

Center for AI and Robotics in medicine (CARE)



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***Auctions, preferences, & wearable robots:
the development of meaningful
exoskeletons & robotic prostheses***

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ABSTRACT

Lower-limb wearable robots—such as exoskeletons and robotic prostheses—have struggled to have the societal impact expected from these exciting technologies. In part, these challenges stem from fundamental gaps in our understanding of how and why these systems should assist their wearer during use. Wearable robots are typically designed to meet a single, specific objective (e.g. reduction of metabolic rate), however, in reality, assistive technologies impact many aspects of gait and user experience. In this talk, I will discuss our recent work leveraging user preference as a ‘meta-criterion’ in design and control, through which the wearer is able to internally balance the quantitative and qualitative tradeoffs that accompany wearing these technologies, including stability, comfort, exertion, or speed. I will highlight our work understanding user-preferred assistance settings in a variable-stiffness prosthesis / orthosis, as well as bilateral ankle exoskeletons. These studies will highlight that user-preferred assistance settings are reliable yet diverse. In addition, I will discuss the Open-Source Leg ecosystem, an open-access hardware and software platform for studying the control of robotic leg prostheses. Finally, I will introduce a new approach for understanding the success of assistive technologies using tools from behavioral economics. I will describe and quantify the economic value provided by ankle exoskeletons, including the cost incurred from wearing the added mass, as well as the value added by the assistance alone. Together, this talk will underscore the role of the user in the development of wearable robots, and advocate for a shift away from the conventional, single-objective assessment of these technologies.

BIOGRAPHY

Elliott J Rouse is an Associate Professor in the Departments of Robotics and Mechanical Engineering at the University of Michigan. He directs the [Neurobionics Lab](#), who studies the dynamics of how and why people use wearable robotic systems. His group uses this understanding to develop novel hardware designs, including the [Open-Source Leg](#). In addition, Dr. Rouse is a Senior Research Scientist at the Institute for Human and Machine Cognition (IHMC). He is a recipient of the NSF CAREER Award and the Henry Russel Award at UM. He is on the Editorial Board of Wearable Technologies and is the Co-Chair of the IEEE RAS Technical Committee on Biorobotics. He received the BS degree in mechanical engineering from the Ohio State University and the PhD degree in biomedical engineering from Northwestern University. Subsequently, he joined MIT as a Postdoctoral Fellow in the MIT Media Lab. Prior to joining U-M, Dr. Rouse was a principal investigator at the Shirley Ryan AbilityLab / Northwestern University, and worked as a mechanic in professional Le Mans autoracing. In 2019 - 2020, he was visiting faculty at (Google) X where he co-founded their exoskeleton development team. In 2024-2025, he was on sabbatical at the Robotics and AI (RAI) Institute, where he worked on advanced machine design workflows.