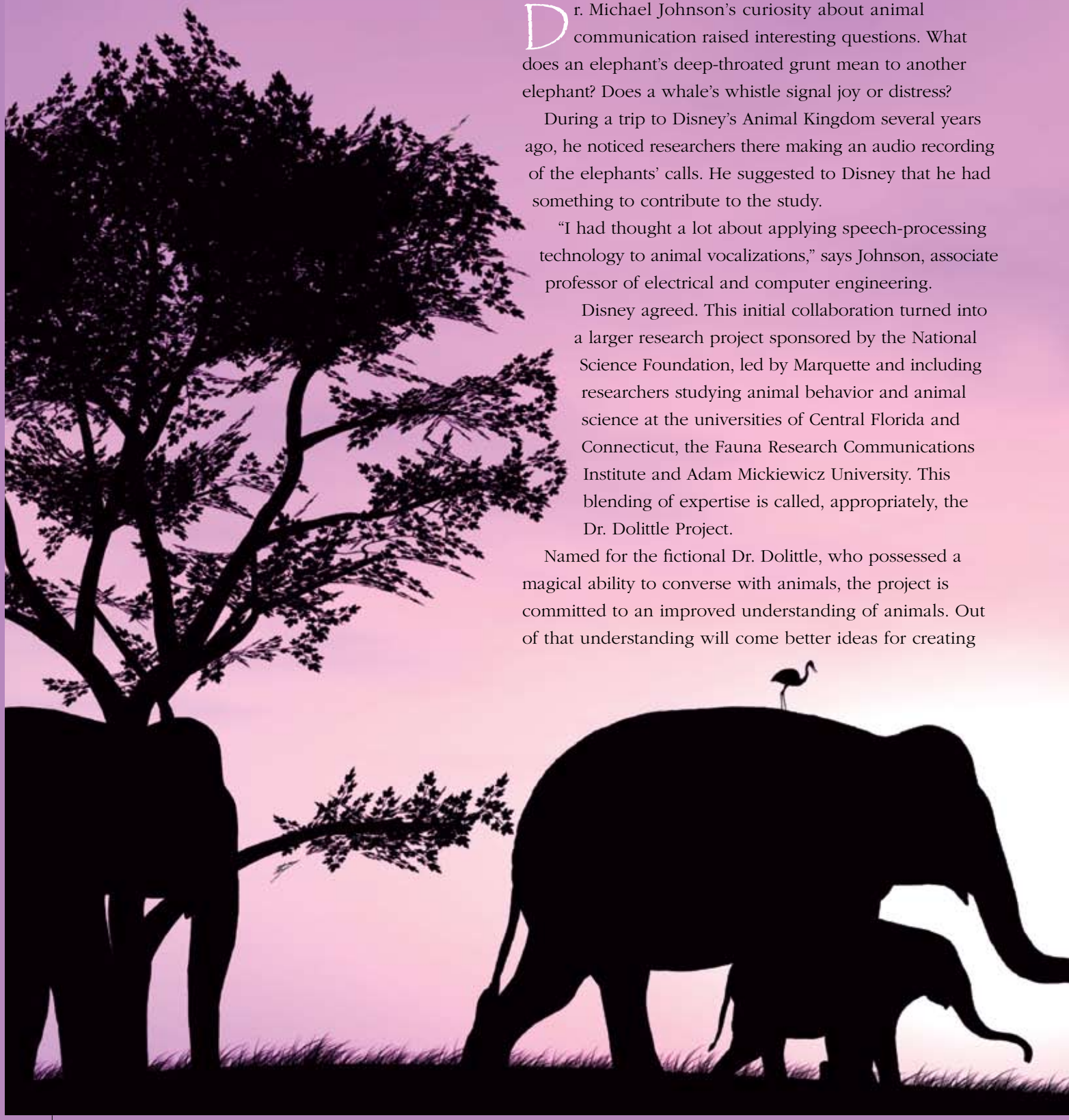
LISTENING
TO THE ANIMAL KINGDOM



Dr. Michael Johnson's curiosity about animal communication raised interesting questions. What does an elephant's deep-throated grunt mean to another elephant? Does a whale's whistle signal joy or distress?

During a trip to Disney's Animal Kingdom several years ago, he noticed researchers there making an audio recording of the elephants' calls. He suggested to Disney that he had something to contribute to the study.

"I had thought a lot about applying speech-processing technology to animal vocalizations," says Johnson, associate professor of electrical and computer engineering.

Disney agreed. This initial collaboration turned into a larger research project sponsored by the National Science Foundation, led by Marquette and including researchers studying animal behavior and animal science at the universities of Central Florida and Connecticut, the Fauna Research Communications Institute and Adam Mickiewicz University. This blending of expertise is called, appropriately, the Dr. Dolittle Project.

Named for the fictional Dr. Dolittle, who possessed a magical ability to converse with animals, the project is committed to an improved understanding of animals. Out of that understanding will come better ideas for creating

habitats and species-survival programs and better technologies for tracking and monitoring animals in their natural habitats. So far, the Dr. Dolittle Project has studied dolphins, African elephants, Beluga whales, Ortolan buntings and domestic species such as poultry, dogs and horses.

