

address the elephant in the room	May 20:30	disoriented	系 why 啊- 20:54
苗雅蕙 20:30	make a quick buck	May 20:54	frazzled/disoriented
address an elephant in the room	阿拉伯土著 20:39	May 20:55	use hierarchies as a tool
Anita 20:30	make a fast/quick buck	May 20:57	egalitarian
address the elephant in the room	JY 20:40	Anita 20:57	egalitarian
May 20:32	social orbit	苗雅蕙 20:57	egalitarian
who wears the pants	May 20:40	剪影 20:57	meritocracy
系 why 啊- 20:32	social orbit/circle		
who wears the pants	剪影 20:44		
May 20:34	He looks familiar, but I can't place him.		
collective failure	May 20:45		
阿拉伯土著 20:37	He looks familiar, but I can't place him		
latent	剪影 20:45		
May 20:37	place 可以表示对不上人名和脸		
latent			
系 why 啊- 20:37			
latent			
Anita 20:48			
at the bottom of the totem pole/pecking order	upend 颠覆		
阿拉伯土著 20:48	苗雅蕙 20:59		
at the bottom of the totem pole	answerable		
May 20:48	July 20:59		
at the bottom of the pecking order/totem pole	answerable / accountable / responsible		
May 20:50	Anita 20:59		
see a bigger world	answerable		
苗雅蕙 20:52	阿拉伯土著 21:00		
defer to 顺从	answerable		
阿拉伯土著 20:52	阿拉伯土著 21:00		
defer to somebody	answerable to anyone		
	苗雅蕙 21:00		
	I am not answerable to anyone.		
	阿拉伯土著 21:00		
	reinstate		

n't it, we feel grateful for:
now, you needn't have
ive happened. But you did

—DOUGLAS HARDING

le is your mistaken belief

—CHARLOTTE JOKO BECK

Introduction: In the Long Run, We're All Dead

The average human lifespan is absurdly, terrifyingly, insultingly short. Here's one way of putting things in perspective: the first modern humans appeared on the plains of Africa at least 200,000 years ago, and scientists estimate that life, in some form, will persist for another 1.5 billion years or more, until the intensifying heat of the sun condemns the last organism to death. But you? Assuming you live to be eighty, you'll have had about four thousand weeks.



To invest successfully over a lifetime does not require a stratospheric IQ, unusual business insights, or inside information.

What's needed is a sound intellectual framework for making decisions and the ability to keep emotions from corroding that framework. You must supply the emotional discipline.

— Warren Buffett —

AZ QUOTES

- 3 -

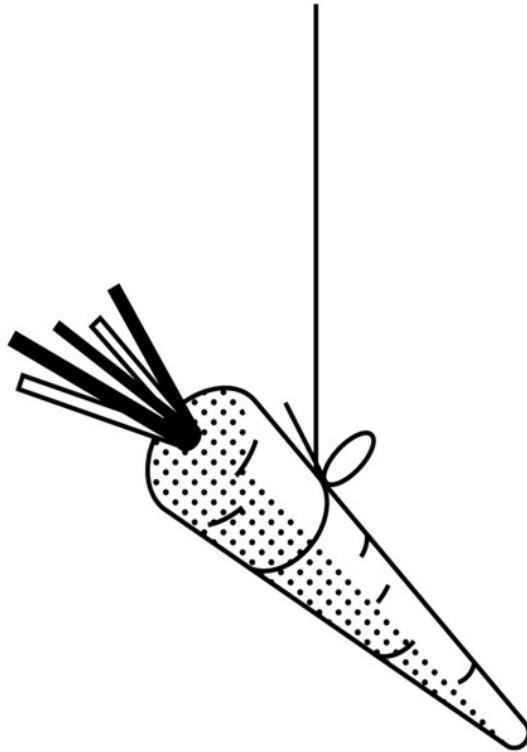
为什么多数股民赚不到钱？

隐藏在经济里。企业家和员工一起，为满足客户和企业的盈利增长而不断努力，制造一个一个编写一行一行代码，积累一个一个订单，这些缓进步，带来了公司的盈利和净资产的增加。内在价值是客观的，但估值背后的预期和情绪，则是主观的。面对同样的企业，同样的市场，同样的信息，我们很难做出正确的估值。与此同时，投资者的情绪还会被市场的其他参与者影响，在贪婪和恐惧中切换，而这会进一步影响我们的行为。

投资大师巴菲特在为本杰明·格雷厄姆的著作《聪明的投资者》作序时，写过这样一句话：“要想在一生中获得投资成功，并不需要顶级的智商、超凡的商业头脑或内幕消息，而是需要一个稳妥的知识体系作为决策的基础，并且有能力控制自己的情绪，使其不会对这种体系造成侵蚀。” ^{stratospheric} ^{intellectual framework} ^{emotional discipline} 他所说的知识体系和情绪控制，即认知和情绪，是我们给企业和市场估值、定价的基础。

Biology

Incentives



—
Shape behavior.

Incentives

Incentives shape behavior in all animals. We move in the direction of rewards and will easily take steps to avoid punishment. Humans, when we are thoughtful about incentives, will change our behavior to attain a perceived benefit. We will go through the same behavioral hoops to detour around perceived disadvantages. However, the ability to identify and respond to incentives is an intrinsic part of our biological makeup. Therefore, their influences on our behavior are not always rational. We often evaluate the value of an incentive through an incredibly biased lens made up of our self-esteem, our personal narrative, and our physiological state.

