RESEARCH BY SUSAN HUTTON

Make Up Your Mind

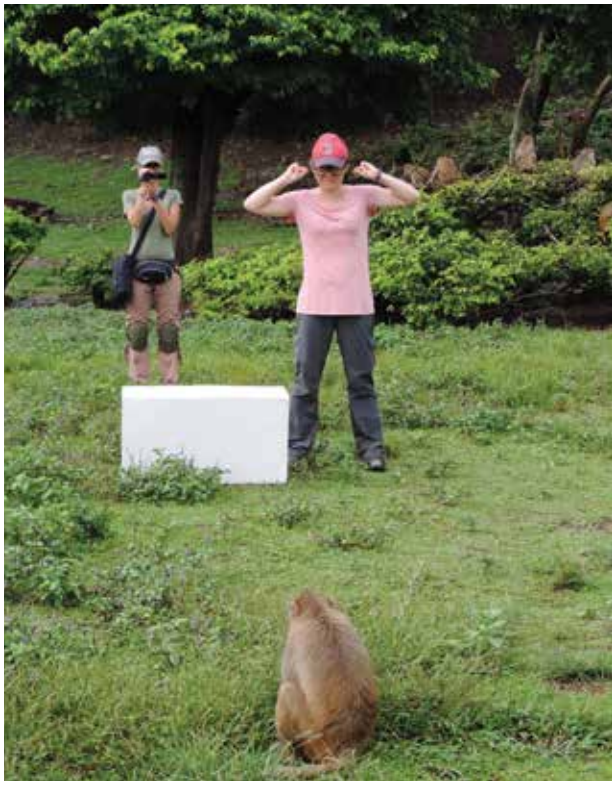
From the Cognitive Evolution Group Lab in East Hall to the trees of Cayo Santiago, LSA's Alexandra Rosati is trying to learn how evolution shaped the way humans think.

FOR CENTURIES, HUMANS have put a lot of stock in thinking we're special. From Aristotle touting our rational minds and deliberative imaginations to Descartes dismissing animals as mere machines, we have a long history of thinking we're unique. As proof, we've pointed to our language, our culture, and our ability to use tools, though these theories seem less certain as time goes on.

More recently, scientists postulated that only humans can think about others' minds. Maybe animals are really good at reading behaviors, the theory goes, but they don't infer how another feels. "Now we have quite a lot of evidence that suggests this theory is not supported either," says Alexandra Rosati, assistant professor of psychology and anthropology.

"The big questions that motivate me are: What is it about humans that allows us to think the way we do?" Rosati says. "How is it that other animals are in some ways very smart, but don't have the kinds of lives we have? They're not going to school or living in buildings. When you study animals and see how intelligent they are, this gap looms even larger."

Rosati's lab investigates primates from a variety of approaches: the complexity of their social groups, what kinds of foods they eat, how they make decisions, how they solve problems. They're trying to find the link between the biological function of cognitive abilities and, ultimately, to understand what made humans capable of such amazing feats of cognition.



"WE STUDY A VARIETY OF DIFFERENT PRIMATE SPECIES THAT DIFFER IN ASPECTS OF THEIR NATURAL LIVES TO TRY TO UNDERSTAND WHAT PROMOTES COMPLEX PROBLEM SOLVING SKILLS," ROSATI SAYS.

A MATTER OF TIME

Visiting the Galapagos in 1835, Darwin first encountered the 14 species of birds that became known as Darwin's finches. "The finches are all closely related, but they have different beaks that allow them to eat different kinds of foods," Rosati explains.

Some evolutionary biologists propose that such subtle differences in traits are caused by small tweaks to the timing of certain genes during development. The concept, known as heterochrony, explains the slight changes between the finches' beaks and similarities in other closely related species. Rosati wonders if the concept might extend beyond physical differences and help explain differences in cognition, too.

There has been some research in this area, but it's been limited in terms of the ages and numbers of the animal subjects, Rosati explains. Her lab is approaching this research from a broader angle. "We've been trying to work at sites that have larger samples of individuals that range in age so we can compare how a baby monkey solves a problem compared to an adult monkey, when a skill comes online, and how it compares to what we know about how this skill develops in humans."

