The Great

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Physics 物理

> Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.
> 生活中没有什么是值得害怕的，只是需要理解。现在是了解更多的时候，这样我们就可以减少恐惧。
> ——Marie Curie 玛丽•居里

Relativity 相对论

We often think someone is wrong because they see things from a different perspective than we do. Relativity helps us to understand that there is more than one way to see everything. That doesn't mean everyone's perspective is equally valid, only that we might not have the most complete view into a problem or situation.
我们经常认为某人是错的，因为他们看问题的角度与我们不同。相对论帮助我们理解，看任何事情都有不止一种方法。这并不意味着每个人的观点都同样有效，只是我们可能对一个问题或情况没有最完整的看法。

> The theory of relativity is founded on empathy. Not empathy in the ordinary emotional sense; empathy in a rigorous scientific sense. The crucial idea is to imagine how things would appear to someone who's moving in a different way than you are.
> 相对论建立在共鸣的基础上。不是普通情感意义上的移情，而是严格的科学意义上的移情。关键的想法是想象事物在一个与你运动方式不同的人眼里会是什么样子。
> ——Steven Strogatz 史蒂芬•斯特罗格茨

Thought experiments that changed the world 改变世界的思想实验

An outside observer, someone standing on a nearby beach or a fish in the water can detect the complete movement of the ball because their perspective is different. By being

outside the ship, they see a more complete version of reality. The scientist on the boat would have to make a conscious effort to remember that both he and the ball are moving with the ship.
一个外部的观察者，站在附近海滩上的人或水中的鱼可以发现球的完整运动，因为他们的视角不同。由于在船外，他们看到的是一个更完整的现实版本。船上的科学家将不得不有意识地努力记住他和球都在随船运动。

Before you conclude that the motion of the ship should be obvious to the scientist, consider how often you reflect on your movement through space every day.Right now you probably feel as though you're stationary. However, if you're on Earth, you're moving around the sun at 67,000 miles per hour. Galileo developed this thought experiment partly thanks to his belief that Copernicus was right and that the earth itself is in motion that we do not perceive.Galileo thus demonstrated that perspective influences what we perceive as reality and how we understand the world. His thought experiment is a great one you can use all the time.
在你得出结论说船的运动对科学家来说应该是显而易见的之前，请考虑一下你每天多长时间反思一下你在空间中的运动。现在你可能觉得你是静止的。然而，如果你在地球上，你正以每小时67,000英里的速度围绕太阳运动。伽利略开发了这个思想实验，部分原因是他相信哥白尼是对的，地球本身也在运动，而我们并没有察觉到。伽利略因此证明，视角影响了我们对现实的感知以及我们对世界的理解。 他的思想实验是一个你可以一直使用的好实验。

Imagine the scientist performing experiments on the boat and ask yourself, now what does a fish see? And how does that relate to what the scientist experiences? Imagine being either one, or a bird in the sky, and you start to get an idea of how multiple eyewitness accounts of the same robbery can be so different.
想象一下，科学家在船上做实验，然后问自己，现在鱼看到了什么？这与科学家的经历有什么关系？想象一下，你要么是一个人，要么是天上的鸟，你就会开始明白，对同一劫案的多个目击者的描述会有很大的不同。

In the early 1900s, Einstein used another famous thought experiment when developing his theory of special relativity, which's inked mass and energy using the formula $E=mc^2$. This formula demonstrates that energy is equivalent to mass times the speed of light squared. With this theory, Einstein stated that the speed of light is fixed within any frame of reference moving at a constant velocity, and therefore there is no fixed frame of reference from which one can measure the physical laws. This is what Galileo had argued, but his ideas were put aside in the 1700s in favor of a view that said that there was an absolute frame of reference.
20世纪初，爱因斯坦在发展他的狭义相对论时使用了另一个著名的思想实验，这是用公式$E=mc^2$来墨迹质量和能量。 这个公式表明，能量相当于质量乘以光速的平方。通过这一理

论，爱因斯坦指出，光速在任何以恒定速度运动的参照系中都是固定的，因此没有固定的参照系，人们可以从这个参照系中测量物理规律。这就是伽利略的论点，但他的观点在1700年代被搁置，而支持一种说有绝对参照系的观点。

Einstein's theory of special relativity revived Galileo's ideas.Einstein's thought experiment to describe special relativity illustrated the concept that observers in relative motion experience time differently. This means that two events can happen simultaneously from one observer's perspective and at different times from another observer's perspective. Both are right.
爱因斯坦的狭义相对论恢复了伽利略的观点。爱因斯坦描述狭义相对论的思想实验说明了相对运动的观察者对时间的体验不同的概念。 这意味着两个事件从一个观察者的角度可以同时发生，而从另一个观察者的角度可以在不同的时间发生。两者都是对的。

Here is the experiment:Imagine you are watching a train go by. Lightning strikes each end just as the train's midpoint is passing you. The lightning strikes are each the same distance from you, so you correctly conclude that the two bolts of lightning hit the train at exactly the same time.Later on, you catch up with your friend who was on the train."Crazy that two bolts of lightning struck your train at exactly the same time," you say."What are you talking about?" she responds. "The front of the train got hit by lightning first."You dismiss her interpretation. After all, you witnessed the whole thing. But here is what was happening for her:She was sitting at the midpoint of the train. If the train had been stationary, she would have observed the two lightning strikes being simultaneous like you did.
实验内容如下：想象一下，你正看着一列火车驶过。就在火车的中点经过你的时候，闪电击中了两端。这两道闪电离你的距离相同，所以你正确地得出结论：这两道闪电正好在同一时间击中了火车。"火车的前面先被闪电击中。"你否定了她的解释。毕竟，你目睹了整个事件。但对她来说，事情是这样的：她坐在火车的中间位置。如果火车是静止的，她会像你一样观察到两道闪电是同时发生的。

However, because the train was moving, the light from the rear strike had farther to travel to reach her. She perceived the light from the strike at the front first. So, she correctly concluded that the lightning strikes were not simultaneous; the one in front happened first.These are two valid interpretations of the same event. Both are correct. The difference arises because of the perspective of each person.Our perspective is very much unique to us, as both Galileoand Einstein so vividly demonstrated.
然而，由于火车在行驶，来自后方雷击的光线需要经过更远的路程才能到达她的身边。她首先感受到的是前面的雷击发出的光。因此，她正确地得出结论，闪电并不是同时发生的；前面的那道闪电先发生。两者都是正确的。 我们的观点对我们来说是非常独特的，正如伽利略和爱因斯坦都生动地证明了这一点。

In the day-to-day world that we live in, this means that you are seeing what nobody else sees but also that you do not automatically, unconsciously see through the eyes of others. There is an objective reality, but none of us can perceive it in totality without doing a little work. Is it any wonder we make suboptimal decisions?
在我们生活的日常世界中，这意味着你看到的是别人看不到的东西，但也意味着你不会自动地、无意识地通过别人的眼睛来看。 有一个客观的现实，但如果不做一点工作，我们没有人能够完全感知到它。我们做出次优的决定有什么奇怪的吗？

The subjectivity of perspective 视角的主观性

You now know that you are always going to have an imperfect perspective. You will never be able to see everything at once. Nor will you be able to completely trust that everything you do see is viewed by others. What you see is useful but limited. The less willing you are to accept and acknowledge limitations, the less useful your perspective.
你现在知道，你总是会有一个不完美的视角。你将永远无法同时看到所有的东西。你也不可能完全相信你所看到的一切都被别人看在眼里。你看到的东西是有用的，但也是有限的。你越不愿意接受和承认局限性，你的视角就越不有用。

You will always have limitations to your frame of reference that you need to account for in an effort to better understand reality. You must recognize what these limits are and, in situations where the risks are high or the outcomes important, take steps to augment your perception. Multiple perspectives are the reality of life. At the most basic application, we see a different view out of each of our eyes. Our brain adjusts the inputs from each eye to give us the perception of a single three-dimensional image.
你的参考框架总是有局限性，你需要说明这些局限性，以努力更好地理解现实。你必须认识到这些限制是什么，并在风险高或结果重要的情况下，采取措施增强你的感知力。多角度是生活的现实。在最基本的应用中，我们的每只眼睛都会看到不同的景象。我们的大脑调整来自每只眼睛的输入，给我们提供一个单一的三维图像的感知。

Seeing with two eyes offers a synthesized view that's more complete than either eye can see individually. This concept helps us understand that integrating multiple perspectives gives us a better view. In any specific moment, we only have one set of information hitting our retina. That image is incomplete in terms of everything occurring and different from the people standing next to us.
用两只眼睛看提供了一个综合的视图，比任何一只眼睛单独看到的都更完整。 这个概念帮助我们理解，整合多个视角会给我们一个更好的视野。 在任何特定的时刻，我们只有一组信息击中我们的视网膜。就发生的一切而言，这个图像是不完整的，与站在我们旁边的人不同。

The reality of multiple perspectives is critical to understanding the world and your

place in it. We can only see so much. In concrete terms, relativity highlights a subjectivity of perspective that explains partly why eyewitness testimonies have lost their credibility over the years.
多角度的现实对于理解世界和你在其中的位置至关重要。我们只能看到这么多。 具体而言，相对论突出了视角的主观性，这部分解释了为什么多年来目击者的证词失去了可信度。

When considering an eyewitness testimony during a trial, there are many aspects to consider in order to understand that person's perspective. First, there are the physical aspects—how good is that person's vision? What was the light like at the time? How long did they have to observe the person in question? But there are also a host of psychological ones—what mood was the person in? Were they rushing to get somewhere? Had they just had a fight with their spouse? Do they have an incentive to take a certain position?
在审判期间考虑目击者的证词时，有许多方面需要考虑，以了解该人的观点。首先，是物理方面，这个人的视力如何？当时的光线是怎样的？他们有多长时间来观察这个人？但也有许多心理方面的因素，这个人当时是什么心情？他们是否急着要去什么地方？他们刚刚和配偶吵架了吗？他们是否有采取某种立场的动机？

And what about the biases—do they consider certain ethnicities as more likely to commit crime? How predisposed are they to being helpful to police? All of this factors into what a witness believes they saw and helps explain why two witnesses can have remarkably different accounts of the same situation, as in Rashomon .
还有偏见呢？他们是否认为某些种族更有可能犯罪？他们对警察的帮助有多大的倾向性？所有这些都是影响证人相信他们所看到的东西的因素，并有助于解释为什么两个证人对同一情况会有明显不同的描述，就像《罗生门》中那样。

Rashomon, the classic Japanese film, is an excellent exploration of the differences in the testimonies of several eyewitnesses to a crime. A samurai is found murdered in a forest.
《罗生门》是一部经典的日本电影，它很好地探讨了几个目击者对犯罪的证词的差异。一个武士被发现在森林中被谋杀。

A bandit is accused of the crime. During the subsequent trial, the bandit, the samurai—speaking through a medium—his wife, and a woodcutter who observed the whole incident each give testimony. Each story is different, partly due to the self-interest of each of the characters, and partly due to the fact that each can only understand the events that play out through a single perspective— their own. Rashomon is exceptionally interesting because the end does not give the viewer "the truth."
一个强盗被指控犯有此罪。在随后的审判中，该强盗、通过灵媒说话的武士，他的妻子，以及观察整个事件的樵夫分别提供证词。每个故事都是不同的，部分原因是每个人物的自我利益，部分原因是每个人只能通过一个单一的视角--他们自己的视角来理解所发生的事件。《罗生

门》特别有趣，因为结局并没有给观众真相。

The audience does not get any closure on what actually happened, which is an accurate portrayal of life. They are simply left with the contradictory testimonies and the implication that each of these have become the truth for the persons telling them. In addition, our memories are not infallible. 'We often think of memories as being like a video recording, capturing a scene with perfect fidelity. The truth is far more complicated. Our memories are highly subjective and malleable.
观众没有得到任何关于实际发生的事情的结论，这是对生活的准确描述。他们只是留下了相互矛盾的证词，并暗示这些证词中的每一个都已成为讲述者的真相。此外，我们的记忆也不是无懈可击的。我们经常认为记忆就像录像一样，以完美的保真度捕捉到了一个场景。事实要复杂得多。我们的记忆具有高度的主观性和可塑性。

We often misattribute memories, such as a witness thinking something they read in the news about a crime is something they witnessed. We are also highly suggestible, such as when a police officer asks us a leading question or uses emotive language.
我们经常对记忆进行错误的归因，例如证人认为他们在新闻中读到的关于犯罪的东西是他们亲眼所见。我们也有很强的暗示性，比如当警察问我们一个引导性的问题或使用情绪化的语言。

Our memories of the past are also distorted by what we know now, such as when a witness learns a new piece of information during a case and feels they knew it at the time. These and other common memory distortions feed into the subjectivity of eyewitness reports. People rewrite and reshape their memories, often to fit their existing beliefs.
我们对过去的记忆也会被我们现在所知道的东西所扭曲，例如当证人在一个案件中了解到一个新的信息，并觉得他们当时就知道。这些和其他常见的记忆扭曲会导致目击者报告的主观性。人们改写和重塑他们的记忆，往往是为了适应他们现有的信念。

