

Portal Wissen


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LEARNING





**"WE
RECOGNIZE
ANIMALS AS
INDIVIDUALS"**

RESEARCHERS OF THE
UNIVERSITY OF POTSDAM
INVESTIGATE THE PERSONALITIES
OF WILD ANIMALS

Jana Anja Eccard knows her mice well. For 27 years, she has been researching the behavior of small rodents in numerous experiments, both in the laboratory and in their natural habitat. The professor and her team in the Department of Animal Ecology are particularly interested in the differences between individuals of a species, in animal personalities. This approach is still new in ecology. “For a long time, ecology worked with the average characteristics of species,” she explains. “Individuality was more of a distracting background noise. We recognize that animals are individuals and consciously gear our research questions to this fact.”

In recent years, the researchers have gone one step further. Prof. Eccard and Dr. Valeria Mazza are now focusing on individual differences in wild populations. This is also pioneering work, which is urgently needed as tests in the laboratory have so far hardly included the ecological significance of behavioral variation. “We are increasingly trying to work with wild animals,” Eccard says. “It is important to understand how they cope with changes in the environment such as urbanization, interference in landscapes, climate change, the introduction of new species. Individual trait combination is important for all of this. Some parts of populations will be able to adapt better than others and we’d like to understand why.”

But what are personalities in the world of mice anyway? The researchers work with behavioral traits that are inspired by the concept of the five personality traits in psychology, and are specific to each species. They distinguish between active and reserved mice, fearful and willing to take risks, aggressive and amicable, explorative and less curious, as well as individuals

that seek the proximity of their conspecifics and those that tend to avoid them. “Just because animals belong to a certain species doesn’t mean that they all react to stimuli in the same way,” Mazza says. “We think that the consistent variation in their behavioral responses describes individuals.”

Invasion of Ireland

In their research projects, Eccard and Mazza look at the behavior of wild voles, both resident and expanding populations. In summer 2019, the researchers had the unique opportunity to study an ongoing biological invasion by a rodent species: “We studied one of our favorite species in Central Europe, the bank vole, during its expansion on an island – Ireland. Animal ecologists rarely have such an opportunity,” says Eccard, because most invasions of mammals, such as rats or house mice, have already been completed. The researchers’ findings on the behavior of bank voles spreading in Ireland are therefore of great importance for invasion biology. The species was introduced 100 years ago and remained unnoticed until the 1950s. It spreads at a rate of 1-2 km per year and is now estimated to have colonized over half of Ireland. For their research, Eccard and Mazza compared the population at the edge of the distribution zone with the population at the origin of the distribution in western Ireland, i.e. the area where it arrived 100 years ago.

The experiments on the island were complex, but the researchers were able to draw on their many years of experience with behavioral experiments. Until then, voles had only been studied by parasitologists; no one had been interested in their behavior. “We dragged a lot of material into the forest, which was only possible because we worked together with Trinity College in Dublin,” Eccard says. The researchers set up traps. All the animals that were caught underwent a series of behavioral tests inside a tent. For three days and then again three weeks later, the total of 200 bank voles completed the experiments, most of them several times. This is because the ecologists can only analyze an animal’s personality index through series of tests. “Personality is defined by consistency in different contexts as well as consistency over time, so behavioral traits don’t change in different contexts and over a short period of time,” she explains. “Every time we catch the mice, we ask them again: Are you still among the bravest? Are you still one of the least active animals?”

First, the voles participated in a dark-light test to assess their penchant for risk-taking: How much time does the animal take to move from the safe, dark shelter into a bright, open arena? In the second test, the researchers observed how the rodent behaved in the arena, which has a diameter of 1.20 meters. Does



THE RESEARCHERS

Prof. Dr. Jana Anja Eccard studied biology and sociology. Since 2008, she has been Professor for Animal Ecology and Human Biology at the University of Potsdam.

✉ jana.eccard@uni-potsdam.de



Dr. Valeria Mazza studied biology in Turin and Florence (Italy). Since 2020, she has been a researcher and Senior Lecturer in the Animal Ecology Group at the University of Potsdam.