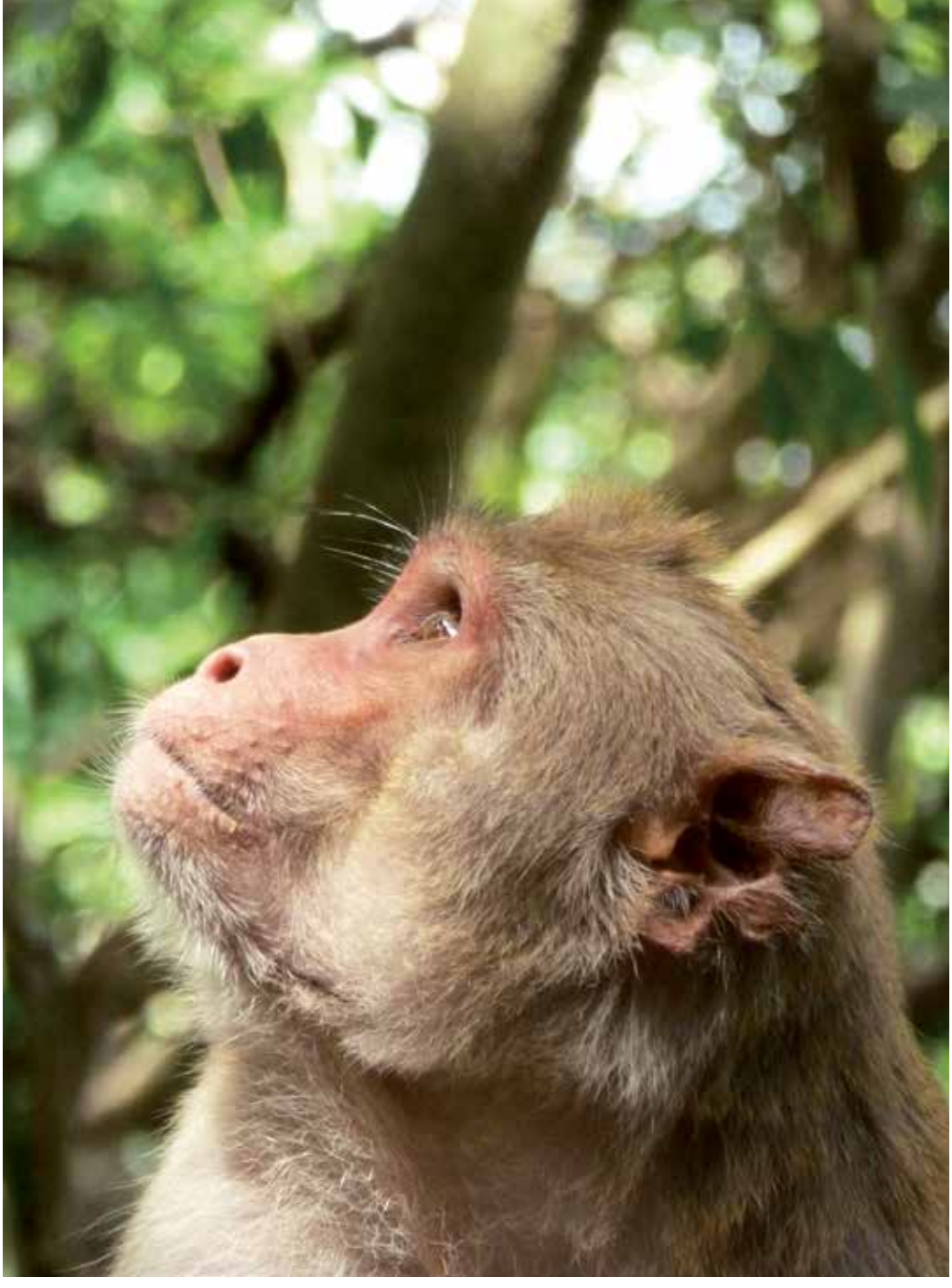
THE SAME, JUST DIFFERENT

Anyone who's spent even a little time around primates can see our similarities: the likeness of our shoulders, hands, and feet, or the way we express emotions through facial expressions. Primate juveniles chase each other around like little kids on a playground. Many primates even smile. Rosati wondered about the extent to which we share more nuanced behaviors, such as the ability to follow another's gaze.

If you see someone staring at the ceiling, you'll probably lean back and look up, too. Babies begin to follow gaze in their first year, and it presages other developmental changes. "It's thought to scaffold other skills like language," Rosati says. "Knowing what others are looking at lets you know what they're talking about.

"It also scaffolds more complex social skills, such as reasoning what's going on in another person's mind," she continues.

(PREVIOUS PAGE) Alyssa Arre; (LEFT) Megan Cole; (RIGHT) Alexandra Rosati



"GAZE FOLLOWING IS A SORT OF CO-ORIENTATION RESPONSE THAT ALLOWS US TO REALLY KEY IN TO WHAT OTHERS ARE SEEING," ROSATI SAYS. "WHERE YOU'RE LOOKING GIVES ME A STRONG CUE OF WHAT YOU'RE THINKING ABOUT."

