

The importance of being vague

In his book *Not Exactly*, Kees van Deemter argues that the very foundations of science don't come in black and white. Try shades of grey, he tells Liz Else

Forgive the oxymoron, but how do you define vagueness?

A vague concept allows borderline cases. The potential confusion is that people think vagueness is when they don't quite get what someone means. For people in my area of logic, it's actually a much narrower phenomenon, such as the word "grey". Some birds are clearly grey, some are clearly not, while others are somewhere in between. The fact that such birds exist makes "grey" a vague concept. The vagueness does not arise from insufficient information: some concepts are fundamentally vague.

On the other hand, if I say that I have fewer than three children, that's not vague. In fact, it is the opposite, it is "crisp". It is true if I have zero, one or two children, and it is false if I have three or more.

Is vagueness anathema to science?

Put a magnifying glass to many scientific concepts and you find vagueness. Take the idea of "species". For centuries, biologists searched for crisp distinctions between species. A common definition today is to say that two animals only belong to the same species if they can interbreed. But if A can interbreed with B, and B with C, it doesn't always follow that A can interbreed with C.

Take the *Ensatina* salamander, which has six subspecies. Suppose subspecies A can interbreed with B, B with C, and so on until the end of the chain when F can no longer breed with A. Intuitively you want to say that they are all one species, but your criterion disagrees.

Should we give up on the concept?

The notion is incoherent, but biologists continue using it – with



a pinch of salt. Richard Dawkins calls this tendency to think in discrete categories "the tyranny of the discontinuous mind".

So we think in discrete categories, but reality really isn't that way?

In the book I talk about a vintage racing car that has been repaired

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so many times that 70 years later only a few of the original parts remain. Is it the same car? The boundaries of objects are vague – and that goes for us, too. The average age of adult cells is 10 years. We are changing all the time.

Describing the world in terms of discrete objects is a useful fiction. Classical logic is discrete, too, based on binary dichotomies: yes/no, true/false. But that is not suited to thinking about the world's fundamentally vague things, which include some of the things science is based on, such as measurement. There is, for example, no such thing as a "perfect" metre, imperfect approximations are all we have. We should recognise we often need other forms of mathematical logic to describe the world.

How vague is everyday life?

Vagueness seeps in everywhere. We think we know what things like obesity or poverty are but they are context-based concepts.

It can be a matter of life and death. We have laws prohibiting poisonous substances in food, say, but ask toxicologists what poisonous means, and all they give you is degrees of toxicity. Thresholds are arbitrary.

Is it ever important to be vague?

Doctors use vagueness all the time. For example, when researching for a project to automate messages about the condition of babies in intensive care, my colleagues found that doctors' written reports say things like: "heart rate OK most of the night, on the high side in the morning". The vagueness of the messages works in a very smart way – leaving out irrelevant details while adding a little bit of opinion. By calling the heart rate high, for example, they suggest there may be cause for worry.

For all these reasons, vagueness is crucial if you want to build computers and robots that communicate with people. If you want to understand or generate language, getting to grips with vagueness is key.

Will the web need vagueness?

As we move toward a semantic web where the formal representations are symbolic, the challenge is to figure out how to represent vague or gradable things, such as "affordable" housing or "ancient" monuments. ■

PROFILE

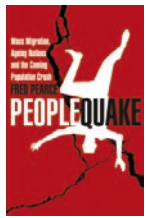
Kees van Deemter is a computational linguist at the University of Aberdeen, UK, and author of *Not Exactly: In praise of vagueness* (Oxford University Press). Visit bit.ly/9vtB9w for more on the book

Population bomb

We ignore the role demography plays in human affairs at our peril

Peoplequake: Mass migration, ageing nations and the coming population crash by Fred Pearce, Random House, £12.99/\$26.95

