The Great Mental Models Volume 3

What’s in it for me? Become better at addressing, solving, and preventing problems in everyday life.

If you’ve ever driven a car, you know about blind spots – the parts of the road that you can’t see through your windshield. To get a full idea of your surroundings, you need to look into your rearview and side-view mirrors, as well as over your shoulder. Similarly, to get a fuller understanding of the world, you need to look at it in more than one way. By cultivating a variety of mental models, you’ll reduce the blind spots in your thinking.

A mental model is a reliable framework for how something works. You already use mental models to cognitively process the world around you. But by incorporating stronger and more diverse mental models from various disciplines, you can navigate the world even more effectively. In the following blinks, you’ll discover seven of the core mental models from two disciplines: systems thinking and mathematics. You’ll see how you can apply these models to improve your ability both to solve problems and to prevent them in the first place.

The more mental models you can grasp, the better your problem-solving skills will be.

Imagine you have a toolbox – but it only has a hammer in it. That’s going to come in handy when you need to pound a nail. But what about when you need to tighten a bolt? A hammer won’t be much use; in that situation, what you need is a wrench. Your knowledge toolbox works in the same way. Everyone uses a set of mental tools – also known as mental models – to understand the world. But each model is useful for different problems and situations. The best way to improve the quality of your thinking is to broaden your repertoire of mental models. The key message here is: The more mental models you can grasp, the better your problem-solving skills will be. The world is incredibly complex. It constantly presents the human mind with overwhelming amounts of information. Mental models are tools for simplifying all of that data into organized portions that you can mentally digest. Most people stick to a specific set of mental models – usually from their given discipline. If you’re a psychologist, you’ll probably think in terms of incentives. If you’re a biologist, you’ll think in terms of evolution. If you’re an engineer, you’ll think in terms of systems. All of these models are useful because they’re durable representations of how the world works; they won’t ever change. But, as we’ve seen, not all tools are useful for all problems. It’s only by combining models that you can broaden your perspective and look at one problem from multiple angles. This way, you’ll be more adept at making decisions that can generate positive changes. In the following blinks, we’ll draw on wisdom from models of systems thinking and mathematics in particular. Systems exist everywhere in the world, and they play an important role in your day-to-day life. Mathematics, too, serves to explain much of how the world works, using patterns of logic. The two disciplines are largely interconnected – just as the models themselves. These disciplines might sound abstract at first. But by breaking each one down, you’ll see that the models have practical – as

well as metaphorical – applications across daily behaviors and interactions. Meanwhile, the more you reflect on your use of individual mental models, the better you'll be able to identify which ones are best for a given situation. Let's dive in.

Identify the right feedback loops to adjust for your own success, as well as others'.

Say you're walking down the street when you bump into a friend. What do you do? You probably won't just ignore him and walk on. You'd be fully within your rights to do so, but then your friend would be upset. So, to avoid negative reactions, you're more likely to stick to social norms like saying hello. Feedback loops – including things like social disapproval – are a common component of many systems in daily life. In fact, feedback loops serve as the basis for all civilization. Once you start looking for them, they'll appear everywhere. Tuning into how they work as a mental model can help you tweak your behavior to be more successful. Here's the key message: Identify the right feedback loops to adjust for your own success, as well as others'. It helps to understand that there are two types of feedback loops in systems theory: balancing and reinforcing. On one hand, balancing feedback leads to equilibrium. Think of how a thermostat works. First, you input the temperature you want. To stay in line with your settings, the thermostat continuously uses feedback about the room temperature to adjust your furnace's output. Balancing feedback is usually most useful in systems that don't fluctuate too much. On the other hand, reinforcing feedback loops lead to continuous change in one direction. This can be seen in the cycle of poverty, which becomes self-reinforcing in response to limited opportunities for social mobility. It's important to pinpoint reinforcing loops; breaking out of them usually requires the introduction of completely new conditions rather than continuous reinforcement of the same. The most practical application of feedback loops is in learning productivity. Your first try at anything, whether it's a new language or an instrument, won't be very good. But with every attempt, you get more feedback. If you pay attention to that feedback and incorporate it into your behavior in incremental stages, you become more capable. Just remember that immediate feedback isn't the only type worth paying attention to. Particularly with complex systems that have multiple feedback sources, it can be tricky to see that adjusting to just one may affect the overall system. For example, when you eat junk food, there is an instant hit of pleasure that implies positive feedback. But if you repeat that behavior over time, feedback might imply negative consequences like type 2 diabetes. To prevent that loop from beginning, ensure that your initial feedback is a reliable indication of long-term effects. To do this, reflect on the feedback you get in everyday life – and how you respond to it. Recognize that the more quickly you adjust your behavior according to reliable feedback, the more effective your efforts will be.

