Vicon Profiles

Dr. David Raichlen and Dr. Herman Pontzer

University Anthropologists Shed Light on the Holy Grail of Anthropology

Vicon motion capture equipment may someday play a role in fully understanding the origins of human bipedalism. According to Dr. David Raichlen, the Holy Grail in the field of anthropology is why did bipedalism evolve in the first place?

↑ **Azy,** 32 year old male Orangutan.

Dr. David Raichlen, Ph.D., Assistant Professor of Anthropology at University of Arizona in Tucson, and Dr. Herman Pontzer, Ph.D., Assistant Professor of Anthropology at the University of Washington in St. Louis each have their own Vicon motion analysis labs at their respective universities. During the summer of 2008, they took a Vicon system on the road to the Great Ape Trust in Des Moines, Iowa, to study the difference in energy output between orangutans and humans.

Dr. Pontzer stated the hypothesis of this research project was that "Humans are a high energy throughput species. We contend that orangutans do not have the same large energy budgets as humans. Evolution is all about how you turn energy into offspring." Scientists know, for example, that human walking is 75% less costly than both quadrupedal and bipedal walking in chimpanzees. The data collected from this recent study on orangutans will hopefully provide information on energy use in a closely related species and will help scientists better understand how human bipedalism evolved.

Challenges Presented Working with Primates

Both scientists reported there were particular challenges working with the orangutans. "You cannot train the orangutans to not pull off the markers; they are too inquisitive," said Pontzer. "So we got one take and were able to do a video analysis. Also, the difference (between humans and orangutans) is so great that the errors that occur from not being able to use the actual markers do not pose a problem. Respiration data was collected (volts vs time) through the Vicon MX Control".

When asked how Vicon contributed to this research project, Raichlen replied "The speed in which we can analyze the data is much faster with Vicon. The whole process is much faster and smoother; it takes five minutes versus

a week to perform the analysis." Pontzer added that he chose Vicon equipment "because it was a greater value for the money. We got more cameras, better equipment and more capability. With Vicon, we have the ability to simultaneously collect multiple data sources—respirometry, EMG, multiple cameras, force plate and more."

The Holy Grail of Anthropology

Raichlen also stated that "the preliminary findings of our study of the great apes give the first view of the empirical evidence of ape energetics. We have the first glimpse at what kind of energy shifts happened 6-8 million years ago." What would constitute a breakthrough in Pontzer and Raichlen's research—to fully understand the origins of bipedalism? Raichlen said "We need to find a pelvis designed like humans. The earliest pelvic structure that has been found existed 3-4 million years after the origin of bipedalism. A breakthrough would be to apply this model of kinematics to fossils that are old enough. The Holy Grail (in this field) is why did bipedalism evolve in the first place? This may never be answered." Analyzing the orangutans will provide one more piece of the anthropological puzzle that spans millions of years of evolution.

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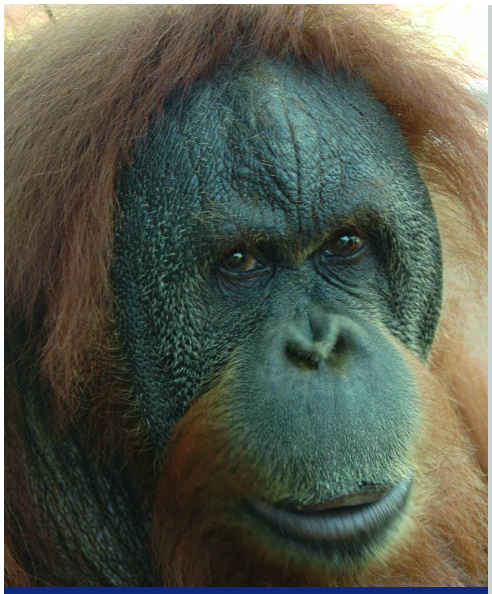
What does the future hold for Pontzer and Raichlen? Visit **http://www.dmanisi.org.ge/** to learn about Pontzer's field work in the Republic of Georgia, where evidence was found of the first hominids to venture out of Africa. Raichlen is currently examining the neurobiology of running in mammals to better understand the motivation for endurance running; ultimately, this study will help determine whether endurance running played a role in the evolution of humans.



↑ **Knobi,** 30 year old female orangutan.

The Great Ape Trust is located in Des Moines, Iowa, and it is a world class research facility that focuses on non-invasive, cognitive research. Its mission is to provide sanctuary and an honorable life for the great apes living there, study their intelligence, advance the conservation of great apes, and provide unique educational experiences to a limited public in a way that cannot be compared in any way to a zoo. The orangutan subjects, Azy, Knobi, Allie and Katy were likeable, willing subjects, and they were never forced to do anything they did not wish to do. More information can be found on them at **www.greatapetrust.org** ■

Related Research

Chimpanzee Energetics
Insights into Ape Locomotor Evolution and the Origins of Bipedalism
Pontzer, Raichlen & Sockol

The Human Evolutionary Biomechanics Laboratory is located at the Department of Anthropology at Washington University, St. Louis, Missouri.

Here, Dr. Pontzer, his team and colleagues study the form, function, and evolution of the primate musculoskeletal system, focusing on locomotor energetics, biomechanics, and ranging ecology in humans and other apes.
http://artsci.wustl.edu/~hpontzer/EvoBiomechLab.htm

Biomechanics of Dmanisi Hominids
Locomotor Adaptations in the First Hominids in Europe
Pontzer, Jashashvilli, Rightmire, & Lordkipanidze

Pelvic Dimorphism and Locomotor Efficiency
Linking Limb Design and Locomotor Energetics
Pontzer

Evolution of Bipedal Walking and Running
the role of endurance running in the evolution of humans
Raichlen, Lieberman & Bramble

Locomotor Ontogeny in Baboons
the effects of limb mass distribution on the locomotor mechanics and energetics of primates
Raichlen & Shapiro

The University of Arizona (Tucson) Evolutionary Biomechanics Lab examines the evolution of mammalian locomotion using a combination of experimental and model-based techniques.

Dr. Raichlen utilizes a wide array of equipment to measure kinematics, kinetics, and muscle activation in both humans and non-human organisms.
http://www.ic.arizona.edu/~raichlen/RaichlenLab.html