The koala: When it's smart to be slow

September 16 2022, by Danielle Clode

Koalas are often regarded as cute but dumb. Credit: Danielle Clode

The koala was clinging to an old tree stag while stranded in the Murray River, on the border between New South Wales and Victoria. A team of students from La Trobe University noticed its predicament as they were paddling by in canoes.

"It almost looked as though he was sussing out if he could jump into the canoe," one of the students reported later.

The koala could have swum ashore if it had wanted to—it was close enough, and koalas are not particularly bothered by rain or water. They are capable, if not elegant, swimmers who launch themselves into rivers and swim with an effective doggy paddle to the other side.

If a boat is offered, however, they will readily accept the more comfortable mode of transport. They have been known to haul themselves aboard passing canoes—content to take a free ride to the other side, without showing any concern about where they might be taken.

This koala opted for the easy option. Standing in the knee-deep water, the students spun one end of the canoe towards the tree, where the koala was waiting on a low stump for transport.

As the boat touched the tree, the koala immediately clambered on board. The students slowly turned the boat around, keeping their distance from the animal, until the bow nudged the bank. As soon as the boat touched the ground, the koala climbed into the bow before leaping out and strolling off into the trees.

It's an indisputably cute video. Both the koala and the students presumably parted company well pleased with the outcome, but I wonder what the koala was thinking—how it was thinking—about that situation. If you've ever had to rescue a pet from an awkward place—a cat up a tree, a dog stuck in a drain or a horse trapped in a fence—you will know that they very rarely show any inkling that your actions might assist them, let alone co-operate with you. And yet this koala seemed to do both.

Planning ahead

I send a link to the video to Mike Corballis, a professor of psychology in New Zealand, who has done a lot of work on foresight and the capacity of animals to "time travel mentally." Humans regularly do this—we spend much of our life thinking about what happened in the past and planning for what might happen in the future. Not to mention imagining things that might never happen at all. We are constantly rehearsing scenarios in our minds, revising and refining our responses to interactions, events and conflicts, so much so that an entire "mindfulness" industry has sprouted to help us stop our whirlwind mental activity and focus on living in the moment.

You'd think that the calm, chilled-out koalas would be the perfect model for living in the moment, but what if they also predict what is going to happen next, based on what's happened in the past, and make plans for the future? The koala in the canoe certainly seemed to do this.

"The koala example perhaps includes problem-solving as well as an element of future thinking," Mike says. "It would surely be interesting to do some more work with them."

The koala wanted to move to a different tree but didn't seem to want to get wet. It saw a means of achieving that goal (the canoe drifting past) and anticipated the possibility that the canoe would come close enough to be used as a bridge, just as the koala might use a floating log. Once on board, it anticipated that the canoe would get near enough to the shore for it to hop off.

It's not clear from the video whether the koala understood the role of the humans in this activity, but it certainly wasn't disturbed by them either. The frequency with which koalas approach humans when in need of assistance suggests that they have some appreciation that humans can provide solutions to problems they are not able to solve themselves. Aside from domestic animals—who recognize that humans can open doors, supply food and perform other simple tasks for them—very few wild animals seem aware of the potential of humans to be useful. And those that do realize this tend to be smart—some of the birds, some dolphins and killer whales, and other primates. But nobody has ever claimed that koalas are smart. Far from it. They are widely regarded as being pretty stupid.

"I'm sure we underestimate animal cognition, partly because we need to believe humans are vastly superior, and partly because we have language and can tell of our plans whereas animals can't," says Mike. But just because animals don't have language doesn't mean they lack the mental capacity that underlies our evolution of complex language.

We need to stop looking for reflections of ourselves in other animals. There's more than one way to be "smart." And accepting a lift from those students to get across the river was, however you look at it, a smart move indeed.

Simple, slow and stupid?

"Marsupials are notably less intelligent than placental mammals, partly because of their simpler brains," states the Encyclopedia Britannica, in sweeping imperial judgment. It's a widespread belief that has led to many peculiar assumptions about koalas, their ecology and the likelihood of their survival.