« Never, ever, think about something else when you should be thinking about the power of incentives. »

Charlie Munger¹

immune
DNA
handwritten
programmed

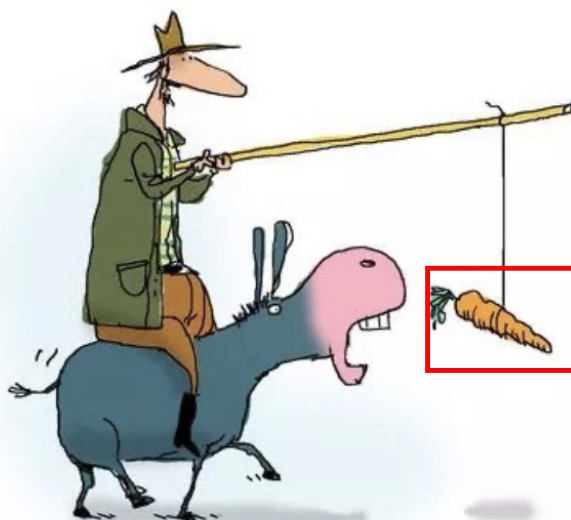
1. 警惕胡萝卜

People's lives are forever controlled by two emotions: fear and greed. Use them in your favor, not against you.

我的生活主要由两种情感支配：恐惧和贪婪。恰当使用这两种情感我们可以获得进步，例如害怕自己会因为考不过四六级拿不到毕业证，你可能会开始拼命学英文；为了说一口漂亮的英文让人刮目相看，你每天比别人多背几个词多练练演讲。

Too much greed is bad, but a little can help spur you on. 如果这两种情感太强烈，它会让我们迷失自己，忘记了自己到底想要什么。如同是刺激驴前进的胡萝卜，会让我们过度追逐眼前的利益，而忘记了自己到底要去哪里。

Money is the carrot, the illusion. If the donkey could see the whole picture, it might rethink its choice to chase the carrot.



Behavior modification

Behaviors can be a response to both internal and external factors. Multiple studies have shown, in both rats and humans, that consistent but infrequent rewards can create stronger behavioral changes than those that are given all the time. →→

A rat learns that a certain lever will sometimes produce food. It's always the same lever, but it doesn't always have food. The rat will continue to press that lever for far longer after food is no longer given than a lever that always gave food then one day just stopped.

Our behavior changes based on both actual reward and punishment and our perceptions of it. If something we did resulted in something good, just the anticipation of having that good thing again is an incentive to repeat the behavior. Same goes with a negative experience. Just the possibility of a repeat of punishment makes us want to avoid similar situations in the future.

The ability to store things such as fat or food gives us flexibility in responding to incentives. Money can be thought of as a form of storage—all the potential purchasing power is stored until used to buy things. “Perhaps the greatest economic innovation in human society was the invention of money, an exchangeable commodity that in effect stores the power to purchase and sell goods.”² This is part of money's incentive. You can choose how and when to spend it, and saving it means that you aren't as vulnerable to having to adjust and respond to every minor or risky incentive that comes your way.

The discovery and reinforcement of a certain incentive can change our behavior. Like helping to build the mechanisms that

where
is it?

allow elephants to remember how and where to find water over vast distances, we can create new neural pathways when obtaining rewards. Uncertain incentives, as well, can be beneficial to survival. Through studies of gambling or loyalty programs, researchers speculate that a tolerance for uncertain incentives is necessary because so many of our attempts to achieve something new fail on the first few tries.

The darker side of incentives is that sometimes pursuing our wants can rewire the brain so that these wants become requirements. This has been seen in studies examining drug addiction. After repeated chasing of an incentive because of the reward of feeling good, the brain no longer pursues the incentive because of how it feels to use drugs but because those wants have become hardwired to be their own reward. It's like the getting of the drug is what now gives the pleasure, beyond the actual use of the drug itself. Thus, incentives can have a powerful impact on our biology as well.

dopamine

The long-term influence of short-term incentives

One of the main challenges with incentives is that they are a factor everywhere: our needs, our wants, short-term interests, and long-term goals. On a basic survey of the people around us, humans do not generally appear to be able to prioritize incentives for deferred rewards over those that bring us immediate pleasure.

This is a problem in democracies, as Aristotle pointed out over 2,000 years ago. For all their political attractiveness, they are essentially governed by millions of people acting in their own self-interest. And those interests tend to be driven by incentives that offer immediate rewards.

Voters want to hear about policies that will have an immediate, positive impact on their lives. Most have less interest in policies that won't have any obvious benefits for years or even generations. As Niall Ferguson writes in *Civilization*, "We love our grandchildren. But our great-great-grandchildren are harder to relate to."³ Politicians have no choice but to respond to the incentives to think short-term; otherwise, they won't gain voter support. They therefore present platforms highlighting the benefits that will miraculously occur should they win. Due to the relatively short term that people tend to hold political office, it's difficult for any particular politician to make significant positive change in that time. They're surrounded by rapid feedback loops that depend on them showing fast results—short election cycles, frequent opinion polls, media reports every minute of the day, and instant social media chatter. The result is a system where politicians have little incentive to think beyond the current election cycle.

In a similar manner, publicly traded companies are incentivized to sacrifice long-term growth in the interest of showing profits on quarterly reports. The short tenure of CEOs and their large bonuses create perverse incentives. As a result, companies have difficulty investing in the sort of improvements that compound over time. For instance, many companies feel the need to jump on every new trend within their market to capitalize on the attention of their customers. This results in a hamster wheel of new tweaks, rather than companies focusing on building timeless products and services.

↳ /mason

Some large organizations have budgets that incentivize reckless spending. Federal agencies with use-it-or-lose-it budgets spend an average of 8.7% of their budgets during the last week of the fiscal year, nearly five times the typical weekly expenditure.⁴ In addition, projects funded during the last week are between two and six times as likely to be rated as low quality than ones from the rest of the year. Furthermore, variable pay for managers in these organizations is often tied to spending their budget.

Incentives have a powerful impact that spreads out like ripples on a pond. The short-term incentives in both politics and business impact every area of our lives. To change a system involving humans, we need to change the incentives.

—Sidebar: Aligning Incentives

Aligning Incentives

One of the challenges of leadership is aligning incentives. How do you get people to move in the same direction without being waylaid by immediate reward? Sun Tzu suggested over 2,000 years ago that a good leader “leads his men into battle like a man climbing to a height and kicking away the ladder.”¹ When you can’t go back, your motivation is to go forward together.

