Why do we move slower the older we get? New study delivers answers

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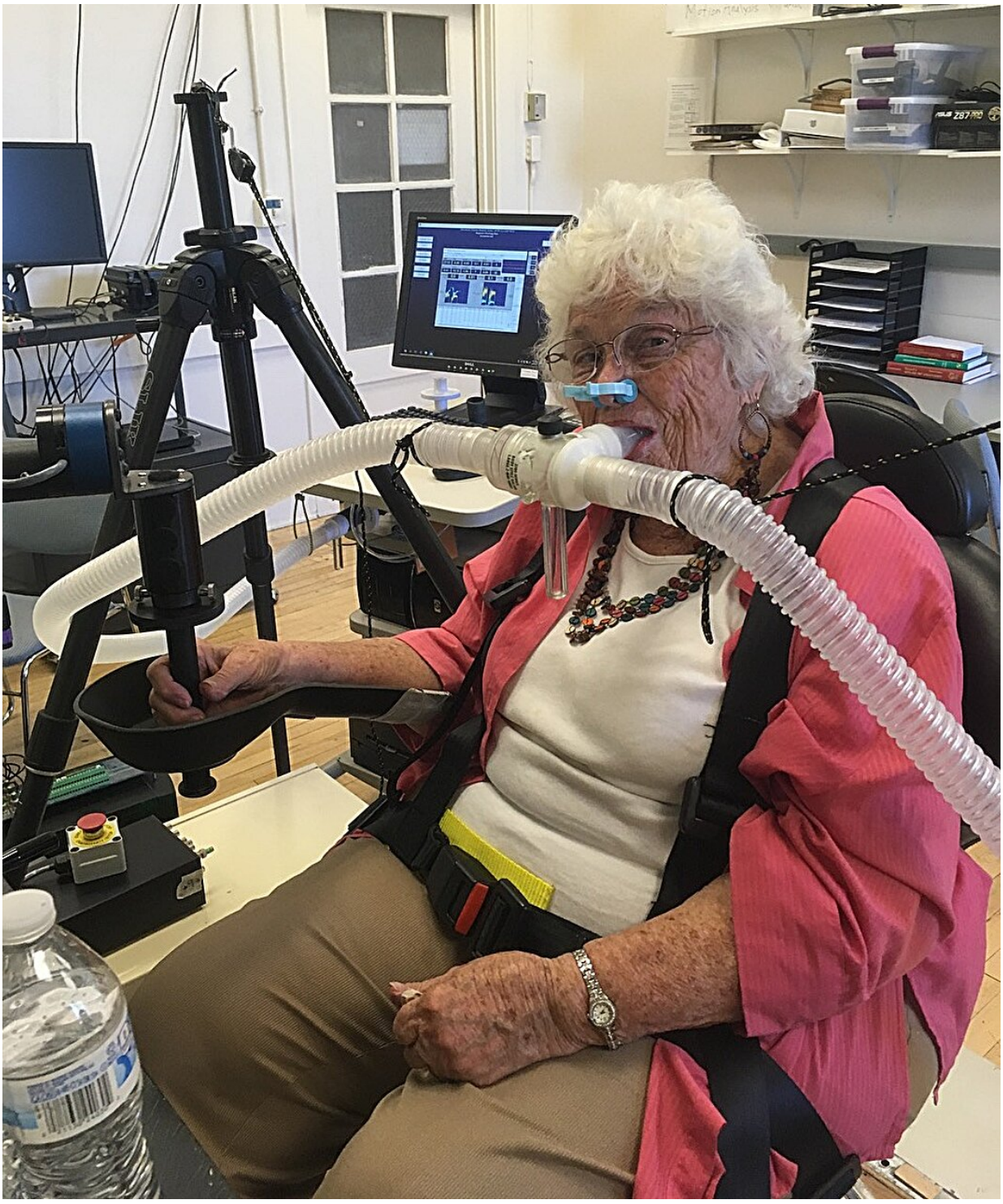

Mary Kaupas participates in a experiment to study how humans of various ages reach for targets. Tubes monitor her breathing to measure how much energy she uses. Credit: Erik Summerside/Mary Kaupas

It's one of the inescapable realities of aging: The older we get, the slower we tend to move—whether we're walking around the block or just reaching for the remote control.

