

## Lessons from orangutans: Upright walking may have begun in trees

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By observing wild orangutans, researchers have concluded that our upright walking style may have first arisen in relatively ancient, tree-dwelling apes. The theory challenges current thinking, which suggests two-legged walking emerged in more recent human ancestors that had already descended to flat lands. The new proposal appears in the June 1 issue of the research journal *Science*.

Upright walking, or bipedalism, has long been considered a defining feature of humans and our closest ancestors. One of the leading explanations, known as the savannah hypothesis, suggests that the ancestors of chimps, gorillas and humans descended from the trees and began walking on all fours. An adult male Sumatran Orangutan and her infant in the Gunung Leuser National Park, Indonesia. (Courtesy SKS Thorpe)

Over time, this four-legged gait would have evolved into the "knuckle-walking" that chimps and gorillas still use today; upright, two-legged walking would have been the next stage. Paleontologists have conventionally used signs of bipedalism as key criteria for distinguishing early human, or hominins, from those of other apes. But this distinction is complicated by recent fossil evidence that some early hominins, including the creature dubbed "Lucy" (Australopithecus afarensis), lived in woodland environments. Still earlier forms seem to have lived in the forest canopy and moved on two legs. "Our findings blur the picture even further," said Robin Crompton of the University of Liverpool, U.K., one of the study's authors. "If we're right, it means you can't rely on bipedalism to tell whether you're looking at a human or other ape ancestor. It's been getting more and more difficult for us to say what's a human and what's an ape, and our work makes that much more the case." Crompton and colleagues at the University of Birmingham in Birmingham, U.K., drew their conclusions by watching wild orangutans in Sumatra, Indonesia. Orangutans spend almost their whole lives in trees, making them useful models for how our ancestors moved around several million years ago, Crompton and colleagues said. To collect the data, the University of Birmingham's Susan Nah Thorpe spent a year in the Sumatran rainforest recording virtually every move the orangutans made. Then, she and her colleagues used these observations to test the hypothesis that bipedalism would have benefited tree-dwelling ape ancestors. Because these ancestors were probably fruit-eaters, as orangutans are, they would have needed a way to navigate the thin, flexible branches at the tree's periphery, where the fruit typically is. Moving on two legs and using their arms primarily for balance, or "hand-assisted bipedalism," may have helped them travel on these branches, the researchers said. They analyzed nearly 3,000 examples of orangutan movement, and found that the orangutans were more likely to use hand-assisted bipedalism when they were on the thinnest branches. When bipedal, the animals also tended to grip multiple branches with their long toes. On medium-sized branches, the orangutans used their arms more to support their weight, changing their moving style to incorporate hanging. They only tended to walk on all fours when navigating the largest branches, the researchers found. Hand-assisted bipedalism may have offered several advantages that allowed our tree-dwelling ancestors to venture onto thin branches, Crompton and colleagues argued. The animals could have gripped multiple branches with their toes and distributed their center of gravity more effectively, while keeping one or both of their long arms free to reach for fruits and other supports. Orangutans also keep their legs straight while standing on bending branches, the authors reported. The benefit of the straight legs is unclear, but when humans run on springy surfaces, we also keep our weight-bearing legs straighter, so this may have an energy-related advantage. "Our results suggest that bipedalism is used to navigate the smallest

branches where the tastiest fruits are, and also to reach further to help cross gaps between trees," said Thorpe. The australopithecines pose an evolutionary scenario that begins as other searchers have envisioned. Somewhere toward the end of the Miocene era, 24 to 5 million years ago, climate in East and Central Africa became alternately wetter and drier, and the rainforest increasingly patchy. Apes living in the forest canopy would have been gun to encroaching gaps between trees that they couldn't cross through the high canopy.

Human ancestors would thus have abandoned the high canopy for the forest floor, where they remained bipedal and began eating food from the ground or smaller trees. The ancestors of chimps and gorillas, on the other hand, became more specialized for vertical climbing between the high canopy and the ground. They thus would have developed knuckle-walking for crossing from one tree to another on the ground. The upright style, called "ear-borne bipedalism," had very strong adaptive benefits. So, we don't need to explain how our ancestors could have gone from being quadrupedal to being bipedal," Thorpe said. Observations of orangutan movement should be useful for conservation efforts, according to Thorpe. These animals are seriously endangered, mainly because of habitat destruction. "If you can understand how they cross gaps in the forest, you can learn about effects that living in logged or degraded habitat would have on their locomotion. These could affect energy levels, for example, if they have to go to the ground, which is incredibly risky because the Sumatran tiger is down there licking its lips. The Sumatran orangutan population is predicted to be extinct in the next decade if habitat destruction continues. Our research further highlights the need for protecting these animals," she said.

Courtesy American Association for the Advancement of Science and World Science staff