Thinking Fast and Slow
Daniel Kahneman

Annotations on Kahneman's table of contents – a survey of logic and illogic

When you come late to the party, writing the 160th review, you have a certain freedom to write something as much for your own use as for other readers, confident that this review will be at the bottom of the pile.

Kahneman's thesis is that the human animal is systematically illogical. Not only do we mis-assess situations, but we do so following fairly predictable patterns. Moreover, those patterns are grounded in our primate ancestry.

The first observation, giving the title to the book, is that eons of natural selection gave us the ability to make a fast reaction to a novel situation. Survival depended on it. So, if we hear an unnatural noise in the bushes, our tendency is to run. Thinking slow, applying human logic, we might reflect that it is probably Johnny coming back from the Girl Scout camp across the river bringing cookies, and that running might not be the best idea. However, fast thinking is hardwired.

The first part of the book is dedicated to a description of the two systems, the fast and slow system., Con introduces them in his first chapter as system one and system two.

Chapter 2 talks about the human energy budget. Thinking is metabolically expensive; 20 percent of our energy intake goes to the brain. Moreover, despite what your teenager tells you, dedicating energy to thinking about one thing means that energy is not available for other things. Since slow thinking is expensive, the body is programmed to avoid it.

Chapter 3 expands on this notion of the lazy controller. We don't invoke our slow thinking, system two machinery unless it is needed. It is expensive. As an example, try multiplying two two-digit numbers in your head while you are running. You will inevitably slow down. NB: Kahneman uses the example of multiplying two digit numbers in your head quite frequently. Most readers don't know how to do this. Check out "The Secrets of Mental Math" for techniques. Kahneman and myself being slightly older guys, we probably like to do it just to prove we still can. Whistling past the graveyard – we know full well that mental processes slow down after 65.

Chapter 4 – the associative machine – discusses the way the brain is wired to automatically associate words with one another and concepts with one another, and a new experience with a recent experience. Think of it as the bananas vomit chapter. Will you think of next time you see a banana?

Chapter 5 – cognitive ease. We are lazy. We don't solve the right problem, we solve the easy problem.

Chapter 6 – norms, surprises, and causes. A recurrent theme in the book is that although our brains do contain a statistical algorithm, it is not very accurate. It does not understand the normal distribution. We are inclined to expect more regularity than actually exists in the world, and we have poor intuition about the tail ends of the bell curve. We have little intuition at all about non-Gaussian distributions.

Chapter 7 – a machine for jumping to conclusions. He introduces a recurrent example. A ball and bat together cost $1.10. The bat costs one dollar more than the ball. How much does the ball cost? System one, fast thinking, leaps out with an answer which is wrong. It requires slow thinking to come up with the right answer – and the instinct to distrust your intuition.

Chapter 8 – how judgments happen. Drawing parallels across domains. If Tom was as smart as he is tall, how smart would he be?

Chapter 9 – answering an easier question. Some questions have no easy answer. "How do you feel about yourself these days?" Is harder to answer than "did you have a date last week?" If the date question is asked first, it primes an answer for the harder question.

Section 2 – heuristics and biases

Chapter 10 – the law of small numbers. In the realm of statistics there is a law of large numbers. The larger the sample size, the more accurate the statistical inference from measuring them. Conversely, a small sample size can be quite biased. I was in a study abroad program with 10 women, three of them over six feet. Could I generalize about the women in the University of Maryland student body? Conversely, I was the only male among 11 students and the only one over 60. Could they generalize anything from that? In both cases, not much.

Chapter 11 – anchors. A irrelevant notion is a hard thing to get rid of. For instance, the asking price of the house should have nothing to do with its value, but it does greatly influence bids.

Chapter 12 – the science of availability. If examples come easily to mind, we are more inclined to believe the statistic. If I know somebody who got mugged last year, and you don't, my assessment of the rate of street crime will probably be too high, and yours perhaps too low. Newspaper headlines distort all of our thinking about the probabilities of things like in and terrorist attacks. Because we read about it, it is available.

Chapter 13 – availability, emotion and risk. Continuation.

Chapter 14 – Tom W's specialty. This is about the tendency for stereotypes to override statistics. If half the students in the University area education majors, and only a 10th of a percent study mortuary science, the odds are overwhelming that any individual student is an education major. Nonetheless, if you ask about Tom W, a sallow gloomy type of guy, people will ignore the statistics and guess he is in mortuary science.

Chapter 15 – less is more. Linda is described as a very intelligent and assertive woman. What are the odds she is a business major? The odds that she is a feminist business major? Despite the mathematical possibility, most people will think that the odds of the latter are greater than the former.

Chapter 16 – causes trump statistics. The most important aspect of this chapter is Bayesian analysis, which is so much second nature to Kahneman that he doesn't even describe it. The example he gives is a useful illustration.

- 85% of the cabs in the city are green, and 15% are blue.
- A witness identified the cabin involved in a hit and run as blue.
- The court tested the witness' reliability, and the witness was able to correctly identify the correct color 80% of the time, and failed 20% of the time.

First, to go to the point. Given these numbers, most people will assume that the cab in the accident was blue because of the witness testimony. However, if we change the statement of the problem so that half the cabs in the city are blue and half are green, but 85% of the cabs involved in accidents are green, people will overwhelmingly say that the cab in the accident was a green madman. The problems are mathematically identical but the opinion is different.

Now the surprise. The correct answer is that there is a 41% chance that the cab involved in the accident was blue. Here's how we figure it out from Bayes theorem.