Manipulated by incentive

✓→ We are vulnerable to the influence of incentives—whether from money, prestige, or power. Most insidious is when an incentive is designed to appeal to our personal narrative about the kind of person we are. No one wants to be thought of as bad, so we often perform intellectual contortions to justify our pursuit of an incentive as good.

Thalidomide is a drug with a tragic history. Discovered and developed by a West German drug manufacturer in the 1950s and widely marketed as a sedative and antinauseant, it was responsible for thousands of infant deaths and deformities. The story of how this happened exposes a lot of the nuances of incentives.

Thalidomide was first produced by the Chemie Grunenthal company. It was “a drug without a disease,”⁵ and thus the first tests in animals and humans were actually to find something it could cure. The scientists there could not find a dosage high enough to kill rats and no side effects were observed on any animals tested. From this they concluded that the drug was completely nontoxic. They still didn’t know what humans could use it to cure, but these original animal testing results formed the foundation of their enduring belief that the drug couldn’t hurt anyone.⁶

The Grunenthal company then began handing out free samples to doctors. There was no clinical trial as we understand it now. Instead the initial users of the drug were the clinical trial. Thalidomide was put out into the world and “tested” on people without their knowledge or consent. The general population was the lab.⁷

As Trent D. Stephens explains in *Dark Remedy: The Impact of Thalidomide and Its Revival as a Vital Medicine*, the drug couldn't kill a rat, so Grunenthal thought it had to be safe. The company developed a large marketing campaign that sold the drug as a sedative. They partnered with drug manufacturers in other countries and brought the drug to market all over the world. In most countries it was available without a prescription. Doctors were routinely given marketing ~~confirming~~ ^{the} drug's safety—information that they passed on to their patients. Thalidomide was sold under various brand names, but with the assurance that it was like aspirin: mild, useful, and certainly not anything that could hurt you.

This, however, was not true. Slowly doctors in different countries began to notice physical impacts where the only thing the patients had in common was their use of thalidomide. First it was permanent nerve damage in the hands and feet, and then it was significant birth defects in the fetuses of otherwise healthy mothers.

The research began to come together showing that thalidomide caused deformities in gestation that were so severe that babies could often not survive after birth. If they did, it was with debilitating and painful abnormalities, most often the lack of properly ² formed limbs. Grunenthal doubled down on their marketing, casting suspicion on the medical articles discussing the dangers of thalidomide and attacking the credibility of the physicians who wrote them.⁸

At no point in the subsequent years did Grunenthal ever admit mistake or wrongdoing. All the drug manufacturers who sold

thalidomide settled all compensation claims out of court. No company was ever held criminally responsible for selling a drug without verifying the claims they made about it such as “safe for pregnant women.”⁹

One way to understand how this happened is to look at the story through the lens of incentives.

As you can imagine, there are financial incentives throughout the story of how thalidomide came to market. The heads of the team that discovered the drug were paid a percentage of the profits of its sales. And thalidomide was a big seller. There was a huge global market for sedatives, and in some countries it became the second-highest-selling drug.

There was also a significant financial incentive for drug companies to partner with Grunenthal. It meant that they could “avoid the cost of research, development, and testing.”¹⁰ And for Grunenthal itself, by not performing proper clinical trials on humans it saved a ton of money.

Thalidomide’s main competition as a sedative was a class of drugs called barbiturates. These had known undesirable side effects, and thus an incentive for doctors to recommend thalidomide was that it was purportedly safer than the alternative.

The drug companies regularly paid doctors for their endorsement, even going so far as to draft their lab articles.¹¹ This created more incentives. The first financial incentive was payment, but then, once your name is linked with endorsement of a drug, you have an incentive in terms of maintaining your reputation by continuing to defend that drug.

In the later criminal trials and civil suits, a lot of drug company executives pointed out that their legal and moral responsibility was to their shareholders. The incentives to keep their shareholders happy in the form of large dividends were far more significant than fairly compensating victims.

One fascinating part of the thalidomide story is that it was never approved for sale in the United States. The Richardson-Merrell company had obtained the rights to distribute to the American market and so sought to obtain the approval of the Food and Drug Administration. The drug approval process in 1960 was not the same as today. The FDA had the responsibility of evaluating the safety and efficacy of all new drugs, powers that it had received in 1938 on account of another pharmaceutical tragedy.¹² But their efforts were often focused on drugs after they hit the market, with pre-market testing and evaluation less regulated and vulnerable to manipulation.

Unfortunately for Richardson-Merrell, and fortunately for the rest of the country, Dr. Frances Kelsey^{*} had just begun to work there. Having spent many years as a researcher, she was deeply concerned about the lack of evidence for the safety of the drug.¹³ Neither Richardson-Merrell nor Grunenthal could provide any documentation to back up their claims of safety for both mother and fetus during pregnancy. Dr. Kelsey determined that there was no way that they had done the research to know that thalidomide did not cross the placental barrier. She stalled approval as long as she could, sending back their application multiple times for being incomplete. She later explained that she had a very low incentive for approving the drug, as it was not a lifesaving one. The delay

tactics worked, and she was able to keep thalidomide out of the American market until reports of its horrible effects were so widespread that countries began to take it off the shelves. ¹⁴

« An incentive is a bullet, a key: an often-tiny object with astonishing power to change a situation. »

Steven D. Levitt and Stephen J. Dubner ¹⁵

How do incentives work to make people seemingly lose their minds?

👉 To make normal people double down on their immoral decisions? In light of how numbers of drug company executives and doctors never admitted that thalidomide caused such horrible effects, it is worth explaining more about the power of incentives.

→ The initial financial component is easy to understand. Money is desirable, and therefore it is a common incentive that modifies behavior everywhere. But money alone isn't often enough. Undoubtedly if you ask people whether they would harm thousands of children for money, most would say no. Therefore, in order to understand the real power of incentives you have to look at the psychological condition they create.

