FOCUS

ALL TOGETHER NOW!

Female olive baboons with young. The females usually stay in their troop for their whole life. They have a fixed position within the hierarchy, which they pass on to their daughters. Until the age of three months, the young hold on to the belly of their mothers, later they ride on their backs like jockeys.

PHOTO: KATHY WEST ©2013, TANZANIA

THE MONKEY TROOP IS ON COURSE

TEXT: CARLA AVOLIO

Baboon troops are famous for sticking together as they traverse the savannah in search of food. For almost a decade, Meg Crofoot, Director at the Max Planck Institute of Animal Behavior in Konstanz, Germany, has been studying a group of olive baboons in Kenya to understand how they do this – how they overcome their individual differences to band together, make a decision, and move forward as one.

It's five in the morning at the Mpala Research Centre in Kenya and the baboon troop is nowhere to be seen. A lingering cold in the pre-dawn air is keeping them high above the ground in their sleeping nest in the trees. Huddled in groups, the troop of 50 olive baboons stays warm and safe from the leopards who stalk them below. But soon enough morning comes. As the sun spills over the horizon, the troop begins to stir. And the game of compromise begins. Compromise is not a word that usually springs to mind when thinking of baboons. More commonly, images of the group-living primates focus on the dominant male – with his extra-large body and shaggy mane of fur – who wields a despotic sway over his tight-knit group. He gorges himself at the best food patches while the rest watch on. He enjoys access to the best sleeping sites, the most mating opportunities and grooming sessions. He keeps the group in check with aggressive tactics.

The majority decides

But in recent years, scientists including Meg Crofoot have built a body of research that adds color to this black and white picture. By studying a troop of olive baboons at the Mpala Research Centre, Crofoot and her team have discovered that the levers of power do not lie solely with dominant individuals.

Far from it. When it comes to choosing where to go, the group can decide democratically. To help the troop stay together, baboons of all sizes will compromise on their preferred pace of movement. Features in the landscape and subtleties of the social group also play a role in shaping the decisions that individuals make. All of this points to a far more nuanced portrait of baboon societies. "It isn't that we have a strictly despotic or democratic decision-making species," says Crofoot. "What we anticipate is that these decisions are flexible and highly context dependent."

Understanding the nuance in these results also requires understanding the technology at the heart of the science: GPS tracking devices that record the position of animals at very high accuracy. Before high-resolution trackers, biologists studying the behavior of social primates in the wild had two choices: "Either you observe one animal through time, but miss out on what's going on in the periphery that sets the social stage for that individual's behavior," says Crofoot. "Or you can do slices through time and record what everybody is doing but miss out on the sequence of events."

GPS trackers changed that. Now, a single researcher can know with centimeter precision where every animal in the group is, and what they are doing, at the same time. In 2012, Crofoot and her team attached GPS collars to 25 olive baboons in a troop, becoming the first scientists ever to do so on a social primate. The collars, which logged one GPS point per second for weeks, have yielded a staggering amount of data. Study by study, these data are allowing the team to fill in the pages of knowledge about the inter-dependencies of baboon societies. "How what I'm doing effects your behavior; how our interactions shape the choices of other group mates," says Crofoot.

The findings of the first study, which asked the question – who does the group follow? – came as a surprise: in a society marked by despotic leadership, rank matters very little. Troop members didn't follow dominants any more than they did subordinates, overturning assumptions about who affects whom in this highly hierarchical society. "Why the dominant males can't, or don't, translate their social power into leadership ability remains a mystery – and one we are actively working to understand," says Crofoot. The team, which included Iain Couzin, Damien Farine and Ariana Strandburg-Peshkin, then showed what happens when the troop has to choose between following two baboons moving in different directions. Their choice, it turns out, hinges on the angle between the two paths. If that angle is less than 90 degrees, then follower baboons

PHOTO: ROB NELSON

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MEG CROFOOT

Roland Kays (left) and Meg Crofoot preparing GPS collars. The researchers equipped a group of 25 baboons with these tracking devices and recorded the positions of all the animals to the second for several weeks.

will compromise and head off down the center. If the angle is bigger than 90 degrees, the followers choose whichever direction is preferred by more members of the group.

This finding, which the team termed "majority rule" showed that the baboons could incorporate democratic decision-making. But without the backdrop of the physical and social environment, the picture of baboon decision-making was incomplete. To help, the team turned again to tech, this time to an unmanned aerial vehicle that flew above the plateau in Kenya collecting high-resolution imagery. With the photos, Strandburg-Peshkin generated a 3-dimensional reconstruction of the landscape with a precision of five centimeters. By overlaying the baboon location data on the 3D landscape, the team could essentially see through the baboons' own eyes how the hills, trees, roads, and other features in the habitat influenced their decisions. They discovered that roads are key to baboon decision-making. So much so that roads override the "majority rule". If a troop is moving along a road and another baboon wants to pull off into the surrounding vegetation, it takes not just a majority but a super majority to make the troop budge.

"Walking on the road is easier, so trying to pull your group mates into a situation that requires them to work harder will justifiably take you more effort," says Crofoot. The baboons also care about where the group has been – preferring to visit locations where other baboons had visited in the last five minutes.

Studies that combine the natural environment with collective movement are surprisingly rare. "What's so fascinating to me is to see how the animals are integrating social and habitat information over different spatial and temporal scales," says Crofoot. "It also illustrates the way results prompt new questions about what matters and why it matters." These new questions began to coalesce around the physical capabilities of the animals. After watching hundreds of hours of baboon videos – standard practice for those studying animal behavior – the researchers noticed a striking pattern. "You would see the troops constantly speeding up and slowing down, having to modulate their own pace as the group is moving," says Crofoot. This got the team wondering how societies like baboons – in which animals of different ages, sizes, and capabilities move together – bear the cost of this cohesion.