Reviewed by Paul and Anne Ehrlich



THIS is a well-written and important book. We hope it will significantly increase the recognition of the central role of

demography in human affairs. *Peoplequake* covers the gamut from Thomas Malthus's correct fundamental assumption (human numbers can always outstrip resources) and his, even for his day, questionable ethics (aid should not be given to the poor), to fears that the greying of Europe will precipitate the end of western civilisation. The book discusses the impact of the green revolution, massive migration, the Chinese one-child family programme, declining birth rates in the

developing world, the rise of death rates in Russia, and more. Even those of us who have been in the population business for half a century can learn from its coverage of controversial topics. We hope *Peoplequake* will convince many decision-makers, especially in the US, that they ignore population issues at their peril.

A wonderful effort, but not perfect. Like many solid reporters, Pearce assumes climate disruption is our most serious climate-related environmental problem, but many scientists do not. They are also deeply concerned about losses of biodiversity and ecosystem services (such as crop pollination), toxification of the Earth and resource wars turning nuclear. On climate, Pearce does not detail the grave threat to future food security posed by rainfall patterns that are likely to shift continuously for the next millennium, and by melting glaciers which feed important

rivers on which billions of people depend for irrigation of crops.

Pearce, a consultant for *New Scientist*, is probably overoptimistic about when global population shrinkage might begin, whether birth rates among the rich will remain low – consumption control being more important than population control – and feeding additional billions even though more than a billion are hungry today. And he doesn't explain that every billion people added to the population will have a more severe impact on human life-support systems than the previous billion, since newcomers must be fed with food grown on more marginal land and provisioned from increasingly lower-grade and distant resources.

From our personal viewpoint, Pearce gives an erroneous description of the “Simon-Ehrlich” bet – a wager with business professor, Julian Simon, about the future cost of five metals – likely based on a bungled article in *The New York Times* (but people who write broadly know well the pitfalls of the necessary dependence on secondary sources). But even when treating our mistakes, he tries to do so fairly. We highly recommend his book – everyone should be grateful that he wrote it.

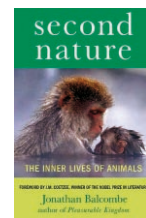
people's quality of life, too much of it can be disquieting.

What sets Iyengar's book apart is her broad reach, with topics as varied as the secret of good improvisation in jazz and the disorientating effects of “liberation” on eastern Europeans. Disappointingly, she does not confront the deeper issue of whether we have any real control over our decision-making, as suggested by some neuroscience experiments that show many of our choices may be made unconsciously. Still, this would have distracted from one of Iyengar's aims, which is to help her readers make better choices.

Feel their pain

Second Nature: The inner lives of animals by Jonathan Balcombe, Palgrave Macmillan, £20/\$27

Reviewed by Sanjida O'Connell



JONATHAN BALCOMBE believes that we have allowed intelligence to become the measure with which we determine how

well to treat animals when what we should be using is how they feel. It is not a new idea – the philosopher Jeremy Bentham originally said in 1789 that how an animal ought to be treated should be dependent on its capacity to suffer. It is a question that has recently been overlooked by biologists, who are instead determined to prove that some species have cognitive capacities akin to our own.

In this engaging book, Balcombe marshals wide-ranging and up-to-date evidence to demonstrate that animals do indeed experience the world as richly as us and may well feel and suffer more intensely than we do. He concludes: “Extending our empathy and concern toward all who experience the ups and downs of life is neither strange nor radical. It is, after all, second nature.”

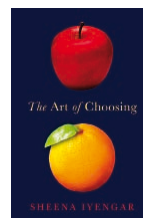


PAWAN KUMAR/REUTERS

Choice words

The Art of Choosing by Sheena Iyengar, Twelve, \$25.99

Reviewed by Michael Bond



THE psychology of decision-making has become a crowded literary genre, though few have tackled it as engagingly as Sheena Iyengar. In *The Art of Choosing* she explores the biases and motivations that influence every choice we make, from which drink to buy to who to marry, and demonstrates that while choice may be important to