The Long and Winding Road to Symbiotic Wearable Robotics

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If we close our eyes and try to extract the first image blinking in our mind when we think of robotics, we probably see a clean, aseptic space where multiple anthropomorphic mechanical arms dance in a coordinated action to assemble a car or an airplane. However, over the past decade, robotics has gradually undergone a metamorphosis and, like a giant growing tree, has dichotomously multiplied its roots and branches. Among the new frontiers of research, wearable robotics is increasingly prominent. Robots and humans have often represented two entities that exist without sharing common spaces (as in the industrial realm where humans and robots are separated by safety fences), but the road taken envisions a future where artificial and biological systems aim at a truly symbiotic interaction.

Wearable robotics has been expanding in several areas, embracing the civilian and industrial domains. The adoption of smart spring-loaded mechanisms and new materials comprising polymers, carbon fibers, and textiles, complemented with novel smart sensing-actuation and human-in-the-loop control strategies, is opening a wide scenario where the exoskeletons and exosuits market is expected to grow to US$5.2 billion by 2025. Applications range from medicine and rehabilitation to industry and wellness, with new implications still unexplored in robotics subfields related to psychology, ergonomics, and biomechanics, in addition to mechanics and electronics. If robotics has been the bailiwick of engineers since its birth, the past two decades have been marked by the need to embrace new disciplines. Wearable robotics is transversally permeating science and its practical spheres.

The new challenges are more like open calls for experts from different scientific backgrounds; if one wants to make the symbiosis between humans and wearable robots a reality, synergistic efforts from multiple actors are paramount. Design guidelines for exoskeletons and exosuits must have a common fulcrum around which multiple professional entities rotate: engineers, clinicians, psychologists, health-care managers, industry representatives, operational and line managers, and investment professionals. How can all this be acheived?

In our opinion, a first igniting spark results from an academic mind-set that values designing an approach to education with new classes, attracting students from different backgrounds, and creating cultural and gender diversity that allows us face the problems on different fronts. To ensure the dissemination of knowledge across disciplines, dedicated events, conferences, and websites must promote these integrations, and, ultimately, the job market must create new professional profiles that work as the glue across multiple backgrounds and application scenarios. This is the long and winding road that can lead to symbiotic wearable robotics being perceived as a part of our everyday life, just as prehistoric clothing was once our main protection from nature.

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We live in an era where technology must provide the next step to our evolutionary path. The wearable robotics challenge is too broad to be faced by a single specialization but rather must be seen as a call for researchers and professionals who want to test themselves on unexplored grounds and accomplish technological wonders. The danger of failure is around the corner; the risks of running into a dead end are a possibility, as is the chance to become the starring actors, the dei ex machina, for the next technological–human revolution.

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