Q & A

Ken Cheng

Ken Cheng was born in Hong Kong. His family emigrated to Toronto, Canada while he was still young, and he attended high school in Toronto, and then the University of Toronto. He has a M.Ed. from Harvard University and a Ph.D. from the University of Pennsylvania in Philadelphia, USA in 1984. He did postdoctoral work at the University of Sussex and at the University of Western Ontario before becoming a University Research Fellow back at the University of Toronto. Since 1995, he has worked at Macquarie University in Sydney, Australia, where he is currently Professor in the Discipline of Brain, Behaviour and Evolution in the Department of Biological Sciences. His field of study is comparative cognition and he is best known for his work on navigation, having conducted research on a range of species including lab rats, various birds, humans, honeybees, and desert ants.

When did you first become interested in the study of behaviour? As barely a teenager, I picked up a paperback copy of Desmond Morris's book *The Naked Ape* lying around on the coffee table. My interest in behaviour was piqued, and the interest in studying behaviour grew from reading that book. Reading it convinced me that there was a lot more to human behaviour than pure rationality, although I was far from convinced of all the arguments about human evolution and what has since become evolutionary psychology. Of course, evolutionary psychology remains controversial today.

And did that then inspire you to study animal behaviour? Well no, that took a far more round-about route. I became interested in psychology and education, and started reading what big names I came across: B.F. Skinner, Sigmund Freud, Jean Piaget, Maria Montessori, Rudolf Steiner among others. I went through the whole first-year psychology textbook before enrolling as a major in psychology. My career plan then was to find out the best way to teach higher thinking, based on scientific evidence. I ended up at the Harvard Graduate School of Education. Then I got disillusioned and switched to studying psychology at the University of Pennsylvania with C.R. (Randy) Gallistel. I studied spatial learning in rats as a graduate student. Gallistel presented me with what I thought was an interesting problem about the geometric power of spatial representations, and I took it on. I switched tack and read about mathematical geometry and some behavioral neuroscience. O'Keefe and Nadel's classic book, *The Hippocampus as a Cognitive Map*, had just come out then. That change got me studying navigation.

And did you continue studying rats? Not at all, my doctoral thesis was the one and only piece of empirical work I've done on rats. I moved on to a postdoc with Tom Collett at the University of Sussex on honeybee spatial learning, wanting to broaden my outlook, widen my horizons, and learn about a different animal. Besides, I got terribly allergic to rats in my graduate school career, and wanted to avoid them as a postdoc, and ever since really. Despite this, some scientists still associate me with rat work because my one empirical paper on rats turned out to be quite influential. I studied spatial cognition in pigeons when I got to the University of Western Ontario, and continued that line of work at the University of Toronto. I did research on bees, and later ants, when I arrived at Macquarie University. Thus, I have focused on a number of different animals over the years, looking at spatial learning in each.

And do you have a favourite animal? Sometimes I reply that it is the desert ants that I am studying at the moment. But mostly, it varies like the foods I eat, and the favourite varies like the flavour of the day. An unkind interpretation is that this indicates fickleness. A kinder interpretation is more Taoist in nature: when I think about an animal, whichever it is, it becomes fascinating to me, and can gain favourite status for those moments. And of course, the business of teaching animal behaviour gets me reading and thinking about a variety of animals. Much of the living world, even seemingly ordinary and mundane events, amazes me.

Do you have particularly memorable moments in science? Of course, these moments are many and the rewards they give keep us going in the face of long delays to tangible rewards such as publications, grants, promotions, and our students' obtaining their degrees. But some are especially memorable. In graduate school at the University of Pennsylvania, I was slow in getting going, with three years gone and little by way of good results to show for them. A number of what I thought were well-conceived and well-done experiments were not 'working'. I was looking for effects of spatial transformations of the features of a rectangular arena on the rats' performance. I could see that, in a transformed space, the rats were clearly flummoxed. But the problem was that they did poorly in the control, untransformed condition as well, so that the results were not statistically significant.

As I am now fond of saying, nature was throwing a curve ball. The 'problem' turned out to be the most interesting finding. The rats were not performing well in the control conditions because they were making a systematic error: they often searched diagonally opposite the correct, target location. That error made performance in the control condition poor. Figuring this out wiped out three years of frustration with sheer joy. In an exciting meeting with Randy the very next morning, he kept muttering "that's interesting, really interesting". It was then straightforward to design the right experiments to document and explore the limits of the phenomenon of rotational errors. The resulting paper, on which Randy declined a deserved authorship on principle, still generates much research today on a range of animals.