A new study led by University of Colorado Boulder engineers helps explain why.

The research is one of the first studies to experimentally tease apart the competing reasons why people over age 65 might not be as quick on their feet as they used to be. The group reported that older adults may move slower, at least in part, because it costs them more energy than younger people—perhaps not too shocking for anyone who's woken up tired the morning after an active day.

The findings could one day give doctors new tools for diagnosing a range of illnesses, including Parkinson's disease, multiple sclerosis, and even depression and schizophrenia, said study co-author Alaa Ahmed.

"Why we move the way we do, from eye movements to reaching, walking, and talking, is a window into aging and Parkinson's," said Ahmed, professor in the Paul M. Rady Department of Mechanical Engineering. "We're trying to understand the neural basis of that."

She and her colleagues published their findings in *The Journal of Neuroscience*

For the study, the group asked subjects aged 18 to 35 and 66 to 87 to complete a deceptively simple task: to reach for a target on a screen, a bit like playing a video game on a Nintendo Wii. By analyzing patterns of these reaches, the researchers discovered that older adults seemed to modify their motions under certain circumstances to conserve their

limited supplies of energy.

"All of us, whether young or old, are inherently driven to get the most reward out of our environment while minimizing the amount of effort to do so," said Erik Summerside, a co-lead author of the new study who earned his doctorate in mechanical engineering from CU Boulder in 2018.

Using engineering to understand the brain

Ahmed added that researchers have long known that older adults tend to be slower because their movements are less stable and accurate. But other factors could also play a role in this fundamental part of growing up.

According to one hypothesis, the muscles in older adults may work less efficiently, meaning that they burn more calories while completing the same tasks as younger adults—like running a marathon or getting up to grab a soda from the refrigerator.

Alternatively, aging might also alter the reward circuitry in the human brain. Ahmed explained that as people age, their bodies produce less dopamine, a brain chemical responsible for giving you a sense of satisfaction after a job well done. If you don't feel that reward as strongly, the thinking goes, you may be less likely to move to get it. People with Parkinson's disease experience an even sharper decline in dopamine production.

In the study, the researchers asked more than 80 people to sit down and grab the handle of a robotic arm, which, in turn, operated the cursor on a computer screen. The subjects reached forward, moving the cursor toward a target. If they succeeded, they received a reward—not a big one, but still enough to make their brains happy.

"Sometimes, the targets exploded, and they would get point rewards," Ahmed said. "It would also make a 'bing bing' sound."

Moving slower but smarter

That's when a contrast between the two groups of people began to emerge.

Both the 18 to 35-year-olds and 66 to 87-year-olds arrived at their targets sooner when they knew they would hear that bing bing—roughly 4% to 5% sooner over trials without the reward. But they also achieved that goal in different ways.

The younger adults, by and large, moved their arms faster toward the reward. The older adults, in contrast, mainly improved their reaction times, beginning their reaches about 17 milliseconds sooner on average.

When the team added an 8-pound weight to the robotic arm for the younger subjects, those differences vanished.

"The brain seems to be able to detect very small changes in how much energy the body is using and adjusts our movements accordingly," said Robert Courter, a co-lead author of the study who earned his doctorate in mechanical engineering from CU Boulder in 2023. "Even when moving with just a few extra pounds, reacting quicker became the energetically cheaper option to get to the reward, so the young adults imitated the older adults and did just that."

The research seems to paint a clear picture, Ahmed said, Both the younger and older adults didn't seem to have trouble perceiving rewards, even small ones. But their brains slowed down their movements under tiring circumstances.

"Putting it all together, our results suggest that the effort costs of reaching seem to be determining what's slowing the movement of older adults," Ahmed said.

The experiment can't completely rule out the brain's reward centers as a culprit behind why we slow down when we age. But, Ahmed noted, if scientists can tease out where and how these changes emerge from the body, they may be able to develop treatments to reduce the toll of aging and disease.

More information: Erik M. Summerside et al, Slowing of Movements in Healthy Aging as a Rational Economic Response to an Elevated Effort Landscape, *The Journal of Neuroscience* (2024). DOI: 10.1523/JNEUROSCI.1596-23.2024

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