We often feel committed to our original perception and unconsciously adjust our memories to support what we think we originally saw. When juries hear eyewitness testimony, they must sort through the limits and influences on that person's perspective, and how self-interest and time have distorted that person's memory. It is no small feat. One example of the challenge is chronicled below. On the morning of July 4, 2000, 20-year-old Chris Kinison was killed in a convenience store parking lot in Ocean Shores, Washington, USA. Minh Duc Hong was charged with the crime. Hong was visiting the area to see a firework show with his twin, Hung Hong.
我们经常觉得自己致力于原来的看法，并不自觉地调整我们的记忆，以支持我们认为自己最初看到的东西。当陪审团听到目击者的证词时，他们必须整理出对该人观点的限制和影响，以及自我利益和时间如何扭曲了该人的记忆。这是一个不小的成就。以下是关于这一挑战的一个例子。2000年7月4日上午，20岁的克里斯-金森在美国华盛顿州海洋海岸的一家便利店停车场被

杀。Minh Duc Hong 被指控犯有此罪。Hong 当时与他的双胞胎兄弟一起到该地区看烟花表演。

Both were Asian-Americans and Kinison was white. During the subsequent trial, a dozen eyewitnesses provided testimony. As David A. Neiwert explains in Death on the Fourth of July , “For every bit of testimony, it sometimes seemed, there arose a view of events that conflicted with the description provided by previous witnesses, creating a web of questions about competing self-interests, and the extent to which they colored different witnesses’ testimony.”
两人都是亚裔美国人，金森是白人。在随后的审判中，有十几位目击者提供了证词。David A. Neiwert 在《七月四日之死》中解释说，"对于每一个证词，有时似乎都会出现与之前的证人所描述的事件相冲突的观点，这就形成了一个关于竞争性自我利益的问题网络，以及它们在多大程度上影响了不同证人的证词。"

Many witnesses described seeing things they physically could not have once their positioning during the violence was mapped out. Others were clearly biased by their relationship with the victim, a local, versus the accused who was from out of town.
许多证人描述说，一旦他们在暴力事件中的位置被描绘出来，他们就会看到他们身体上不可能看到的东西。其他证人显然因为他们与受害者（当地人）的关系而对来自外地的被告产生了偏见。

Racial bias was a huge factor, and in his book, Neiwert makes the case for Hong first being a victim of a hate crime and whose subsequent actions were really about defense. According to witnesses, Kinison waved a Confederate battle flag at Hong and his friends and shouted racial slurs. He also made threatening gestures, indicating a desire to harm Hong who took a knife from the convenience store, fearing for his safety.
种族偏见是一个巨大的因素，在他的书中，Neiwert 提出了 Hong 首先是仇恨犯罪的受害者，其随后的行动实际上是为了防卫。据目击者称，金森向 Hong 和他的朋友挥舞着邦联战旗，并大喊种族口号。他还做出了威胁性的手势，表明他想伤害洪，Hong 从便利店拿了一把刀，担心自己的安全。

When Kinison physically assaulted Hong’s brother, Hong used the knife on him. Kinison had previous accusations of racist violent threats. Many of the witnesses had been drinking, and many admitted to being scared. These distortions meant that the jury did not get a reliable, consistent account from each witness. They had to piece together what might have happened. The jury then had to evaluate the credibility of how each witness saw the crime and the laws of physics governing the physical perspectives. One life had already ended. The future of another one was completely dependent on how the jury untangled the testimony through the limits of their own perceptions.

当金尼森对洪的兄弟进行人身攻击时，Hong 对他使用了刀子。金尼森以前曾被指控有种族主义暴力威胁行为。许多证人都喝了酒，许多人承认自己很害怕。这些歪曲意味着陪审团没有从每个证人那里得到可靠、一致的陈述。他们不得不把可能发生的事情拼凑起来。然后，陪审团不得不评估每个证人如何看待犯罪的可信度，以及支配物理视角的物理学规律。一个生命已经结束。另一个人的未来完全取决于陪审团如何通过他们自己的感知限制来解开证词。

After deliberation, the jury could not reach a verdict and the judge declared a mistrial. The jury revealed that they had deadlocked 11-1 in favor of acquittal. What's interesting, though, is the ambiguous end to the story. The jurors continued to be comfortable with the position they took, believing that Minh Hong acted reasonably in self-defense.
经过商议，陪审团无法达成裁决，法官宣布审判无效。陪审团透露，他们以11比1的比例僵持，支持无罪释放。不过，有趣的是，故事的结局很暧昧。陪审员们继续对他们采取的立场感到满意，认为 Hong 的行为是合理的自卫。

The local sheriff's office recognized that Minh Hong had been the victim of a hate crime and the officers committed to an education program so they could deal with similar situations better in the future. But, Neiwert further writes, "if there is any lingering sentiment in Ocean Shores, it is a quiet dismay at the outcome of Minh Hong's trial. Even though the 4 Grays Harbor jury found otherwise, many in town, especially those who knew Chris Kinison, believe an injustice was done."
当地警长办公室认识到 Minh Hong 是仇恨犯罪的受害者，官员们承诺开展教育计划，以便他们将来能更好地处理类似情况。但是，Neiwert进一步写道，"如果在海洋海岸有任何挥之不去的情绪，那就是对 Minh Hong 的审判结果的无声失望。尽管格雷斯港的4个陪审团发现情况并非如此，但镇上的许多人，尤其是那些认识克里斯•金森的人，认为这是一种不公正的行为。"

The multiple and conflicting perspectives displayed in the trial of Minh Hong are a common phenomenon. We have all been in situations where we have a totally different perspective on events than the person standing next to us. It's important to be aware of and compensate for different perspectives if you want to get the most complete picture possible of the situation you are in. What you see is never all there is.
在对 Minh Hong 的审判中表现出的多重和冲突的观点是一种常见现象。我们都曾遇到过这样的情况：我们对事件的看法与站在我们旁边的人完全不同。如果你想尽可能全面地了解你所处的情况，就必须意识到并弥补不同的视角。你所看到的永远不是全部。

> John, when people thought the earth was flat, they were wrong. When people thought the earth was spherical, they were wrong. But if you think that thinking the earth is spherical is just as wrong as thinking the earth is flat, then your view is wronger than both of them put together.
> 约翰，当人们认为地球是平的，他们就错了。当人们认为地球是球形的时候，他们也是错的。

> 但是如果你认为认为地球是球形的和认为地球是平的一样错，那么你的观点比他们两个加起来都要错。
> ———Isaac Asimov 艾萨克-阿西莫夫

Through the eyes of others 透过别人的眼睛

The limits of perspective are fundamental to how the world works. As we have seen, considering multiple perspectives is the best chance we have to understand what is really going on. Given that you can't go back in time to situate yourself differently, what can you do to augment your perspective? This is where thought experiments come in handy.
观点的局限性是世界如何运作的根本。正如我们所看到的，考虑多视角是我们了解真实情况的最好机会。鉴于你无法回到过去，以不同的方式定位自己，你能做什么来增加你的视角？这就是思想实验派上用场的地方。

Think back to Galileo's scenario of the scientist conducting experiments on the boat. The scientist cannot hang out in the ocean and watch the boat go past. Our scientist can, however, imagine what the view would be like from the perspective of a fish. Thought experiments need not be literal. They don't have to be confined to what already is or even what's possible.
回想一下伽利略的科学家在船上做实验的情景。科学家不能在海里闲逛，看着船驶过。然而，我们的科学家可以想象，从鱼的角度来看，景色会是怎样的。思想实验不需要是字面上的。他们不必局限于已经存在的东西，甚至不必局限于可能的东西。

The scientist, when considering the perspective of the fish, can also imagine the boat as being made of glass and the water as easy to see through as air. Or he need not limit the experiment to the visual perspective of the fish. After all, we don't gain perspective only with our eyes, but through the lens of our experiences, biases, desires, and more.
科学家在考虑鱼的视角时，也可以把船想象成玻璃做的，把水想象成空气一样容易看穿。或者他不需要把实验限制在鱼的视觉角度上。毕竟，我们并不是只用眼睛来获得视角，而是通过我们的经验、偏见、欲望等的镜头来获得。

When you see someone doing something that doesn't make sense to you, ask yourself what the world would have to look like to you for those actions to make sense. While we all see our own version of events, the goal is to enlarge our perspective to be a closer representation of reality by removing some of the factors that cloud our judgment. One of the best ways to do this is by noticing and observing the details of what is going on around you.
当你看到有人做了一些对你来说没有意义的事情时，问问自己，在你看来，这个世界应该是什么样的，这些行为才有意义。虽然我们都看到了自己版本的事件，但目标是通过消除一些影响

我们判断的因素，扩大我们的视角，使之更接近现实。做到这一点的最好方法之一是注意和观察你周围发生的事情的细节。

> It is good to know something of the customs of various peoples, so as to judge our own more soundly and so as not to think that everything that is contrary to our ways is ridiculous and against reason, as those who have seen nothing have a habit of doing.
> 对不同民族的习俗有所了解是很好的，这样可以更正确地判断我们自己的习俗，不至于像那些什么都没看过的人习惯性地认为一切与我们的方式相反的东西都是荒谬的、违背理性的。
> ——笛卡尔 Descartes

There is a fascinating story of six Muslim students landing in London in 1815, one of whom kept a diary of his observations and experiences. The story provides a gateway to exploring the effects of bias and how to look at the world through another's eyes. Britain and Iran were allies at the time, for the moment politically aligned. From Iran, the students had been sent by their prince to learn what the English were doing that was giving them such power in the world.
有一个引人入胜的故事：1815年，六名穆斯林学生在伦敦登陆，其中一人将他的观察和经历写成了日记。这个故事为探索偏见的影响以及如何通过他人的眼睛看世界提供了一个途径。英国和伊朗当时是盟友，目前在政治上是一致的。这些学生被他们的王子从伊朗派来，学习英国人在世界范围内给予他们的权力。

They were to gather knowledge on technology, medicine, military matters, and anything else Iran could use to gain an advantage in dealing with their neighbors, particularly Russia. One of the students, Mirza Salih, kept a diary. In his book The Love of Strangers , Nile Green translates and puts into context the experience of these students as they navigate Britain, based on this diary and letters that they wrote.
他们要收集技术、医学、军事方面的知识，以及其他任何伊朗可以用来在与邻国，特别是俄罗斯打交道时获得优势的东西。其中一个学生米尔扎-萨利赫写了一本日记。在他的《陌生人的爱》一书中，尼罗-格林根据这本日记和他们写的信，翻译了这些学生在英国的经历，并将其融入背景之中。

It provides an interesting way to consider how relativity helps to understand perspective. Green recounts Mirza Salih's visit to the British Museum. Part of the vast collection was taken from ancient Iranian ruins. For the first time, 7 8 Salih could instead see Iranian history in a comparative setting, its artistic achievements displayed side by side with those of ancient Egypt, Rome, and especially Greece. It helped him see history in a new way. We can detect the influence of this side-by- side approach in his diary's lengthy summary of world history, where he applied this comparative method to the history of France, America,

and India by making sense of historical developments through connection and comparison. As Salih discovered, we are not dispassionate, neutral observers.
它提供了一种有趣的方式来考虑相对论如何帮助理解视角。格林讲述了米尔扎-萨利赫对大英博物馆的访问。庞大的藏品中有一部分是从古代伊朗的废墟中提取的。萨利赫第一次可以在一个比较的环境中看到伊朗的历史，它的艺术成就与古埃及、罗马，特别是希腊的艺术成就并列展示。这帮助他以一种新的方式看待历史。我们可以从他日记中对世界历史的长篇总结中发现这种并列式方法的影响，他将这种比较方法应用于法国、美国和印度的历史，通过联系和比较来理解历史发展。正如萨利赫所发现的，我们不是冷静的、中立的观察者。

We bring our sensibilities into what we see. The problem is, most of us usually forget this. We are so used to being on Einstein's train that we forget it is there. But traveling to new places far outside our normal experiences can jolt us into remembering our train, seeing it in a new light, understanding better its size and shape, and remind us that not everyone is on it. Another story that drives home the point that considering others' perspective can substantially enrich our own, is that of Rifa'a Rafi' al-Tahtawi , an Egyptian who traveled to Paris in the late 1820s and recorded in detail the minutiae of what he saw in his book An Imam in Paris .
我们把自己的感觉带入我们所看到的东西。问题是，我们大多数人通常会忘记这一点。我们如此习惯于在爱因斯坦的火车上，以至于我们忘记了它的存在。但是，到远远超出我们正常经验的新地方旅行，可以使我们猛然想起我们的火车，以新的眼光看待它，更好地理解它的大小和形状，并提醒我们，不是每个人都在火车上。另一个故事是里法-拉菲-塔塔维（Rifa'a Rafi' al-Tahtawi）的故事，他是埃及人，19世纪20年代末到巴黎旅行，在他的书《巴黎的伊玛目》中详细记录了他所看到的细枝末节。

His book tells us a lot about Parisian society in the late 1820s. We can learn loads about the social customs and idiosyncrasies of the urban French and how they reconciled scientific development with religious sensibilities. We can also, however, draw some conclusions about the author al-Tahtawi. His book is more like a report, a gathering of facts about a foreign culture. He was an observer who was seeking not only to understand the French, but how what he could see related to French culture and France's influence in the world. In so doing, he hoped to gain useful knowledge that he could bring back to Egypt to encourage development.
他的书告诉我们很多关于19世纪20年代末巴黎社会的情况。我们可以了解到法国城市人的社会习俗和特质，以及他们如何调和科学发展与宗教情感。然而，我们也可以得出一些关于作者塔塔维的结论。他的书更像是一份报告，一份关于外国文化的事实收集。他是一个观察家，他不仅要了解法国人，而且要了解他所看到的与法国文化和法国在世界上的影响有什么关系。在这样做的过程中，他希望获得有用的知识，并将其带回埃及以鼓励发展。

