CONVERSATIONS WITH SCIENTISTS

Andrew N. Radford: Talking to the Animals

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University of Bristol

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Andrew N. Radford is a professor of behavioral ecology at the University of Bristol's School of Biological Sciences in England. Radford earned a bachelor's degree in zoology from Cambridge University (Girton College) in 1996 and completed a master's degree in integrative bioscience at Oxford University (New College) in 1998. Returning to Cambridge, Radford obtained a Ph.D. in zoology in 2003. (One of his thesis examiners was Tim Clutton-Brock.) He continued his studies as a postdoctoral fellow at Cambridge until 2005, when he received a research fellowship and relocated to the University of Bristol the following year. He became a full professor there in 2016.

Radford is currently involved in five research projects, and, since 2000, has published more than 240 peer-reviewed papers and reports, book reviews, and popular interest media articles.

Radford's research focuses on two main themes: the behavior and vocalization of social animals, and the potential impact of anthropogenic noise. In studying the former, Radford combines "observational data, sound recordings and a variety of experimental manipulations" to investigate "bird, mammal, fish and invertebrate study systems in captivity and around the world (South Africa, Australia, Panama, Trinidad)." This work includes the Dwarf Mongoose Research Project begun in 2011. In studying anthropogenic noise, Radford combines "laboratory and field experiments (in Scotland, France, French Polynesia and Australia)" to determine how it "affects the behaviour, physiology and development of a variety of fish and invertebrate species."

Below are Andrew Radford's October 23, 2018 responses to questions posed to him by Today's Science*. Some of the questions deal with how he became interested in science and began his career in behavioral ecology, while others address particular issues raised by the research discussed in Mongooses Trade Guard Duty for Grooming.*

Q. When did you realize you wanted to become a scientist?

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A. I was fascinated by animals as a child, as are many people. Perhaps a little more unusually, from an early age I was interested in their behavior and their interactions with one another, rather than simply in finding or collecting them. For example, I remember on long walks across the North Yorkshire Moors (dragged there by my parents!) hearing the plaintive cries of curlews overhead and wondering what in the world they might be talking about. I used to read books about expeditions to collect animals, but was really enthralled by those that included more about the behavior of the different species—what the behaviors might mean, why the animals might be doing what they did. And, of course, [David] Attenborough-narrated wildlife documentaries also fired my imagination. There were hints from those books and television series that people were studying animal behavior as scientists...and that is what I longed to be able to do.

Q. How did you choose your field?

A. I always wanted to work in the broad fields of animal behavior and behavioral ecology (the latter is the study of why animals do what they do in the context of their environment), and to do so with wild animals. A long-standing interest had been in vocal communication, particularly in social species, and so that is what I first started researching during my Ph.D. and onwards. Subsequently, I have become involved in all sorts of different research fields, but always with a core grounding in communication, cooperation and conflict, and social behavior; whenever possible, that work is done on wild animals in natural settings, and with carefully controlled experiments to test key ideas. Most recently (in the last decade), I wanted to start conducting work with a more applied, conservation angle, in addition to what is sometimes called "blue-skies" research. So now, we also consider the potential impacts of man-made noise on wildlife, and how we might mitigate those effects. But that work is based on all the core principles of behavioral ecology and experimental design.

Q. Are there particular scientists, whether you know them in person or not, that you find inspiring?

A. One is my Ph.D. supervisor, Professor Nick Davies. He is a universally acknowledged, all-time great in the field of behavioral ecology—testing ideas of broad relevance with incredibly elegant field-based experiments. He wrote THE text book on behavioral ecology, which was a key element of my student days and is a book that I use in my own teaching today. He was a great mentor and teacher. He is an outstanding natural historian—most of the best ideas in behavioral ecology come from close observations of the organisms being studied—and he has huge amounts of time for others; he is as inspiring as a person as he is as a scientist—a great role model in all respects.