Before this, according to Johnson, no one had applied modern speech-processing algorithms to animal vocalizations. Marquette's speech-processing lab became the hub for that portion of the Dolittle Project studies, and the results are enlightening.

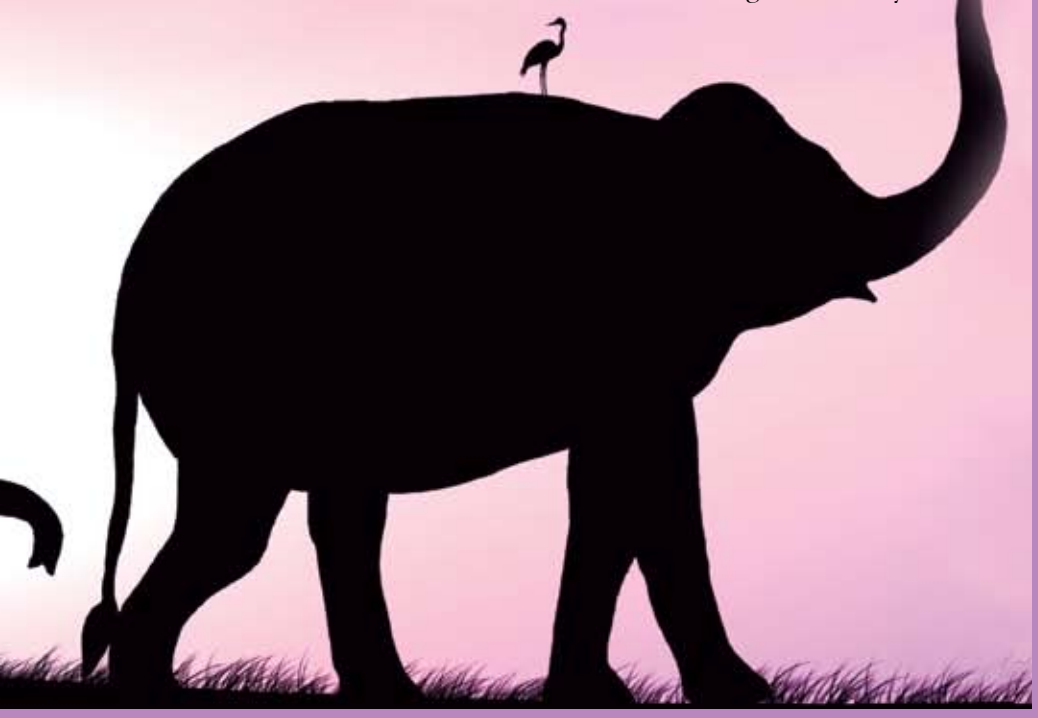
"We have demonstrated that elephants have different vocal patterns at different times of the estrous cycle (the hormonal cycle related to ovulation)," he says. "Knowing that could reduce the need to draw blood to measure hormone levels when breeding. We also have used these techniques to quantify the impact of man-made noise on the Beluga whale population living in the St. Lawrence River Estuary. Specifically, we've shown fairly consistently that these animals need to talk louder when such noise is present. For instance, when the whales are near shipping lanes, it is much harder for them to communicate."

Speech-processing technology and methods make it possible for Johnson to separate and classify sounds, including sounds occurring at frequencies not normally detected by the human ear.

"We can't hear a difference but the computer can," he says. "Elephants often talk at a very low frequency, eight to 14 hertz. We hear it as a rumble, but it is actually a vocalization that they can hear just fine."

The Dolittle Project is working to set benchmarks or starting points that relate a vocal pattern with the animal's activity at a precise moment. Does an elephant make one sound to say "hello" and another to say "let's go?"

"The goal is to identify specific vocalization patterns with specific meaning," Johnson says. "We may not reach 100 percent accuracy, there are so many unknowns, but we are having excellent success categorizing sounds with higher accuracy."



IN THE NEWS

Whether it's because of the public's perpetual fascination with animals or the catchy title of the Dr. Dolittle Project, Dr. Michael Johnson's research has attracted attention around the world. In the last few years, he and his Dolittle colleagues have been featured in *National Geographic*, *Wired* magazine, the Discovery Channel and other media outlets. He was most recently profiled in the Milwaukee Journal Sentinel's series "Brainpower: Groundbreaking Thinkers in Wisconsin." In the article by Mark Johnson (no relation), colleagues enthused about the impact of Marquette's Dr. Dolittle. An excerpt:

By taking techniques used to examine human speech and tailoring them to the study of animals, Johnson "made a major leap," says Michael Darre, a professor of animal and poultry science at the University of Connecticut. Darre, who examined the connections between chicken calls and stress, is now expanding this work to hogs, horses and dairy cattle.

"A lot of it," he says, "is because Mike Johnson has spurred us on."

"I think it's great work. Insightful," says John R. Buck, who teaches in the department of electrical and computer engineering at the University of Massachusetts Dartmouth. Buck compares Johnson's innovations to "building a better set of binoculars" for animal researchers.

Go to *www2.jsonline.com:80/features/* to see the Journal Sentinel's complete package on the Dr. Dolittle Project, including an audio quiz and video of Johnson explaining his research in more detail.