

Summary of "Inventology" by Pagan Kennedy

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Find out the science behind invention and how we have dreamed up inventions that have changed the world.

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Introduction

In 2012, author Pagan Kennedy was hired by *The New York Times* magazine to write a column titled "Who Made That?" She began to hunt the people down behind inventions like sliced bread, the 3-D printer, and lipstick. As she began researching, she realized that inventors come from all walks of life, no two are the same. For instance, "a test pilot created aviator sunglasses; a frustrated father devised the sippy cup to foil his own toddler; and experiments in a kitchen in Queens, New York, led to the Xerox machine." Kennedy quickly questioned the formula for inventions and if each invention followed the same pattern. She sought to observe the techniques that led to the success of many inventions and extrapolate the best methods. But first, what is an invention? According to Art Fry, the originator of the Post-it Note, inventions are what happen when you translate a thought into a thing. Innovation, on the other hand, is what happens afterward. This is the part when you work through all the obstacles to turn your creative idea into a business. Throughout this book, Kennedy investigates the origins that give birth to new things and the process that involves a craftsmanship of the imagination. She aims to find out what people do when they invent things, what goes through their minds and how they use their hands. This investigation, she says, is a new science of invention: Inventology.

Familiarity in Inventing

If you've ever traveled through an airport, you know exactly how handy it is to have a suitcase on wheels. Pushing or pulling our luggage through widespread airports is much easier than lugging our heavy suitcases by hand. Well, before the 1970s that's exactly how people moved through the airport, making traveling more exhausting than it already is! Bernard D. Sadow, however, became inspired when walking through an airport and seeing an airport employee pushing a machine on a dolly. He immediately thought, "Why can't luggage have wheels too?"

Sadow got to thinking and invented a suitcase that you pulled behind you on a "leash." Of course, this idea was still not perfect. The wheels of the suitcase were on the long side of the suitcase, so if you pulled the leash too hard, the suitcase would crash into your legs. If you yanked it around a corner, it flopped onto its side. It wasn't until the 1980s when pilot, Robert Plath, decided to improve Sadow's invention.

Plath invented the suitcase that you know today, putting wheels on one edge of the bag and adding an adjustable rigid handle to pull the bag without attacking your ankles. This bag could comfortably travel miles around the airport with you and has become a travel staple today. But why was Plath's invention so much better than Sadow's? Well, Sadow was simply a businessman who only traveled for vacation. He was a tourist looking for a better way to travel and invented a short-term solution. Plath, on the other hand, carried luggage day after day for work, he was motivated to think more deeply about the suitcase problem and come up with a longterm solution for frequent flyers. Plath was more familiar with traveling woes and, as we'll see, familiarity and repetition are critical for an inventor's success.

In 1776, Adam Smith observed the "magic" of factory workers in which each laborer became an expert in one small task. This close attention and repetition might inspire him to find an easier method for performing his job. For instance, one boy's job was to pump a lever repetitively. This task inspired him to figure out that tying a string between the lever and a moving part elsewhere on the machine would pull the lever for him. The boy automated his job then ran off to play with his friends! Smith's idea expanded in 2005 when Eric Von Hippel also observed that repetition can feed the imagination which we'll dive into in the next chapter.

Lead Users

In 2005, Eric von Hippel stated, "I've learned personally that you can get a graduate student to do a lot of things, but you can't get them to do it twenty thousand times in a row, they will start to invent." Von Hippel introduced the idea that there seems to be a threshold - or a number of hours - after which frustration produces creative insight. In the 1970s, von Hippel even came up with a name for people who seek to solve such problems, naming them *Lead Users*.

Von Hippel became a Lead User himself in the 1960s when he contacted a manufacturing company to produce a tiny fan that would improve the performance of his fax machine. Soon, he received a call from the manufacturer wanting to produce the product for other people as well. Von Hippel said yes. Then one day he picked up a magazine and noticed an advertisement for his fan, a company had claimed credit for inventing it. Instead of being angry, von Hippel was fascinated and it inspired him to answer the question of, "Who *really* dreams up breakthrough ideas?"