More generally, I am inspired by those who can communicate their work clearly, enthusiastically and to broad audiences, be that in written or spoken form. Many scientists do great work; far fewer can convey that in a way that inspires others.

Q. What do you think is the biggest misconception about your profession?

A. That it is easy and that lots of what we “discover” was already known anyway! Often, when we have spent months designing carefully controlled experiments, refining protocols to make them actually work, collecting reams of data, analyzing and interpreting those data, and presenting our findings, we can be met with comments along the lines of: "Why was that funded? I knew that because the birds in my garden do that all the time." There is a big difference between seeing something happen and proving a reason or function for it. I think because we are ourselves animals and we exhibit many similar behaviors to non-human animals, much of what we work on and demonstrate is intuitively obvious—in contrast, say, to complicated physics or chemistry—but that does not mean that we KNOW scientifically, that things are true; they must still be tested and proved, which is what we do as scientists.

Q. Your study poses the question that is of chief interest to you in rather general terms: whether non-human animals can do things for delayed rewards. Your study, however, was not of non-human animals in general—obviously that's not possible. My question is: how did you decide in particular to look at dwarf mongooses? Did you expect that they might be more likely than some other species to show a capacity to work for delayed rewards, or was it something else?

A. You can answer the question "Why dwarf mongooses?" in two different ways. First, from a biological perspective. Dwarf mongooses live in small, relatively stable and permanent groups. As a consequence, individuals interact with the same small number of groupmates every day over extended periods. They can therefore build up long-term relationships with, and garner extensive knowledge about, those other individuals. That is likely to set the scene for rewarding of cooperative acts in general, and delayed rewarding in particular, because there is the possibility for reciprocation at a later stage. The small group sizes mean it is more plausible that there can be tracking of what others have been doing, and hence a more accurate memory of who might deserve rewarding later on than in much larger aggregations.

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"As a research team, we have spent literally 1000s of hours watching the mongooses in their natural habitat. We therefore had a strong inkling that the behaviors we tested were going on [...] and were in a position to collect the relevant data and run the necessary experiments."

The second reason for studying this behavior in dwarf mongooses is that we have been working on a habituated wild population of this species in South Africa since 2011. We have eight groups that we have trained to become used to our close presence, who we can therefore walk close to throughout an observation session. It also means that we can mark them individually with blonde hair dye (applied with an elongated paintbrush), can get them to climb onto a balance scale to weigh themselves, and can run experimental manipulations that are usually rather difficult with wild animals. Since we have monitored the population constantly for years, we also have extensive knowledge about individual life-histories, including emigration and immigration, breeding success, etc. Moreover, as a research team, we have spent literally 1000s of hours watching the mongooses in their natural habitat. We therefore had a strong inkling that the behaviors we tested were going on (though they still needed to be proven scientifically) and were in a position to collect the relevant data and run the necessary experiments.

Q. Is there any level of brain complexity that you think is required for behavior that might be seen as evidence of "delayed contingent cooperation"? Would you, for example, not expect to see anything like this in social insects?

A. Delayed contingent cooperation requires both a calculation of how much other individuals have contributed and memory of those contributions for later rewarding. Both of those things require some level of cognitive power or brain complexity. It is therefore unlikely that you would see delayed contingent cooperation in, say, social insects (although they are capable of all sorts of amazing and wonderful feats, too). One thing that amazes me in general about the natural world is what non-human animals are capable of doing. There have now been many examples of behaviors that were originally thought to be uniquely human, then believed to be the preserve of just higher primates (our closest relatives), but which careful testing and detailed observation have demonstrated to occur in a much wider range of taxa.

Q. Where do you spend most of your workday? Who are the people you work with?

A. Earlier in my career (as a Ph.D. student, as a research fellow, etc.), I used to spend many months at a time in the field, collecting the data I needed to test hypotheses I was interested in. For example, for my Ph.D., I would disappear to the Eastern Cape, South Africa for 6-7 months at a time and spend the majority of each day in the field tracking the birds I was studying (green woodhoopoes), collecting observational data or running playback experiments.

