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By Laurence B. Siegel

## How To Think

### Steven Pinker's Instruction Manual For Your Brain

An urban legend has Amos Tversky, the late co-founder (along with Daniel Kahneman) of behavioral economics, asking a computer scientist what he was working on. The computer man responded, "I study artificial intelligence." Tversky, a notorious smart aleck, responded, "I study natural stupidity."

Steven Pinker has studied natural stupidity more carefully than almost any other living writer. Trained as a cognitive psychologist and linguist, Pinker's books on human behavior include *How the Mind Works*, *The Blank Slate*, and *The Stuff of Thought*. Pinker became one of the world's foremost public intellectuals with his book on the decline of violence over time, *The Better Angels of Our Nature*, and its sequel, *Enlightenment Now*, which I reviewed [here](#).

#### Why we need to learn how to think

Pinker goes back to basics with *Rationality*, a beautifully written book on how to think. Why do we need to be taught how to think? Our brains evolved under conditions very different from those we face now, so that our instincts that promoted survival under those conditions may harm us today. We mix up logic with emotion, data with information, and information with wisdom.

*Rationality* is a step-by-step guide to unmixing these and using hard-headed logic to arrive at useful conclusions.

Readers with a business or economic education will find the material in *Rationality* familiar and a bit elementary. However, Pinker has an unusual gift for clarity of expression and effectively draws in readers who think they know this stuff already. He takes the reader through the building blocks of

rational thought: logic and the perils of logical fallacies, probability, Bayesian inference, risk and utility, signal detection and statistical decision theory, game theory, correlation and causation, and behavioral and cognitive biases. That's the outline of the book, which I enthusiastically recommend.

It's not possible to go over all this material — basically, a college-level course in how to think rationally — in a book review, so I'll focus on three chapters of particular interest to investors: (1) Bayesian inference; (2) risk and utility (briefly); and (3) signal detection and statistical decision theory (that's how we pick managers). The other topics are very important, but most of them, especially correlation/causation and behavioral biases, have been covered in other literature familiar to well-read investors.

#### Bayes' wonderful theorem

Scott Alexander, pseudonymous author of the mega-popular intellectual blog Astral Codex Ten, posted the following recently:<sup>1</sup>

$$P(A|B) = \frac{P(A) \cdot P(B|A)}{P(B)}. \text{ All the rest is commentary.}$$

Huh?

Those familiar with Jewish texts will recognize the second expression immediately: Rabbi Hillel of Babylon, asked by an onlooker to explain the Torah while standing on one foot, said "What is hateful to thee, do not do unto thy neighbor... The rest is commentary."

<sup>1</sup>Formerly Slate Star Codex. <http://astralcodexten.substack.com>. Alexander is part of the "rationality community"; Pinker is on the fringes of it (as am I).

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**Kathryn M. Welling**  
Editor, Publisher & Principal  
Kate@WellingonWallSt.com  
Office. (631)315-5076  
Cell. (973)650-2722

**Donald R. Boyle**  
Chief Financial Officer  
Chief Marketing Officer  
Don@WellingonWallSt.com  
Office. (631)315-5077  
Cell. (201)394-1548

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PO Box 620  
Mattituck, NY 11952

Office:(631)315-5076  
Fax. (631)315-5077  
[www.wellingonwallst.com](http://www.wellingonwallst.com)

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The first, more challenging expression is Bayes' theorem, which provides a formula for blending one's prior beliefs about the likelihood of a phenomenon,  $P(A)$ , with experimental evidence ( $B$ ), to produce a "posterior belief" about  $A$  given  $B$ . The posterior,  $P(A|B)$ , blends that experimental evidence with the prior to arrive at the best estimate of the likelihood of that phenomenon given both sets of information (the prior and the experiment).

Alexander is implying that the theorem is the most important lesson you will ever need. I'm not sure about that, but it's one of the most important.

Developed by the Reverend Thomas Bayes (1702-1761), and separately by Pierre-Simon Laplace (1749-1827), Bayesian inference is one of the most useful concepts in statistics and in human thought. It is also one of the most confusing. Yet, without Bayesian inference, our thinking about the likelihood of events will be muddled and wrong. Steven Pinker gives Bayesian inference a central place in his instruction manual for your brain.

The most confusing part of Bayesian inference is why one's prior beliefs should have any weight at all. Suppose I believe the moon is made of green cheese. Or that flying as a passenger in a commercial airplane is more dangerous than piloting a hang glider. Or that bitcoin is going to \$1 million.