To answer this question, von Hippel began digging deep into the origin of many inventions. He quickly noticed a pattern of big companies investing a few hundred million dollars into perfecting and making a product successful, meanwhile, they ignore the person who truly invented the product. This isn't necessarily done maliciously, it's simply become a part of the culture in today's climate. In the end, people tend to take the ideas of others and make them better, essentially working together to create something revolutionary.

For instance, Tim Derk became frustrated when hyping up the crowd at basketball arenas as the Coyote mascot for the San Antonio Spurs. His frustration came when using a slingshot to fling souvenirs into a crowd that was unable to reach the fans at the top of the arena. So he created a better way. According to Derk, his invention "weighed ninety pounds…it was like carrying a TV set on your back. The gun was probably at least four feet long." Despite the imperfections, fans loved it and the T-shirt gun went viral and was soon seen in arenas across the nation.

Derk never received credit for this "invention," but that never bothered him. As he saw it, "It wasn't that one minute it didn't exist, and then it did. It just evolved." The mascot community is constantly evolving as professional mascots continue to share ideas to make their jobs easier and more fun. When people share their inventions, it's considered a "negative space" in which people create without seeking to patent their ideas. For example, the internet is a vast negative space because nobody owns it and it constantly evolves as Lead Users add their own ideas.

Super-Encounters

When it comes to luck, many of us might consider ourselves either lucky or unlucky. Those who seem to make excuses for their life call themselves unlucky; however, lucky people are typically successful because they create their own luck. But did you know that lucky people are more likely to be inventors? According to a study by British psychology professor, Richard Wiseman, this idea isn't necessarily wrong.

Wiseman suspected that people who feel "lucky" might actually be more observant and scan their surroundings more carefully, making them better at identifying solutions. In one experiment, Wiseman gathered two groups of people: those who considered themselves lucky and blessed, and others who believed they were cursed and unlucky. He simply gave them each a newspaper asking them to count the number of photographs inside.

While this experiment sounds fairly simple, there was a trick. On the second page, there was a small note saying: "Stop counting. There are 43 photographs in this newspaper." The study revealed that the lucky people were more likely to notice the message, finding the solution in only a few seconds while the unlucky people took around two minutes. Maybe you're thinking that these results were simply coincidental, well, psychologist Mihaly Csikszentmihalyi experimented to study this behavior as well.

In a famous experiment, Csikszentmihalyi gathered a group of art students and told them to pick out objects to draw from a previously set-up room. Suddenly, two types of behavior emerged within this group: those who chose an object and immediately started drawing, and those who took their time observing different objects before choosing one. While one student simply picked up a book and hat and started drawing, others picked up objects, looked through them, opened them up, and drew more improvised exploratory objects. So what did this study reveal? The results wouldn't show until seven years later when Csikszentmihalyi checked in on the students. Those in the first group were struggling to make ends meet and had given up on painting while many from the second group went on to become professional artists or teachers. Back in the 1990s, Sandra Erdelez called such people "Super-Encounters." These people all share the thrill of searching and discovering new things, making them overall more successful.

Big Data

While Lead Users and Super-Encounters are out there searching, noticing, and creating things to make their lives easier, others are changing with the times. Some aren't waiting for their lucky break, instead, they're using computers and science to create their own luck. I mean, we live in a digital era so it was only a matter of time before people began systemizing the process.

This group of people is a new breed of inventors called bioinformaticians. They use "Big Data," using computers to check the results of thousands of past experiments in hopes of revealing meaningful connections. According to a McKinsey report from 2013, this research called *data-mining* is worth an estimated \$100 billion per year. But why has it become so successful? The biggest advantage is the time it saves. Think about it, computers can search through huge piles of data and analyze thousands of medical trials in a single afternoon. Not only does this save you time, but it saves you money as well! No longer do you need a team of scientists to pore over experiments; instead, a computer does it for you at an incredibly accurate rate.

