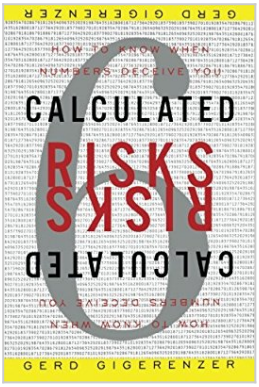

Calculated Risks: How to Know When Numbers Deceive You

By Gerd Gigerenzer

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At the beginning of the twentieth century, H. G. Wells predicted that statistical thinking would be as necessary for citizenship in a technological world as the ability to read and write. But in the twenty-first century, we are often overwhelmed by a baffling array of percentages and probabilities as we try to navigate in a world dominated by statistics.

Cognitive scientist Gerd Gigerenzer says that because we haven't learned statistical thinking, we don't understand risk and uncertainty. In order to assess risk -- everything from the risk of an automobile accident to the certainty or uncertainty of some common medical screening tests -- we need a basic understanding of statistics.

Astonishingly, doctors and lawyers don't understand risk any better than anyone else. Gigerenzer reports a study in which doctors were told the results of breast cancer screenings and then were asked to explain the risks of contracting breast cancer to a woman who received a positive result from a screening. The actual risk was small because the test gives many false positives. But nearly every physician in the study overstated the risk. Yet many people will have to make important health decisions based on such information and the interpretation of that information by their doctors.

Gigerenzer explains that a major obstacle to our understanding of numbers is that we live with an illusion of certainty. Many of us believe that HIV tests, DNA fingerprinting, and the growing number of genetic tests are absolutely certain. But even DNA evidence can produce spurious matches. We cling to our illusion of certainty because the medical industry, insurance companies, investment advisers, and election campaigns have become purveyors of certainty, marketing it like a commodity.

To avoid confusion, says Gigerenzer, we should rely on more understandable representations of risk, such as absolute risks. For example, it is said that a mammography screening reduces the risk of breast cancer by 25 percent. But in absolute risks, that means that out of every 1,000 women who do not participate in screening, 4 will die; while out of 1,000 women who do, 3 will die. A 25

percent risk reduction sounds much more significant than a benefit that 1 out of 1,000 women will reap.

This eye-opening book explains how we can overcome our ignorance of numbers and better understand the risks we may be taking with our money, our health, and our lives.

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Calculated Risks: How to Know When Numbers Deceive You By Gerd Gigerenzer Bibliography

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Editorial Review

Amazon.com Review
In the tradition of *Innumeracy* by John Allen Paulos, German scientist Gerd Gigerenzer offers his own take on numerical illiteracy. "In Western countries, most children learn to read and write, but even in adulthood, many people do not know how to think with numbers," he writes. "I focus on the most important form of innumeracy in everyday life, statistical innumeracy--that is, the inability to reason about uncertainties and risk." The author wisely uses concrete examples from the real world to make his points, and he shows the devastating impact of this problem. In one example, he describes a surgeon who advised many of his patients to accept prophylactic mastectomies in order to dodge breast cancer. In a two-year period, this doctor convinced 90 "high-risk" women without cancer to sacrifice their breasts "in a heroic exchange for the certainty of saving their lives and protecting their loved ones from suffering and loss." But Gigerenzer shows that the vast majority of these women (84 of them, to be exact) would not have developed breast cancer at all. If the doctor or his patients had a better understanding of probabilities, they might have chosen a different course. Fans of *Innumeracy* will enjoy *Calculated Risks*, as will anyone who appreciates a good puzzle over numbers. --*John Miller*

From Publishers Weekly
If a woman aged 40 to 50 has breast cancer, nine times out of 10 it will show up on a mammogram. On the other hand, nine out of 10 suspicious mammograms turn out not to be cancer. Confused? So are many people who seek certainty through numbers, says Gigerenzer, a statistician and behavioral scientist. His book is a successful attempt to help innumerates (those who don't understand statistics), offering case studies of people who desperately need to understand statistics, including those working in AIDS counseling, DNA fingerprinting and domestic violence cases. Gigerenzer deftly intersperses math lessons explaining concepts like frequency and risk in layperson's terms with real-life stories involving doctors and detectives. One of his main themes is that even well-meaning, statistically astute professionals may be unable to communicate concepts such as statistical risk to innumerates. (He tells the true story of a psychiatrist who prescribes Prozac to a patient and warns him about potential side effects, saying, You have a 30 to 50 percent chance of developing a sexual problem. The patient worries that in anywhere from 30% to 50% of all his sexual encounters, he is going to have performance problems. But what the doctor really meant is that for every 10 people who take Prozac, three to five may experience sexual side effects, and many have no sexual side effects at all.) All innumerates buyers, sellers, students, professors, doctors, patients, lawyers and their clients, politicians, voters, writers and readers have something to learn from Gigerenzer's quirky yet understandable book.

