Deliver us from evil: How biology, not religion, made humans moral

Our survival instinct should undercut morality – but our mammalian brains pulled off an amazing evolutionary trick, says neurophilosopher **Patricia Churchland**

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A SIMPLE interpretation of biological evolution says that nature selects for selfishness. Always. Selfish genes increase survival, so are the ones that get passed on. If altruistic genes happen to poke their heads up, they are quickly whacked. In this reading, the desire to do good by others must be taught – usually with the threat of punishment by a wrathful God, censorious parent or nosy cop. The only underlying motive for any altruism is fear.

But here is the thing: all highly social mammals sacrifice their own needs for others, as do birds. In the first instance, the beneficiaries are offspring, but they can also be mates, kin and friends. Chimpanzees reconcile after a squabble and console each other after a defeat, rats share food with another rat pal, and wolves, fully aware of the danger, defend each other against a grizzly bear. Male marmosets and chimpanzees have been observed to adopt orphaned young to whom they have no genetic connection. Early-hatched bluebirds help feed and guard their siblings in later broods. Humans do variants of all these things.

Charles Darwin puzzled over this selflessness in his 1871 book *The Descent of Man*. Where does our moral sense, or conscience, something that seems to fly in the face of biology, come from? A century and a half on, advances in our understanding of evolution and neuroscience are serving up some intriguing answers.

Among animals, the self-sacrifice of mammals and birds is unusual, both in its breadth and its flexibility. Other social species – insects such as termites, for example – have little behavioural flexibility. Loners such as reptiles and amphibians tend not to exhibit selflessness at all. A salamander will continue to forage rather than defend her brood. Although garter snakes do give birth to live young, hinting that some parenting might be forthcoming, the mother snake blithely abandons her 50 or so squirming babies to fend for themselves. Her brain simply isn't made for offspring care.

But mammals and birds seem wired for love and affection. Ethologists such as Frans de Waal have documented empathic behaviour and social emotions among mammals in detail: pleasure when kith and kin are safe and fed and close by; pain and anxiety when they are threatened or suffering or far away.

Self-fixated reptiles were doing very nicely before mammals and birds came to rule the roost. So what was the big advantage of selfless behaviour? It isn't that nature suddenly went soft and sentimental. The main driver of the social brain in these animals was an ingenious new feature that emerged some 200 million years ago: being warm-blooded.

Morality's warm glow

Endothermy was a master stroke in biological evolution. If you are warm-blooded, you can store energy and feed at night, while your cold-blooded competitors must wait for the sun to come up. Those competitors are also hassle-free prey: cold, dozing crickets are an easier catch than warm hopping ones.

Like all upgrades, endothermy came with a cost: gram for gram, warm-blooded animals need 10 times as many calories as cold-blooded ones. This is a challenging trade-off, requiring body adaptations such as fur to prevent heat loss, and upgraded intelligence to make mammals and birds more competitive in the basic four Fs, as neurologist Paul MacLean put it – feeding, fleeing, fighting and reproduction.

In this context, being intelligent means making more flexible decisions about how to interact with your environment: reacting on the fly to unexpected events and adapting tactics when the world changes. Wolves aiming to bring down a caribou may have a very general plan (identify a calf, attack first from the rear), but they will encounter novel obstacles to which they must respond moment by moment. Importantly, they also need to read each other's intentions quickly and accurately throughout the hunt. Mammals and birds have some form of "theory of mind", an understanding of what others intend to do. The intelligence of mammalian predators goes well beyond the capacity of a lizard or even a loosely assembled gang of lizards.

The pressure on endotherms for lots of calories favoured a big capacity to learn and heightened intelligence. To that end, a new and remarkably powerful neural structure emerged over millions of years of evolution: the cortex. All mammals have a cortex, and no non-mammals do, although birds have something similar. The bigger the cortex, the bigger the capacity for learning, and the greater the adaptability in problem-solving, pattern recognition and decision-making.

But what have calories and a cortex got to do with morality? The perhaps surprising answer is if you want to be a big learner, you need to be a social creature – and that brings you to the doorstep of morality.

The cost of the big learning strategy is that your potentially smart brain must be immature at birth, so its cells can sprout new wiring as they learn. To scale up learning mechanisms in a game-changing way, profound immaturity of the brain at birth is your inevitable lot. The cost of potential smartness is early helplessness. That means vulnerability to predation, starvation and cold weather – a howling handicap for neonatal survival.

The remedy was mothers, as the anthropologist Sarah Hrdy became the first fully to appreciate in the early 2000s. The sheer proximity of mother mammals when their babies are born singles them out as the convenient candidates to nurture helpless infants. In mammalian species where there is long-term pair-bonding, such as titi monkeys, prairie voles and humans, fathers share the parenting. Active fatherhood is also typical in about 98 per cent of bird species.

Simplified, the biological solution seems to have been to modify the emotions associated with self-survival (fear when threatened, discomfort when hungry) so they are also aroused for baby-threat and baby-discomfort. In effect, the mammalian mother feels her babies are part of her, which indeed they are until birth. Sharing the attachment wiring, the baby becomes increasingly connected to its mother and father, further enhancing its chance of survival. In effect, evolution expanded the ambit of "me" to include "me-and-mine".

What counts as "me-and-mine" varies across species. Attachments can form between mates, as they do in wolves, beavers and most humans, or between kin but not mates, as in baboons and vervet monkeys, or between friends as well as between mates and kin, as in marmosets and wolves. Caring can come in varying degrees. Commonly, for example, care for one's own family is stronger than care for friends or for strangers. Biology being biology, individual variability is always present.