Boost your innovation abilities by preventing – and leveraging – bottlenecks.

Maybe you've heard of the Trans-Siberian Railway – also known as the longest railway

in the world. At 9,500 kilometers, it spans all of Russia, from St. Petersburg to just east of North Korea. So, as you can imagine, when the Russian state began building it in the late nineteenth century, the scope of the project was so great that delays were inevitable. There was a continual shortage of construction supplies. As soon as that was fixed, weather-affected delays took hold. Once the weather improved, a physical barrier came up: there was a massive lake in the middle of the planned railway that would call for a total redesign of the route. In fact, the first Trans-Siberian track was rendered almost unusable, and Russia had to rebuild the railway multiple times. These problems are examples of a bottleneck, or the slowest part of a system. And patching up bottlenecks with short-term solutions just enables them to multiply and move around a system, leading to far-reaching consequences. The key message is this: Boost your innovation abilities by preventing – and leveraging – bottlenecks. Instead of addressing every bottleneck as it appears, consider the first one you encounter as an indication of future bottlenecks. This way, you won't risk simply transferring the problem to somewhere further down the line. Whenever you encounter a bottleneck, ask how the system could be designed to avoid that problem in the first place. This is where it stops being an inconvenience and can be leveraged to propel innovation. For instance, during World War I, many people, including children, became malnourished due to the frequent unavailability of food. This led one German doctor, Kurt Huldschinsky, to research alternative ways to meet people's nutritional needs. Through his research, he found that children's vitamin D levels rose after he sat them in front of a sun lamp. It was a bottleneck – lack of food resources – that led him to innovate a new way of addressing the problem of malnutrition. Today, sun lamps are used to treat dermatological and psychological conditions alike. This shows that bottlenecks aren't all bad. In fact, when there are no severe bottlenecks, there's no motivation to innovate. But when faced with a lack of resources, you're forced to be more creative – and that leaves you better off in the long run.

Reduce risk and prevent disaster by knowing when to incorporate a margin of safety.

Imagine you've just gotten a drug prescription from your doctor. It has two main components: the medicine you're supposed to take, and how much of it you need to treat your ailment. To determine the right dosage for your treatment, pharmacologists have to make two calculations. First, they calculate the lowest possible amount of a medication that can achieve a meaningful benefit. Next, they calculate the largest amount the average patient could take without suffering harm. These calculations are collectively known as a margin of safety – one of the key mental models in systems theory. The key message here is: Reduce risk and prevent disaster by knowing when to incorporate a margin of safety. A margin of safety is the space between what a system is required to handle and what it is actually capable of handling. You can think of it as a buffer against the unexpected, leaving space for you to adapt when something goes wrong. The greater the threat of system failure, the more important it is to plan for the worst. Jacques Jaujard, the director of the French National Museums during World War II, understood this well. Before the war started, many people were optimistic that the Nazis would not invade Paris and plunder its artistic treasures. But Jaujard was less hopeful. In anticipation of the worst-case scenario, he ordered the Louvre Museum in Paris to be emptied out. Of course, he couldn't be sure that the Nazis would invade. But

the threat was too great to leave things to chance. So, out of extreme prudence, he dispersed the artworks across multiple locations – and even asked curators to sleep next to the most important pieces. By the end of the war, the Nazis had plundered around five million artworks from different countries. And yet, thanks to Jaujard's margin of safety, the Louvre's collection survived. Aside from planning for the worst, you can also create backups to make a system resilient in high-stakes situations. If you're going on a solo hiking trip in the middle of nowhere, for instance, you'll probably want to take your smartphone. But you'll also want backup communication tools, like a radio or tracking device, in case your phone runs out of battery or you lose network connectivity. After all, every system breaks down at some point. If you don't account for margins of safety and prepare backups, your system is destined to fail. The key is to anticipate the worst, and plan for it.