From The New England Journal of Medicine
The father of modern science fiction, H.G. Wells, is reported to have predicted at the beginning of the 20th century that "statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." Calculated Risks was motivated by a cognitive scientist's interest in why most people appear to be unable to reason about uncertainties and risk, a limitation Gigerenzer refers to as "statistical innumeracy." Physicians are often aware of their innumeracy. What they may be less aware of is how simple adjustments in the way in which numerical information is presented and the development of intuitively understandable illustrations can help to shift "innumeracy into insight." One barrier to understanding numbers is our seeming inability to live with uncertainty. Using the familiar examples of screening for breast cancer, testing for the human immunodeficiency virus, and DNA fingerprinting, Gigerenzer points out our nearly universal

tendency to create an "illusion of certainty." He describes three distinct forms of innumeracy, which he refers to as ignorance of risk (in which a person does not know, even approximately, how large a personally or professionally relevant risk is), miscommunication of risk (in which a person knows the risks but does not know how to communicate them effectively), and clouded thinking (in which a person knows the risks but draws incorrect inferences from the relevant statistical facts). For example, physicians often know the performance characteristics of a diagnostic test (e.g., mammography) and the prevalence of a disease (e.g., breast cancer), but they may not know how to infer from this information the likelihood that the disease is present in a patient with a positive test result (e.g., the risk of breast cancer in a woman with an abnormal mammogram). For each of the three distinct forms of innumeracy, there is a tool to facilitate improved thinking. Most of the book focuses on the presentation of "mind tools" that are easy to learn, remember, and apply in the effort to overcome innumeracy. These tools focus on ways to overcome the illusion of certainty, devices for communicating risk intelligibly, and the use of natural frequencies for drawing inferences from statistical information. An important consequence of innumeracy is that miscommunication of risk is often the rule rather than the exception. Three major types of risk that invite miscommunication are single-event probabilities, relative risks, and conditional probabilities. Unfortunately, all of these are standard ways to communicate information. Single-event probabilities can lead to miscommunication because people tend to fill in different reference classes. This type of miscommunication happens frequently with mundane statements such as those made in weather reports: hearing that "there is a 30 percent chance that it will rain tomorrow," some people think that it will rain 30 percent of the time, others that it will rain in 30 percent of the area, and still others that it will rain on 30 percent of the days that are like tomorrow. Although the third option is the intended message, approximately two thirds of the people will interpret this statement incorrectly. One of the most common means of describing clinical benefits in the world of medicine and public health is the relative risk reduction. Since relative risks are larger numbers than absolute risks, results presented in this manner appear to be greater than the same results presented as absolute risk reductions. Presenting benefits as absolute benefits or in terms of the number needed to treat to save one life are two simple examples of ways to make results more understandable. Finally, information in the form of conditional probabilities is often misinterpreted. Even highly educated professionals have difficulty making key inferences on the basis of probabilities. The statement "If a woman has breast cancer, the probability that she will test positive on a screening mammogram is 90 percent" is often confused with the statement "If a woman tests positive on a screening mammogram, the probability that she has breast cancer is 90 percent." Creative representation is an indispensable part of solving problems and of using different formats to represent probabilistic information. For example, changing risk representations from probabilities to natural frequencies can be enormously useful. Probabilities -- especially conditional probabilities -- tend to impede human inference, whereas natural frequencies demand less computation, are far more similar to the ways in which we experience numerical information in our daily lives, and appear to help both experts and laypeople. The representation does part of the reasoning, taking care of the multiplication the mind would have to perform if provided only with probabilities. Algebra, geometry, and calculus teach thinking in a world of certainty. Medical schools and law schools routinely teach some form of statistics but generally have not integrated formal education on reasoning on the basis of uncertain evidence into their curriculum. Gigerenzer, the director of the Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin, Germany, calls for an educational campaign aimed at teaching schoolchildren, undergraduate and graduate students, ordinary citizens, and professionals how to deal with risk. The topics he writes about are not new and have been the subject of a wealth of literature in recent years. The unique value of his book lies in the practical and simple tools it provides to help readers understand risks and communicate them effectively to others. These tools are easy to learn and should be mastered by every medical student, health care provider, and professional who is in the position of having to understand and explain to others choices involving risks and uncertainties. *Sue Goldie, M.D., M.P.H.*

Users Review

From reader reviews:

Patrick Adkins:

Book is written, printed, or descriptive for everything. You can learn everything you want by a publication. Book has a different type. As we know that book is important point to bring us around the world. Adjacent to that you can your reading expertise was fluently. A e-book Calculated Risks: How to Know When Numbers Deceive You will make you to always be smarter. You can feel a lot more confidence if you can know about almost everything. But some of you think which open or reading the book make you bored. It isn't make you fun. Why they might be thought like that? Have you trying to find best book or appropriate book with you?

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Mindy Martinez:

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David Paras:

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