engineering and Associate Director of the Closed-Loop Engineering for Advanced Rehabilitation research core. Prior to joining NC State, he was an Assistant and then Associate Professor at the Illinois Institute of Technology and a Research Scientist at the Rehabilitation Institute of Chicago. Dr. Kamper received an AB and a BE degree in Electrical Engineering from Dartmouth College and MS and PhD degrees in Biomedical Engineering from Ohio State University. His research interests include mechatronics and upper extremity neuromechanics, with the goal of facilitating sensorimotor rehabilitation.

