Researchers use parkour athletes to test energy demands of tree dwelling apes

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(a)
(b)
(c)
(d)

Horizontal jumping (a); pole swaying (b); climbing a ladder (c) and a rope (d). Photographs by Lewis Halsey. Credit: *Biology Letters* (2016). DOI: 10.1098/rsbl.2016.0608

(Phys.org)—A team of researchers with the Universities of Roehampton and Birmingham in the U.K. has found a unique way to measure the energy spent by tree-dwelling apes when faced with gaps in a jungle canopy. In their paper published in the journal *Biology Letters*, the team describes how they created an artificial canopy and enlisted the assistance of parkour athletes to find out how the different approaches to dealing with canopy gaps compared.

Living in the trees can sometimes require the expenditure of enormous amounts of energy, particularly when attempting to move between trees when there is a gap. An ape, such as an orangutan, must size up the situation and make a decision—try to jump, to swing across, or climb down to the ground and then climb up the other tree. Factors at play include the gap distance, fear of falling, estimated strength of the branches and the size of the ape. The researchers wondered if energy expenditure might also play a role—after all, the more energy an ape uses in getting around, the more food it must obtain and consume.

Figuring that it was likely impossible to measure the amount of energy being used by real apes in their natural environment the researchers looked for a viable substitute and found parkour athletes.

Parkour athletes are people who engage in moving around in urban environments without using any equipment—they jump from building to building, climb walls and do whatever comes to them as they attempt to get from one place to another. Similar in many respects, the researchers noted, to the behavior of apes up in the trees.

To test the energy requirements of dealing with canopy gaps the researchers created artificial tree branches from fiberglass poles and vines using ropes and ladders. They then fitted each of 28 athletes with a mask that allowed for monitoring oxygen intake—a measure of energy use. The researchers than had the athletes engage in a variety of activities meant to simulate the various actions an ape might take when faced with a gap.

In studying the data, the researchers found that climbing down and back up consumed the most energy by far—the energy requirements for jumping or swinging, on the other hand, were much more complicated. It depended on how stiff the branches were, the distance of the gap, number of sways needed and how big the athletes were.

The findings by the team offer some possible explanations regarding why some apes spend more time on the ground than others and perhaps why human ancestors abandoned tree-dwelling altogether.

More information: Lewis G. Halsey et al. Bridging the gap: parkour athletes provide new insights into locomotion energetics of arboreal apes, *Biology Letters* (2016). DOI: 10.1098/rsbl.2016.0608

Abstract
The tree canopy is an energetically challenging environment to traverse. Along with compliant vegetation, gaps in the canopy can prove energetically costly if they force a route-extending detour. Arboreal apes exhibit diverse locomotion strategies, including for gap crossing. Which one they employ in any given scenario may be influenced by the energy costs to do so, which are affected by the details of the immediate environment in combination with their body size. Measuring energetics of arboreal apes is not tractable; thus our knowledge in this area is limited. We devised a novel, custom-made experimental set-up to record the energy expenditure of parkour athletes tree-swaying, jumping and

vertical climbing. The latter strategy was vastly more expensive, indicating that when energy economy is the focus arboreal apes will prioritize routes that limit height changes. Whether tree-swaying or jumping was most economical for the athletes depended upon interactions between tree stiffness, the distance to cross, number of tree-sways required and their own mass. Updated analysis of previous interspecific correlations suggests that whether the relative costs to vertical climb are size-invariant across primate species is complicated by details of the climbing context.