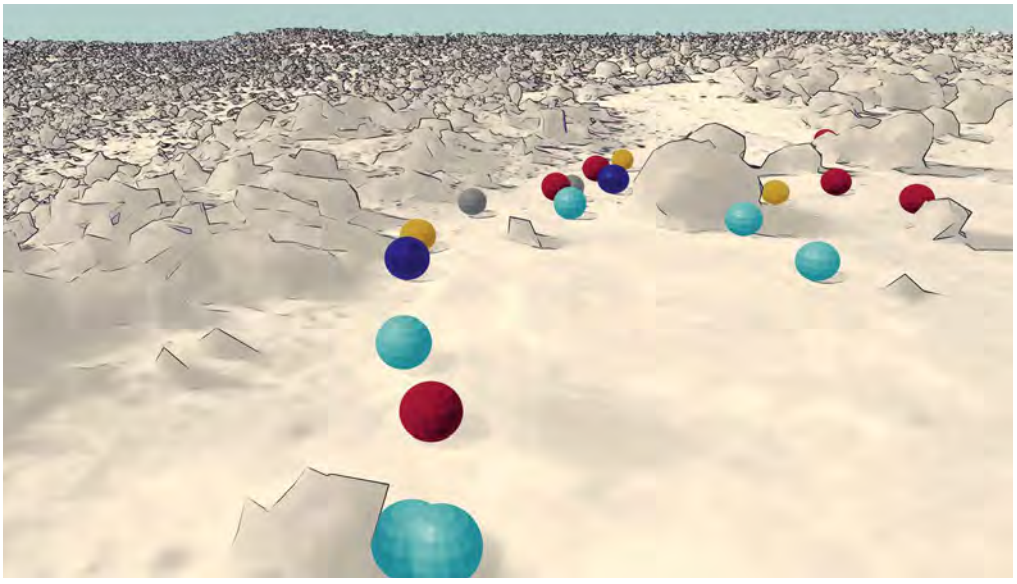
To find out, Crofoot tapped an untouched stream of data. Back in 2012, she had integrated accelerometery sensors into the GPS collars "because they didn't cost anything in terms of battery life." In the background, these powerful sensors had been collecting information about the performance, behavior, and energetics of the wild animals. "We had this pile of accelerometery data that nobody had dared to look at," she remembers.

PHOTO: MEG CROFOOT

This page:
The thick mane is the typical feature of the adult males of the troop. They weigh up to 40 kilograms and have longer canines than a lion.

Next page:
A group of olive baboons in the savannah of Kenya. The animals like to follow roads, probably because they can travel faster that way. To keep the troop together, the animals have to adjust their speed to each other.

PHOTO: CARTER LOFTUS



GRAPHIC: GCO ACCORDING TO MEG CROFOOT

Linking GPS location and landscape reconstruction: the spheres indicate the positions of the members of the baboon troop:

- Adult female
- Sub-adult female
- Adult male
- Sub-adult male
- Juvenile

Then COVID-19 happened. International travel was banned, fieldwork ground to a halt, and scientists were stuck at home with just their computers to keep them company. It was the perfect time to mine the data. Roi Harel led the investigation into the locomotor consensus costs of the troop's cohesion. He found that the mixed size of the troop members does pose an obstacle to collective movement. Each size class is compromising on their optimal speed in order to keep the group together. However, Harel also found that the costs fall most heavily on the youngest members who, by virtue of their smaller size, also have the most to gain by safety in numbers.

If the accelerometery data was complicated, it's just the beginning. With computer science collaborators, the team have incorporated wrist watches on baboons that add an additional array of sensors: magnetometers, gyroscopes, temperature loggers, and acoustic recorders to name a few. The goal is to create an electronic ethogram for each animal – a digital description of its behavior rendered in exquisite detail.

With that toolkit, researchers studying sociality in nature can begin to grasp at questions that once seemed out of reach, but which are essential to an integrative understanding of social behavior. Questions such as: how do wild animals sleep when they are together? "Sleep is usually studied in labs using single subjects," says Crofoot. "One of our next projects is to move this into an ecologically relevant setting that also captures the collective dynamics of this mysterious behavior."

Sleeping together, moving together, deciding together. It's easy for the mind to wander and to arrive at another, extraordinary ape.

"It's wonderful to watch baboons in the wild as they argue, make up, help each other, and sometimes trick each other," says Crofoot. "It inevitably makes you draw parallels to humans and think about our own evolutionary path."

"How did we come to be such an unusual ape? The answer to this question lies in understanding the similarities, and differences, in how we and other socially complex animal species overcome conflicts of interest to achieve shared goals. My lab tackles this problem by using powerful remote-sensing technologies to escape the limitations of the human observer, and attain a novel vantage point from which we can understand how animal societies emerge and function."

www.mpg.de/podcasts/zusammenhalt (in German)

SUMMARY

Thanks to modern GPS tracking, researchers can see where every animal in the group is and what they are doing, at the same time. Using this and other environmental data, they want to find out what determines the animals' behavior.

Rather than always following the dominant male, the members of a baboon troop often choose the direction that more group-mates are moving in. The choice of direction is then effectively made in a democratic manner.

Troop members have to compromise on their preferred speed of movement to ensure that the group remains together, whereby the younger ones have to adapt more than older ones.