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INSIDE JEB

Humans didn't trade efficiency when they descended from the trees

A climber wearing a gas analyser ascending a climbing wall. Photo credit: Herman Pontzer.

At some point in our evolutionary history, our ancient ancestors descended from the trees and we never returned. 'For me, a key question has always been was there an evolutionary trade-off? Did our ancestors concurrently lose abilities when they became bipedal?', says Elaine Kozma from the Catholic University of Leuven Kulak, Belgium. An occasional climber herself, Kozma explains that most apes and primates have much longer arms and shorter legs in proportion to their bodies than we do and she was curious to find out whether our shorter forelimbs could have prohibited our return to the branches. 'I suspected that short arms and long legs might have decreased our climbing efficiency', says Kozma. So, when she joined Duke University's Herman Pontzer while based at the City University of New York, USA, the pair decided to investigate whether our shorter arms make climbing more costly.

'We found most of our climbers by word of mouth and posting flyers in gyms', says Kozma, who recalls recruiting 12 climbers, 9 men and 3 women, to clamber up three routes, ranging from easy to difficult, designed by an experienced route setter on a 9.5 m high climbing wall. 'One wall can have several routes, the holds have coloured tape that tell you whether or not you can use them for a particular route', Kozma explains. She and Pontzer then filmed the participants as they ascended while wearing a mask with a gas analyser carried on their back to record the amount of oxygen they consumed while scaling each route multiple times. 'Before the hardest trial, they all completed three easy trials, and one intermediate one, so the participants had climbed the wall about 20 times by then', says Kozma, adding that the final climb was demanding even for experienced climbers. In addition, Kozma and Pontzer measured the climbers' height, mass and their arm and leg lengths before analysing the athlete's exertions.

Comparing their data on human climbers with results from another lab, which recorded non-human primates – including slender lorises (*Loris tardigradus*) and squirrel monkeys (*Saimiri boliviensis*) – ascending a rope treadmill, Kozma and Pontzer found that the slower climbers of all species used more energy during ascents than the fastest climbers. In addition, the human athletes moved more slowly up the tougher routes. However, when the pair directly compared the amount of energy used by the human athletes during their ascents, Kozma was surprised that the length of the humans' arms had no effect on the amount of energy they put in to their ascents. 'I really thought that people with longer arms would spend less energy when climbing than people with shorter arms, but our data just didn't support this', says Kozma. In fact, the human climbers were using roughly the same amount of energy as primate climbing specialists, 'suggesting arboreal adaptations have a negligible effect on climbing efficiency', say Kozma and Pontzer in their JEB paper.

So, it seems that we are every bit as efficient at climbing as our primate cousins. Our shorter arms and reach have not made climbing more costly, 'although we likely lost many other aspects of our climbing abilities', says Kozma; for example, the ability to grasp branches with our feet, as our big toe no longer functions like a thumb. And she is intrigued by the unexpected discovery that faster climbers move more efficiently. 'Our results show that, in principle, a climber could choose to climb faster in order to save energy. I'd be curious to know more about the factors that influence the speed at which someone chooses to climb', she muses.

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