In the evolutionary race to supremacy, koalas are regularly pitched as having made poor choices. Like pandas, they are regarded as cute but dumb—soon to be relegated to the growing pile of evolutionary failures, destined for extinction. They are described as slow, stupid and often considered incapable of change. Their diet is often described as so low in nutrients and toxic that it almost poisons them and prevents them from being as active, or as smart, as other animals. If all these beliefs were true, it's a wonder they aren't extinct already.

When I complain to a friend about the negativity around koalas, he looks puzzled.

"Well, they are stupid, aren't they?" he says. "Isn't that what you get from eating toxic gum leaves?"

The marsupial brain

The marsupial brain is indeed quite different from that in eutherians, or placental mammals. For one thing, it lacks a corpus callosum, the super connector of bundled fibers that link the brain's left hemisphere to the right hemisphere. Like interstate electricity connectors, this highway is probably more of an equalizer than a one-directional transfer—smoothing the overall transfer of information between the hemispheres, and perhaps allowing one side to take over if the other fails to function.

Brains, though, have more than one way of doing the same thing. What the marsupials lack in a corpus callosum they make up for with an anterior commissure, a similar information superhighway that connects the two hemispheres of the brain.

Marsupial brains are also smooth. Mammal brains are characterized by having a "second" brain—a neocortex that overlays the old structures we share with reptiles that regulate movement, sensory inputs, body functions, instincts and simple stimulus-responses.

The neocortex is our rational, conscious brain. It performs many of the same functions as the old brain, but processes information differently. Rather than using instinct, the neocortex is capable of more complex responses to changes in the environment by learning, interacting and making more intricate interpretations of the world. We attribute much of our intelligence to our overly large neocortex while denigrating the cognitive capabilities of animals without one. Whether this is true or not is unclear.

Brains are remarkably flexible organs. They need as much space as they can get, but are constrained by sensory organs in the skull—eyes, tongues, eardrums and others—as well as teeth.

Associate Professor Vera Weisbecker is an evolutionary biologist who heads up the Morphological Evo-Devo Lab at Flinders University. She came to Australia on an exchange from Germany as a student and was fascinated by the country's remarkable, and under-studied, marsupials. Twenty years later, she is a local and world expert on marsupial brains.

"They're hugely undervalued in science," she says. "The trouble is that most researchers live in the northern hemisphere, where there is only one species of marsupial—the Virginia opossum. Most of the marsupials live in the southern hemisphere, in South America, and more particularly in Australia, but there are not as many researchers to study them here."

Vera is convinced there is much to learn from marsupials.

"Firstly, they are a completely different line of mammalian evolution," she explains. "They diverged from the other mammals a long time ago and have evolved separately ever since. And they are also very diverse in shape, form, diet and locomotion—carnivores, herbivores, ant-, nectar-, leaf-specialists, bipeds, quadrupeds, gliders and climbers. It gives us a huge range of species, parallel to the eutherian mammals, to study and understand what underlies the different adaptations they have."

Vera and her colleagues have investigated the different sizes and shapes of Australian marsupial brains. Using the skulls of both living and extinct species, they have created endocasts of the brains—imprints of the inside of their heads. In most mammals, the brain is pressed hard against the skull and squeezed into every space possible. In the past, measuring the size of the brain was done by filling the skull cavity with tiny glass beads and then weighing it. Now the skulls are 3D scanned and the brain shapes can be re-created in intricate detail.

"So are marsupial brains smaller than the brains of all the other mammals, the eutherians?" I ask.

Vera pushes some graphs across the table—clusters of scatter plots with different colored lines fitted to them, indicating the relationship between brain size and body size for hundreds of species, classified into groups.

"If you look at the lines comparing marsupials versus the eutherians, they follow pretty much the same slope," she says. "On average, a marsupial has much the same brain size as a eutherian of the same size."

"What about these dots that are way above or way below the line?" I ask.

