

## Muscle synergies, and the future of robotics rehabilitation

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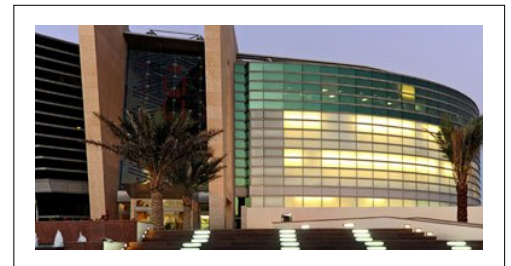
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### Abstract

Understanding the complex neuromuscular strategies underlying behavioral adaptation in healthy individuals and motor recovery after brain damage is essential for gaining fundamental knowledge on the motor control system. Relying on the concept of muscle synergy, which indicates the number of coordinated muscles needed to accomplish specific movements, we investigated behavioral adaptation in nine healthy participants who were introduced to a familiar environment and unfamiliar environment. We then compared the resulting computed muscle synergies with those observed in 10 moderate-stroke survivors throughout an 11-week motor recovery period. Our results revealed that computed muscle synergy characteristics changed after healthy participants were introduced to the unfamiliar environment, compared with those initially observed in the familiar environment, and exhibited an increased neural response to unpredictable inputs. The altered neural activities dramatically adjusted through behavior training to suit the unfamiliar environment requirements. Interestingly, we observed similar neuromuscular behaviors in patients with moderate stroke during the follow-up period of their motor recovery. This similarity suggests that the underlying neuromuscular strategies for adapting to an unfamiliar environment are comparable to those used for the recovery of motor function after stroke. Both mechanisms can be considered as a recall of neural pathways derived from pre-existing muscle synergies, already encoded by the brain's internal model. Our results provide further insight on the fundamental principles of motor control and thus can guide the future development of post stroke therapies.

### Biography

Fady S Alnajjar is the Head of AI and Robotics Lab and Asst. Professor of Computer Science and Software Engineering. And he is visiting researcher at RIKEN Center for Brain Science (CBS), Japan.



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