If the cab was blue, a 15% chance, and correctly identified, an 80% chance, the combined probability is .15 * .8 = .12, a 12% chance

If the cab was green, an 85% chance, and incorrectly identified, a 20% chance, the combined probability is .85 * .2 = .17, a 17% chance

Since the cab had to be either blue or green, the total probability of it being identified as blue, whether right or wrong, is .12 + .17 = .29. In other words, this witness could be expected to identify the cab as blue 29% of the time whether she was right or wrong.

The chances she was right are .12 out of .29, or 41%. Pecommend that you cut and paste this, because Bayes theorem is cited fairly often, and is kind of hard to understand. It may be simple for Kahneman, but it is not for his average reader, I am sure.

Chapter 17 – regression to the mean. If I told you I got an SAT score of 750 you could assume that I was smart, or that I was lucky, or some combination. The average is only around 500. The chances are little bit of both, and if I take a test a second time I will get a lower score, not because I am any stupider but because your first observation of me wasn't exactly accurate. This is called regression to the mean. It is not about the things you are measuring, it is about the nature of measurement instruments. Don't mistake luck for talent.

Chapter 18 – taming intuitive predictions. The probability of the occurrence of an event which depends on a number of prior events is the cumulative probability of all those prior events. The probability of a smart grade school kid becoming a Rhodes scholar is a cumulative probability of passing a whole series

of hurdles: studying hard, excelling in high school, avoiding drink and drugs, parental support and so on. The message in this chapter is that we tend to overestimate our ability to project the future.

Part three – overconfidence

Chapter 19 – the illusion of understanding. Kahneman introduces another potent concept, "what you see is all there is," thereinafter WYSIATI. We make judgments on the basis of the knowledge we have, and we are overconfident about the predictive value of that observation. To repeat their example, we see the tremendous success of Google. We discount the many perils which could have totally derailed the company along the way, including the venture capitalist who could have bought it all for one million dollars but thought the price was too steep.

Chapter 20 – The illusion of validity. Kahneman once again anticipates a bit more statistical knowledge than his readers are likely to have. The validity of a measure is the degree to which an instrument measures what it purports to measure. You could ask a question such as whether the SAT is a valid measure of intelligence. The answer is, not really, because performance on the SAT depends quite a bit on prior education and previous exposure to standardized tests. You could ask whether the SAT is a valid predictor of performance in college. The answer there is that it is not very good, but nonetheless it is the best available predictor. It is valid enough because there is nothing better. To get back to the point, we are inclined to assume measurements are more valid than they are, in other words, to overestimate our ability to predict based on measurements.

Chapter 21 – intuitions versus formulas. The key anecdote here is about a formula for predicting the quality of a French wine vintage. The rule of thumb formula beat the best French wine experts. Likewise, mathematical algorithms for predicting college success are as least as successful, and much cheaper, than long interviews with placement specialists.

Chapter 22 – expert intuition, when can we trust it? The short answer to this is, in situations in which prior experience is quite germane to new situations and there is some degree of predictability, and also an environment which provides feedback so that the experts can validate their predictions. He would trust the expert intuition of a firefighter; there is some similarity among fires, and the firemen learns quickly about his mistakes. He would not trust the intuition of a psychiatrist, whose mistakes may not show up for years.

Chapter 23 – the outside view. The key notion here is that people within an institution, project, or any endeavor tend to let their inside knowledge blind them to things an outsider might see. We can be sure that most insiders in Enron foresaw nothing but success. An outsider, having seen more cases of off-balance-sheet accounting and the woes it can cause, would have had a different prediction.

Chapter 24 – the engine of capitalism. This is a tour of decision-making within the capitalist citadel. It should destroy the notion that there are CEOs who are vastly above average, and also the efficient

markets theory. Nope. The guys in charge often don't understand, and more important, they are blind to their own lack of knowledge.

Part four – choices

This is a series of chapters about how people make decisions involving money and risk. In most of the examples presented there is a financially optimal alternative. Many people will not find that alternative because of the way the problem is cast and because of the exogenous factors. Those factors include:

Marginal utility. Another thousand dollars is much less important to a millionaire than a wage slave.

Chapter 26 – Prospect theory: The bias against loss. Losing $1000 causes pain out of proportion to the pleasure of winning $1000.

Chapter 27 – The endowment effect. I will not pay as much to acquire something as I would demand if I already owned it and were selling.

Chapter 28 – Bad Events. We will take unreasonable risk when all the alternatives are bad. Pouring good money after bad, the sunk cost effect, is an example.

Chapter 29 – The fourfold pattern. High risk, low risk, win, lose. Human nature is to make choices which are not mathematically optimal: buying lottery tickets and buying unnecessary insurance.

Chapter 30 – rare events. Our minds are not structured to assess the likelihood of rare events. We overestimate the visible ones, such as tsunamis and terrorist attacks, and ignore the ones of which we are unaware.

Chapter 31 – Risk policies. This is about systematizing our acceptance of risk and making policies. As a policy, should we buy insurance or not, recognizing that there are instances in which we may override the policy. As a policy, should we accept the supposedly lower risk of buying mutual funds, even given the management fees?

Chapter 32 – keeping score. This is about letting the past influence present decisions. The classic example is people who refuse to sell for a loss, whether shares of stock or a house.

Chapter 33 – reversals. We can let a little negative impact a large positive. One cockroach in a crate of strawberries.

Chapter 34 – Frames and reality. How we state it. 90% survival is more attractive than 10% mortality.

Part V. Two selves: Experience and memory

Our memory may be at odds with our experience at the time. Mountain climbing or marathon running are sheer torture at the time, but the memories are exquisite. We remember episodes such as childbirth by the extreme of pain, not the duration.

Lift decision: do we live life for the present experience, or the anticipated memories? Are we hedonists, or Japanese/German tourists photographing everything to better enjoy the memories?