Humans don't like cognitive dissonance—"the state of tension that occurs whenever a person holds two cognitions (ideas, attitudes, beliefs, opinions) that are psychologically inconsistent." ¹⁶ We engage in self-justifying rhetoric to reduce this dissonance. In the case of incentives for endorsements, the often subconscious thought process might go like this: "I am a good person. I supported

this drug. A good person would not support a drug that is harmful. So the drug can't be harmful because I am a good person." We don't see these connections laid out, and so what is produced is the opinion the drug is good without having a window into the mental gymnastics that got us there.

Carol Tavris and Elliot Aronson have written about the manifestation of cognitive dissonance due to incentives in the medical profession. "Physicians, like scientists, want to believe their integrity cannot be compromised. Yet every time physicians accept a few dollars or other incentives for performing certain tests and procedures, for channeling some of their patients into clinical trials, or for prescribing a new, expensive drug that is not better or safer than an older one, they are balancing their patients' welfare against their own concerns." ¹⁷

Consider the story of Andrew Wakefield, the lead author on the paper published in *The Lancet* that claimed it had found a positive correlation between vaccines and autism. Later debunked, but not before causing a widespread drop in vaccinations that has resulted in needless deaths, the article was retracted. He did not sign the retraction. Why?

He had "a conflict of interest that he had failed to disclose to the journal: he was conducting research on behalf of lawyers representing parents of autistic children. Wakefield^{*} had been paid more than eight hundred thousand dollars to determine whether there were grounds for pursuing legal action." ¹⁸ Tavris and Aronson demonstrate that "unlike truly independent scientists, however, he had no incentive to look for disconfirming evidence of a correlation

between vaccines and autism, and every incentive to overlook other explanations.”¹⁹



This is why understanding the power of incentives is both critical and tricky. The acceptance of an initial incentive creates a psychological state whereby we become invested in maintaining whatever story brought about that incentive, so we can justify our acceptance of it.

The greater danger to the public comes from the self-justifications of well-intentioned scientists and physicians who, because of their need to reduce dissonance, truly believe themselves to be above the influence of their corporate investors. Yet, like a plant turning toward the sun, they turn toward the interests of their sponsors without even being aware they are doing so.²⁰

If we're not aware of the incentives that direct our behavior, we can end up doing things we might prefer not to. It's also important to be aware of how other people can incentivize us to do things that go against our wishes and values—much like those who sold thalidomide for the powerful incentive of money. By being aware of the incentives that may be directing our actions, we can recognize any unsavory influences and refocus by considering what we are really valuing. We may be driven by rewards like money, attention, and power, but we may actually value things like making a positive impact on the world, kindness, and honesty. [We need not blindly follow incentives if they don't align with our values.]

—Sidebar: Motivated by Uncertainty

Motivated by Uncertainty

Humans can also be heavily motivated by uncertainty. There are particular situations in which we find it more compelling to go after a possible payoff instead of a sure thing. Why? Because it is often more stimulating, which is an incentive in itself. Think of getting together with a group of friends every Saturday to play board games. Numerous studies have shown that we would cease this behavior if we knew we were going to win every time. Winning is fun. Guaranteed winning is not.

The limit to this is when the value of the result outweighs the value of the process. Winning a game against your friends is not life-changing, and thus the incentive to have fun in the process of playing is more compelling than the incentive to be sure about winning. Conversely, if an amount of money was involved that would allow us to quit our jobs and travel around the world, we would go for the guaranteed win every time.

Conclusion

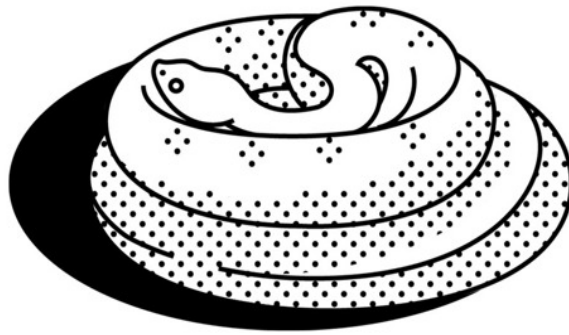
It always pays to consider the real incentives that are influencing our choices. We often tell ourselves that our motivation is based in goodness, or doing the right thing, when actually we are incentivized by the allure of rewards. It is a problem for humans that we have a hard time turning down the pleasure of immediate gains, like a hit of sugar or a windfall in our bank account, in favor of future satisfaction and reward. We often instead make choices that result in long-term negative consequences.

A doughnut may provide an immediate energy reward, but a doughnut a day for years will lead to a long-term health problem. Making choices to maximize your satisfaction today often leads to less reward down the road. Sometimes, then, it is beneficial to frame your choices in terms of the eventual rewards you desire and evaluate incentives in terms of their ability to get you there.

Knowing how incentives work to motivate us can help us be less easily manipulated. Advertisers know when we are more likely to be vulnerable and bombard us with incentives for short-term pleasure. Sometimes it's okay to give in. You're hungry, and those doughnuts look really good. We need, however, to be mindful of the power of incentives over ourselves and others as we navigate through the incentive laced territory of daily life.

Biology

Tendency to Minimize Energy Output



—
Least effort principle.

Tendency to Minimize Energy Output

All living beings require energy to perform their daily functions, including sleeping. Over time, species have developed different mechanisms to increase their energy efficiency. The tendency in organisms to conserve their energy is what ensures they will have extra to draw on in times of increased need. For humans, we have to be careful though, to make sure minimizing our energy output increases our effectiveness and doesn't lead to laziness.

Saving it up

There are many cold-blooded species. By not having the biological requirement to maintain stable internal body temperatures, these animals do not need to expend energy for this purpose, allowing them to save energy for other activities. Some turtles, for example, can spend winters at the bottom of very cold waters without moving because they have body parts that can maintain their integrity in extreme temperatures. Moreover, these turtles have powerful mechanisms to direct blood flow to essential organs during these times. They also have advanced energy storage abilities which they make use of when they are in nutrient-deficient environments.