"We know that a lot of other primates follow gaze in some way—other species like tortoises do, too—but it's less clear if they do so in the same way as humans."

Rosati and her team investigated gaze following in 480 rhesus macaque monkeys, ranging in age from two weeks to 28 years. Like humans, the monkeys follow gaze early, from around five months. Younger monkeys were most sensitive to gaze following, Rosati found, which is consistent with human development. For little kids learning about the context of their social world, gaze is an important cue.

Though young monkeys did appear to follow gaze like young human children, that didn't necessarily mean they were experiencing the same thing developmentally. Maybe in monkeys, for example, gaze following is only a reflexive response, which Rosati and her team tested by examining if the monkeys would control their behavior and refrain from gaze following if they saw someone look repeatedly at the same spot. "The monkeys realized this crazy lady kept looking up for no reason," she recalled, "and they stopped responding once they realized there was nothing there to see."

Like kids, the monkeys also tried to triangulate what the researchers were seeing with their gaze. "Children will actually check back: Am I really looking at the right spot? Is this what she's trying to see?" Rosati explains. "The monkeys seemed to show patterns surprisingly like a human even though, in many ways, their social life is different."

For Rosati, then, the question is: Why do monkeys have this early emerging skill if it doesn't bootstrap language? This is

one possible point of insight into where the biology of cognitive function in primates diverged, and Rosati is working with her lab to understand it.

ON THE ISLAND

When Hurricane Maria slammed into Puerto Rico last fall, the small fishing village of Punta Santiago was annihilated. Buildings were destroyed, and its pier became little more than a skeleton. The force of the storm had pried off its planks and strewn them around town.

Collecting the pier's detritus was one problem, but the bigger issue was the loss it had created for the town's two industries: fishing and looking after the colony of rhesus monkeys that live on a small island a half-mile from shore, one of the most studied groups of primates anywhere in the world. This is where Rosati has conducted most of her lab's gaze-following research.

Commonly known as Monkey Island, the 38-acre landmass has been home to a colony of rhesus monkeys since 1938, when the founding population of 400 monkeys was first brought to the island from India. The monkeys have thrived—they now number 1,700—and they have been a resource for generations of students and researchers who have investigated, among many other things, the monkeys' cognition, parenting, diet, social groups, and genetics.

The monkeys are free-ranging on the island: They breed naturally and form social groups without interference from the people who study them, but they rely on the caretakers living in Punta Santiago for their survival. Aside from rain, there is no source of fresh water on the island, and the monkeys subsist on the food the caretakers bring to the island every day.

"This isn't their wild habitat," says Rosati. "There aren't any freshwater sources, and the hurricane blew all the rainwater cisterns away. It also destroyed all of the scientific infrastructure on the island. To collect genetic data, for example, you need a research lab. That was all blown away."

Like many, Rosati's first field experience took place on Cayo when she was an undergrad. Now she's come full circle, conducting research with students of her own. "It's really like no other place in the world," Rosati marvels. "There's no other place in the world where you could know 1,700 monkeys individually, know all of these different aspects of their life, and have these records going back this amount of time."

IN CRISIS

The hurricane created a devastating crisis for a scientific resource, and its timing was terrible, too. Each fall Cayo Santiago's staff identify and record all of the new babies born on the island, and because the babies tend to stay with their mothers during their first year of life, researchers can record the mother-baby relationship, too. Last fall the hurricane hit as researchers were gearing up to identify the new babies, which means they've missed a generation of monkeys. "If we don't ID them this year, there will be a bunch of three-year-olds and two-year-olds and one-year-olds," Rosati says, "and we will not know exactly who they are or who their family is without genetic testing."

PATERNITY INFORMATION IS A GAP IN WILD PRIMATE DATA. ON CAYO SANTIAGO, PATERNITY DATA WERE COMPLETE FROM THE 1990S UNTIL HURRICANE MARIA. TO RESUME COLLECTING GENETIC DATA, YOU NEED A LAB. THE HURRICANE BLEW THEIRS AWAY.