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In the last few years, though, I have had more and more teaching and administrative commitments...and I also had two children (who are now 10 and 8). Consequently, only rarely do I spend time in the field these days (perhaps 2 weeks a year), although I miss it very much. Instead, I have an amazing team of postdoctoral researchers and Ph.D. and master's degree students (16 of them at the moment!), who all disappear to the exotic places I used to spend huge amounts of time in (currently, they work in South Africa, Australia, French Polynesia, Malawi and the Maldives, among other places). I spend lots of time planning field seasons with them, and discussing how things are going and how to overcome problems with them whilst they are in the field, but from my office or home! As my children get older, I hope to return to doing more fieldwork myself, not least because I think the best ideas about animal behavior come when you are spending time watching the very behaviors you are interested in.

Q. What do you find most rewarding about your job? What do you find most challenging about your job?

A. At the moment, the most rewarding aspects of my work are interacting with my research team—who are all hard-working and fun—teaching undergraduates about animal behavior, and finding ways to communicate our research and love of the natural world to wider and wider audiences. Also, in terms of our work on man-made noise, it is exciting that we are now starting to work with industry, policy-makers and managers to try to find ways of mitigating the problem of noise pollution.

Q. What has been the most exciting development in your field in the last 20 years? What do you think will be the most exciting development in your field in the next 20 years?

A. I don't think there have necessarily been any big new theories in the field of behavioral ecology in the last 20 years; those big breakthroughs came earlier. But the methods available to test ideas are developing at a faster pace than ever. Probably the biggest of those has been genomics (the mapping of genomes or, put another way, the collective characterization and quantification of an organism's genes). Whereas previously we might have focused on the function of a behavior (i.e., why it might have evolved; what advantages it could bring an organism in terms of survival and reproductive success) and mechanisms at the level of, say, hormones, now we can consider which genes or combinations of genes might drive particular behaviors, and how the expression of those genes can change during an individual's lifetime. I think another noteworthy ongoing development has been the increasing realization about the full extent of the capabilities of non-human animals—lots of what was originally considered uniquely human is displayed not just in apes or other primates, but in other mammals, birds and even fish and invertebrates in some cases.

It's obviously really hard to predict what will happen in the future. But my hope is that we will continue to help to find ways to mitigate our impacts on the environment and the wildlife we share it with. Behavioral ecology has been at the forefront of developing our understanding about the effects of, for example, pollutants such as light, chemicals and noise. It has an equally important role to play in developing successful measures to mitigate those impacts.

Q. How does the research in your field affect our daily lives?

A. I think that research into the behavior of animals enriches lives by creating a greater understanding and appreciation of the natural world; certainly, as the basis for television documentaries, magazine and news articles, radio shows, etc., it can have a powerful, lasting and far-reaching effect. Some animal behavior research, at least, can improve our understanding of human behavior; whilst we are more complex than non-human animals in some (e.g., cultural) respects, we are still governed by many of the same forces (such as natural and sexual selection). Finally, I hope that work on human impacts on wildlife can help to improve the way that people, from individuals all the way through to governments, interact with the environment.

Q. For young people interested in pursuing a career in science, what are some helpful things to do in school? What are some helpful things to do outside of school?

A. Read as much and as widely as possible (and watch relevant presentations online) to get a feel for all the different possibilities out there.

Don't make snap decisions or feel that you need to know right now what you want to be doing in 5 or 10 years, let alone 20+. Get hands-on practical experience of different science careers; it is as useful to rule out things you don't enjoy as to find those that you do love. Take any and all opportunities that are presented to you, but be proactive in seeking them out; don't wait for things to fall into your lap. Spend as much time in the natural world as you can—it is inspiring, as well as being positive for mental health and wellbeing, and constantly rewarding.

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