Shark skin is another example of biological energy efficiency. The skin is composed of backward-structured scales that reduce water resistance. Along with the wavy motion in which they move, these scales allow sharks to swim at incredible speeds in an energy efficient manner. There is a significant increase in survival potential for organisms that develop efficiency in handling the ongoing, repetitive requirements of their environments.

Change is costly for most organisms. It can be easier to keep doing whatever has guaranteed their survival so far than to try something new that might fail and waste energy or endanger them.

→ The instinct to minimize energy output can lead us to be resistant to change or risk-taking. Using this model as a lens help us better understand our default thinking tendencies, and how our patterns of movement impact our physical environments.

—Sidebar: Desire Paths

Desire Paths

Cutting through forests and fields, snow and debris, are paths created by the feet of people who wanted to get between two points as efficiently as possible. Our tendency to minimize our energy output means that we don't always defer to the paths that have been set out for us. Sometimes these desire paths unwittingly trample on sensitive vegetation or cause other environmental fractures. But other times they are used by city or park planners to design traffic flows and the spaces around them. When designers and planners don't take our idea to minimize energy expenditure into account, we end up with spaces that impede our movement and which people must use in a different way.

« The way people solve problems is first by having an enormous amount of common-sense knowledge, like maybe 50 million anecdotes or entries, and then having some unknown system for finding among those 50 million old stories the 5 or 10 that seem most relevant to the situation. This is reasoning by analogy.»

Marvin Minsky¹

The lazy brain

Humans, like every other species, are energy minimizers—intensely so. Our brain has developed as an energy minimizer, as have the rest of our body parts.

Psychologists have a word for the efficiency mechanism in how we think: heuristics. When we're thinking of making a decision, large or small, we use shortcuts developed from our long experience in the world; in chess terms, we do not consider 10 million different moves, but instead rapidly choose the two or three that are most likely to work.

Decisions carry a “cognitive load,” meaning they require brain power. Taking the time to analyze 10 million moves requires significant effort, which uses significant energy. We cannot possibly stop in our day to do the work required to make the most optimal decision in all cases.

Heuristics are shortcuts and thus require us to expend less energy. The results may not always be the best that could have been (they usually aren't), but they are often good enough for whatever situation we are in. In a process known as “satisficing,” we'll often search for the first thing in our brain that satisfies our minimum acceptable conditions. This saves time and energy, but it doesn't mean we get the best outcome.

Some heuristics develop based on previous experience. These are going to be the most reliable if the prior experiences are themselves fairly consistent. Heuristics are more likely to be accurate in situations with a stable environment, frequent exposure (large sample size), and immediate, unambiguous feedback.

↳ Blink

In his studies of firefighters, for example, Gary Klein demonstrates the accuracy of the quick decisions that firefighters make in the course of their jobs, and how this accuracy increases over time.² Why? Fires are governed by rules of chemistry and physics, and thus exhibit consistent behaviors. The more you interact with fires the more you will build knowledge that allows you to intuitively make good decisions in future fire situations.

The more unreliable the previous experience, such as by being too complex to identify true cause and effect or being based on too small a sample size, the more likely your heuristics aren't going to be particularly useful. Clinical therapy has this problem. The nature of the situation makes it hard to receive immediate feedback on if the therapy is actually working. There could be a host of other factors that contribute to eventual improvement, even simple regression to the mean. The confidential nature and often long duration of the therapy process makes it very hard for each individual practitioner to build experience over a large sample size.

Other heuristics seem to be built into how our brains operate.

★ The most famous of these—anchoring, availability, and representativeness—were extensively studied by Daniel Kahneman and Amos Tversky. They demonstrated that these heuristics are essentially innate to the human brain. They are just how we do things, even when it's comparatively simple to demonstrate that they are often ineffective and filled with bias.

In *Thinking Fast and Slow*, Kahneman also writes of the affect heuristic “in which people make judgments and decisions by consulting their emotions: Do I like it? Do I hate it? How strongly do I feel about it?” Kahneman explains that “the affect heuristic is an

instance of substitution, in which the answer to an easy question (How do I feel about it?) serves as an answer to a much harder question (What do I think about it?).”³ Answering the easier question is not necessarily a bad thing; we substitute our emotional response for a thinking response because we have to. We absolutely must react, and trust our reactions, in order to process the many interactions we have in a day. Our brain goes to the emotional reaction because it takes less energy to figure out how we feel about something than it takes to do the work to have an informed perspective. Often this is useful, as it lets us put minimal effort into decisions of little consequence, such as buying laundry detergent based on your love of its smell. Sometimes, however, we would increase our skills and knowledge if we put the effort into answering the harder question of what we think about something and not relying on the emotional shortcut.

Heuristics exist because they are way more efficient—efficient in terms of energy use, not necessarily efficient in getting the most useful answer. As Kahneman explains, “A general ‘law of least effort’ applies to cognitive as well as physical exertion. The law asserts that if there are several ways of achieving the same goal, people will eventually gravitate to the least demanding course of action. In the economy of action, effort is a cost, and the acquisition of skill is driven by the balance of benefits and costs. Laziness is built deep into our nature.”⁴

We often do what feels good. Using less energy often feels better than mentally taxing ourselves. We fall to the level of our evolutionary programming, not our best, often naive, intentions.

When we think we can overcome our basic instincts, we forget that our brains want to do the exact opposite.