That's not what prior belief (or "Bayesian prior") means — although students of statistics can be forgiven for making that mistake, because part of the mystery surrounding Bayes' work is his fault. He never wrote up his research, and what remains of it is found in a nightmarish mathematical paper *about* Bayes, written by one Richard Price in 1763.<sup>2</sup>

What a Bayesian "prior" means in modern practice is *prior knowledge*, the probability you would assign to an event *before that event occurs*. That probability,  $P(A)$  in the above expression, is the "base rate" or likelihood that events of that general kind will occur. This is best taught by example.

<sup>2</sup> Price, Richard. 1763. "An Essay towards solving a Problem in the Doctrine of Chance. By the late Rev. Mr. Bayes, communicated by Mr. Price, in a letter to John Canton, A. M. F. R. S." *Philosophical Transactions of the Royal Society of London*. 53: 370–418. For a full history of Bayes' theorem, including Laplace's contribution, see the delightful blog post by 'lukeprog' at <https://www.lesswrong.com/posts/RTt59BtFLqQbsSiqd/a-history-of-bayes-theorem>.

(A full explanation of the Bayes theorem is too lengthy to include here; read Pinker's book or check out the [Bayes theorem](#) and [Bayesian inference](#) Wikipedia entries.) Here is an example, similar to Pinker's but simpler, from the University of Chicago professor Thomas Coleman:<sup>3</sup>

Consider breast cancer, which is relatively rare in the general [female] population (say, 5 in 1,000). Thus, the prior probability that a woman has breast cancer, given no symptoms and no family history, is only about 0.5%. Now consider the woman undergoing a mammogram, which is roughly 95% accurate (in the sense that the test falsely reports a positive result about 5 percent of the time).

What is the chance that, if a patient has a positive mammogram result, she actually has breast cancer? The temptation is to say 95% because the test is 95% accurate, but that [is wrong] ... Out of a pool of 1,000 test-takers, roughly 5 (5 in 1,000) will actually have cancer and roughly 50 will receive false positives (5% false-positive rate, 5 in 100, or 50 in 1,000). That is, there will be roughly 55 positive test results, but only 5 will be true positives. This means the probability of truly having cancer given a positive test result is roughly 5 in 55, or 9% — not 95 in 100 or 95%.

Pinker comments,

The most popular answer from a sample of doctors given [similar] numbers ranged from 80% to 90%. Bayes' rule allows you to calculate the correct answer: 9%. That's right, the professionals with whom we entrust our lives flub the basic task of interpreting a medical test, and not by a little bit.

Bayes' theorem is a good place to start learning about how to think rationally. It could be a matter of life or death. And "what is the base rate?" is a good question to ask in any situation requiring forecasts and estimation of probability.

### Risk and utility

Pinker explains risk and reward, not in relation to

<sup>3</sup> Coleman, Thomas S. 2011. *A Practical Guide to Risk Management*. Charlottesville, VA: CFA Institute Research Foundation. Page 42.

investing, but in terms of gambling and other choices. This is probably a good decision given that his primary audience consists of general readers with no special investment knowledge; investing is packed with other confounding variables, making the risk-reward relationship in our field counterintuitive. (“I want investments with *low* risk and *high* reward!”<sup>4</sup>)

Moreover, investment advisors and other professionals who need a tutorial on the basics of risk and reward should find another occupation.

But there is a gem in the otherwise humdrum risk-return chapter. For investors and (especially) economists, the most fun part of the chapter is Pinker’s treatment of the silly charge that economists believe people are robotic utility maximizers who engage in coldhearted calculations before making decisions:

Some theories are unlovable. No one has much affection for the laws of thermodynamics... [because they rule out] a perpetual-motion machine. Ever since Darwin proposed the theory of natural selection, creationists have choked on the implication that humans descended from apes...

One of the most hated theories of our time is rational choice...[or] *Homo economicus* ... What exactly is this mean-spirited theory? It says that when faced with a risky decision, rational actors ought to choose the option that maximizes their “expected utility” ... People interpret it as claiming that humans are, or should be, selfish psychopaths.

Fortunately, Pinker doesn’t believe for a moment that expected-utility theory is mean-spirited, or that people are or should be selfish monsters. He’s raising a straw-man argument to show how silly the charge really is.