"Let's look at the groups those outliers belong to," says Vera, moving to a different graph. "This cluster up the top are the primates. Primates as a group do tend to have larger brains for their size. So do cetaceans. But sometimes that average is influenced by an outlier. Humans, all the hominids, are really unusual—they have particularly large brains for their body size. They are bringing up the average."

"Are there any particular outliers among the marsupials?" I ask.

Vera laughs.

"Well, there is one that sits pretty low," she says. "Definitely below average on the brain stakes—and it's the Virginia opossum. So I think this is perhaps why northern hemisphere researchers assume that marsupials are dumb. Because they are working with the one species that doesn't have a very big brain."

"And what about koalas?" I ask. "Where do they sit on the graph?"

"Let's have a look," she says, turning to her computer monitor.

"We'll have to hunt for that one. I need to go back to the code and turn on all the labels. It's going to be messy."

I wait while Vera alters the program and re-runs the graph. The screen suddenly fills with hundreds of species names layered thickly over the top of each other.

"Now, it should be around about here," Vera says, expanding the screen so that the words start to separate out slightly. "Ah yes—here it is, I can just make out Phascolarctos. Pretty much right on the line—completely average for a marsupial of that size, and completely average for a eutherian mammal of that size."

It's neither in the top 10% nor the bottom 10% for mammals. There's just nothing out of the ordinary about it. Koalas have a completely average-sized brain for an average-sized mammal.

"There is that argument, though, that koala's brains don't fill the capacity of their skull," I comment. "That they only take up 60% of their brain case—which is much less room than any other animal's brain."

Vera shakes her head.

"There is a little bit of variation in how tightly packed brains are, but not that much. Body evolution isn't wasteful. Why would an animal build a big empty skull it had no use for?"

It turns out that most of the early studies used koala brains that had been preserved, but pickled brains often shrink or dehydrate over time. In addition, brains are often highly suffused with blood while alive, so in death their volume may not accurately reflect their size when functioning.

Both of these factors likely led anatomists to think that koalas' brains rattled about in their skulls, floating in liquid. In fact, the amount of fluid surrounding a living koala's brain is much the same as that around the brains of most other mammals.

A more recent study used magnetic resonance imaging to scan the size of living koalas. Rather than a cranial capacity of 60%, this study found that koala brains filled 80–90% of the cranium—just as they do in humans and other mammals.

Rethinking koala brains

We really need to radically rethink our common assumptions about the size of koala brains and how they work.

Even if koala brains were smaller than average, it wouldn't necessarily mean that the animals are stupid. Brain size is just too "noisy," Vera says, to accurately predict mammalian cognition.

"It doesn't reflect the brain infrastructure very well," she explains. Mammal brains differ greatly in their cell density and connectivity, and in any case there is little connection between cognitive performance and brain size or structure either across species or within species.

Human brain size does not correlate with intelligence. Einstein's brain was significantly smaller than average, sending scientists scrambling for significant differences in his parietal lobes and corpus callosum, or the existence of rare knobs and grooves, to explain his extraordinary intelligence.

The relationship between brain structure and function is complicated and only just beginning to be understood. Intelligence may not be a simple matter of how many interconnected neurons you have, but how well those connections are made, pruned and shaped by experience. Brain wiring may be more about the useless connections we lose with age than the valuable ones we strengthen.

Some birds are capable of complex problem-solving and formidable feats of memory, and have mastered tool use and language for their own purposes—rivaling the much-vaunted skills of many big-brained primates and cetaceans. And yet their brains not only don't have a neocortex, but are much smaller and smoother than those of mammals. Flight does not allow birds to develop big, heavy brains, so they have developed small, efficient ones instead. It is not necessarily how much you've got that counts, but how you use it.

Humans are a bit obsessed with brain size—with anything, actually, that we think separates us from other animals, such as tool use, language and sociality. We're a bit touchy, really, about our relationship with the natural world, our place in it.