Construct reliable algorithms in your mind to improve your chance of success.

Let's say someone asks you to press "enter" on your keyboard every minute, for eight hours a day. Doesn't sound like a terribly exciting way to spend your time, does it? For most people, engaging in repetitive actions over and over again gets boring very quickly. That's why we codify machines to do tasks for us. To tell those machines what to do, like press a button every minute, we use one of the most important models in human civilization: the algorithm. In fact, all systems – not just computers – need algorithms to function. Here's the key message: Construct reliable algorithms in your mind to improve your chance of success. Algorithms are developed to produce a certain output in response to a given input. You can think of it as an if-then process that is consistently repeatable. An algorithm can be simple, like a clear set of instructions for a recipe. You put the ingredients together, run them through a process, and, in the end, you get a cake. An algorithm can also be complicated, like a computer algorithm designed to predict future crime locations. For the best chance of achieving a predictable outcome, all the parts of an algorithm need to be aligned toward the same goal. The question is, how do you know which inputs will result in the desired outputs? Well, you can actually use "algorithmic thinking" to help you decide what inputs to feed into your system in the first place. In the 1920s, Bayer, a German pharmaceutical company, exemplified the power of algorithmic thinking as it pursued a cure for major bacterial infections, including tuberculosis and E. coli. Until then, almost no antibacterial compounds had been discovered. So Bayer's scientists decided they would test every single chemical compound against the most deadly bacteria. During the research, thousands of mice died. But despite the negative results, the scientists at Bayer did not change their method. They continued to test every chemical, keeping careful records of each test. Finally, in 1932, the methodology paid off when Bayer created the world's first broad-spectrum antibiotic. This goes to show that as long as your algorithmic process is accurate, it will eventually produce results that will help you refine your inputs. In other words, you don't need to know the answers – you just need a good algorithm for finding them.

Embrace randomness to enhance your

creativity.

Have you ever had one of those days where everything seems to go wrong? In the span of a few hours, you lose your phone, stub your toe, get a parking ticket, and drop your groceries in a puddle. It would be easy to think the world is out to get you. But this is just an illusion. From a mathematical perspective, your series of misfortunes was pure randomness at play. The key message is this: Embrace randomness to enhance your creativity. You can think of randomness as, to quote the authors, “the opposite of predictability and order.” Mathematically speaking, life is random. But since the human mind is designed to create order where there is none, true randomness can be a difficult concept to grasp. When you open a history book, you’ll notice that it has a beginning, middle, and end. But this sense of order only emerges in hindsight. Actually, what happened in the past was random, just as the materials used in the process of writing history are random. For instance, many historical records don’t survive or are ignored. And yet, when we look back on history, we tend to digest it as a structured narrative and rely on it to understand the world. It’s as if life presents you with a set of dots, and your mind is constantly drawing connections between them – even if there aren’t any. This struggle to grasp randomness means we usually behave more predictably than we think. And when asked to make a random choice, we tend to fall into certain predictable patterns. This is especially true when we’re under pressure. Say someone asks you to pick a random number between one and five. The mentalist and magician known as Banachek found that most people pick three. When asked to name a shape, most people will opt for a square. For a flower, they will usually say a rose. This tendency toward pseudorandomness can be unproductive, particularly with artistic endeavors. Say you’re writing a novel. Instead of planting yourself in front of a computer every day waiting for magic to strike, recognize that ideas are random. In other words, they don’t come from sitting at a desk. They can come when you’re changing a diaper, washing dishes, or on your morning commute. If you tap into the randomness of your process, you allow yourself to be more creative – and you’ll come up with less-predictable ideas.

Reap exponential gains by reinvesting in experiences that compound.

