# CoExo

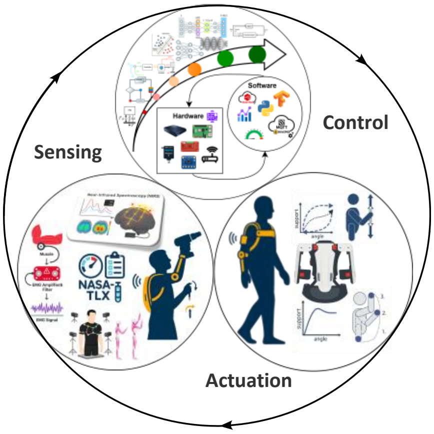
## Cognitive-motor interference during exoskeleton use

### BACKGROUND

Work-related musculoskeletal disorders (WMSDs) are common worldwide in industry and construction, causing disability, reduced productivity, and high healthcare costs. Exoskeletons have been developed as ergonomic support devices to address these issues. However, they must avoid cognitive–motor interference (CMI), where cognitive and motor tasks compete for neural resources, reducing performance. While beneficial effects on biomechanical factors like muscle activity and joint loads are well-studied, neurocognitive mechanisms behind CMI during occupational tasks with exoskeletons are less understood. This project, “CoExo”, will examine different levels of intelligent exoskeleton support functions and their impact on CMI in real-world scenarios. It aims to provide critical insights into neurocognitive processes underlying exoskeleton use to improve and optimise exoskeleton integration through intelligent, adaptive support, thereby enhancing usability and user well-being.

### FOCUS OF WORK

On one side, **AAS** focuses on defining, modelling, and integrating different levels of intelligent assistance, ranging from basic passive support to fully adaptive AI-driven functions within the exoskeleton system. On the other side, **DSHS** handles extensive experimental evaluations involving comprehensive biomechanical, physiological and cognitive assessments under single-task and dual-task conditions. The project has three main studies: (**1**) analysing factors affecting CMI allocation, (**2**) testing new exoskeleton features, and (**3**) evaluating the support levels (ranging from passive to AI-based) in complex work scenarios. The self-developed prototype exoskeleton “Lucy” serves as the central platform for these developments and validations. Multimodal information from 3D motion capture, electromyography (EMG) and functional near-infrared spectroscopy (fNIRS) is integrated into both experimental and simulation studies of real-world tasks. This biomechanical information will be used to analyse and evaluate CMI in applied models.




### KEY MESSAGES

This research enables (**a**) the implementation and validation of various intelligent exoskeleton support functions, ranging from basic passive assistance to sophisticated AI-supported adaptive systems, and (**b**) the systematic assessment of these functionalities regarding cognitive and motor performance. The findings will facilitate the development of adaptive support technologies, improving ergonomics, reducing physical and cognitive loads, and significantly enhancing worker productivity and comfort in diverse industrial settings.

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