✉ vamazza@uni-potsdam.de

Behavioral experiment with wild rodents



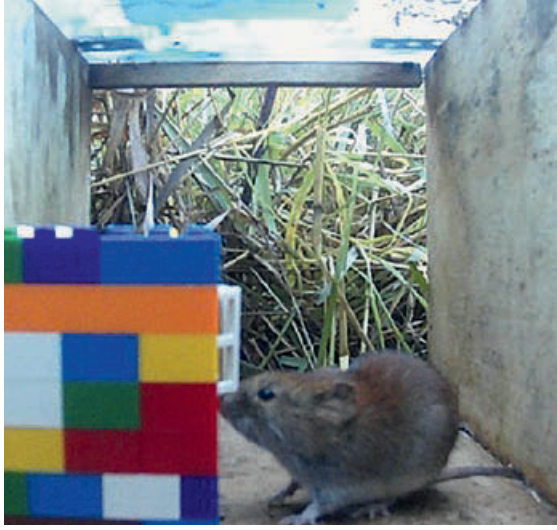
it walk carefully along the wall or does it boldly walk through the middle, potentially exposing itself to predators? Does it move and explore through the arena during the five minutes of the test or does it remain in one corner? In the third test, the animals were released through a simple maze: There were several possible exits. One led to freedom, the others were locked. Here, the researchers investigated a combination of orientation, need for safety, and exploration.

The results show that the animals at the edge of the distribution zone are much more cautious and also much more flexible than in the center, where the

animals were rather bold and inflexible in their behavioral response. “When it came to exploring unknown territory, the voles at the edge of the distribution zone were slower and more cautious,” Mazza says. “They were even cautious when jumping out of the maze into their own habitat,” Eccard adds. This was similar during the experiments that the mice had participated in before their release. “Our cautious candidates on the edge of the distribution zone kept visiting the same place. At first, we thought they were making ‘mistakes’ because they had already been in the arms of the maze and should know there was no way out. But then we came to think that they were checking everything more thoroughly before making a decision.” After all, they are dealing with many more unknown dangers compared to the resident populations.

Caution as a life assurance

Eccard explains the behavior with the different “selection pressures” during expansion: While it is about competition with conspecifics in an established area, at the distribution edges it is about being successful



in the environment and vis-à-vis other species and perhaps about occupying a new territory. “The ability to adapt to natural conditions is quite essential for exploring new spaces. We had assumed that expansion had something to do with pioneering and courage. That was probably a rather anthropocentric perspective. It is probably more about not being eaten.” The researchers suspect that it is precisely the rodents’ caution that benefits them in unfamiliar habitats: “Rodents are incredibly successful colonizers,” she says. “At the same time, they have many predators, making caution a life assurance.” According to Mazza, this strategy is rare among species that conquer new territories. “We know from other expanding species that they are faster and bolder at the distribution edge,” Mazza says. “Our voles, which have so many predators, follow the opposite strategy. They are cautious and check information carefully.”

Once the whole island will be colonized by the voles, the differences between the center and the distribution edge will slowly disappear. Their special caution and flexibility will no longer make the animals successful at the edge. “In another 50 years, we will no longer see this behavior,” Eccard says. Incidentally, the change in the species community means a gain for diurnal predators. This is because the immigrant bank voles are active at daylight, while the resident wood mice become active only at night. “With video camera

traps, we are currently investigating whether the species, which was already there before and now has to share space with the bank vole, shifts its activity peak a little. We are currently conducting a study on this as part of an exciting Master’s thesis.” The animal ecology team likes to work with non-invasive methods such as camera traps and relies on the voluntary participation of the animal test subjects. “We want the animals to enter the visiting arenas on their own and to engage with puzzle tests.” Strong personality differences, after all, are found in problem-solving strategies, Valeria Mazza’s area of expertise.