His time in France changed his perception of his own culture, and when he returned he

instituted teachings based on the things he had learned from observing the French. Daniel L. Newman explains in his introduction to al- Tahtawi's book: "In the end, al-Tahtawi stayed in Paris for five years and the experiences, know-how and skills acquired during his Paris days ... were to have a decisive and lasting impact on the cultural and scientific development of his native country." Al-Tahtawi had multiplied his perspective and in doing so contributed to significant change in Egypt.
他在法国的时间改变了他对自己文化的看法，当他返回时，他根据他从观察法国人中学到的东西建立了教义。 丹尼尔-L-纽曼（Daniel L. Newman）在为塔塔维（al-Tahtawi）一书所作的介绍中解释道。"最后，塔塔维在巴黎呆了五年，他在巴黎期间获得的经验、知识和技能.....对他的祖国的文化和科学发展产生了决定性的持久影响"。Al-Tahtawi扩大了他的视野，并在此过程中为埃及的重大变革做出了贡献。

How other people frame something is their vantage point. It's not an unobstructed description of reality, but rather their individual perspective. Making efforts to understand someone's view helps you understand their frame, their set of beliefs and biases that guide how they see their world. The core concepts of relative perspective and framing have a broad application. When someone gives you something, an opinion, a report, an article, a plan, consider how it is framed. Who is involved in this information, and what do you know about their vantage point? Knowing the factors that influence how a person frames issues helps you understand their perspective and how you can use it to augment your own.
其他人如何框定一件事是他们的有利条件。这不是对现实的无障碍描述，而是他们的个人观点。努力理解别人的观点有助于你理解他们的框架，他们的一套信念和偏见，指导他们如何看待自己的世界。相对视角和框架的核心概念有广泛的应用。当有人给你一些东西，一个观点、一份报告、一篇文章、一个计划，考虑它是如何被框住的。谁参与了这些信息，你对他们的观点了解多少？了解影响一个人如何框定问题的因素有助于你理解他们的观点，以及你如何利用它来增强你自己的观点。

Salih and al-Tahtawi's experiences of trying to understand their own cultures by juxtaposing them against other cultures demonstrates the value of considering other perspectives and comparing them with your own. Namely, that you get a more complete picture of the context in which you are operating and where opportunities might be. This is why the publishing industry relies heavily on editors, and research needs peer review to be credible.
Salih和al-Tahtawi试图通过与其他文化并列来理解他们自己的文化的经历表明了考虑其他观点并与自己的观点进行比较的价值。也就是说，你可以更全面地了解你所处的环境和可能存在的机会。这就是为什么出版业在很大程度上依赖于编辑，而研究需要同行评议才是可信的。

Outside views combine to make a better product. Perspective often comes from distance

or time. If you're trying to solve a problem and you're stuck, try shifting your vantage point. Examples of this are moving up and contemplating the bigger picture, moving down and seeing more details, or assuming the perspective of other stakeholders—customers, suppliers, partners, government. Many problems become clearer if you extend the timeline.
外界的观点结合在一起，使产品变得更好。观点往往来自于距离或时间。如果你试图解决一个问题，而你被卡住了，试着转移你的有利位置。这方面的例子有：往上走，考虑大局；往下走，看到更多的细节；或者假设其他利益相关者的视角--客户、供应商、合作伙伴、政府。如果你延长时间线，许多问题会变得更加清晰。

What does this situation look like in the weeks, months, and years ahead? Assuming different perspectives allows you to gain a more complete understanding of what's really going on.
在未来的几周、几个月和几年里，这种情况是什么样子的？假设不同的视角，可以让你更全面地了解真正发生了什么。

Conclusion 结论

In the physical world, there is subjectivity of perception partly because everything is moving relative to everything else. Back to Einstein's scenario, both the lightning and the train are moving relative to the location of each observer. Our perspective has similar complexity. What matters is understanding the complexity and value of multiple perspectives.
在物理世界中，存在着感知的主观性，部分原因是一切都在相对于其他事物运动。回到爱因斯坦的情景中，闪电和火车都是相对于每个观察者的位置而移动的。我们的视角也有类似的复杂性。重要的是理解多视角的复杂性和价值。

No one sees it all. Multiple perspectives layered together reduce blind spots and offer us a more textured and truer sense of the underlying reality. Furthermore, we are constantly confounded by the unknown which we must somehow make sense of through the lens of our own experience.
没有人可以看到所有的东西。多重视角叠加在一起可以减少盲点，为我们提供一个更有质感和更真实的基本现实。此外，我们经常被未知的事物所困扰，我们必须通过自己的经验来理解这些事物。

We all get stuck, frustrated when no one seems to understand us, or angry that we aren't making progress based on how we understand the world. This is when it is most helpful to remember relativity and refresh our perspective by stepping outside of ourselves for a little bit.

我们都会被卡住，当没有人似乎理解我们时感到沮丧，或者因为我们没有根据我们对世界的理解取得进展而感到愤怒。这时，记住相对性，并通过走出自己来刷新我们的视角是最有帮助的。

Reciprocity 互惠性

Reciprocity teaches us why win-win relationships are the way to go, why waiters leave candies with the bill, why it's a good idea to use the least force possible to secure an outcome, and why a lot of companies don't permit their employees to accept gifts. This model demonstrates why we should view giving as being as valuable as having. It prompts us rewrite the Golden Rule to say, "Do unto others knowing that something will be done unto you."
互惠告诉我们为什么双赢的关系才是王道，为什么服务员会在账单上留下糖果，为什么用最少的力量来保证一个结果是个好主意，以及为什么很多公司不允许他们的员工接受礼物。这个模型展示了为什么我们应该把给予看作是和拥有一样的价值。它促使我们把黄金法则改写为："以其人之道还治其人之身"。

So what exactly is reciprocity? In physics, reciprocity is Newton's third law, which states that for every force exerted by object A on object B, there is an equal but opposite force exerted by object B on object A. Every force involves the interaction of two objects where the force asserted by one is reciprocated with an equally powerful and directionally opposite force by the other object. Forces always occur in pairs of the same type of force, and it is not possible for one object to exert a force without experiencing a reciprocal force. When I land on the ground after jumping, I am exerting a force on the ground.
那么，究竟什么是互惠性？在物理学中，互惠是牛顿第三定律，它指出，物体A对物体B施加的每一个力，都有一个物体B对物体A施加的相等但相反的力。力总是以同一类型的力成对出现，一个物体不可能施加一个力而不经历一个对等的力。当我跳下后落在地上时，我对地面施加了一个力。

At the moment of landing, the ground is also applying a force that is equal but opposite in direction on me. The earth applies a force on me even when I am just standing. This force is gravity. But the gravitational force exerted on me by Earth is reciprocated by me through the force I am exerting on the earth. In the natural world, this third law of Newton's explains jet propulsion. The word propulsIon comes from two Latin terms meaning "forward" and "drive"—propulsion is a force that drives an object forward. Jet propulsion works by forcing matter, such as 1 gas produced by burning fuel, in one direction, leading to a corresponding movement of the vehicle in the opposite direction.
在落地的那一刻，地面也对我施加了一个方向相反但相等的力。即使我只是站着，地球也会对

我施加一个力。这个力就是重力。但是，地球对我施加的引力，通过我对地球施加的力，由我进行反作用。在自然界中，牛顿第三定律解释了喷气推进。推进这个词来自两个拉丁词，意思是前进和驱动，推进是一种驱动物体前进的力量。喷气推进的工作原理是迫使物质，如燃料燃烧产生的气体，向一个方向移动，导致车辆向相反方向相应移动。

This holds true for everything from fireworks and guns to huge spacecrafts. Jet propulsion only works if the forward push is stronger than the forces acting on the object, like air friction and its own weight. The greater the force in comparison to drag (the amount of force opposing the motion), the faster the object can move. Octopi and squid force water through their mantle and out through a siphon at a high speed that compensates for their weight and the viscosity of the water. As the animal asserts a force on the water, the water exerts a force on the animal, and this makes the octopus or squid move. Consider the tackle in American football.
从烟花和枪支到巨大的航天器都是如此。喷气推进只有在向前的推动力强于作用在物体上的力量，如空气摩擦力和自身重量的情况下才能发挥作用。与阻力（反对运动的力量）相比，力量越大，物体就能移动得越快。八爪鱼和乌贼迫使水通过它们的地幔，并通过虹吸管高速流出，以补偿它们的重量和水的粘性。当动物对水施加一个力时，水也对动物施加一个力，这使得章鱼或乌贼移动。考虑一下美式足球中的擒抱动作。

The force that the defender puts on the receiver's body in order to bring him to the ground is equivalent to the force felt by the defenseman's body during the tackle. You can't initiate force without having a force put on you. For the tackle, this is very important. If the defenseman felt nothing there would be no incentive for him to be strategic in the application of his force on the receiver. And who would actually want to be a receiver if this were the case? If the guy who initiates the force feels nothing—much better to be him. Since this is not the case, the tackle is more about using the least amount of force required to bring the receiver to the ground. It's better for the receiver, and it's also better for the guy doing the tackling, because the more force you apply to others, the more damage you do to yourself. Reciprocity can be summed up like this: when you act on things, they act on you.
防守队员为了把接球者带到地上而对其身体施加的力相当于防守队员在擒抱时身体所感受到的力。如果没有施加在你身上的力，你就不可能发起力来。对于擒抱，这一点非常重要。如果防守队员什么也感觉不到，他就没有动力在对接球队员施力时采取策略。如果是这样的话，谁会真的想成为一个接球手呢？如果发起力量的人没有感觉，那么做他就会好很多。由于情况并非如此，擒抱更多的是使用最少的力量将接球者带到地上。这对接球者来说更好，对做擒抱的人来说也更好，因为你对别人用的力越大，对你自己的伤害就越大。互惠性可以这样总结：当你对事物采取行动时，它们也对你采取行动。

> For every action, there is an equal and opposite reaction.

> 每一个行动，都有一个相等和相反的反应。
> ——牛顿第三定律 Newton's Third Law

What We Give 我们给予的

It would be amazing if every time you did something good for the world, you received a corresponding amount of positive effect in your life. We all know that unfortunately this is not true. Sometimes positive intentions produce negative results, or bad things happen to people who do good things for others. Although the connection between good deeds and a good life isn't perfect, there is a documented relationship between the two. Using the model of reciprocity can help us understand why people benefit themselves when they work for what they believe is good.
如果你每次为世界做了一件好事，你就会在你的生活中收到相应的积极效果，那就太不可思议了。我们都知道，不幸的是，这不是真的。有时积极的意图会产生消极的结果，或者坏事发生在为他人做好事的人身上。虽然善行和美好生活之间的联系并不完美，但这两者之间存在着有据可查的关系。使用互惠模式可以帮助我们理解为什么人们在为他们认为是好的事情工作时，会使自己受益。

The life of Norman Bethune, a Canadian surgeon, is one that can teach us a lot about the nuances of reciprocity. Bethune was not a volunteer in the sense we often use the term now to describe activities that are an adjunct to daily life. His efforts to help others were completely integrated into his work and life. What made him a volunteer is that he did it of his own volition, at no obvious personal benefit. Therefore, his story provides an interesting example to really explore reciprocity. What do you get when you give?
加拿大外科医生诺曼•白求恩的一生可以教我们很多关于互惠的细微差别。白求恩不是我们现在经常用来描述日常生活中的辅助活动的意义上的志愿者。他帮助他人的努力完全融入了他的工作和生活。使他成为志愿者的原因是，他是出于自愿，没有明显的个人利益。因此，他的故事提供了一个有趣的例子来真正探讨互惠。当你付出时，你能得到什么？

What kind of tensions are created when the two forces interact? Norman Bethune grew up wanting to be a surgeon, inspired by his doctor grandfather. He completed his studies during the First World War, during which he also volunteered providing medical support on the battlefield. During the 1920s he practiced medicine in the United States and Canada, eventually settling in Montreal. He initially specialized in thoracic surgery and developed a solid reputation as a surgeon.
当这两种力量相互作用时，会产生什么样的紧张关系？诺曼-白求恩从小就想成为一名外科医生，受到他的医生祖父的启发。他在第一次世界大战期间完成了学业，在此期间他还自愿在战场上提供医疗支持。1920年代，他在美国和加拿大行医，最终在蒙特利尔定居。他最初专攻胸腔外科，并作为外科医生建立了良好的声誉。

However, he had an ongoing commitment to help people beyond what he did in his practice. This goal he pursued in a variety of ways. During the early 1930s, while in Montreal, Bethune provided medical services free to the poor and established a free-of-charge clinic he ran once per week. He vocally advocated for universal health protection, explaining that many medical issues were created by poverty and negligent employers. In addition, and unique for the time, he used radio broadcasts to educate the public on tuberculosis. Bethune volunteered his time, energy, and intelligence to try to bring about meaningful improvements in the lives of the most impoverished.
然而，他一直致力于在他的实践中帮助人们。他以各种方式追求这一目标。1930年代初，在蒙特利尔时，白求恩向穷人提供免费医疗服务，并建立了一个每周一次的免费诊所。他大声倡导全民健康保护，解释说许多医疗问题是由贫困和雇主疏忽造成的。此外，他还利用无线电广播对公众进行结核病教育，这在当时是独一无二的。白求恩自愿贡献他的时间、精力和智慧，试图为最贫穷的人的生活带来有意义的改善。

