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MEDIA RELEASE

Wired for laziness

Study finds that people subconsciously and continuously fine-tune their movements to minimize energy use

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Contact:

Max Donelan, Department of Biomedical Physiology & Kinesiology, 604.992.4986, mdonelan@sfu.ca

Diane Mar-Nicolle, Communications Officer, Faculty of Science, 778.782.9586, dianem@sfu.ca

Marianne Meadahl, University Communications, 778.782.9017, Marianne_Meadahl@sfu.ca

Media resources

Do you feel lazy? Most of us do when we choose to drive somewhere when we could have walked or skip daily exercise to binge watch “Game of Thrones”. New research from Simon Fraser University professor Max Donelan and his team demonstrates that this inherent laziness extends to our subconscious nervous system.

Published in the Sept 10 issue of *Current Biology*, their research shows that even within a well-rehearsed movement like walking, the nervous system subconsciously monitors energy use, and continuously re-optimizes movement patterns in a constant quest to move as cheaply as possible.

This finding arose through experiments designed to test theories of how people learn to move. The central claim of these theories is that the nervous system does not move as accurately as it possibly can, but instead selects coordination patterns that are a compromise between accuracy and energetic cost. These theories, while influential, have proven difficult to test resulting in little scientific evidence to support the role of continuous energy optimization - until now.

PhD student and lead author Jessica Selinger explains how she tackled this problem: “We asked participants to wear a robotic exoskeleton that made certain abnormal ways of walking energetically easier than walking in a ‘normal’ way. They accomplished this by applying high energetic penalties to ‘normal’ ways of walking, and much smaller penalties to specific abnormal way of walking.”

Researchers found that after just minutes of wearing the exoskeletons, people changed fundamental characteristics of their gait—characteristics that have been established with millions of steps over the course of their lifetime. “And, they did this even to gain just a few percent savings in energetic cost,” notes Selinger. “Sensing and optimizing energy use that quickly and accurately is an impressive feat on the part of the nervous system. You have to be smart to be that lazy!”

Donelan adds: “While we suspected that the nervous system could optimize energy use, it was surprising to us how small of a cost it cared about. We found that people would adapt their gait even in response to remarkably small energetic savings, at times for less than five per cent of their total cost. Had they simply suffered this small penalty, their energetic debt after one hour of walking would be roughly equivalent to the energy contained in a single peanut. The savings were literally peanuts!”

It makes sense that our movements remain malleable because people’s bodies, and the tasks they are presented with, can change, Donelan adds. “Continuous energetic optimization benefits our ability to adapt our movements by keeping them close to energetically optimal. It helps backpackers efficiently adapt to changing terrains, it helps patients compensate for

movement deficits after injury or disease, and, for better or worse, it helps all of us move with as little energy as possible.”

Support for this work came from a Vanier Canadian Graduate Scholarship (J.C.S), a Michael Smith Foundation for Health Research Fellowship (J.D.W), and a grant from the U.S. Army Research Office.

WHY IT MATTERS:

Why do we walk the way we do? While many of us have puzzled over this question, it is also a matter of scientific importance to a diverse range of disciplines that include neuroscientists, biomechanists, medical practitioners, anthropologists, control theorists and roboticists. The present study contributes a key answer by showing that the nervous system controls our movements to quickly and precisely minimize energetic cost. The results have broad implications for those seeking to rehabilitate mobility disorders, understand the evolution of bipedalism in hominids, or design efficient legged robots, to name a few.

ABOUT SIMON FRASER UNIVERSITY:

As Canada's engaged university, SFU is defined by its dynamic integration of innovative education, cutting-edge research and far-reaching community engagement. SFU was founded 50 years ago with a mission to be a different kind of university—to bring an interdisciplinary approach to learning, embrace bold initiatives, and engage with communities near and far. Today, SFU is Canada's leading comprehensive research university and is ranked one of the top universities in the world. With campuses in British Columbia's three largest cities – Vancouver, Burnaby and Surrey – SFU has eight faculties, delivers almost 150 programs to over 35,000 students, and boasts more than 135,000 alumni in 130 countries around the world.

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Simon Fraser University

8888 University Drive

Burnaby, B.C.

Canada V5A 1S6

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