“Problem-solving tests can tell us something about the ability of animals to display new behaviors,” Mazza explains. The researcher calls this “animal innovation propensity.” Cognition, personality, and flexibility are in turn key to determining whether an animal has the ability to respond to changing conditions with behaviors that researchers did not previously know from a species. “This ability is very helpful when an animal

leaves its traditional territory,” she says. “Cognitive flexibility allows animals to decide on the spot what the best strategy is to meet environmental challenges.” This is especially important, she says, in the face of sudden changes caused by humans. Since behavioral innovations of animals in nature are not easy to study empirically though, the researchers use “problem-solving box set”. It was developed by Dr. Anja Guenther from the Max Planck Institute for Evolutionary Biology, originally for house mice in the laboratory. Mazza and Eccard now also use the test battery for wild animals. “If we want to look at cognitive flexibility, it’s not enough to just look at what happens under laboratory conditions,” Mazza explains.

The researchers worked with animals in Berlin, Potsdam, Gülpe, and in the Uckermark region and thus considered very different degrees of urbanization in the region. In addition, they included different species such as the striped field mouse and the common vole. First, they trained the mice that were willing to participate in the experiment to collect a reward in the form of a mealworm at one location. Then this reward was hidden in the puzzle box, for example in a petri dish. Getting to the worm became increasingly difficult. Some containers could be opened in three ways, some in two, others only in one. For example, the lid of a petri dish could only be lifted with the teeth or paws. “When you stop the time and look at how many ways are tried, you can see clear differences between the populations,” Eccard says. “We were able to show that small mammals in the city can solve a problem much more often than their counterparts in the countryside. But when they can’t solve it, they give up more quickly.” The results, incidentally, are similar for the different species.

The cautious flexible ones and the brave ‘old hands’

The animal ecologists are also interested in the different learning styles of the rodents. In an earlier experiment, for example, Mazza placed bank voles in a maze with two exits – one led to a reward, one didn’t. The animals learned to associate each of the two exits with a specific scent. The researchers then swapped the two scents. The result was that the more courageous bank voles used the same solution again and again if it had worked in the past. The more cautious ones, on the other hand, always checked a solution they had found anew. “At first we thought they were not as good at learning, but that was not true,” the professor says. “They were flexible, kept their return path open, and were quick to relearn if we changed the solution.” Mazza’s experiments show that cautious animals acquire knowledge more slowly and braver animals form routines more quickly. The researchers

THE PROJECTS

Urban Cognition

Participating: Dr. Valeria Mazza, Dr. Annika Schirmer, Prof. Dr. Jana Eccard
Duration: since 2021

Behavioral adaptations to biological invasions

Participating: Prof. Dr. Jana Eccard, Dr. Valeria Mazza, Prof. Dr. Celia Holland (Trinity College, Dublin, Ireland), Dr. Peter Stuart (Institute of Technology, Tralee, Ireland)
Duration: 2019–2023
Funding: German Research Foundation (DFG)

Innovation and social learning in small mammals

Participating: Dr. Valeria Mazza, Dr. Anja Guenther
Duration: since 2019

believe that while the “brave routineers” are more in line with the traditional standards of learning research, “in a normal learning test, these would be the ones who, once they have found a rule, display what we call the ‘right behavior,’” Eccard says. “We are not getting anywhere here with our learning paradigm. Because when environmental conditions change, for example, it’s a great advantage not to stubbornly insist on something but to question it.” Research results like these always draw a great response. Learning types are also of interest to dog schools in the training of rescue dogs, for example. “If you know that there are different learning types, you might have to come up with different teaching styles.”

However, research also benefits from the findings that the researchers gain in experiments. They are included in computer models that biologists at the University of Potsdam and beyond use to learn more about how species deal with ecological changes. “Colleagues use our empirical data in computer simulations to predict the compositions of populations, for example.”

Although the researchers have a passion for rodents, Valeria Mazza could imagine studying the personalities of other mammals. She has developed an interest in raccoons, for example – a species that has been spreading in Europe since the middle of the last century and about whose personality traits there is certainly a lot to discover.

DR. JANA SCHOLZ
TRANSLATION: SUSANNE VOIGT