"If you want to learn, you need to be social – and that brings you to the doorstep of morality"

The underlying genetic trick was to expand the territory of the ancient hormone oxytocin from the body to the brain. In the body, it has a role in sperm ejection, egg release from the ovaries, milk discharge in lactation and contraction of the uterus when giving birth, as well as assorted jobs in the gut, adrenal glands, pancreas and eyes. In the brain, however, oxytocin triggers the discharge of neurocannabinoids – cannabis-like molecules that make us feel good. This happens in the brains of mothers and babies during suckling and cuddling, but also during coitus in monogamous mammals such as beavers, prairie voles and, as far as we know, humans. Oxytocin is released even during food sharing among friends – maybe even sharing a pot of tea.

Prairie voles, which mate for life and are strongly bonded to one another, provide a useful model for how such chemistry works in human brains to create a sense of empathy. Research published in 2016 showed that, if you remove one prairie vole from a cage shared with a mate and subject it to stress such as banging noises, upon its return to the cage, the mate immediately rushes to its stressed partner, and fervently grooms and licks it. Remarkably, the levels of the stress hormone corticosterone in the untraumatised animal's brain shoot up to match those in its partner's.

Unusual empathy; in 2008, a sheep on an African reserve forged a strong bond with an orphaned elephant
Caters News Agency LTD/Shutterstock

This matching of corticosterone levels across the two brains, and the heightened intensity of grooming, is seen only when the removed mate is subjected to stress, and only when the animals are bonded. The grooming elicits the release of oxytocin, reducing corticosterone levels and abating anxiety. This resonates with our own experience of stress triggered by suffering in someone to whom we are attached. The gradual reduction of stressful feelings with physical and verbal comfort is familiar, too.

This attachment circuitry is the platform for what we call morality. It regulates our disposition to cooperate and to compromise, to work together and work it out. Because one powerful effect of oxytocin is to lower the level of stress hormones, we have less anxiety when among trusted friends. We can tolerate more annoying foibles when among friends than when among strangers. We feel the warmth of bonding to those in our group. Such tolerance eases the way for cooperation and trust.

Our social instincts include the intense urge to belong. The approval of others is rewarding, while their disapproval is aversive. These social emotions prime our brains to shape our behaviour according to the norms and values of our family and our community. More generally, social instincts motivate us to learn how to navigate in a socially complex world, something that starts pulling these instincts towards particular habitual behaviours.

The mechanism involves a repurposed reward system originally used to develop habits important for self-care. Our brains use the system to acquire behavioural patterns regarding safe routes home, efficient food gathering and dangers to avoid. Good habits save time, energy and sometimes your life. Good social habits do something similar in a social context. We learn to tell the truth, even when lying is self-serving; we help a grandparent even when it is inconvenient. We acquire what we call a conscience.

Battle of good and evil

Social benefits are accompanied by social demands: we must get along, but not put up with too much. Hence impulse control – only being aggressive, compassionate or indulgent at the right time – is advantageous. In humans, a greatly expanded prefrontal cortex boosts self-control, just as it boosts problem-solving skills in the social as well as the physical world. These aptitudes are augmented by our capacity for language, which allows social practices and institutions to develop in exceedingly subtle ways.

For most of our 300,000 years on the planet, *Homo sapiens* lived in small groups. Moral practices were part of a shared tradition, maintained in habits as well as in songs, stories and rituals. Long before us, Neanderthals and Denisovans probably enjoyed social lives quite similar to those of early *H. sapiens*.

The anthropologist Franz Boas's description of Inuit life in the 19th century illustrates the probable lifestyle of early humans. Here, norms were unwritten and rarely articulated, but were well understood and heeded. Deception and aggression were frowned upon; leadership, food sharing, marriage and interactions with other groups were loosely governed by traditions. Conflict was often resolved in song duels or, failing that, in ritualised combat. Because feuding leads to instabilities, it was strongly discouraged. With life in the unforgiving Arctic being so demanding, the Inuit's practical approach to morality made good sense.

The overlap of moral virtues across cultures is striking, even though the relative ranking of the virtues may vary with a clan's history and environment. Typically, vindictiveness and cheating are discouraged, while cooperation, modesty and courage are praised. These universal norms far predate the concept of any moralising God or written law. Instead, they are rooted in the similarity of basic human needs and our shared mechanisms for learning and problem-solving.

Not surprisingly, this can go awry in various ways. About 1 per cent of humans seem incapable of feeling shame, remorse or genuine affection, and they are apt to lie and injure without compunction. These are psychopaths and they lack a conscience. To a lesser degree, dealing with discordant urges regarding self-care and other-care is something we all struggle with, but that is what makes mammalian life so rich and yet so complicated.

Does knowing the neurobiological story of our social nature help with the moral questions we face? In a restricted sense, no. None of it bears directly upon any specific moral question; none of it sets us on a direct path from neuronal function to the "right" moral norms. We must work through moral issues the way we always have: by discussion, negotiation, listening, trying to resolve conflicts and reaching agreements, with admittedly mixed results.

There is, however, another sense in which I think the answer is yes. Neuroscience reminds us that our social nature and cultural practices, including the ones we call morality, are products of evolution, constrained by our biological heritage. Perhaps that knowledge, of a sense of morality rooted in nothing more than our mammalian origins, makes us a little less likely to be infatuated with our own moral superiority, and more likely to cast a sceptical eye on those who peddle utopian remedies to our problems.