So does data-mining really work? Of course! Data-mining algorithms can check through thousands of trials, both old and new, which has led to some surprising discoveries. For instance, Atul Butte, a biomedical researcher and entrepreneur who works at the University of California at San Francisco discovered a pattern in imipramine, a medication developed as an anti-depressant. He stumbled upon a pattern that suggested that imipramine could be effective in fighting small-cell lung cancer. In just two years, researchers went from analyzing data to performing clinical trials because of data-mining.

Create Something Out of Nothing

In the 1960s, Lawrence Herbert was hired by an advertising company as a part-time employee. His job was in the ink and printing division, and it was at this job that he noticed a problem. He stated that, "every designer had about half a dozen color books in his drawer," and "every ink company used different sets of pigments which react differently under different lights." The problem? Herbert was never sure which color he would get when sending out orders for ink.

He knew there had to be a better way, something that could make ordering ink easier, but nothing existed. He had an idea. What if he created a system in which all printers and ink makers could speak a universal language? He began to imagine that "If somebody in New York wanted something printed in Tokyo, they would just simply open up the book and say, 'Give me Pantone 123.'" Each color would have a corresponding number, so Pantone 123 would give them a Daffodil Yellow.

Herbert sought to bring this system to life and created a sample page to introduce to other ink companies and graphic designers. People were on board with the system and so began the Pantone Matching System. The system was so successful, Herbert was able to bring the company out of debt and he became a multimillionaire. Herbert started with nothing but an idea and a piece of paper. He didn't have money, experience, or even connections. And yet, we now have something as valuable as Pantone because of him.

The idea of creating something out of nothing continues today. When it comes to the human gut, modern research has revealed the importance of microbes to our overall health. For instance, if our levels of microbes become unbalanced, the consequences can be severe and deadly, even resulting in a stomach infection called Clostridium difficile, or C-diff. The cure, of course, came from nothing. Scientists discovered that C-diff could be cured with healthy human feces. Using microbes from the feces of a healthy donor and transplanting them into the sick person's gut through infusion, a patient can be cured from the fatal infection in just a few hours.

The Wayne Gretzky Game

Wayne Gretzky, the Michael Jordan of hockey, is perhaps recognized as the greatest hockey player ever. There's a reason for this. You see, Gretzky was able to anticipate and predict the movement of the puck better than anyone else. When he moved, he skated to where the puck was heading, not where it had been. Gretzky saw a second more into the future, unlike other players.

Inventors share this same characteristic. Successful inventors can forecast and create products that not only solve today's problems, but also solve problems of the future. So how can you forecast? First, you must imagine the future. Imagine the type of technology that will exist, think about human desire and how you think our existing technology will evolve. This thinking will allow you to begin creating for the future. If this seems impossible, then let's take a look at Xerox.

In the 1970s, Xerox forecasted that someday people would want a personal computer in their homes. Much of the population had never even seen a computer, but Xerox knew that would all change soon. Of course, forecasting isn't always successful. In the 1960s, Herman Kahn attempted to determine how well we could predict the future. He conducted a study in which he asked leading minds to give 100 technological predictions for the year 2000.

By the time 2000 came along, those predictions for communications and computing were about 80 percent accurate. Those minds were able to accurately forecast the internet, VCRs, and cell phones. However, their predictions regarding transportation, medicine, and architecture were far less accurate; including inventions like hibernating spaceships and appetite-control pills. Predicting the future may sound difficult, but the famous Moore's Law aims to make it easier. According to Moore's Law, computing power doubles every year and a half. Gordon E. Moore noticed that while his law was originally an observation, it began to turn into an objective. People in the technology industry didn't want to fall behind Moore's Law, and therefore the law became an impetus for creating new inventions. In the end, Moore found a way to both predict and shape the future.