During the 1930s he became a supporter of communism and joined the Communist Party, mostly on account of what he saw of the benefits of the Soviet socialized health care system. These political beliefs took him further afield in his efforts to improve access to and outcomes in healthcare. In 1936 in Spain during the Spanish Civil War, Bethune designed and developed the first ever mobile blood transfusion unit. This vehicle could draw and store blood, was used to give transfusions, and most importantly, could be used on the front lines of the battlefield. It was a remarkable innovation that saved countless lives and inspired the medical approach used in World War II.
在20世纪30年代，他成为共产主义的支持者并加入了共产党，主要是因为他看到了苏联社会化医疗系统的好处。这些政治信仰使他在改善医疗服务的获取和效果方面走得更远。1936年，在西班牙内战期间，白求恩设计并开发了第一个移动输血装置。这种车辆可以抽取和储存血液，用于输血，最重要的是，可以在战场的前线使用。这是一项了不起的创新，挽救了无数人的生命，并启发了第二次世界大战中使用的医疗方法。

All of the work that Bethune did in Spain, and later China, was not for profit. The mobile blood unit and all his other surgical 2 innovations and inventions did not make Bethune any money. In 1938 Bethune went to China, desiring again to help people. China was fighting a war with the Japanese, the Sino-Japanese War, and Bethune's belief in communism led him to deploy his efforts in support of Mao and the Communist Party of China. He was made commander of all Chinese medical forces and immediately set about modernizing the existing primitive health care in China.
白求恩在西班牙以及后来在中国所做的所有工作都不是为了盈利。流动血站和他所有其他的2号外科手术创新和发明都没有为白求恩带来任何收益。1938年，白求恩去了中国，再次渴望帮助人们。当时中国正在与日本人打仗，即中日战争，而白求恩对共产主义的信仰使他努力支

持毛泽东和中国共产党。他被任命为中国所有医疗部队的指挥官，并立即着手对中国现有的原始医疗服务进行现代化。

Helping the Chinese in their fight, he again deployed his practice of bringing the surgeon to the battlefield, designing mobile operating equipment and improving the survival rate of the injured. He also extensively trained doctors and nurses and established hospitals in areas that had neither. In their article, "The Medical Life of Norman Bethune," Deslauriers and Goulet write, "his courage, determination and will to fully employ his talents of ingenuity, aggressiveness and selfless response to social concerns when the time came is truly remarkable."
在帮助中国人的战斗中，他再次部署了将外科医生带到战场的做法，设计了移动手术设备，提高了伤员的存活率。他还广泛地培训医生和护士，并在没有医院的地区建立医院。Deslauriers 和 Goulet 在他们的文章《诺曼•白求恩的医学生活》中写道："他的勇气、决心和意志，在时机成熟时充分运用他的聪明才智、积极进取和对社会关注的无私回应，确实令人瞩目"。

He accomplished so much in his 18 months in China that when he died of septicemia after operating on a soldier, Mao delivered his eulogy, describing him as "a man who is of value to the people." Bethune's achievements continue to be regarded as heroic by the Chinese. The first hospital he founded still exists, and his story is mandatory learning for primary school students in China. Bethune's story, however, is not solely one of accolades and recognition, heaps of positive effects achieved as a result of a life spent trying to bring about good. He died at age 49 as a direct result of his efforts to improve health outcomes on the battlefield.
他在中国的18个月里取得了如此大的成就，以至于当他在为一名士兵做手术后死于败血症时，毛泽东为他致悼词，称他是一个对人民有价值的人。白求恩的成就继续被中国人视为英雄。他创办的第一家医院仍然存在，他的故事是中国小学生的必修课。然而，白求恩的故事并不仅仅是一个荣誉和认可的故事，他的一生都在努力创造美好的结果，取得了大量的积极效果。他死于49岁，这是他在战场上努力改善健康状况的直接结果。

The fact that he was a communist led him to be written out of Canadian history during the Cold War years, when communism was seen as a direct threat to Western democracy. His personal life wasn't great, and his aggressive personality earned him enmity from many colleagues. Normally one would talk about a life like Norman Bethune's in terms of sacrifice. He sacrificed personal relationships, social acceptance, and ultimately his life in order to take actions in accord with his beliefs and values. But using the lens of reciprocity suggests there is another way to interpret the story.
他是一个共产主义者的事实导致他在冷战时期被写进加拿大历史，当时共产主义被视为对西方民主的直接威胁。他的个人生活不是很好，他咄咄逼人的个性使他遭到许多同事的敌视。通常人们会从牺牲的角度来谈论诺曼•白求恩这样的人生。他牺牲了个人关系、社会接受度，并最

终牺牲了自己的生命，以采取符合其信仰和价值观的行动。但是，使用互惠的角度来看，有另一种方式来解释这个故事。

In a paper on the health benefits of volunteering in adults, the authors explain, “The beneficial effects of volunteering on health outcomes have been well documented. Research has found that participation in voluntary services is significantly predictive of better mental and physical health, life satisfaction, self-esteem, happiness, lower depressive symptoms, psychological distress, and mortality and functional inability. ” Multiple studies have demonstrated the positive consequences of volunteering that are conferred on the volunteer. We may volunteer for a variety of reasons, based on our interests, goals or values, but regardless, we reap health benefits when we do so.
在一篇关于成人志愿服务的健康益处的论文中，作者解释说："志愿服务对健康结果的有益影响已被充分记录。研究发现，参与志愿服务对更好的心理和身体健康、生活满意度、自尊、幸福感、较低的抑郁症状、心理压力以及死亡率和功能不全有明显的预测作用"。多项研究表明，志愿服务的积极后果是赋予志愿者的。我们可能出于各种原因，基于我们的兴趣、目标或价值观做志愿者，但无论如何，当我们这样做时，我们收获了健康的好处。

The studies on the positive aspects of volunteering for the volunteer bring to mind the concepts we outlined above in the science of reciprocity, like how forces always occur in pairs. Although volunteering is not governed by the laws of physics, using reciprocity as a metaphor can help us understand why volunteering appeals to so many people. And consequently, why some people make the choice to help others at seemingly great cost to themselves. The research on volunteering makes it clear that when we give, we get. We improve our physical health; we feel better about ourselves and our place in the world. We evaluate our lives as having more meaning.
关于志愿服务对志愿者的积极意义的研究让我们想起了我们在上面概述的互惠科学的概念，比如力量总是成对出现。虽然志愿服务不受物理学定律的支配，但用互惠性作为比喻可以帮助我们理解为什么志愿服务吸引了这么多人。因此，为什么有些人选择帮助别人，而自己却要付出看似巨大的代价。关于志愿服务的研究清楚地表明，当我们付出时，我们会得到。我们改善了我们的身体健康；我们对自己和我们在这个世界上的位置感觉更好。我们评价自己的生活更有意义。

One way of understanding people who take the kinds of actions that Bethune did, which on their face seem to risk so much, is that they receive a benefit from the world proportional to what they put out there. It’s not a benefit that can always be measured in legacy or reward. Sometimes those things come; for Bethune, although North America struggled for decades to appreciate him as the dedicated medical innovator he was on account of his political views, China continues to go all out in its appreciation of his contributions to their country.

理解那些采取白求恩那样的行动的人的一种方式是，他们从这个世界上得到的好处与他们所付出的成正比，表面上看起来风险很大。这种好处并不总是可以用遗产或报酬来衡量的。有时这些东西会出现；就白求恩而言，尽管北美几十年来由于他的政治观点而努力欣赏他作为一个专注的医学创新者，但中国继续全力以赴地欣赏他对国家的贡献。

However, perhaps the benefit is better conceptualized as the reciprocity received by the individual in terms of the satisfaction they have regarding the choices they've made. The act of doing good causes an equal reaction in terms of feeling good. In reading Bethune's story it is clear that he was not motivated by recognition, but rather a genuine desire to help people that gave him an exceptional amount of energy and drive. It is highly possible that he didn't evaluate his life as one of sacrifice, but instead derived satisfaction from his efforts.
然而，也许将利益概念化为个人对自己所做选择的满意程度而得到的回报会更好。行善的行为在感觉良好方面引起了同样的反应。在阅读白求恩的故事时，很明显，他的动机不是被认可，而是帮助人们的真正愿望，这给了他极大的能量和动力。他极有可能没有把自己的生活评价为牺牲，而是从自己的努力中得到满足。

> Many, many men have been just as troubled morally and spiritually as you are right now. Happily, some of them kept records of their troubles. You'll learn from them, if you want to. Just as someday, if you have something to offer, someone will learn something from you. It's a beautiful reciprocal arrangement.
> 很多很多人都像你现在这样在道德和精神上有过困扰。令人高兴的是，他们中的一些人记录了他们的烦恼。你会从他们身上学到东西，如果你想的话。就像有一天，如果你有东西可以提供，有人会从你身上学到东西。这是一个美丽的互惠安排。
> ——J.D.塞林格 J.D.Salinger

Tit for Tat 以牙还牙

Tit for tat is a strategy which, according to game theory, is the most effective choice for iterated games based on mutual cooperation or defection. Both players benefit if they cooperate, but one benefits and the other loses out if only they defect, and both lose out to a lesser extent if they simultaneously defect. As abstract as such games sound, they have important implications for understanding everything from group selection in biology to cooperation in economics.

以牙还牙是一种策略，根据博弈理论，它是基于相互合作或叛逃的迭代游戏的最有效选择。如果双方都合作，那么双方都会受益，但如果只有一方叛变，另一方就会损失惨重，如果双方同时叛变，损失就会小一些。尽管这种游戏听起来很抽象，但它们对理解从生物学中的群体选择到经济学中的合作都有重要意义。

Under tit for tat, a player will begin by cooperating, then in subsequent iterations will replicate whatever their opponent did last time. So if their initial cooperation is punished with defection, they will then reciprocate in kind. In games that are not iterated and only consist of a single round, defection is thought to be the best strategy. Tit for tat was codified as a game theory strategy by mathematical psychologist AnatolRapoport, but it builds upon our instinctual notions of reciprocity.
在以牙还牙的情况下，玩家会从合作开始，然后在随后的迭代中复制他们的对手上次所做的一切。因此，如果他们最初的合作受到叛逃的惩罚，他们就会以牙还牙。在没有迭代的游戏中，只包括一个回合，叛逃被认为是最好的策略。以牙还牙是由数学心理学家AnatolRapoport编撰的博弈论策略，但它建立在我们本能的互惠概念之上。

It teaches us that our best option when dealing with other people we cannot trust entirely is to reciprocate their choices. Since we can rarely place full trust in anyone, especially if they stand to gain by screwing us over, we lean toward tit for tat. In general, we view this as fair and just. If someone helps us, we‘re quite happy to assist them the next time they need help. But if they ignore our plight when we need help, we‘re highly unlikely to care in the inverse situation.
它告诉我们，在与我们不能完全信任的其他人打交道时，我们最好的选择是对他们的选择进行回报。由于我们很少能完全信任任何人，特别是当他们通过坑害我们而获益时，我们倾向于以牙还牙。一般来说，我们认为这是公平和公正的。如果有人帮助我们，我们很乐意在他们下次需要帮助时帮助他们。但是，如果他们在我们需要帮助时无视我们的困境，那么在相反的情况下，我们就很可能不会关心。

For this reason, evolution tends to select for cooperative behavior in groups, it benefits everyone in the long run. However, straightforward tit for tat is not as effective as the strategy known as tit for tat with forgiveness. This strategy involves occasionally cooperating in the face of defection. It is easy for two opponents to get stuck in a cycle of mutual defection from which they cannot escape unless and until one decides to cooperate.
出于这个原因，进化倾向于选择群体中的合作行为，从长远来看，它对每个人都有好处。然而，直接的以牙还牙并不像所谓的以牙还牙与宽恕的策略那样有效。这种策略包括在面对变节时偶尔进行合作。两个对手很容易陷入相互背叛的循环中，除非有一方决定合作，否则他们无法摆脱。

If both are using tit for tat, a cycle of mutual cooperation will then commence. Life is an iterative and compounding game. In the words of Peter Kaufman, it pays to “go positive and go first.” Also, remember that people make mistakes. Assuming there is no maliciousness, it pays to forgive.
如果双方都是以牙还牙，那么相互合作的循环就会开始了。生活是一个迭代和复合的游戏。用彼得-考夫曼的

话说，"积极进取，勇往直前 "是有好处的。此外，请记住，人们会犯错误。假设没有恶意，就应该原谅。

Loss Aversion 损失厌恶

Loss aversion is one of the principles that govern the value of outcomes. Daniel Kahneman explains it like this: “When directly compared or weighted against each other, losses loom larger than gains.“ According to Kahneman, people are willing to risk losing $100 for every $250 of potential gains. The loss aversion coefficient is 1:2.5. This asymmetry between the power of positive and negative expectations or experiences has an evolutionary history.
损失厌恶是支配结果价值的原则之一。丹尼尔-卡尼曼这样解释它。"当直接比较或相互加权时，损失比收益更大"。根据卡尼曼的说法，人们愿意为每250美元的潜在收益承担损失100美元的风险。损失厌恶系数是1：2.5。这种积极和消极预期或经验的力量之间的不对称有一个进化的历史。

Organisms that treat threats as more urgent than opportunities have a better chance to survive and reproduce. When it comes to reciprocity, we need to understand, “We are driven more strongly to avoid losses than to achieve gains. “ This is why putting ourselves out there, engaging people who might dismiss or reject us, is so scary. Because in the one-off situation, the pain it will cause is perceived as stronger than the positive feelings of acceptance. The trick is to start looking at outcomes in the aggregate instead of focusing on each unique situation.
将威胁视为比机会更紧迫的生物体，有更好的机会生存和繁殖。当涉及到互惠时，我们需要理解，"我们避免损失的动力比实现收益的动力更强"。这就是为什么把自己放在那里，与那些可能否定或拒绝我们的人接触，是如此可怕。因为在一次性的情况下，它所带来的痛苦被认为比接受的积极感受更强烈。诀窍是开始从总体上看结果，而不是关注每个独特的情况。

The rise of the win-win 双赢的兴起

In the physical world, the law of reciprocity works 100% of the time. The harder you punch a wall, the more force pushes against your fist, the more damage is caused to both you and the wall. In the biological world, reciprocity doesn’t have the same perfect record. However, it has been discovered to work mu ch more often than not, and thus harnessing it has significant long-term benefits. Evolutionary biologists argue that our tendency to engage in reciprocal behavior is a natural product of evolution. You are more likely to survive if you receive help from others. And you are more likely to receive that help if you have offered assistance in the past.