The good news is, when we are willing to expend the energy, Kahneman offers a couple of corrections for the tendencies of heuristics: remember the base rates and pay attention to the quality of information.⁵ If you know that 20% of people like chocolate ice cream and 80% like vanilla, you can easily guess that your new friend prefers vanilla. Even after you are exposed to a series of news stories about a current trend of athletes to partake in cocoa-avocado ice cream, you can still safely guess your friend's preference of vanilla. Always go back to the base rates and then ask if this new information you have could affect those rates substantially enough for you to change your guess. Without this vigilance, the availability of the news stories or the anchor of the word *cocoa* would likely prompt you to choose chocolate when asked to guess your friend's favorite ice cream. But this new information has no relevance to your situation, unless your new friend is a professional football player. Your best guess is the probability indicated by the base rates.

Thinking that expends the least amount of energy possible is often what feels most natural. Sometimes though, we have to invest extra calories to get more relevant, useful results.

To cubicle or not to cubicle



Designing environments for focus, to give people the space and time to do what they actually need to do, will allow for maximum energy efficiency. Like the hydrodynamic shark whose scales allow for minimum water resistance, we need to develop mechanisms that promote efficiency in the ongoing, repetitive activities we undertake every day.

Open-plan homes can be beneficial in reducing energy expenditure. With an open plan living space, you can cook dinner while keeping an eye on your kids. You can spot the keys you left in the hallway from the couch. You can move around with ease, transitioning between different spaces and activities without needing to open and close doors. Natural light can flood in from the right angles. Adapting the space to different needs, such as moving the living room furniture to make space for a dinner party, is simple.

But our homes are very different from our offices. They're a space where we're meant to be surrounded by people we trust, where we can let our guard down and relax. We can reshape them at will, and we're not confined by someone else's rules. Plus, even mostly open-plan homes tend to have private spaces, such as bedrooms, bathrooms and studies to retreat to.

When it comes to offices, open-plan layouts don't reduce overall energy expenditure. They may make it easier to move around, but they vastly increase the effort needed to focus and get work done—which are what matters most in an office. In an open office, workers have to ignore the constant onslaught of stimulus and disruptions—the ding of phones, the slurping of drinks, the

sound of music leaking out of headphones, the clatter of feet, the sound of laughter, the annoyance of coworkers tapping on shoulders to ask questions, the slamming of doors, and so on. Not only are they expending energy on their work, they're also expending energy on ignoring distractions, which means work is even more exhausting, without more getting done. Without control over when and where we interact, we get overloaded and drained.

Furthermore, people talking in an open office have no control over who is listening and who isn't. They can't form strong, one-on-one social ties. Social interactions become more superficial and performative when there's always an audience. When people need privacy and don't have spaces that allow it, they turn to means of communication that can't be overheard. It takes less effort than staying vigilant to see who is listening in.

A large part of the appeal of open offices to employers and designers is that they reduce costs. They also look impressive on the recruitment page of a website or when showing an investor around. However, any claims that they also increase collaboration and reduce information silos tend not to be substantiated by research, which means that they actually are likely to increase costs in the long term. For example, face-to-face interactions decrease by as much as 70%, with more emails, messages, and other forms of digital communication making up the difference.⁶

What is really interesting is that open-plan offices are far from modern and have indeed been the standard throughout much of history. Although their design has taken on many different iterations, their deficiencies are not new.

Frank Lloyd Wright,^{*} the iconic architect, designed the first modern open office in the 1930s for the Johnson Wax headquarters. The headquarters features incredibly high ceilings that let in natural light, with delicate supporting columns designed to look like trees. Despite its industrial surroundings, the inside of the building felt airy and natural. Administrators had their own private offices on a mezzanine level so they could focus and enjoy privacy while still being part of the office floor.⁷ Wright designed the desks to be spaced out enough to reduce distraction and enable free movement within the space.⁷ The columns and filing cabinets acted as unofficial divisions too. With the success of the Johnson Wax headquarters, open-plan offices became increasingly popular, but they lacked the careful design and ample space of Wright's work and devolved into rows of cramped desks.

In the 1950s, a German design group designed the "office landscape," with partitions dividing different parts of companies up in a manner designed to reflect the way information needed to flow. Essentially, the office landscape was about minimizing the energy people needed to collaborate or to focus.⁸ And if someone's needs changed, they could just move the partitions around.

In the 1960s, designer Robert Propst^{*} saw some of the problems with open offices and, to expand upon office landscaping, developed the Action Office, designed as a middle way. It involved flexible furniture and movable dividing walls that could be adapted to suit the day-to-day needs of employees. The Action Office was the perfect compromise to support both connection and privacy, but it was too expensive to become mainstream. Employers simply took the basic notion of dividing walls and ran with it, creating the

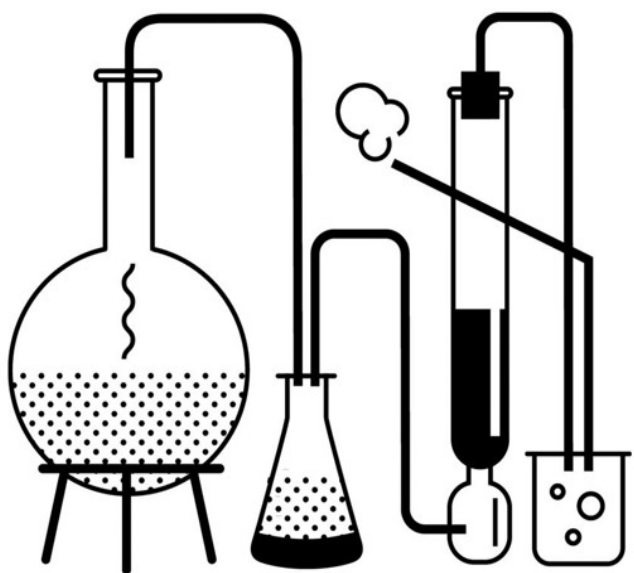
notorious cubicle-farm office where everyone sat in tiny boxes, tapping away. Modern open offices were in part a means of stepping away from this imposed separation.

So, it's a cycle of open offices as a reaction against cubicles, then cubicles as a reaction to open offices. What's clear is that effective office design needs to recognize and honor the human tendency to minimize energy output in the same way Wright originally did. People need the space to focus as well as to move around, instead of environments that increase the energy required to get work done.