Great Inventions Come From the Mind

Some of the most successful inventors didn't have a team of scientists working in a laboratory day and night trying to create new things. Instead, many successful people use the laboratory of their minds to imagine their ideas before they attempt to bring them to life. Nikola Tesla, for example, may have died poor, alone, and forgotten in a New York hotel room in 1943, but his ideas have since turned him into one of the most brilliant scientists ahead of his time.

Tesla wrote, "Every night (and sometimes during the day), when alone, I would start on my journeys - see new places, cities, and countries - live there, meet people and make friendships and acquaintances. This I did constantly until I was about seventeen when my thoughts turned seriously to invention. Then I observed to my delight that I could visualize with the greatest facility." Tesla didn't need models, drawings, or experiments. Instead, he could see his inventions so clearly in his mind that he dreamed of inventing a camera to capture his visions.

Elon Musk built upon Tesla's dream and built a system that allows people to design objects simply by moving their hands through the air. The key to bringing these visions to life is to imagine them in such great detail that you can pinpoint exactly what you need. Kennedy, the author and writing teacher, suggests exploring your creative mind by giving the example of a student who struggled to put his idea for a movie on paper. To get the student started, Kennedy asked, "How does the movie start?" "Whose point of view is being used?" even more, "What do you imagine it smelling like?"

Like all inventions, there are countless details. You can use a similar technique to bring your ideas to life. Instead of stressing over how to begin, simply ask yourself many questions to help you design and bring your ideas from mind to paper.

Everyone is Useful

Inventing something useful doesn't mean you have to be an expert in a particular field. Some of the greatest and successful inventions come from open systems in which people from all over can contribute their ideas. Kennedy writes that, "Breakthroughs often happen when we allow unlikely collaborators and odd bedfellows to share our problems, or when we leap across boundaries."

Let's take a look at how this concept worked in the 1700s. A major problem of the 18th century surrounded the sailors' inability to calculate their longitudinal position, heightening the danger of crashing into rocks, other ships, and thus sinking to the depths of the ocean. In 1707, thousands of British sailors lost their lives when an English fleet crashed because of bad naval navigation. Therefore, the British parliament promised to award £20,000, or 3 million of today's dollars, to anyone who could improve naval navigation.

People thought the answer would come from an astronomer or someone from the Royal Observatory, but the solution came from John Harrison, a carpenter and clockmaker. Harrison claimed the prize by producing a marine chronometer, a clock able to accurately tell time down to the second. This clock allowed sailors "to calculate longitude by comparing the precise clock readings with the position of the stars and the sun; it was time, as much as celestial maps, that turned out to be key to solving the problem."

Harrison was able to bring knowledge from various relevant fields, connecting his knowledge of timekeeping with navigation. Another example comes from Adam Rivers, a researcher at the University of Georgia's marine sciences department. In 2012, his company struggled to produce the right food coloration for the sake of their health. Rivers, however, used his knowledge of marine biology to chemically alter the mix of metals in the water. The alterations led to a beverage that was more drinkable and appealing to the consumer.

At the end of the day, Kennedy says, there "are certain people who - by luck, design, or some quirk of personality - are able to bring together knowledge from several fields. They inhabit the cracks and interstices between different disciplines." In other words, people from all backgrounds can contribute to any field. All it takes is the desire to take initiative and the determination to create something revolutionary.

Final Summary

A great idea can begin anytime, anywhere. It doesn't necessarily require scientists in white coats experimenting in laboratories to bring a revolutionary idea to life. Some of the greatest inventions came from ordinary people who simply had the desire to solve a persistent problem in their lives. Whether it was making travel easier or picking up tennis balls less back-breaking, inventions can be in the minds of people from all walks of life. The most successful inventions, however, come from those who have a deep understanding of the problem and can forecast the future. Being able to see potential problems and foresee where society is headed will give you an advantage in creating something out of nothing. Everyone has the potential to create something great. So who knows? Maybe you've got the beginnings of an idea for something we never knew we needed.



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