在物理世界中，互惠法则在100%的时间内起作用。你越是用力打墙，就会有更多的力量推到你的拳头上，对你和墙都造成更大的伤害。在生物世界中，互惠性并没有同样完美的记录。然而，它已经被发现在更多时候起作用，因此，利用它有重大的长期利益。进化论生物学家认为，我们从事互惠行为的倾向是进化的自然产物。如果你接受他人的帮助，你就更有可能生存下去。而如果你过去曾提供过帮助，你就更有可能得到这种帮助。

So the genes that encode the reciprocal instinct were more likely to be passed on. And thus the fact that the human species has ma de it to now is directly dependent on our building social interactions that are reliable, useful, and trustworthy. Humans engage in two types of reciprocity with each other: direct, which is "I help you and you help me;" and indirect, which is either a pay-it-forward concept, "I help you and then you help someone else," or more about reputation building, "I help you, building a reputation as one who helps, so that someone else helps me in the future." Both kinds work.
因此，编码互惠本能的基因更有可能被传递下去。因此，人类之所以能有现在的马德，直接取决于我们建立了可靠、有用和值得信赖的社会互动关系。人类相互之间有两种类型的互惠：

- 直接的：我帮助你，你帮助我
- 间接的，我帮助你，然后你帮助别人或者更多的是建立声誉，我帮助你，建立一个帮助人的声誉，这样别人将来就会帮助我。

While reciprocity isn't as reliable when it comes to humans as it is with physics, the concept can help you achieve better outcomes. Sometimes we go first and go positive and get nothing back, as is the case if we smile at a stranger walking on the street. Most times they'll smile back at you, but every once in a while, you're met with a scowl.
虽然当涉及到人类时，互惠性并不像物理学那样可靠，但这个概念可以帮助你取得更好的结果。有时候，我们先去积极地去做，却没有得到任何回报，就像我们在街上走的时候对一个陌生人微笑的情况。大多数时候，他们会对你回以微笑，但每隔一段时间，你就会遇到一个皱眉头。

We tend to forget the times our smile elicited a smile in response and remember the times when we received nothing in return, and so we stop smiling. However, the small loss we occasionally experience as a result of putting ourselves out there and not having it reciprocated is more than compensated for by the gains the rest of the time. If you want to get an idea of the true value of engaging in positive reciprocal behavior, just make a list of your outcomes in any given week. Life is easier and more enjoyable when we act on starting and maintaining win-win relationships with everyone. And as we explained, reciprocity has been part of our biological makeup for a very long time.
我们往往会忘记我们的微笑引起回应的时候，而记住那些没有得到任何回报的时候，所以我们不再微笑。然而，我们偶尔因为把自己放在那里而没有得到回报而经历的小损失，在其余时间里会得到更多的补偿。如果你想了解参与积极互惠行为的真正价值，只需列出你在任何特定一

周的成果。当我们采取行动开始并维持与每个人的双赢关系时，生活会更容易、更愉快。正如我们所解释的，互惠是我们生物构成的一部分，已经有很长一段时间了。

Let’s go back to the eastern Mediterranean around 1250 BCE. The bulk of the power in the region was held by the four kings of Egypt, Hatti (a region in present day Turkey), Assyria and Babylon. They didn’t like each other much, in fact, “ they deeply distrusted each other and frequently squabbled.” Demonstrating military prowess was often a way that a king achieved legitimacy in the eyes of his subjects, and there were constant conflicts, from skirmishes to full-on battles between these four areas.
让我们回到公元前1250年左右的地中海东部。该地区的大部分权力由埃及、哈提（今土耳其的一个地区）、亚述和巴比伦的四个国王掌握。他们彼此都不太喜欢对方，事实上，"他们深深地不信任对方，经常发生争吵"。展示军事力量往往是国王在其臣民眼中获得合法性的一种方式，而且这四个地区之间的冲突不断，从小规模冲突到全面的战斗。

Fighting was the norm. Then, one day, as Trevor Bryce chronicles in his article on "The Eternal Treaty", years after a “great military showdown” between the Egyptians and the Hittites, an interesting thing happened. The two kings decided to enter into the world’s first known peace treaty. The treaty was not about peace in the global sense, stemming from a desire to have a world without war. It was about peace in the immediate sense; two parties trying to establish a mutually beneficial relationship. The treaty, known as the Eternal Treaty, was the laying out of a directly reciprocal relationship between two civilizations.
战斗是常态。然后，有一天，正如特雷弗-布莱斯在他的《永恒的条约》一文中所记载的那样，在埃及人和赫梯人之间的 "伟大的军事对决 "多年后，发生了一件有趣的事情。两位国王决定签订世界上第一个已知的和平条约。该条约不是关于全球意义上的和平，而是源于对没有战争的世界的渴望。它是关于直接意义上的和平；双方试图建立一个互利的关系。该条约被称为 "永恒的条约"，是两个文明之间直接对等关系的铺垫。

Egypt was led by Ramesses, whose prima ry goal was to build “monumental construction projects, and to build his kingdom’s wealth through trade and the exploitation of its mineral-rich regions.” He had other security issues, most notably the Libyans to the west. So his interest in the treaty was to give himself some space to accomplish the legacy that mattered to him. The reality is, if you’re fighting with everyone all of the time you have to spread your resources along many fronts and you likely don’t have time to do anything else.
埃及由拉美西斯领导，他的首要目标是建造 "不朽的建筑项目，并通过贸易和开发矿产丰富的地区来建立他的王国的财富"。他还有其他安全问题，最明显的是西边的利比亚人。因此，他对条约的兴趣在于给自己一些空间来完成对他来说很重要的遗产。现实情况是，如果你一直在和所有人打仗，你就必须把你的资源分散到许多战线上，你很可能没有时间去做其他事情。

One less border to defend was an opportunity to put his efforts elsewhere. The Hittites had a similar problem, in a growing military threat from the Assyrians. In addition, their ruler Hattusili had usurped the throne from his nephew and was badly in need of some external power to legitimize his rule. Ramesses comma need great respect in the region, and his acknowledgment of Hattusili's 10 leadership would go a long way to ma in taining stability. In pursuing the treaty with Egypt, "his hope was that Ramesses' endorsement of his own position, and by imp location that of his lineal descendants, would provide some security against future challenges."
少了一条边界的防守，就有机会把他的精力放在其他地方。赫梯人也有类似的问题，在来自亚述人的军事威胁越来越大。此外，他们的统治者哈图西里从他的侄子手中篡夺了王位，并且非常需要一些外部力量来使他的统治合法化。拉美西斯需要在该地区得到极大的尊重，他对哈图西里的领导地位的承认将对维持稳定起到很大的作用。在寻求与埃及签订条约时，"他希望拉美西斯对其自身地位的认可，以及对其嫡系子孙地位的认可，能够为应对未来的挑战提供一些保障。"

The treaty contained provisions for future military support, the kind of alliance in which an attack on one is an attack on the other. Assyria, despite having both interest and a good position did not, in fact, invade Hatti during Hattusili's reign, so "quite possibly, the Egyptian-Hittite alliance did prove an effective deterrent against such an enterprise."
该条约包含了对未来军事支持的规定，这种联盟中对一方的攻击就是对另一方的攻击。亚述尽管既有利益又有良好的地位，但事实上并没有在哈图西里统治期间入侵哈提，所以 "很可能，埃及-赫梯人的联盟确实证明了对这种行为的有效威慑。"

Reciprocity based on self-interest is still reciprocity. Engaging in positive behavior to then be a receiver of positive behavior is about the long game. For both Ramesses and Hattusili, the benefits of trying to develop an alliance were clear. It gave them both an opportunity to exit fighting that consumed resources and allowed them to focus those resources on long-term stability and their legacies. Over time, the likelihood of reciprocal interactions increases, and thus it's a much better strategy to try to make them positive. The more people you help, the more people you will have willing to help you.
基于自我利益的互惠仍然是互惠。参与积极的行为，然后成为积极行为的接受者，是关于长期的游戏。对于拉美西斯和哈图西利来说，试图发展联盟的好处是显而易见的。它给了他们俩一个退出消耗资源的战斗的机会，使他们能够将这些资源集中在长期稳定和他们的遗产上。随着时间的推移，互惠互动的可能性会增加，因此，努力使其成为一种积极的战略。你帮助的人越多，你就会有更多的人愿意帮助你。

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Schadenfreude 幸灾乐祸
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Schadenfreude is a German word that has the literal translation of “damage-joy” and the more nuanced translation of delight or satisfaction at another person‘s misfortune or suffering. As Tiffany Watt-Smith writes in Schadenfreude: The Joy of Another‘s Misfortune, equivalent concepts pop up in proverbs and words from numerous countries: France, Japan, Holland, Denmark, Israel, China, Russia, and Ancient Greece and Rome. Schadenfreude is closely linked to our sense of reciprocity.
Schadenfreude是一个德语单词，直译为 "损害快乐"，更细微的翻译是对他人的不幸或痛苦感到高兴或满足。正如蒂芙尼-瓦特-史密斯在《幸灾乐祸：他人不幸的快乐》一书中写道，在许多国家的谚语和词语中都出现了类似的概念。法国、日本、荷兰、丹麦、以色列、中国、俄罗斯，以及古希腊和罗马。幸灾乐祸与我们的互惠意识密切相关。

We feel it strongest when someone‘s misfortune seems earned, as penance for their misdeeds. No one of sound mind would feel joy at the sight of an elderly lady tripping up in the street or a dog getting its paw stepped upon. But when a homophobic politician accidentally tweets a link to gay porn?
当某人的不幸似乎是应得的，作为对其错误行为的忏悔，我们的感觉最强烈。没有一个心智健全的人在看到一位老太太在街上被绊倒或一只狗被踩在脚下时会感到高兴。但是，当一个仇视同性恋的政客不小心在推特上发了一个同性恋色情的链接。

That‘s when we feel a sense of glee and feel less need to hide it. Schadenfreude is not sadism, it‘s a normal feeling that ties to our evolutionary programming and sense of fairness. We even use it as a form of bonding. According to research, schadenfreude is tied to three things: aggression, rivalry, and justice. First, our sense of belonging to a particular group leads us to feel aggression toward anyone outside our tribe.
这时，我们就会感到一种欢欣鼓舞，觉得不需要再隐藏了。幸灾乐祸不是虐待狂，它是一种正常的感觉，与我们的进化程序和公平感有关。我们甚至把它作为一种联系的形式。根据研究，幸灾乐祸与三件事有关：侵略、竞争和正义。首先，我们对某一特定群体的归属感导致我们对我们部落以外的任何人感到攻击性。

The misfortunes of those perceived as outsiders bring us satisfaction because we perceive it as benefiting our own group, even if it might not. Second, seeing things go wrong for other individuals gives us a stronger sense of our own superiority because we look and feel better in comparison. We naturally position ourselves within hierarchies based on every possible quality and are highly sensitive to where we stand in relation to others. Any sign of their inferiority transpires to be a plus for us. Status is always relative.
那些被认为是外来者的不幸给我们带来了满足感，因为我们认为这对我们自己的群体有利，即使它可能没有。第二，看到其他个人的事情出错，会让我们对自己的优越感更加强烈，因为相比之下，我们看起来和感

觉更好。我们自然而然地根据各种可能的品质将自己定位在等级制度中，并对自己与他人的关系高度敏感。他们的任何劣势的迹象对我们来说都是一种好处。地位始终是相对的。

Finally, we experience schadenfreude when our sense of reciprocity is satisfied, when we feel someone deserves a comeuppance. We may not be willing or able to enact vengeance ourselves, but we're delighted when it seems the universe has done it for us. Sometimes we are content to bide our time until this happens, as our sense of reciprocity is so strong that we expect people to get what they deserve sooner or later. Research supports this, suggesting that we feel more schadenfreude when we think someone deserves misfortune.
最后，当我们的互惠意识得到满足时，当我们觉得某人应该受到惩罚时，我们会体验到幸灾乐祸。我们可能不愿意或不能自己进行报复，但当宇宙似乎已经为我们做了这件事时，我们会很高兴。有时我们满足于等待时机，直到这种情况发生，因为我们的互惠意识非常强烈，我们期望人们迟早会得到他们应得的东西。研究支持这一点，表明当我们认为某人应得的不幸时，我们会感到更多的幸灾乐祸。

