



The relationship between mother and child might have been the evolutionary foundation of conscience.

## EVOLUTION

# Moral bonds

An exploration of the neurobiology of conscience from Patricia Churchland engages **Nicholas A. Christakis**.

What is our conscience, and where does it come from? In her highly readable *Conscience*, the philosopher Patricia Churchland argues that “we would have no moral stance on anything unless we were social”.

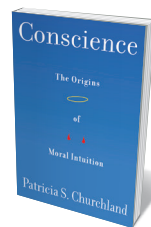
That we have a conscience at all relates to how evolution has shaped our neurobiology for social living. Thus, we judge what is right or wrong using feelings that urge us in a general direction and judgement that shapes these urges into actions. Such judgement typically reflects “some standard of a group to which the individual feels attached”. This idea of conscience as a neurobiological capacity for internalizing social norms contrasts with strictly philosophical accounts of how and why we tell right from wrong.

There is a strand of thought in evolutionary biology (advanced, for instance, by the theorist Bret Weinstein) that the capacity for moral debate itself has a social function, binding groups regardless of the topics contested or their abstract moral ‘rightness’. Moreover, many of our moral rules — such as the idea that we should not betray our friends or abandon our children — have clearly been shaped by natural selection to optimize our capacity to live in groups. Other rules, for instance regarding the correctness of reciprocity, are

similar: we feel quite intensely and innately that if someone gives us a gift of food, we should reciprocate on a future occasion.

Churchland briefly touches on how other primates, such as chimpanzees, have been observed acting in ways that echo conscience. These include behaviours analysed by primatologist Frans de Waal: cooperating towards common goals, sharing food, adopting orphans and grieving. Churchland argues that such examples point to the evolutionary origins of human conscience.

To build that case, she first focuses on the fundamental bond between mothers and children. This relationship, she argues, was eventually extended across evolutionary time to mates, more distant kin, and friends. Conscience is essential to our ability to sustain and benefit from such attachments. As Churchland writes, “attachment begets caring; caring begets conscience”. The capacity to formulate and act on moral norms therefore



**Conscience: The Origins of Moral Intuition**  
PATRICIA CHURCHLAND  
W. W. Norton (2019)

arises from the need to develop practical solutions to social problems. Our conscience is reinforced by social stimuli: for instance, we face disapproval for lying and approval for courteous behaviour. Thus, conscience, as Churchland sees it, involves “the internalization of community standards”.

Commitment to one’s conscience is not always good. We applaud the antislavery stance of nineteenth-century US abolitionist John Brown, but some people question his belief that the only solution to the evil of slavery was armed insurrection. And we are repulsed by extremists who go on shooting rampages in mosques or detonate bombs in churches in the name of their ‘conscience’. Conscience is complex, and moral rules (such as those against killing) are not themselves what our neurobiology encodes. Churchland explores related topics — including the absence of conscience, as in antisocial personality disorder, or its over-abundance, as in people who follow the moral strictures of a religion with excessive scrupulousness.

Churchland also sharply critiques the state of her field. She is frustrated by sequestered academic philosophy, in which “practical wisdom may be in short supply, replaced either by endless dithering or unwavering adherence to a favorite ideology”. She eviscerates moral philosophers who believe that moral rules can be utterly divorced from biology and find a foundation based on reasoning alone. She points out that the assumption that morality is not properly philosophically grounded unless it is universal is itself merely a rebuttable stipulation. She notes that decades of attempts to define universal rules have not succeeded. And finally, she shows that most moral dilemmas are just that: dilemmas in which it is impossible to satisfy all the constraints, and which put ostensibly universal principles into conflict with each other.

Such problems would seem to be insuperable for those who believe that moral rules can be rendered absolute, based on moral reasoning alone and disconnected from real life, as if driven simply by a kind of philosophical logic. But, as Churchland notes, “you cannot get morality out of merely not contradicting yourself”.