Conclusion

Sometimes our tendency to conserve energy helps us, and sometimes it hurts us. While minimizing our output ensures we will have extra to draw on in times of increased need, it can also get in the way of learning. Experience doesn't become learning without reflection, and reflection is an energy expenditure.

If we want to develop our thinking and get the most out of our environments, then we have to be aware of the natural tendency to minimize energy output and correct for it where doing so creates value.



Putting It All Together

The models in this book give you the tools that you need to better understand the world. We've explored fundamentals from physics, chemistry, and biology to show you how scientific concepts have wider applications in all sorts of everyday situations. The more tools you have in your mental toolbox, the more likely you are to make better decisions. In turn, better decisions should free up your time and help you live a more meaningful life.

The world is fundamentally connected together. However, the ideas in this volume are presented without connection deliberately, leaving to you the building of your own latticework of mental models. While challenging, this is the work of how we assimilate information and make it usable. First you have to develop the models in your mind by learning about the fundamentals, applying them to situations in your life, and learning from the results. Then you have to keep using your latticework, refining and updating as you go. You must always be willing to adjust for new information, but be knowledgeable enough to be selective about what you let in.

We recommend journaling your successes as well as your failures to stimulate learning from your experiences. While most people assume that experience is the key to learning, the key is actually reflection. Journaling works because it prompts reflection. Keeping a journal, where you chronicle your use of the models and your expected results, allows you to build a repertoire that you can begin to rely on time and again. Using the models does get easier.

What is most important, however, is to find a method of reflection, feedback, and learning that works for you. Reread the

chapters. Fill in the margins. Make a note about any relevance that pops into your mind. Usually when we finish a book that inspires us, we get excited and want to make changes right away. Then we get caught up in something else and forget about it. Before life gets in the way, take a step in the direction you were inspired to go. Pick one model and use it today. Test it out. Make the models in this book, and the rest of the series, something you reach for in your everyday life. They're too useful to leave on a bookshelf.

This is a multi-volume series. The next book, Volume3, covers models from systems and numeracy. This book will present the fundamentals from these two disciplines that govern our world and show how we can harness them to improve our thinking and outcomes in a wide variety of situations. Systems and numeracy models have broad applicability and are the best source we have for trying to anticipate and plan for the future.

As the series goes out into the world, we will post resources on our website at fs.blog/tgmm to help you integrate the models into your thinking. Before long, when it comes to using mental models, you will be capitalizing on the powerful momentum you have created. These ideas will become such an integral part of the fabric of your thinking that it will become impossible to view any situation without the valuable lenses they provide.

Mini-Bios

Relativity

* Rifa'a Rafi' al-Tahtawi - (1801 - 1873). Egyptian writer, teacher, and scholar. Tahtawi first traveled to Paris at the age of about 25, kicking off his fascination with the relationship between East and West. He spent much of his life considering how his culture could modernize Islamic principles and otherwise reconcile with a changing world. In particular, Tahtawi translated thousands of European texts into Arabic to allow the wider dissemination of knowledge between cultures.

Reciprocity

* Norman Bethune - (1890 - 1939). Canadian physician and medical innovator. Bethune developed the first mobile blood transfusion unit and brought modern medicine to China. His legacy has been somewhat obscured in North America due to his writings in support of Communism.

Thermodynamics

* Hadrian - (76 - 138). Roman emperor. As one of the 'Five good emperors' according to Machiavelli, Hadrian turned his focus from growing the Roman Empire to strengthening and merging its existing land into a cohesive whole. His most enduring creation was Hadrian's Wall, delineating the northern border of Roman-controlled Britain. He is also notable for being the first openly queer Emperor, having founded a cult dedicated to the worship of his lover, Antonius.

* Hans Christian Andersen - (1805 - 1875). Danish author and poet. When you think of fairy tales, you're likely almost exclusively thinking of Andersen's work. The thousands of stories he wrote have become definitive, providing a set of narratives suitable for limitless revamping, remixing, and reshaping. He also wrote autobiographies, plays, travelogues, and other texts, but these are less well known.

Inertia

* Marcus Vitruvius Pollio - (app. 80 BCE - app. 15 BCE) - Not much is known about the life of Vitruvius, except that he served in the Roman army under Caesar. His *De architectura* inspired the famous Vitruvian Man painting by Leonardo da Vinci.

* Alice Hamilton - (1869 - 1970). American scientist, physician, and author. A fearless trailblazer, Hamilton consistently broke down barriers and ignored social norms. Hamilton led the growing field of occupational health, launching research into the harmful effects of substances ranging from lead and carbon monoxide to mercury and radium. She lived to 101 and won innumerable awards for the strides she made in improving society.

* Lise Meitner - (1878-1968) - Austrian-Swedish physicist. She made numerous contributions to physics in radioactivity research. Although she discovered nuclear fission, she was never a supporter of its eventual use in weapons. The chemical element 109 was named meitnerium in her honor.

Friction and Viscosity

* Taiichi Ohno - (1912 - 1990). Japanese industrial engineer and manager at Toyota Motor Corporation. Ohno helped found the Toyota Production System, a method of reducing costs and increasing flexibility in manufacturing. He was strongly opposed to wasteful practices and advocated for perseverance and learning through experience.

Velocity

* Napoleon Bonaparte - (1769 - 1821). Emperor of France and King of Italy. A difficult figure to define in brief, Napoleon emerged from the chaos of the French Revolution as a smart, strategically minded leader who expanded the French empire across a sizeable portion of Europe. He had a strong influence on French education and military organization. However, he was far from infallible, facing notable defeats during his invasion of Russia and the Battle of Waterloo.

* Mae West - (1893 - 1890). American actress, writer, and comedian. Commencing her career at the age of 14 as a vaudeville performer, West soon transitioned to burlesque, then Broadway, before making it to Hollywood in her late thirties. At one point, she was the second highest paid individual in the US, maintaining tight control of her image and possessing a keen sense for attracting publicity.