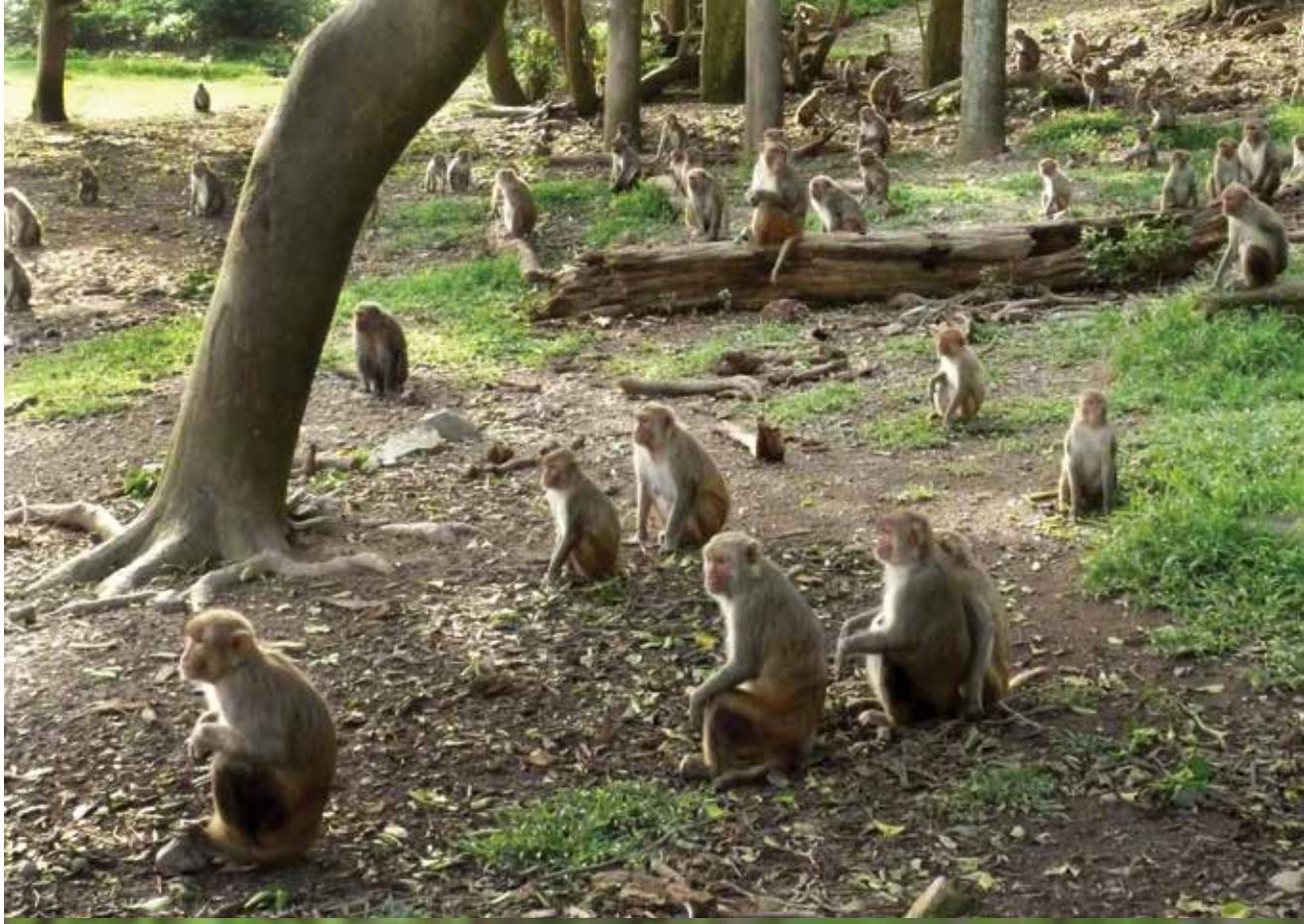
Rosati is concerned about the monkeys and the continuity of the research she and hundreds of other researchers have contributed to this population of macaques, and she's very concerned about the people who take care of them, too. "A lot of the people living in the local community use the same dock, or are supported by family members that have worked on this island for years. The things we need to do to help the monkeys are the same things we need to do to help everyone in the community, too," she says. "It's not a trade-off."