Conclusion 结论

A lot of people seem to expect the world to just hand them things without putting in any effort. This is a poor strategy because it doesn't align with the human behavior you can observe around you every day. Reciprocation teaches us that if you give people cynicism and curtness or nothing at all, you are likely to receive the same.
很多人似乎期待着世界会不费吹灰之力就把东西交给他们。这是一个糟糕的策略，因为它与你每天都能观察到的人类行为不一致。互惠原则告诉我们，如果你给别人以嘲讽和诅咒，或者什么都不给，你很可能会收到同样的东西。

But if you give people opportunity and the benefit of the doubt, you will, more often than not, be on the receiving end of the same behavior. Become what you want to see in the world and it will be so. If you want an amazing relationship with your partner, be an amazing partner. If you want people to be thoughtful and kind, be thoughtful and kind.
但是，如果你给人们机会和怀疑的好处，你将更经常地收到同样的行为。成为你想在这个世界上看到的东西，它就会变成这样。如果你想和你的伴侣有一个令人惊奇的关系，就做一个令人惊奇的伴侣。如果你想让人们变得体贴和善良，就变得体贴和善良。

If you want people to listen to you, listen to them. The best way to achieve success is to deserve success. Small changes in your actions change your entire world. People tend to receive what they offer to the world. Thus, to change our world, we must change what we offer to others. Reciprocity teaches us to be mindful of how our actions tend to come back on us. It's important to remember that we are part of the world, and thus our actions do

not happen in isolation, but are instead part of an interconnected web of effects.
如果你想让人们听你说话，就听他们说话。获得成功的最好方法是值得成功。你行动中的微小变化会改变你的整个世界。人们往往会接受他们提供给世界的东西。因此，为了改变我们的世界，我们必须改变我们提供给别人的东西。互惠教导我们要注意我们的行为是如何倾向于反作用于我们。重要的是要记住，我们是世界的一部分，因此我们的行动不是孤立发生的，而是一个相互联系的影响网络的一部分。

Thermodynamics 热力学

Thermodynamics refers to a set of laws that provide the ultimate foundation in how the world really works. It helps us understand randomness and disorder in systems and explains the conversion of energy from one form to another, the direction in which heat will flow, and the availability of energy to do work. One of the most useful aspects of thermodynamics is that it applies to all systems everywhere in the known universe, giving it a broad applicability. All work requires energy, and all systems are headed toward equilibrium. In order to explore where using the model of thermodynamics might give us new insights, we need to explain the four laws that comprise the theory.
热力学指的是一套为世界如何真正运作提供最终基础的定律。它帮助我们理解系统中的随机性和无序性，并解释了能量从一种形式到另一种形式的转换，热量的流动方向，以及能量做功的可用性。热力学最有用的方面之一是，它适用于已知宇宙中所有的系统，使其具有广泛的适用性。所有的工作都需要能量，而所有的系统都在朝着平衡的方向发展。为了探索使用热力学模型可能给我们带来的新见解，我们需要解释构成该理论的四个定律。

Here they are:

1. The first law of thermodynamics states that energy cannot be created or destroyed; it can only be transferred or changed from one form to another, such as from light to heat. The first law is known as the law of conservation of energy and it deals with the transfer of energy. There are two forms of energy exchange—heat and work. Heat is energy exchange through thermal interaction and work is energy exchange by any process other than heat. Whereas work can be completely converted into heat, heat cannot be completely converted to work.
热力学第一定律指出，能量不能被创造或破坏；它只能被转移或从一种形式改变为另一种形式，例如从光到热。第一定律被称为能量守恒定律，它涉及到能量的转移。有两种形式的能量交换--热和功。热是通过热的相互作用进行的能量交换，功是通过热以外的任何过程进行的能量交换。而功可以完全转化为热，热不能完全转化为功。

2. The second law of thermodynamics states that entropy (a measure of disorder simply understood as energy unable to be used to do work) of an isolated system always

increases. Isolated systems are those that spontaneously progress toward the state of maximum entropy of the system, also described as thermal equilibrium—no net heat flow between objects. The entropy of the universe only increases with time. One of the impacts of this law is that we need to expend energy to create order. Without the deployment of energy, all things move away from order.
热力学第二定律指出，一个孤立的系统的熵（对无序性的衡量，简单理解为无法用于做功的能量）总是在增加。孤立的系统是那些自发地朝着系统的最大熵状态发展的系统，也被描述为热平衡--物体之间没有净热流。宇宙的熵只随时间增加。这一规律的影响之一是，我们需要消耗能量来创造秩序。没有能量的部署，所有事物都会远离秩序。

3. The third law of thermodynamics states that as temperature approaches absolute zero, the entropy of a given system approaches a constant value.
热力学第三定律指出，当温度接近绝对零度时，一个特定系统的熵会接近一个恒定值。

4. The fourth law of thermodynamics is known as the zeroth law. This is because it was formulated after the first three laws but is fundamental to and assumed by the others. It states that if two objects are in thermal equilibrium with a third object, then those two objects are also in thermal equilibrium with each other.
热力学第四定律被称为第三定律。这是因为它是在前三个定律之后制定的，但却是其他定律的基础和假设。它指出，如果两个物体与第三个物体处于热平衡状态，那么这两个物体之间也处于热平衡状态。

Aside from powering most of the world, the laws of thermodynamics have many metaphorical applications. One is that contrast is valuable in achieving success, like being a big fish in a small pond. We can focus on demonstrating our value in relation to those around us. We can also recognize that we will be influenced by the behavior of the people around us, and therefore, that is why it's so important to be wise in choosing who they are. Entropy reminds us that energy is required to maintain order. You need to anticipate things falling apart and focus on prevention.
除了为世界上大部分地区提供动力之外，热力学定律还有许多隐喻性的应用。一个是对比在获得成功方面是有价值的，就像在小池塘里做一条大鱼。我们可以专注于展示我们与周围人之间的价值。我们还可以认识到，我们会受到周围人行为的影响，因此，这就是为什么明智地选择他们是谁是如此重要。熵提醒我们，维持秩序需要能量。你需要预计到事情会分崩离析，并把重点放在预防上。

> The energy state of an economy—that is, its temperature—largely determines what its members can do and how fast they can do it. Temperature—the average kinetic energy of the moving molecules in a gas—affects every chemical process and every physical property associated with life. It influences not only the cost of doing business, but the speed at

> which tasks can be accomplished, and perhaps most importantly the range of adaptive options available. Temperature is, in other words the crucial link between energy and time; the two components of power.
> 一个经济体的能量状态--也就是它的温度--在很大程度上决定了其成员能做什么以及他们能做多快。温度--气体中运动分子的平均动能--影响着每一个化学过程和与生命相关的每一个物理特性。它不仅影响做生意的成本，而且影响完成任务的速度，也许最重要的是影响可用的适应性选择范围。换句话说，温度是能量和时间之间的关键环节，是力量的两个组成部分。
> ——盖拉特•维梅伊 Geerat Vermeij

Putting up walls 筑起高墙

Much of thermodynamics is about equilibrium, including the fact that two systems of different temperatures, when exposed to each other, eventually become the same temperature. If thermal equilibrium is desirable, we can expend our efforts to maximize the exposure of the two systems to each other. Conversely, in order to keep them from reaching a state of equilibrium, some sort of insulating barrier is required. Similar to the experience of using a thermos to keep coffee hot, insulators can slow down the temperature change but cannot stop it completely.
热力学的大部分内容都是关于平衡的，包括两个不同温度的系统在相互接触时，最终会变成相同的温度这一事实。如果热平衡是可取的，我们可以花费我们的努力，最大限度地提高两个系统的相互接触。反之，为了不让它们达到平衡状态，需要某种绝缘屏障。与使用保温瓶保持咖啡温度的经验相似，绝缘体可以减缓温度变化，但不能完全阻止它。

> The physical world, all of it, only ever has one destination: equilibrium.
> 物理世界，它的全部，只有一个目的地：平衡。
> ——海伦•策尔斯基 Helen Czerski

What if we consider the equilibrium of two systems not between two containers of different temperature water, but two societies with different values. If we want to encourage equilibrium, then we can think of sharing as transfer of energy. There are three physical modes through which to transfer energy: radiation, convection and conduction. There are clear analogies of how these modes are used socially to achieve equilibrium across boundaries. For example, radio and TV radiate ideas across borders. Teacher-student exchanges act as intellectual and social convection currents.
如果我们考虑两个系统的平衡，不是两个不同温度的水的容器之间的平衡，而是两个具有不同价值的社会之间的平衡。如果我们想鼓励平衡，那么我们可以把分享看作是能量的转移。有三种物理模式可以用来转移能量：辐射、对流和传导。对于这些模式如何在社会上用于实现跨边界的平衡，有明确的类比。例如，广播和电视跨越国界辐射思想。师生交流作为知识和社会对

流的作用。

Brands and foreign aid conduct values. Mixing cultures gives them common ground. We move toward social equilibrium when we share ideas and values that have the same foundations. Much of thermodynamics is about equilibrium; including the fact that two systems of different temperatures, when exposed to each other, eventually become the same temperature. Sometimes, however, for various political or cultural reasons we decide we don't want social or cultural equilibrium and so choose to erect an insulator in the hopes of keeping the two systems from mixing. Humans have been putting up border walls for millennia.
品牌和对外援助传播价值观。文化的混合给了他们共同的基础。当我们分享具有相同基础的思想和价值观时，我们就会走向社会平衡。热力学的大部分内容都是关于平衡的；包括两个不同温度的系统，当相互接触时，最终会变成相同的温度这一事实。然而，有时出于各种政治或文化原因，我们决定不想要社会或文化平衡，因此选择竖起一个绝缘体，希望能阻止两个系统混合。几千年来，人类一直在竖立边界墙。

They often serve a physical and psychological purpose, and are a line demarcating some sort of contrast. Us and them. My land, your land. Our values, your values. Our resources, your resources. These walls, however, never seem to work. From Hadrian's Wall to the Great Wall of China to the Berlin Wall, these complex, expensive structures stopped the movement of neither people nor ideas. Why? Because contrast is hard to maintain. It is hard to keep groups of people from sharing ideas, customs, or language, just as it is difficult and expensive to keep a cube of ice solid on a hot summer day.
它们通常具有生理和心理上的目的，是划分某种对比的界线。我们和他们。我的土地，你的土地。我们的价值观，你们的价值观。我们的资源，你们的资源。然而，这些墙似乎从未起作用。从哈德良长城到中国长城，再到柏林墙，这些复杂、昂贵的结构既没有阻止人的流动，也没有阻止思想的流动。为什么呢？因为对比是很难维持的。很难阻止一群人分享思想、习俗或语言，就像在炎热的夏天保持一块冰块的牢固性一样困难和昂贵。

Through social structures such as trade or marriage, borders tend to be places of exchange and social evolution. Two different states, whether of matter or people, will be impacted by what they are exposed to. An ice cube will undergo a temperature change if left outside in warmer air, and similarly a group of people will undergo changes in custom based on who they interact with outside their group.
通过贸易或婚姻等社会结构，边界往往成为交流和社会演变的场所。两种不同的状态，无论是物质还是人，都会受到它们所接触的东西的影响。一个冰块如果被放在外面较温暖的空气中，会发生温度变化，同样，一群人也会根据他们与群体之外的人的互动而发生习俗上的变化。

Division shapes politics at every level—the personal, local, national and international. Every

> story has two sides, and so does every wall. It's essential to be aware of what has divided us and what continues to do so, in order to understand what's going on the world today.
> 分裂塑造了各个层面的政治--个人、地方、国家和国际。每个故事都有两面性，每堵墙也是如此。为了理解当今世界发生的事情，必须意识到是什么造成了我们的分裂，是什么继续造成了我们的分裂。
> ——蒂姆•马歇尔 Tim Marshall

The Romans, building Hadrian's Wall from coast to coast in northern England, seemed to best appreciate the limits of what a wall could achieve. From the outset, "Hadrian's Wall was not designed to withstand attack by a large and determined hostile army, for it was 3 too long for the defenders to be strong at every point." Rather, the wall functioned much like a border wall today. Its design was more about controlling the movement of people and goods versus stopping it completely. From the outset, it was accompanied by a diplomatic presence, with the Roman army regularly crossing its line to engage with local tribes, building relationships to gather intelligence and to try to deter major attacks.
罗马人在英格兰北部从海岸到海岸修建哈德良长城时，似乎最能体会到一堵墙所能达到的极限。从一开始，"哈德良长城的设计就不是为了抵御一支庞大而坚定的敌对军队的攻击，因为它太长了，防御者不可能在每一个点上都很强大"。相反，该墙的功能很像今天的边境墙。它的设计更多的是为了控制人员和货物的流动，而不是完全阻止它。从一开始，它就伴随着外交存在，罗马军队定期越过边界与当地部落接触，建立关系以收集情报并试图阻止重大攻击。

The Romans knew Hadrian's Wall would not stop a strong enemy force, and thus the placement and design was about slowing down aggression or giving the Romans the opportunity to be proactive by developing relationships with those on the other side. Trade continued, information and materials were shared, and personal relationships were maintained by those living on both sides. Hadrian's Wall thus was just one part of the overall strategy to maintain contrast between Roman territory and the tribes of the north.
罗马人知道哈德良长城无法阻挡强大的敌军，因此，长城的布置和设计是为了减缓侵略，或者给罗马人提供机会，通过与另一边的人发展关系来主动出击。贸易继续进行，信息和材料被分享，生活在两边的人也保持着个人关系。因此，哈德良长城只是保持罗马领土与北方部落之间对比的整体战略的一部分。