Another magic moment, much later in my career, came from finding the red honey ant (*Melophorus bagoti*) in Alice Springs. I was with the Wehners, Rüdiger and Sybille, who were visiting our University for a few weeks on a Visiting Scholarship, early in 2001. Rüdiger had invited me to go to Alice Springs for a reconnaissance trip, to look for a suitable field site where this most thermophilic ant on the continent could be found, this with a view to striking up a collaboration. I had never seen the ant before, although I had worked at Rüdiger's field site in Tunisia (at Maharès) on the North African desert ant *Cataglyphis fortis*. We looked all over the CSIRO Centre

for Arid Zone Research, the site where much of the research is now done, although it is no longer owned by the CSIRO, but we could not find *M. baogti* on that day. The reasons are unclear why they were not out, as the ants are all over that site. We then went out of town to Simpson's Gap, a tourist attraction in the West McDonnells mountain range west of Alice Springs. In a magic moment on getting out of the car at the Visitor's Centre, I spied a sizeable red ant dashing across the parking lot. We spent a few happy days noting the activity pattern of one nest. *M. bagoti* nests were all over the site. The rest as they say is history, with the research on the red honey ant still going on.

What is your favorite activity in doing science? Oh, without hesitation, it is playing with data. Data rule! When a student or a research assistant, and sometimes I myself, come up with a spreadsheet of freshly gathered data, then I really enjoy playing with the numbers, plotting graphs, doing a bunch of analyses, most of which never get reported, and generally exploring all angles as much as possible. Playing with data is an activity that can dislodge me from that admin task I should be doing for the afternoon meeting, or grading a student's paper. Otherwise, I am quite disciplined about what I have to do.

What are some key issues in navigation now? I'll find out in September when I attend a forum on comparative cognition. At these Ernst Strüngmann fora, participants sit around and discuss key issues on selected topics. The topics of this forum are navigation, decision and memory processes, animal communication, and social processes. I am of course taking part on the navigation topic. I would say that a key issue is what view-based navigation consists of, and what that tells us about the nature and evolution of intelligence. Most terrestrial animals move in visually rich environments, our species included. It is information overload rather than a dearth for most animals. Our central Australian desert ants are different from those that live on salt pans or in the barren deserts, because the Australian desert is much like our urban environment in that it is filled with a lot of objects, many of which are similar. I have the sense that something far simpler than mapping the whole visual scene, with object extraction and identification thrown in, is what does the trick. Studying desert ants who navigate this messy outdoors is one hope for cracking this problem. I will venture to say that parallel mechanisms would be found in vertebrates navigating the messy outdoors. The common ecology has a way of generating convergent evolution in widely different animals.

I see the importance of comparative approaches as well. Classically, this is the way to try to sort out evolutionary origins. A lot of mechanistic questions remain murky, but the field is far more advanced on mechanisms than on evolutionary questions.

Otherwise, this field is diverse, ranging widely in animal systems and sensory ecologies. It varies enormously in scale, from a metre or two in tidal crabs to the whole globe in migrating birds. It makes the range of issues really diverse.

What do you see as important to achieve in your career? Bridge building across disciplines. The study of behaviour is fragmented across major discplinary boundaries of biology and psychology, and across a host of subdisciplines as well: neuroethology, behavioral ecology, comparative cognition, behavioral neuroscience among others. I would like to see more connection across these disparate fields. For me personally, bridge building efforts include publishing in journals in different fields, collaborating with scientists in different disciplines, and reviews aimed at bringing a body of work to the attention of another discipline. To me, a scientific career is more than individual achievement, now made so glaringly public with ready bibliometric measures from databases. I suppose that it might be the easterner in me coming out a bit, but at this juncture of my career, it is about a sense of collective achievement and rejoicing in the field as a whole as well. It is about promoting the future, especially in supporting young minds who deserve a chance to show what they are capable of.

Any final words? Watch for those curve balls from nature.

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Tropical treasure trove

The remote Foja mountain region of Indonesian Papua had already revealed a wealth of new species in an expedition there in 2007 by Conservation International and the National Geographic Society. Researchers reported two new mammals, a pygmy possum and a giant rat amongst others. But a new report of discoveries made in an expedition one year later, just announced, have been even more impressive.

The team describe several new mammals — including a new bat, tree mouse, dwarf wallaby and woolly rat — a reptile, an amphibian, at least 12 insects and, remarkably, a new bird.

"While animals and plants are being wiped out across the globe at a pace never seen in millions of years, the discovery of these absolutely incredible forms of life is much-needed positive news," says Bruce Beehler, a senior research scientist with Conservation International. "Places like this represent a healthy future for all of us and show that it is not too late to stop the current species extinction crisis."

The expedition, which lasted four weeks, was part of Conservation International's Rapid Assessment Program (RAP). Developed in the 1990s, RAP is the unlikely approach of Nobel Prize-winning physicist Murray Gell-Man who, along with the late ornithologist Ted Parker, realised that what conservationists could greatly benefit from was an ability for biologists to be able to get to a wilderness area and take a fast, thorough census of its wildlife so that policy makers could have the information they need to protect new and endangered species.

The first RAP surveys were carried out in the Andes, where Gell-Man and Parker first considered the idea. "It was rough and ready and addressed a pressing need to know what's out