Leverage

* Eleanor of Aquitaine - (1124 - 1204) Duchess of Aquitaine, Queen of France and then Queen of England. Eleanor lived a long, dramatic life, as one of the wealthiest and most powerful women of her time and place. Her legacy has had to overcome many myths and

lies, as many of her (male) contemporaries, not understanding women at all, chronicled her as a harlot and temptress who had nothing more valuable than beauty.

Activation Energy

* Thomas Sankara (1949–1987). Burkinabe revolutionary and president of Burkina Faso. The sheer breadth of Sankara's achievements and significance to the people of Burkina Faso make it hard to believe he was in power for a mere four years. After seizing control of the country in a coup, he worked to transform everything from healthcare and literacy to gender equality and government spending.

Catalysts

* Louis XV (1710–1774). King of France. Coming from the House of Bourbon, Louis effectively came into power at the age of five and ruled for 59 years. He had some successes but also faced a number of embarrassing defeats, and his poor choices lit the fuse for the French Revolution.

Alloying

* Tecumseh (1768–1813). Shawnee Indian leader and warrior. Spurred on by the death of his father in a battle with the French, Tecumseh dedicated his life to leading fights against the white settlers to protect his people's land. He had a number of successes but was finally defeated in battle.

* Isaac Brock (1769–1812). English Major-General and administrator. Was one of the few who understood war with United States was likely, consequently seeing the British well prepared for attack.

* Aristotle (384–322). Greek philosopher and scientist. In seemingly every field, it can feel as if all roads sooner or later lead back to Aristotle. A philosopher of unparalleled significance, his work covered a broad yet organized range of topics. Few details of his life and little of his original work have survived. Aristotle was a student of Plato and tutor of Alexander the Great.

* Leonardo da Vinci (1452–1519). Italian polymath, artist, architect, scientist, and musician among other things. The quintessential and original Renaissance man, Leonardo had a seemingly limitless ability to master new fields. Today we primarily remember him as one of the most skilled artists of all time, though only a few of his paintings survive.

Evolution Part Two: Adaptation Rate and the Red Queen Effect

* Heinz Guderian (1888–1954). German general and military theorist. He made it to the end of World War II, surrendering to the Russians. After the war he managed to convince himself that his part of the Nazi army fought a “clean war” and was not guilty of any war crimes.

* Hedy Lamarr (1914–2000). Austrian-American actress and inventor. Lamarr’s acting prowess and beauty often distract from her other talents; she worked with George Antheil to develop the technology that now forms the basis of Bluetooth and some forms of Wi-Fi. She also helped fundraise during wartime and produced films.

* George Antheil (1900–1959). American composer, musician, inventor, and writer. Antheil worked with Hedy Lamarr on the technology that is now part of Bluetooth and Wi-Fi. He was a versatile musician, creating scores for movies and television programs, as well as a productive writer. Antheil’s music was unusual and often controversial.

Ecosystem

* Bill Walsh (1931–2007). American football coach. Walsh developed the “West Coast Offense” during his tenure with the Cincinnati Bengals, which he continued to develop and refine during his success as head coach of the San Francisco Forty-Niners. The “West Coast Offense” changed professional football and continues to influence the way the game is played.

Self-Preservation

* Gioconda Belli (b.1948). Nicaraguan writer, poet, and activist. In her early twenties, Belli joined the Sandinistas, a socialist political party aiming to overthrow the existing dictatorship. Her allegiance to the group has characterized much of her life since, forcing her to spend time away from her country at various points. Belli has also published a number of feminist books and poems, and has been rewarded numerous times for her poetry.

Cooperation

* Ethel Stark (1910–2012). Canadian violinist and conductor. Stark was a successful violinist in New York before becoming the first conductor of an all-female symphony in

Montreal in 1940. She was made a member of the Order of Canada, the highest honor in the country, in 1979.

Hierarchical Organization

* Maximilien Robespierre (1758–1794). French lawyer, politician, and revolutionary. The French Revolution was such an eventful, tumultuous time that it can be a challenge to identify the most significant events and periods. Nonetheless, Robespierre was unquestionably one of the main players, as president of the Jacobin political club, then first deputy for Paris to the National Convention. He helped lead the abolition of the monarchy and the execution of the king.

* Charles Maurice de Talleyrand-Périgord (1754–1838). French politician and diplomat. Much like Robespierre, it is impossible to discuss the French Revolution without considering the influence of Talleyrand. Holding a series of prominent roles in the French government, he was a chameleonic figure, able to adapt to any political system.

Incentives

Ping

* Dr. Frances Kelsey (1914–2015). Canadian-American pharmacologist and physician. A somewhat heroic figure in the history of medicine, Kelsey helped save or improve the lives of countless people through her work with the FDA. In particular, she helped unearth the teratogenic properties of thalidomide and ensured its removal from the market. As a result, the FDA implemented stricter standards for the approval of new drugs.

* Andrew Wakefield (b. 1957). English anti-vaccine activist and former doctor. Wakefield rose to prominence after publishing a paper claiming a link between vaccines and autism. Although the paper was soon proven to be a fraud motivated by financial gain and Wakefield was stripped of his medical credentials, it sparked an anti-vaccine movement that continues to have disastrous effects.

Tendency to Minimize Energy Output

* Frank Lloyd Wright (1867–1959). American architect, designer, writer, and educator. For over seven decades, Wright worked tirelessly to create a new vision for American architecture, designing buildings that blended seamlessly with their environment. He designed over 1,000 buildings, wrote 20 books, and taught widely.

* Robert Propst (1921–2000). American inventor. Propst has the dubious honor of having spawned the much-maligned, though now sorely missed, office cubicle culture. But his

original work, the Action Office, was a fresh, carefully designed system of reconfigurable elements intended to energize workers. Propst filed over 120 patents on his work.