Maybe you have a savings account. You know that the longer you leave that money untouched, the more savings you’ll have. This is thanks to the concept of compound interest. Compounding is a core mental model of financial systems. It indicates that the longer you let your gains compound, the more dramatically they will increase. But it’s not just money that compounds. Everything from knowledge to relationships has a capacity for exponential growth if you make continual investments. The key message here is: Reap exponential gains by reinvesting in experiences that compound. When the money you deposit in your savings account earns interest, you don’t usually take it out and spend it right away. The point is to continue depositing more money into your account in order to increase the amount of funds earning interest. In the same way, to make steady gains in your everyday life, you have to reinvest continuously in your knowledge and experience. Unlike with money, compounding as a mental model can’t be applied literally here. After all, knowledge and relationships can’t really be measured quantifiably. But it’s still an incredibly useful metaphor that can help you reap long-term benefits. On one hand, compounding helps us accrue more knowledge as a society. For instance, during the first century CE, Jewish people were mostly farmers. But their

culture was also the only one that required fathers to formally educate their sons, starting at the age of six. Over the next millennium, investment in these early education norms compounded. As changes in the world economy began to value workers with an understanding of words and numbers, Jewish people were consistently able to move into more financially rewarding professions at comparatively higher rates than people from other backgrounds. But compounding is useful on an individual level, too. Take the example of Mireya Mayor, a wildlife correspondent for National Geographic. On one dangerous expedition to Tanzania, she faced illness, mud up to her waist, snakes and crocodiles, and insufficient clothing. In her account of the expedition, she recalls how she endured it by drawing on an experience from high school. As a cheerleader, she'd had to dance in front of 75,000 fans in scorching heat after twisting an ankle – all while grinning. Let's face it: most success is a result of compounding. If you recognize that each day, you will be more likely to choose experiences that lead to future success.

Expand your understanding of the world through the power of sampling.

Imagine you want to investigate the color of swan populations. If you go out to your neighborhood ponds to collect data, you might conclude that all swan populations are white. But if you were to expand your research sample and study a larger number of swans from across the country, you would discover that some are actually black. When you want to get representative information about a population, you usually need to look at a sample – meaning a part of that population. But if that sample is not truly representative, you risk being misled. Here's the key message: Expand your understanding of the world through the power of sampling. Sampling is a particularly common measure in scientific studies of people, especially statistics. In many societies, statistics often determine how resources are allocated. That's what makes it so important for measures to be accurate. Thinking about sample size shows how samples can counter some forms of bias. For example, if you move to a big city where you're exposed to a large sample of diverse people, you may end up with fewer prejudices. Similarly, if you read books from across various disciplines, you may become more open-minded. But gathering representative samples takes effort. In fact, sampling can reinforce bias if it's done haphazardly. The first factor to take into consideration is sample size. The higher the number of participants in a study, the lower the margin of error – and the more likely it is that the study accurately generalizes the whole population. It's important to acknowledge that one measurement isn't enough. For example, most people tend to rely on anecdotes to get a sense of the world. But they forget that an anecdote is just a sample of one – so it can't be a reliable representation. In addition to being large, samples need to be random in order to be representative of a varied population. This means every subject within the population should have an equal chance of ending up in the sample. You can't study the behavior of three-year-olds in California and then make universal deductions about children. Rather, you have to expand the variety of your sample. The same applies in your personal life. Remember to scrutinize the quality of your samples, including your generalizations about the world. When your decisions affect others, ensure that you're equipped with information that is truly representative of those people. This way, you'll minimize risk and maximize reward.

Final summary

The key message in these blinks: Integrating mental models from systems and mathematics can help you overcome blind spots in your thinking. Challenge your perspective on the world by reflecting on it through the lens of systems theory. Models from mathematics can also help you become more tolerant and enhance your creative capabilities. By integrating models from these disciplines as much as possible, you'll be sure to sharpen your problem-solving and decision-making skills. Actionable advice: Put your mental models into practice. The first step in learning is to expose yourself to new information. But if you want to benefit from the knowledge in any practical way, you also need to put the learned concepts to the test. Every week, pick one mental model, and start looking at your life in that context. What do you see? What appears new or different? Write down your observations. By taking the time to reflect on your experiences through each set of insights, you'll be able to apply that wisdom more easily.