We prefer to consider ourselves different, separated, superior, better. We admire animals that share traits or habits with us: the prodigious spatial skills of octopuses, the family life of socially bonded birds, the complex communication of cetaceans. But intelligence that does not look like our own, or that results in behavior or choices different from our own, we don't always recognize or even notice.

We think animals are smart when they make choices we would make, even when those choices are dictated by evolutionary selection or instinct, rather than thinking. "Intelligence" is the ability to make advantageous decisions in a changing and variable world, to solve problems, to adapt behaviorally to shifting circumstances. Some species benefit from being able to do this. Other species, like many sharks or crocodiles, have adopted a strategy that has allowed them to survive unchanged over millennia of changing conditions. Being smart is not always the best strategy.

Dr. Denise Herzing suggests that we should use more objective methods to assess non-human intelligence, including measuring the complexity of brain structure, communication signals, individual personalities, social arrangements and interspecies interactions. Ultimately, I wonder if animal intelligence isn't more about behavioral flexibility—the ability to adapt and respond to changing circumstances within the course of an individual's lifetime.

This adaptability is even more important than genetic variation for a species' survival—particularly in an environment that is changing as fast as it currently is.

Perhaps we'd be better off spending less time ranking animals on a scale where we are always at the top, and considering them by their own merits and capabilities—in terms of how they live and what makes them successful at what they do.

We might have a greater chance of learning something from them that way.

The human attraction

I'm still thinking about the koala that hitched a ride with the students on the River Murray. Like most wild animals, koalas prefer to avoid coming too close to humans. They typically move away, swing behind a tree trunk or simply look the other way. But not always. On rare occasions, koalas tolerate or even seek out human company. They come down from their trees and solicit aid, or simply appear to satisfy their curiosity. It is often younger animals that exhibit this curiosity—who touch noses with people or reach out to them. Sometimes they just seem to want company, which seems odd for an otherwise solitary animal.

In many of these cases, the koala wants something—water or a free ride or safety. They are not the only animals to approach humans for assistance, especially in an emergency, but for others it is rare.

Animals do coincidentally use humans to protect themselves, such as a penguin or a seal seeking refuge on a passing boat to escape hunting killer whales, or an injured kangaroo sheltering near a house. Nor do koalas passively accept aid, like a whale that allows rescuers to cut it free from tangled netting and lines. In these cases, the animal tolerates our presence as being a lower risk than the alternative.

Perhaps we'd be better off considering animals by their own merits and capabilities. Credit: Danielle Clode

But these koalas are not avoiding a greater risk; the odds are not so immediately dire. In some cases, the koala might be ill or severely dehydrated. But even so, it is unusual for other animals to actively seek out humans when they are sick.

One of my friends once recalled a strange scratching at her front door. When she investigated, she found a koala looking through the glass, apparently trying to get in. Koalas, like a lot of animals, find glass confusing. It's either an invisible impediment that they unsuccessfully try to get through, or it presents the reflection of trees or an unwelcome rival.

My friend opened the door and put some water out for the koala as it sat on her front step, apparently unsure of what to do next. When she returned sometime later, the koala was gone.

Was the koala who climbed into the farmer's air-conditioned car, while the farmer was in the vineyard, wanting to enjoy the cool on a hot day? Or was the car simply an interesting obstacle to investigate that happened to appear in her path? It's difficult to know, but even in cars, glass is a problem. It's not easy for anyone to work out how to get around an unexpected sheet of invisible nothingness. What is it that a koala sees when it approaches a window, a human or a building?

I am not entirely sure what it is that makes koalas approach humans when they are in need. Or what it is they perceive when they reach out to bump noses with you. But when a koala does request help, it does so in a way that is intrinsically appealing to humans. Their forward-facing eyes, round face and attentive expressions clearly trigger the facial template that humans are programmed to respond to and read for social cues.

Dr. Jess Taubert is a cognitive neuroscientist at the University of Queensland who has worked with a range of species on functions like facial recognition, including at the Yerkes National Primate Research Center in the United States. She tells me that people, especially children and those with affective disorders, often respond more strongly to animal faces than to humans.