Neither does she have much use for utilitarians, with their simple calculus of adding up the greatest good for the greatest number. She rightly points out that living in a utilitarian society would be unsatisfying for most people, because we are not partial to all members of our society equally. We prefer our own groups, our own friends, our own families. For most people, as she argues, “love for one’s family members is a colossal neurobiological and psychological fact that mere ideology cannot wish away”. She concludes that utilitarianism is irresolvably at odds with how our brains function, given that we evolved to care more deeply about people we know than about those whom we do not. ▶

► The book is decorated, in the manner of our best philosophers, with pithy illustrative examples. Many are drawn from Churchland's upbringing on a farm in the wilderness of the Pacific Northwest. (She calls herself a "country bumpkin".) They are wonderful: rafting teams circumventing rapids in Canada's Yukon Territory; ways to chop firewood; the strategic hunting behaviour of the grizzly

bear (*Ursus arctos*); the spontaneous actions of farmers who milk the cows of a neighbour stricken by influenza; a sign in a farm kitchen proclaiming, "Them that works, eats."

The limitations in Churchland's account are mostly limitations in the state of the field. As she repeatedly notes, many aspects of how conscience comes to be embodied in the brain, and shaped by natural selection, are

simply not yet known. But she nevertheless makes a mighty effort. *Conscience* is illuminating, entertaining and wise. ■

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## MATHEMATICS

# The principles of uncertainty

Statistics and real life? It's messy, writes **Andrew Gelman** on Ian Stewart's analysis.

Uncertainty "isn't always bad", begins *Do Dice Play God?*, the latest book from celebrated mathematics writer Ian Stewart. It ends: "The future is uncertain, but the science of uncertainty is the science of the future." In between, Stewart discusses topics from mathematics to meteorology, in which accepting uncertainty is necessary to understand how the world works. He touches on probability theory and chaos (the subject of his 1989 book *Does God Play Dice?*). And he probes the connection between quantum entanglement and communication, with interesting excursions into the history of mathematics, gambling and science.

My favourite aspect of the book is the connections it makes in a sweeping voyage from familiar (to me) paradoxes, through modelling in human affairs, up to modern ideas in coding and much more. We get a sense of the different "ages of uncertainty", as Stewart puts it.

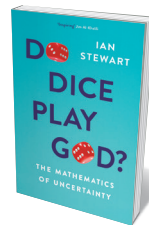
But not all the examples work so well. The book's main weakness, from my perspective, is its assumption that mathematical models apply directly to real life, without recognition of how messy real data are. That is something I'm particularly aware of, because it is the business of my field — applied statistics.

For example, after a discussion of uncertainty, surveys and random sampling, Stewart writes, "Exit polls, where people are asked who they voted for soon after they cast their vote, are often very accurate, giving the correct result long before the official vote count reveals it." This is incorrect. Raw exit polls are not directly useful. Before they are shared with the public, the data need to be adjusted for non-response, to match voter demographics and election outcomes. The raw results are never even reported. The true value of the exit poll is not that it can provide an accurate early vote tally, but that it gives a sense of who voted for which parties once the election is over.

It is also disappointing to see Stewart trotting out familiar misconceptions of hypothesis testing, the statistical theory underlying

the familiar  $P < 0.05$  (in which  $P$  signifies probability) so often used in this and other journals to indicate that a certain empirical result has a statistical seal of approval.

Here's how Stewart puts it in the context of an otherwise characteristically clearly described example of counts of births of boys and girls: "The upshot here is that  $p = 0.05$ , so there's only a 5% probability that such extreme values arise by chance"; thus, "we're 95% confident that the null hypothesis is wrong, and we accept the alternative hypothesis". (In general, the null hypothesis is a comparison point in a statistical analysis. Here, it is the supposition that births of boys and girls occur with equal probabilities; in fact, the birth of a boy is slightly more likely.)



**Do Dice Play God? The Mathematics of Uncertainty**  
IAN STEWART  
Profile (2019)

Stewart makes the common mathematical error of transposing the probabilities. He interprets 0.05 as the probability that the hypothesis is true; it is actually a statement about how probable it would be to see the results or something more extreme if the null hypothesis were true. (It isn't, in this case.)

Later, he erroneously states that a confidence interval indicates "the level of confidence in the results"; in fact, it is a statistical procedure for expressing uncertainty, or a range of values consistent with the data.

Stewart does, however, discuss a mistake all too common among researchers and students: using the statistical rejection of a straw-man null hypothesis to validate a scientific claim about the real world. In simple cases, this might not be an issue. In rejecting the model that births of boys and of girls are equally likely, we at the same time learn the general fact of likelier boy births. But this kind of learning-by-rejection can fail in more complicated settings. A null hypothesis is extremely specific, and the alternative



Drug testing is reliant on statistical models.

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