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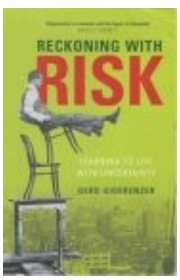
Reviews

'Reckoning with risk'

reviewed by Helen Joyce

BOOKMARK



Reckoning with risk: learning to live with uncertainty

By Gerd Gigerenzer

Gerd Gigerenzer is not a mathematician or statistician *per se*, but primarily a psychologist, working across disciplines to understand how human beings make decisions in the face of uncertainty. What he offers here is nothing less than a prescription for how to think, how to choose, and how to live, when the information on which we base our decisions is necessarily incomplete and flawed. For example − how worried should you be if you have a positive mammogram as part of a screening programme for breast cancer, or a positive HIV test despite the fact that you are in a low−risk group? You may be surprised to learn that the answer may well be "not too worried" − what should really worry you is that not many medical personnel know this!

The book also looks at the way courts deal with uncertainty, and offers some suggestions for improving the handling of statistical evidence such as DNA testimony (for more on what can go wrong when courts and statistics interact, have a look at Beyond reasonable doubt, from issue 21 of *Plus*).

The prescription put forward is simple. Essentially, we should all be using *natural frequencies* to express and think about uncertain events. Conditional probabilities are used in the first of the following statements; natural frequencies in the second (both are quoted from the book):

> *The probability that one of these women [asymptomatic, aged 40 to 50, from a particular region, participating in mammography screening] has breast cancer is 0.8 percent. If a woman has breast cancer, the probability is 90 percent that she will have a positive*

> *mammogram. If a woman does* not *have breast cancer, the probability is 7 percent that she will still have a positive mammogram. Imagine a woman who has a positive mammogram. What is the probability that she actually has breast cancer?*
>
> Eight out of every 1,000 women have breast cancer. Of these 8 women with breast cancer, 7 will have a positive mammogram. Of the remaining 992 women who don't have breast cancer, some 70 will still have a positive mammogram. Imagine a sample of women who have positive mammograms in screening. How many of these women actually have breast cancer?

The author claims − and backs up his claim with convincing evidence − that we are all much more likely to draw sound inferences from the second description.

One word of caution about the book. Although the author states that logically the two presentations are equivalent, and that the second − which is much more readily understandable − is therefore in every way better, this is not quite the case. You can see this by imagining a particular group of 1,000 women. It may be that 9, or 7, or some other number of them, have breast cancer, rather than the typical 8, and so on with the other uncertainties involved. In other words, it is not only uncertain *which* of the women will be one of the 8 with breast cancer, or the 70 who have false positive mammograms − in any given group of women, there is uncertainty about the *actual numbers* 8 and 70 as well. When none of the events involved are fantastically unlikely − of the order of 1 chance in a million, or even a billion − this distinction is unlikely to matter. Screening programmes involve tens, or hundreds, of thousands of women, and so we can imagine "averaging over all the thousands" involved in the programme. But some events − such as a random individual matching a DNA sample at a crime scene − may be of this higher order of unlikelihood.

And in such a situation the presentation using natural frequencies fails. It is not the same to tell a jury that the probability of a random individual matching the DNA found at a crime scene is 1 in 250 million (a statement involving probabilities) as to say that only 1 person in 250 million will have matching DNA (a statement using natural frequencies). The second statement would no doubt convince the jury that the defendant's guilt was mathematically certain, and lead to a conviction. Nevertheless, *in any given group of 250 million people* − for example, the population of the US or Northern Europe − it is not all that unlikely that other people besides the defendant do in fact match. However, for most purposes this distinction is a fine one.

Although uncertainty in fields other than medicine is discussed, this is the most striking and important material in the book. If you want to know how to interpret the results of medical tests, or how to decide whether to accept a medical treatment that has unwanted side effects (and they all do) you simply must read this book. And prospective patients are not the only group who would benefit − it should also be required reading for medical personnel.

Book details:

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