I do not find these theories unlovable at all. Theories like these are what allows us to make

<sup>4</sup> There is a thread of semi-respectable thinking in the investment field, associated with the late Robert Haugen, that says investments with low risk and high expected reward exist. (Obviously there are investments with low risk and high realized reward; we just don’t know which ones these will be.) See Haugen, Robert A. 1999. *The New Finance: The Case Against Efficient Markets* (2nd Edition). Upper Saddle River, NJ: Prentice-Hall.

sense of the universe. I never expected to create energy out of nothing and was not disappointed to find out we couldn’t. I am proud of my pithecinic and simian cousins. Evolution is one of the most beautiful theories ever imagined.

Pinker’s demolition of the straw man teaches one of the most important lessons in how to think. The lesson is in understanding the role of a theory. Economists (with a few exceptions) do not believe, any more than Pinker does, that people should make cold-hearted calculations before making any decision. Instead, they believe that economic choices can be analyzed *as if* people were utility-maximization machines. There is a big difference.

“As if” is the key here and is part of every economist’s vocabulary. In the social sciences, a theory, such as utility theory, is supposed to be a stylized or simplified model of reality — not a full description of it. A full description of the conditions under which people make economic decisions would involve understanding the neural architecture of our brains, the influence of evolution and experience on our animal natures and, even more fundamentally, the actions of the chemicals in our bodies.

Economics does not try to do all that. What economics does is to momentarily pretend that the world is simpler than it is, to make analysis possible. That is one reason the analysis is not always correct, but without the “as if” assumption there would be no analysis at all.

#### **Statistical decision theory: Signal versus noise**

Statistical decision theory sounds very complex and geeky, something only an engineer would love. But it’s just Pinker’s moniker for statistical significance and how it captures “real” (in this case, economic) significance. Pinker adds the phrase “signal detection” to his chapter title because statistical decision theory is what enables us to distinguish signal from noise.

This issue is at the heart of manager selection, the principal activity of many investment advisors. It helps us answer this question: “How confident can we be that manager A, having beaten manager B by x% over such-and-such a period, is really the better manager — rather than just lucky over that past time span?” (Manager B can be the benchmark, or an index fund.) The excess return that we can attribute to skill and not luck is the signal and is the part of the return that we can reasonably expect to persist in the future (although even that will fade over time). The rest

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of the return variation is noise.

As this preamble suggests, statistical significance is harder to interpret than most people think: Distinguishing signal from noise is challenging. For example, if a manager has an alpha (measured over some past period) with a T-statistic greater than 2, an investor may feel “confident,” based on the use of the term *confidence interval* to describe the error bars around an estimate, that the manager is adding value.

Note the tense of the expression, “adding,” implying continuation of the past into the future. With this T-stat, an investor is likely to conclude that the manager is a good choice for beating his or her benchmark in the future. After all, the evidence is that, in the one “run” of the past that we have available to study, the manager did beat the benchmark with 100% certainty.

But that one run of the past will not occur again. In the future, which is what we’re concerned about, what is the probability that the manager with a T-stat of 2 will beat the benchmark again?

Naively, if the run in the future were drawn from the exact same distribution as the past period that we examined, the answer would be about 95%, based on our understanding of statistical significance and T-stats. But we don’t know what distribution the future run will be drawn from. There is an infinity of possible distributions that could have produced the one run that happened, and only one of those — and we cannot know which one — did. And that unknowable run is the one that will produce the next run, in the future when our money will be at work.

Past performance is not as good an indicator of future performance as the naïve interpretation of statistical significance might suggest. No wonder so many people buy index funds!

#### How common is “statistically significant” alpha?

In a study I did with my friends Ken Kroner and Scott Clifford at Barclays Global Investors,<sup>5</sup> we found that, over 1980-2000, only 10 out of 494 managers (in all asset classes) had alpha T-stats greater than 2. Only 224, fewer than half, had positive alphas at all! So, although the very best active

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<sup>5</sup> Siegel, Laurence B., Kenneth F. Kroner, and Scott W. Clifford. 2001. “[The greatest return stories ever told.](#)” *Journal of Investing* (Summer). Manager rankings by alpha T-statistic are not in the article but are in my background materials and may be obtained by E-mailing me.

managers produced results far in excess of what could be explained by random variation, “statistically significant” active management alpha is rare in the long run. You needed to have special knowledge of the manager’s people, philosophy, and process — plus some plain old luck — to have a good chance of picking winning managers over that period, and presumably also today.

