

Thesis Project Portfolio

Soft Robotic Exoskeleton for Elbow Assistance

(Technical Report)

Dual Use of Medical Exoskeletons in the Military

(STS Research Paper)

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Sociotechnical Synthesis

Neuromuscular disorders, a variety of conditions that result in progressive loss of muscle control, affect hundreds of thousands of people around the world. There is currently no cure, but one method of helping patients cope with mobility loss is the use of robotic exoskeletons. A robotic exoskeleton arm was designed and fabricated to help patients with neuromuscular disorders regain arm function and mobility, improving their quality of life and helping them regain autonomy. Sensors placed on the wearer's arm measure electromyographic signals from the contraction of the arm muscles and respond with soft pneumatic actuator motion to help the wearer achieve their desired motion. This technology, however, is not limited to healthcare. Another major application of robotic exoskeletons is in the military, and technologies such as these that are intended for medical use often end up being used in military applications. Since both applications are very human-centered, the social dimensions of this technology critical to understand and optimize. Interactions of wearable exoskeletons with users could significantly impact the users' lives, including their own interactions with related societies and infrastructure. To understand these interactions and unintended consequences, the Interactive Sociotechnical Analysis (ISTA) framework is applied to dual use of exoskeleton technology. ISTA is a model for sociotechnical systems that includes workflows, culture, social interaction, and technologies. It analyzes recursive technological feedback loops and unintended consequences of technology in five distinct interactions. These interactions between social systems, technology-in-use, new technology, and technical and physical infrastructure have been analyzed for both medical and military exoskeletons using case study instances for each. The hope of this research is to understand how robotic exoskeletons and humans interact, the impact of both medical and military applications on societies, and how this medical technology being developed could have unintentional consequences in the military.