"My intuition is that animal faces have easier signals to read than adult human faces because we don't always smile when we are happy or stare at what we are attending too," Jess says. "Folks with baby faces are rated as more warm, naïve, kind and trustworthy and koalas might also benefit from those biases."

Jess is neither sentimental about koalas nor immune to their charms. She tells a story about being bitten by a koala she was carrying for visitors to photograph when she worked in a wildlife park.

"I knew something was different from the moment I picked him up. I should have just put him down," she relates. "He was usually very sweet and patient, but after one or two photos he just chomped down on my shoulder. I had to back away quickly off the exhibit before anyone saw what had happened."

"He wasn't the only animal to bite me when I worked in zoos," Jess says, "but he was the cutest and I instantly forgave him."

It's not just their faces that make koalas cute. It is also their tendency to lift their arms towards human rescuers when on the ground.

It is the action of a tree-climber, an arboreal animal that carries its young and has arms free to lift. As apes, we humans share this instinctive response with koalas. Our infants cling to us, just as the infants of monkeys grip their mother's fur as they ride through the trees. We may have adapted to become fleet-footed, savannah-dwelling creatures, but our infancy betrays our origins. We carry our young like tree-dwellers. Newborn babies grip fingers and objects within reach in a vestigial instinct derived from our primate ancestry, but shared with many arboreal creatures, including marsupials like the koala.

Perhaps when koalas reach up to humans, they are seeking an escape, the tallest object to climb. And when we see them lift their arms, we respond by picking them up.

Where they see a tree, we see an infant asking for help. Perhaps we are both victims of our own pre-programmed instincts.

Sweet dreams

A koala is asleep in one of the trees by the road. I go and check on it a couple of times, but it doesn't move. It is still asleep the next day, but is now on a different branch in the same tree. It must have moved at some point. I just didn't notice it because I was asleep.

I think about doing a behavioral activity survey where I check on it every half an hour and record its behavior, but I decide against it. I'm meant to be writing a book, not doing a zoology paper, and besides—koalas don't do very much, do they?

I go back to my desk, where I occupy myself for hours every day in front of my computer. I wonder what my own activity cycle would look like. Long stretches of "nothing" at my desk, broken by brief forays into the kitchen to eat and perhaps an occasional walk outside. Then another period of sitting on the couch, and a pronounced period of complete inactivity overnight.

I look at the dog, asleep in her basket, and the cat curled up on my bed, and I envy them their relaxed lives. Doing nothing, doing something—it's all relative, isn't it?

It occurs to me that koalas sleep all day because they can, not because they have to. It's certainly not because they are stoned or lack the wits to do anything more interesting with their time. They probably sleep up to 80% of their time, just as cats and dogs do, because they have everything they need in terms of food, shelter and safety.

Animals that stay awake all the time do so because they have no choice—because they must move constantly for food (like hummingbirds or pygmy shrews), to fly (like oceanic migrating birds) or swim (like whales), or to maintain constant vigilance for predators (like deer and sheep).

Far from being trapped in some kind of maladaptation, koalas have been set free by their remarkable diet from the anxieties and challenges that trouble so many other species. Once they have found a suitable area, koalas have no need to search for food. They only have to stretch out a hand and pluck it from the tree in front of them, like an emperor plucking grapes from a golden bowl.

They have no need for the constant vigilance required by herbivores of African, Asian or American plains. They have few arboreal predators to hide from and their best defense from hunters on the ground is to stay still and quiet and pass unnoticed—even sleeping while they do so. Even their social system requires minimal engagement. They signal their occupation with their scent and respect each other's presence, with almost no contact required. Mating season is the only time that requires any effort, and even then they keep things simple.

All in all, it seems like a pretty good life to me.

Provided by The Conversation

Citation: The koala: When it's smart to be slow (2022, September 16) retrieved 21 June 2024 from https://phys.org/news/2022-09-koala-smart.html

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