Controlling the interaction between both sides of the wall, instead of trying to stop it completely, was enough for the Romans, probably because they realized that there is a significant cost to improved insulation. Border walls do not do their jobs on their own; they need to be augmented by border personnel. As Adrian Goldsworthy writes of Hadrian's Wall, "Ultimately, its success rested less on the fortifications and barriers than on the soldiers who manned them." This statement is true of all walls.
控制墙两侧的互动，而不是试图完全阻止它，对罗马人来说已经足够了，可能是因为他们意识

到改善隔离效果需要付出巨大的代价。边境墙本身并不能完成其工作；它们需要得到边境人员的支持。正如Adrian Goldsworthy在谈到哈德良长城时写道："最终，它的成功与其说是依靠防御工事和障碍物，不如说是依靠守卫它们的士兵。" 这句话对所有的墙都是正确的。

With Hadrian's Wall, the Romans did not try to prevent cultural equilibrium completely. They recognized that the resources required to prevent any interaction across the border were more than they were willing to invest. They seemed to accept that their society could function as desired despite the influence from the cultures on the other side. To relate to thermodynamics, if we think of Roman culture as "hot," Hadrian's Wall acted as an insulator; it slowed down the cooling from exposure to other cultures but did not stop it completely.
对于哈德良长城，罗马人并没有试图完全阻止文化平衡。他们认识到，防止任何跨越边界的互动所需的资源超过了他们愿意投入的程度。他们似乎接受了这样的事实：尽管有来自另一边文化的影响，他们的社会仍能如愿运作。联系到热力学，如果我们认为罗马文化是 "热的"，哈德良长城就像一个绝缘体；它减缓了与其他文化接触的冷却，但并没有完全阻止它。

> But a boundary line, as any military expert will tell you, is also a potential battle line, for a boundary line marks off the territory of two opposed and potentially warring camps.
> 但是，正如任何军事专家会告诉你的那样，一条边界线也是一条潜在的战线，因为一条边界线标志着两个对立和潜在的交战阵营的领土。
> ———肯•威尔伯 Ken Wilber

Another famous wall that teaches us a lot about social equilibrium is the Great Wall of China. Walls have been going up between present day China and Mongolia for at least 2,000 years. Far from the restored stone wall that captures imagination today, there are actually many walls built of different materials, executed by many different dynasties along this northern border. The history of these Chinese walls is a lesson in why barriers designed to completely prevent the mingling of two sides are a bad idea. It's similar to trying to completely prevent two substances in direct contact from reaching thermal equilibrium—the barrier required requires too many resources to be practical.
另一堵著名的墙告诉我们很多关于社会平衡的知识，那就是中国的长城。在今天的中国和蒙古之间，墙已经至少有两千年的历史。远远不是今天吸引人们想象的修复后的石墙，实际上在这个北方的边界上有许多用不同材料建造的墙，由许多不同的朝代执行。这些中国城墙的历史是一个教训，说明为什么旨在完全防止双方交融的障碍是一个坏主意。这类似于试图完全阻止直接接触的两种物质达到热平衡--所需的屏障需要太多资源，不切实际。

First, walls are expensive. There is the maintenance, as well as provisioning for the people stationed at them. Second, people can go around or over walls, because walls have to end somewhere. The Chinese walls were an expression of political desire to set the location of

the northern border, and as Julia Lovell explains in The 8 Great Wall, they were not purely defensive structures. Instead they often pushed into foreign territory as a way of asserting claim.
首先，墙是昂贵的。有维护，以及为驻扎在墙边的人提供经费。其次，人们可以绕过或越过墙，因为墙必须在某处结束。中国的城墙表达了确定北方边界位置的政治愿望，正如Julia Lovell在《长城》一书中解释的那样，它们并不是纯粹的防御性建筑。相反，他们经常向外国领土推进，作为宣示主权的一种方式。

So, these walls were often not close to major centers and they covered vast territory. Not only did they have to be staffed, they required that outposts and associated supply lines be maintained in order to provision them. Right from the beginning there are stories about the essentially slave labor that was used to build the Chinese border walls and the horrible living conditions for those who staffed them.
因此，这些城墙往往不靠近主要中心，而且覆盖了广阔的领土。它们不仅需要配备人员，还需要维持前哨和相关的供应线，以便为它们提供补给。从一开始，就有关于建造中国边境墙的故事，这些墙基本上都是用的奴隶劳工，而那些工作人员的生活条件也很糟糕。

What good are walls without the loyalty of the troops stationed at them? Not much. The Great Wall was quite porous because “invaders could make detours around strong defenses until they found weaknesses and gaps,” and it was often staffed by guards who made a better living accepting bribes from those wanting to cross.
没有驻扎在那里的部队的忠诚，墙有什么用？没什么用。长城的漏洞很多，因为 "入侵者可以绕过强大的防御系统，直到他们找到弱点和缺口"，而且长城上的工作人员往往以接受那些想要越过长城的人的贿赂为生。

Lovell describes the Ming dynasty attitude toward the Great Wall as “define, enclose and exclude” which sums up the entire philosophy behind the Chinese border walls right from the beginning. On the one hand was the desire to keep the barbarians out. The nomads from the steppes of present-day Mongolia, the most famous of which was Genghis Khan, were a constant threat to the Chinese people. But there was also a desire to keep Chinese culture in; to not pollute it with the ideas and sensibilities of others.
洛弗尔将明朝对长城的态度描述为 "定义、包围和排斥"，这从一开始就概括了中国边境墙背后的整个哲学。一方面是希望把野蛮人拒之门外。来自现今蒙古草原的游牧民族，其中最著名的是成吉思汗，对中国人来说是一个持续的威胁。但也有一个愿望，就是把中国文化留在国内；不要用别人的思想和情感来污染它。

The walls were thus also inward-looking, a way of maintaining “cultural superiority.” However, as Lovell describes, “it was not the case that border walls absolutely and immovably separated a culture of rice, silk and poetry on the one side from a culture of

horse milk, pelts and war on 9 10 11 the other." There was a lot of intermingling. There were ethnic Chinese. They were invaded by barbarians. The barbarians adopted some Chinese ways. They became the new ethnic Chinese, who were, in turn, invaded by barbarians. This cycle played out multiple times over the centuries, influencing the development of Chinese culture.
因此，城墙也是内向型的，是保持 "文化优越性 "的一种方式。然而，正如Lovell所描述的那样，"并不是说边境墙绝对地、不可动摇地将大米、丝绸和诗歌的文化与马奶、皮毛和战争的文化分开。有很多人混杂在一起。有汉族人。他们遭到了野蛮人的入侵。野蛮人采用了一些中国的方式。他们成为新的中国人，反过来，他们又被野蛮人入侵。这种循环在几个世纪里多次上演，影响了中国文化的发展。

The more cultures mix, the more likely they are to reach cultural equilibrium; we tend not to regard as different people we share customs with. Lovell tells the following story, which demonstrates the natural push for equilibrium and how hard it is to maintain contrast between two cultures who are in direct contact: In 307 BC—in the middle of the Warring States period —King Wuling of the northern state of Zhao started a court debate about fashion: should upper garments be buttoned to the left or down the middle? Behind this seemingly frivolous and innocuous question of style lay a strategic issue of huge political and cultural significance. King Wuling planned to swap the traditional Chinese gown for the side-buttoning tunic of the nomads, and the aristocratic Chinese chariot for their mounted archers.
文化混合得越多，就越有可能达到文化平衡；我们往往不会把与我们有共同习俗的人视为异类。洛弗尔讲述了下面这个故事，它显示了对平衡的自然推动，以及在两种直接接触的文化之间保持对比是多么困难。公元前307年--战国中期--北方赵国的武灵王开始了一场关于时尚的宫廷辩论：上衣应该向左扣还是向中间扣？在这个看似轻率无害的风格问题背后，隐藏着一个具有巨大政治和文化意义的战略问题。武陵王计划将传统的中国长袍换成游牧民族的侧扣长衫，将贵族式的中国战车换成他们的骑射手。

Embedded in the mooted change of dress was a revolution in worldview: an acceptance of the military superiority of the nomads and of the need to fight them on their own terms. Thus the history of China is not the story of a culture that managed to completely insulate itself and remain "pure." Current 12 13 Chinese culture is composed of influences and ideas that were exchanged along its borders.
酝酿中的服装改变是世界观的革命：接受游牧民族的军事优势，并需要按照他们自己的条件与他们作战。因此，中国的历史并不是一个成功地将自己完全隔离并保持 "纯净 "的文化的故事。当前12 13中国文化是由沿其边界交流的影响和思想组成的。

Of all the walls in history, the Berlin Wall stands out as one that was erected to be an absolute, uncompromising barrier that was intended to prevent the mixing of two

ideologies; to stop equilibrium. Walls don't just restrict physical movement: they can shape and modify ideas and social norms. The Berlin Wall was different from Hadrian's Wall and the Great Wall of China in that it was less part of a military and diplomatic strategy and more a psychological barrier. It was not designed to facilitate interaction with potentially hostile tribes (like Hadrian's) or to claim territory and preserve culture (like China's).
在历史上所有的墙中，柏林墙作为一个绝对的、不妥协的屏障而脱颖而出，其目的是为了防止两种意识形态的混合；阻止平衡。墙不只是限制物理移动：它们可以塑造和修改思想和社会规范。柏林墙与哈德良长城和中国长城不同，它不是军事和外交战略的一部分，而更像是一道心理屏障。它的设计不是为了促进与潜在敌对部落的互动（如哈德良长城），也不是为了主张领土和保护文化（如中国长城）。

The Berlin Wall tried to stop the movement of ideas as well as people. Soviet Communism and its East German counterpart depended on behavior-shaping propaganda and psychological controls, neither of which would work if challenged by outside economic or political ideas. The Berlin Wall was built to stop every possible transfer from one side to another. After World War II, when Germany was divided into East and West, Berlin became this little oasis of democracy behind the Iron Curtain of Communism. It was the only weak point in an otherwise formidable barrier between the ideas and politics of the Americans and the Soviets.
柏林墙试图阻止思想和人员的流动。苏联共产主义和它的东德同行依靠的是塑造行为的宣传和心理控制，如果受到外部经济或政治思想的挑战，这两者都不会起作用。柏林墙的建立是为了阻止每一个可能的从一边到另一边的转移。二战后，当德国被分为东西两部分时，柏林成为共产主义铁幕后的这块小小的民主绿洲。它是美国人和苏联人的思想和政治之间的强大屏障中唯一的薄弱点。

Berlin was occupied by Britain, the United States, France, and Russia after the war. Until 1961 it still functioned as one city, which allowed for an escape route for those who wanted to leave communist East Germany. As Frederick Taylor explains, explains in The Berlin Wall, Between 1945 and 1961, some two and a half million fled in this way, reducing [East Germany's] population by around 15 per cent. Ominously for the Communist regime, most emigrants were young and well qualified. The country was losing the cream of its educated professionals and skilled workers at a rate that risked making the Communist state totally unviable.
战后，柏林被英国、美国、法国和俄罗斯占领。直到1961年，它仍然作为一个城市运作，这使得那些想离开共产主义东德的人有了一条逃生通道。正如弗雷德里克-泰勒在《柏林墙》中解释的那样，在1945年至1961年期间，约有250万人通过这种方式逃离，使[东德]的人口减少了约15%。对共产党政权来说，不祥的是，大多数移民都是年轻的、合格的。这个国家正在失去其受过教育的专业人员和熟练工人的精英，其速度有可能使共产主义国家完全无法生存。

During the summer of 1961, the exodus reached crucial levels. Every day, thousands of East Germans slipped into West Berlin and from there were flown to West Germany itself along the so-called “air corridors.” The regime was not prepared to abandon the political and economic restrictions that fueled the hemorrhaging of its brightest and best. So they built a wall. And not just any wall—one with multiple layers of complexity and deterrents. In addition to the structure above ground, subway tunnels, sewers, and anything that could give passage to the west was sealed off or modified so that human passage was thwarted. The Berlin Wall never worked completely.
在1961年的夏天，移民潮达到了关键的程度。每天都有成千上万的东德人溜进西柏林，然后从那里沿着所谓的 "空中走廊 "飞往西德。该政权不准备放弃政治和经济限制，这些限制助长了其最聪明和最优秀的人的流失。所以他们建造了一堵墙。而且不是普通的墙，而是具有多层复杂性和威慑性的墙。除了地面上的结构外，地铁隧道、下水道和任何可以通往西部的地方都被封锁或修改，以便阻挡人类通行。柏林墙从未完全发挥作用。

People still crossed, albeit at huge risk, and some lost their lives in the attempt. But what is even more remarkable is that the Berlin Wall contributed to the very ideology it was trying to keep out. Effectively keeping the population prisoner only served to undermine the values of communism East Germany was trying to promote. The pressure built until one day, in November 1989, it was taken down by the very people it had been trying to keep apart. The story of the Berlin Wall is a clear example the inevitable force toward equilibrium. There was no way for the East German state to invest enough energy to prevent the social heat exchange and eventual equilibrium.
人们仍在穿越，尽管面临着巨大的风险，一些人在尝试中失去了生命。但更值得注意的是，柏林墙促成了它试图阻止的意识形态。有效地将民众囚禁起来，只会破坏东德试图推动的共产主义价值观。压力越来越大，直到有一天，1989年11月，它被它一直试图隔离的人拆掉了。柏林墙的故事是一个明显的例子，说明了走向平衡的不可避免的力量。东德国家没有办法投入足够的能量来阻止社会热交换和最终的平衡。