#### Why progress is possible but not inevitable

In Pinker’s other books, he has been enthusiastic about the possibility of progress — especially moral progress, something that most other progress advocates avoid discussing. *The Better Angels of Our Nature* shows, mostly convincingly, that both state-sponsored violence (war) and interpersonal violence (as revealed by murder statistics) have declined dramatically over the centuries when measured on a per capita basis. By this measure, even the 20th century “hemoclysm” (his coinage), consisting of World Wars I and II and the Chinese and Indian civil wars, is not much of an outlier; long-forgotten catastrophes such as the Chinese War of the Three Kingdoms (A.D. 184-280) were worse.

In a later book, *Enlightenment Now*, Pinker attributed this decline in violence, as well as other elements of the improvement in living conditions over the centuries, to the intellectual European Enlightenment of the 1600s and 1700s. He asks us to embrace Enlightenment values, fearful that if we do not do so, we will be governed by the strong rather than the wise, and without the consent of the governed. Some current political trends around the world make this fear realistic. The liberal triumphalism of the late 20th century now seems like a dispatch from a lost world.

As a result, while Pinker believes that progress — economic, environmental, moral, and so forth — is possible (after all, we got here), it is not guaranteed. When people abandon the rationality so carefully cultivated by civilized people from the ancient Greeks to the Italian humanists to the Enlightenment philosophers of whom Pinker is so fond, progress goes into reverse. And when things go wrong, they can go very wrong very quickly. Thus Pinker’s passion for teaching the elements of rationality in this book, something one might think is no longer needed — but it is.

#### Why rationality matters

Let’s pursue this line of thinking, key to Pinker’s philosophy, in a little more detail. The most important chapter in his book is the closing one, “Why Rationality Matters.” Becoming rational can be

viewed simply as an accumulation of skills, something that can be taught to any willing learner. Most of the readers of this review will have had some of this training.

But what is so important about learning to be rational? Pinker argues that rationality is a push-back against the chaos of an indifferent universe; we use our intellect to try to make order out of that chaos. And we do that partly to satisfy our curiosity about how the universe works, but more importantly to better our lives: to make progress. Pinker writes,

Having documented [human progress in two of my previous books], I'm often asked whether I "believe in progress." The answer is no. Like the humorist Fran Lebowitz, I don't believe in anything you have to believe in. [Progress has occurred] not because of some force or...evolutionary law that lifts us ever upward. On the contrary, nature has no regard for our well-being, and often, as with pandemics and natural disasters, looks as if it's trying to grind us down. "Progress" is shorthand for a set of pushbacks and victories wrung out of an unforgiving universe, and... needs to be explained.

"The explanation," Pinker continues, "is rationality." His take on how the process works is one of the most powerful closing statements in any book of this genre:

When humans set themselves the goals of improving the welfare of their fellows... and they apply their ingenuity in institutions that pool it with others', they occasionally succeed. When they retain the successes and take note of the failures, the benefits can accumulate, and we call the [result] "progress."<sup>6</sup>

Here's the recipe:

- Establish and maintain institutions that nurture applied ingenuity.
- Keep a record, not just of the successes but of the failures.

<sup>6</sup> My emphasis.

- Allow the benefits to accumulate — don't cut them off with bad policies.

Now, start cooking.

### Advice for investors and other readers

Thinking rationally is a requirement for investors and advisors, who are constantly being thrown curve balls by the markets, other people, and their own biases and instincts. And it doesn't come naturally!

In *Rationality*, Steven Pinker presents a short but powerful total-immersion course in the elements of logical thinking. While some of the material is old hat to experienced investors, *Rationality* is an exceptionally well-written refresher. Gary Geipel in *National Review* wrote that Pinker's chapters "might in different hands be impassable. Pinker makes them page-turners."<sup>7</sup> Read this book!

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Laurence B. Siegel is the Gary P. Brinson Director of Research at the CFA Institute Research Foundation, the author of *Fewer, Richer, Greener: Prospects for Humanity in an Age of Abundance*, and an independent consultant. His latest book, *Unknown Knowns: On Economics, Investing, Progress, and Folly*, contains many articles previously published in *Advisor Perspectives*. He may be reached at [lsiegel@uchicago.edu](mailto:lsiegel@uchicago.edu). His website is <http://www.larrysiegel.org>.

<sup>7</sup><https://www.nationalreview.com/magazine/2021/11/1/1/5/rationality-if-you-can-keep-it/>

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