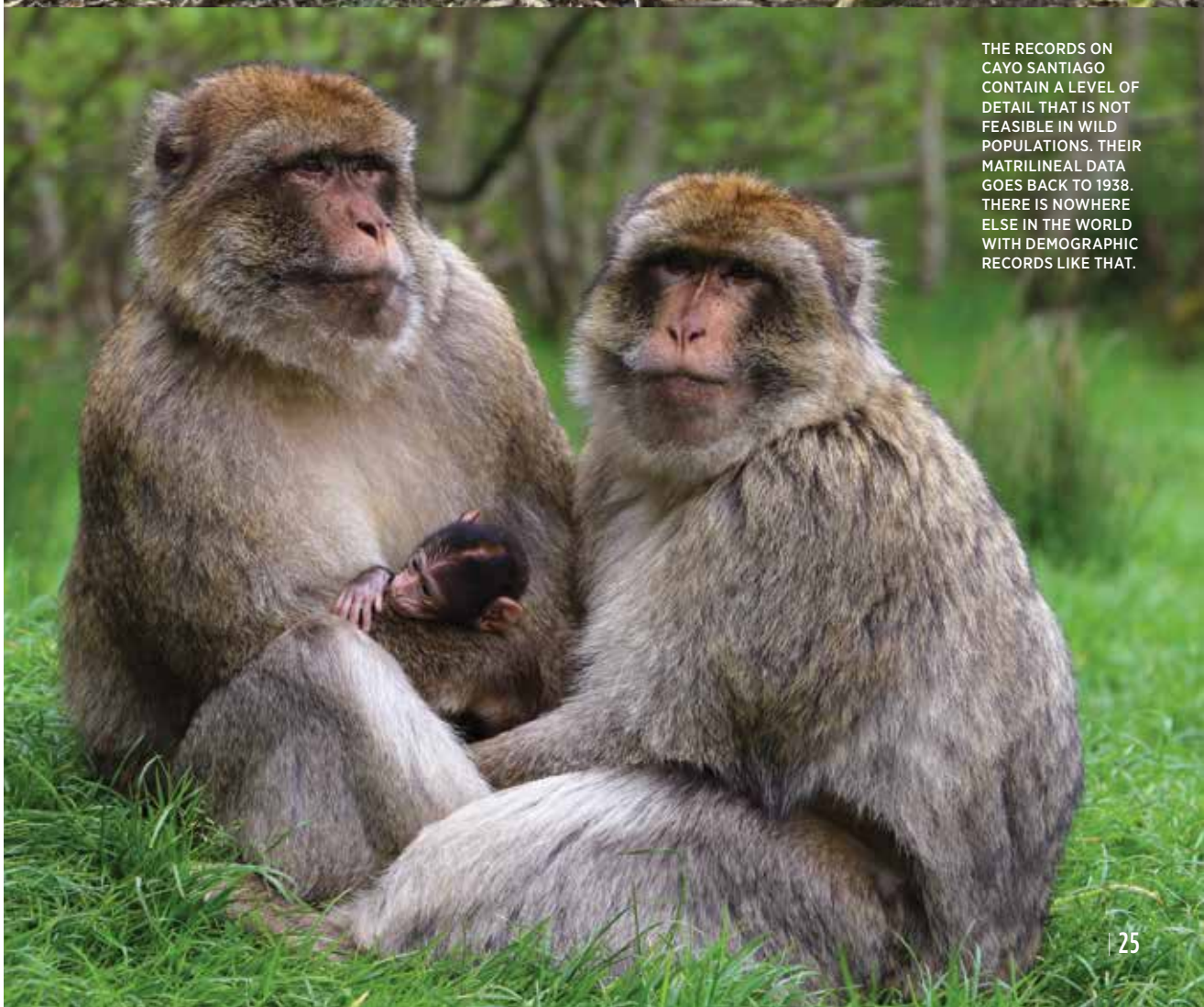
Rosati believes scientists cannot conduct primate research without also keeping the environments and communities in which the animals exist clearly in mind. Many primate species, including some that Rosati studies, are in jeopardy. Cayo Santiago is in peril, but the rhesus monkeys that live there are not endangered like the chimpanzees, barbary macaques, and lemurs that Rosati also studies. She partners with other researchers through organizations such as the Pan African Sanctuary Alliance to create sanctuaries for animals that have been confiscated from illegal trade, and to create the highest quality environment possible for them. Many of the projects in which Rosati is involved promote education and conservation of the animals while they're researching them.

Rosati is interested in what she and other researchers can learn from primate research, but she's equally concerned about their welfare.

"You can't just study these endangered species and ignore the fact that they're not going to be alive in the wild anymore unless we act fast," she says. ■

(THIS PAGE) Associated Press/Ramon Espinosa; (RIGHT) Alexandra Rosati





THE RECORDS ON CAYO SANTIAGO CONTAIN A LEVEL OF DETAIL THAT IS NOT FEASIBLE IN WILD POPULATIONS. THEIR MATRILINEAL DATA GOES BACK TO 1938. THERE IS NOWHERE ELSE IN THE WORLD WITH DEMOGRAPHIC RECORDS LIKE THAT.