To keep two substances in direct contact from adjusting to the same temperature is difficult. It requires an insulator and preventing any temperature change in the two substances is only possible with a constant investment of energy. The concept of equilibrium is a useful lens to understanding the inevitable fall of physical walls that humans have built around the globe. It is difficult to prevent two cultures in direct contact from sharing ideas and customs.
要让直接接触的两种物质不调整到相同的温度是很困难的。它需要一个绝缘体，防止这两种物质的任何温度变化，只有在不断投入能量的情况下才有可能。平衡的概念是一个有用的镜头，可以理解人类在全球范围内建立的物理墙的不可避免的下降。很难阻止直接接触的两种文化分享思想和习俗。

We don’t Like disorder 我们不喜欢无序

As we have seen, maintaining order requires energy. Why put in that energy? Why extended ourselves to avoid the inevitable disorder of life? Using the second law of thermodynamics as a lens provides valuable insight into why reducing entropy is important. Entropy can come across as too complicated or nonsensical, so some effort in coming up with an easy to use definition is well worth it. Murray Gell-Mann, a Nobel prize winning physicist, clarifies entropy in contexts such as organizing a pile of coins or the mixing of jelly and peanut butter in their containers. Why is it that if someone knocks the table the coins will get mixed up, or that despite their best efforts your children inevitably get jelly into the peanut butter jar and vice versa? “The explanation is that there are more ways for [coins] to be mixed up than sorted. There are more ways for peanut butter and jelly to contaminate each other’s containers than to remain completely pure. To the extent that chance is operating, it is likely that a closed system that has some order will move toward disorder, which offers so many more possibilities.”
正如我们所看到的，维持秩序需要能量。为什么要投入这种能量？为什么要扩大自己的范围来避免生活中不可避免的无序？以热力学第二定律为视角，对减少熵的重要性提供了有价值的洞察力。熵可能被认为是太复杂或无意义的，所以在想出一个容易使用的定义方面的一些努力是非常值得的。诺贝尔物理学奖得主默里-盖尔-曼（Murray Gell-Mann）在整理一堆硬币或将果冻和花生酱混合在容器中等情况下阐明了熵的含义。为什么如果有人敲桌子，硬币就会被混在一起，或者尽管你的孩子尽了最大努力，但还是不可避免地把果冻弄到花生酱罐里，反之亦然？"解释是，[硬币]被混在一起的方法比分类的方法多。花生酱和果冻污染对方容器的方式比保持完全纯净的方式要多。在机会运作的范围内，一个有一些秩序的封闭系统很可能会走向无序，这提供了更多的可能性。

The Value of Contrast 对比的价值
The problem of equilibrium. Writing in Twilight of the Idols, Friedrich Nietzsche says of politics, “Almost every party grasps that it is in the interest of its own self-preservation that the opposing party should not decay in strength.” This is pointing out that there is value in contrast. If all the forces are balanced, a true state of equilibrium, there is no change, no growth, no movement. It is contrast that drives development.
平衡的问题。弗里德里希-尼采在《偶像的黄昏》中写道，关于政治，"几乎每一个政党都掌握着，为了自己的自我保护，反对党的力量不应该衰落"。这是在指出，对比中存在价值。如果所有的力量都是平衡的，是真正的平衡状态，那么就没有变化，没有增长，没有运动。正是对比推动了发展。

A simple example of entropy is to consider life itself. There is a constant effort to maintain structure (avoid entropy) by consuming external energy (sunlight, food). In the process, life increases the entropy of (destroys) its environment and decreases entropy (builds or repairs) the organism's body. Another way to think of entropy is to imagine the game of broken telephone that you might have played when you were younger.
熵的一个简单例子是考虑生命本身。通过消耗外部能量（阳光、食物），不断努力维持结构（避免熵）。在这个过程中，生命增加了其环境的熵（破坏），减少了熵（建立或修复）有机体的身体。另一种思考熵的方式是想象你年轻时可能玩过的破电话游戏。

A group of children are sitting around in a circle, and one child starts the game by whispering a sentence into the ear of the person next to them. The sentence gets transferred one child at a time until it has made its way around the circle. The final sentence is compared to the original, often with much hilarity. Something mundane like "today is Wednesday" can turn into "I like scary movies." Because there are so many more options for change to occur, each repetition is more likely to drift from the original.
一群孩子围坐一圈，一个孩子开始游戏，向旁边的人耳语一句话。这句话每次由一个孩子转过来，直到它绕了一圈。最后的句子与原来的句子进行比较，往往会有很多欢笑声。像 "今天是星期三 "这样平凡的事情可以变成 "我喜欢恐怖电影"。因为有这么多变化的选择，每一次重复都更有可能偏离原来的内容。

> Art is born out of as well as encapsulates the continuing battle between order and chaos. It seeks order or form, even when portraying anarchy.
> 艺术诞生于秩序和混乱之间的持续斗争，同时也概括了这种斗争。它寻求秩序或形式，即使是在描绘无政府状态的时候。
> 约翰•约克 John Yorke

Humans put a lot of effort into preventing disorder. If we look at society broadly, we notice that disorder flares up all the time. The structures we create nudge the natural disorder of life into order. Examples of this are laws, religions, social norms, customs, and the stories that explain and perpetuate them. While the stories we tell are unimaginably diverse on the surface, if we go deeper we can spot distinct patterns and structures that emerge every single time.
人类在防止无序方面付出了很多努力。如果我们广泛地看一下社会，我们注意到无序状态一直在爆发。我们创造的结构将生活中的自然无序推向秩序。这方面的例子有法律、宗教、社会规范、习俗，以及解释和延续它们的故事。虽然我们讲述的故事在表面上有难以想象的多样性，但如果我们深入了解，就能发现每一次出现的独特模式和结构。

The content may vary, but the form of the stories we tell is remarkably predictable. Fairy tales are one way we have combated disorder in our history. They offer explanations for

occurrences that seem to have none, giving a structure to what we find hard to comprehend. Fairy tales also set out a common understanding that everyone can buy into, trying to slow down entropy by preemptively fitting the unexplainable into a systematic order. The patterns in our fairy tales are so inescapable across time and cultures that it seems logical to suggest there must be a reason.
内容可能有所不同，但我们讲的故事的形式是非常可预测的。童话是我们在历史上与混乱作斗争的一种方式。它们为似乎没有的事件提供解释，为我们难以理解的事情提供了一个结构。童话还提出了一个每个人都能接受的共同理解，试图通过预先将无法解释的事物纳入一个系统的秩序来减缓熵的增长。我们的童话故事中的模式在不同的时间和文化中是如此不可避免，以至于认为一定有其原因，这似乎是合乎逻辑的。

Soap operas may not seem to have much in common with Shakespeare, yet at the heart of every story is the drumroll moment –the turning point when everything changes, and the characters 16 must go on a journey to restore normality. As if we can slow down entropy by telling stories to reduce disorder. Fairy tales these days are often associated with the Disney renditions most of us are familiar with. But the original compilations, such as those collected by the Grimm brothers, or the more original versions pulling from even older stories, like those by Hans Christian Andersen , offer a better view to show how fairy tales can be understood as combating entropy.
肥皂剧似乎与莎士比亚没有太多共同之处，但每个故事的核心都是击鼓传花的时刻--当一切发生变化时的转折点，人物必须踏上恢复正常的旅程。仿佛我们可以通过讲故事来减缓熵，减少无序。如今，童话故事往往与我们大多数人熟悉的迪斯尼改编版联系在一起。但是，原始的汇编，如格林兄弟收集的那些，或从更古老的故事中提取的更原始的版本，如安徒生的那些，提供了一个更好的视角，以显示童话如何可以被理解为对抗熵。

In Into The Woods, John Yorke suggests that the way we tell stories is indicative of our desire to find order in the world. Stories are an attempt to tame the terrifying randomness that surrounds us. As we go through life, we are constantly absorbing chaotic information that we make sense of through narratives. Yorke writes that “every act of perception is an attempt to impose order, to make sense of a chaotic universe. Storytelling, at one level, is a manifestation of this process.”
在《走进森林》中，约翰-约克提出，我们讲故事的方式表明了我们在世界中寻找秩序的愿望。故事是驯服我们周围可怕的随机性的一种尝试。在我们的生活中，我们不断地吸收混乱的信息，并通过叙述使之合理化。约克写道："每一个感知行为都是一种强加秩序的尝试，使混乱的宇宙变得有意义。讲故事，在一个层面上，是这个过程的表现"。

The core structure of the stories we tell can be described in a few different ways; equilibrium–disequilibrium–new equilibrium, journey there / journey back, someone is looking for something and someone or something is in their way, and so on.

我们讲的故事的核心结构可以用几种不同的方式来描述；平衡--失衡--新的平衡，去那里的旅程/回来的旅程，有人在寻找什么，有人或东西挡住了他们的路，等等。

Fairy tales beat back the stress that disorder can cause by putting the world back in order. As Marina Warner argues in Once Upon a Time: A Short History of Fairy Tale, they convey a hope that order can come about even in the face of almost unexplainable acts. Child abandonment and neglect, rape and death, fairy tales take away the randomness by putting these acts into a larger, explainable structure and offering insight on how to process them.
童话故事通过让世界恢复秩序来击退无序可能造成的压力。正如玛丽娜-华纳在《曾几何时：童话简史》中所说，它们传达了一种希望，即即使面对几乎无法解释的行为，秩序也能实现。遗弃和忽视儿童、强奸和死亡，童话通过将这些行为放入一个更大的、可解释的结构中，并提供如何处理它们的见解，从而消除随机性。

We are drawn to stories that make things feel a little less random, just as we are drawn to storytellers who seemingly simplify complexity. We are all aware of disorder and the natural uncertainty that follows it and are attracted to stories that reduce it. By turning individual struggles into common experience, fairy tales put order into the disorder of “assault, cruelty, and injustice.”
我们被那些让人感觉不那么随机的故事所吸引，就像我们被那些似乎简化了复杂性的讲故事的人所吸引。我们都意识到无序和随之而来的自然不确定性，并被减少这种不确定性的故事所吸引。通过将个人的挣扎变成共同的经历，童话将秩序纳入 "攻击、残酷和不公正 "的无序中。

These stories do not feature gods or superheroes, and instead look at the everyday person as they navigate their ordinary lives. “The structures of wonder and magic open ways of recording experience while imagining a time when suffering will be over.” Namely, when disorder will be conquered. There are no surprises in fairy tales. Not for the characters and not for us. We have heard the story before and know what will happen. However magical the world they depict, we have total faith in the structure of the story. That predictability is one means of providing order to things that would otherwise seem chaotic.
这些故事不以神或超级英雄为特色，而是着眼于日常生活中的人，因为他们在平凡的生活中穿梭。"奇迹和魔法的结构打开了记录经验的方式，同时想象着一个痛苦将结束的时代"。也就是说，当无序将被征服的时候。童话故事里没有惊喜。对人物和我们来说都不是。我们以前听过这个故事，知道会发生什么。无论他们描绘的世界多么神奇，我们对故事的结构完全信任。这种可预测性是为本来看似混乱的事物提供秩序的一种手段。

What you learn about the world through fairy tales is to accept things that may not make obvious sense. Trust that there is order behind them, and by doing so slow down the entropy of life. “The landscape of fairy tales is symbolic: ‘the forest is where you are when

your surroundings are not mastered'." Fairy tales provide a means of mastering your surroundings by presenting a way to understand your world, giving it some order and helping you make your way through it. While works that deviate from the archetypal narrative can be interesting, those that follow it most closely tend to enjoy the most commercial success.
你通过童话故事了解到的世界是接受那些可能没有明显意义的事情。相信它们背后有秩序，并通过这样做减缓生命的熵。"童话的景观是象征性的：'当你的周围环境没有被掌握时，森林就是你所在的地方'"。童话提供了一种掌握周围环境的手段，它提出了一种理解你的世界的方法，赋予它一些秩序，并帮助你在其中找到出路。虽然偏离原型叙事的作品可能很有趣，但那些最紧跟原型的作品往往享有最大的商业成功。

They just feel right. They are an escape from the chaotic real world. Unable to face meaninglessness, "in order to stay sane we must impose some kind of pattern." This is what narratives achieve, and it's the same reason we craft them within our own lives. They give us a sense of a coherent identity. It is interesting that fairy tales cross cultural and geographical boundaries. Similar stories occur in many places. Sometimes this is due to exchange via travel. The stories carried by wanderers were then modified and built on in their new homes easily because their structure had already occurred.
它们只是感觉正确。它们是对混乱的现实世界的一种逃避。由于无法面对无意义，"为了保持理智，我们必须强加某种模式"。这就是叙事的目的，这也是我们在自己的生活中制作叙事的原因。它们给我们一种连贯的身份感。有趣的是，童话故事跨越了文化和地理界限。类似的故事发生在许多地方。有时这是由于通过旅行进行交流。流浪者携带的故事在他们的新家很容易被修改和建立，因为他们的结构已经出现了。

Often, though, fairy tales in different cultures are very similar even when it's not believed they were shared through travel. They are a common cultural phenomenon. So it is understandable that they have a lasting, worldwide appeal. The staying power of fairy tales "suggests that they must be addressing issues that have a significant social function." By informing behavior in a similar way, fairy tales combat entropy by creating a common understanding that most people can interact with.
但通常情况下，不同文化中的童话故事非常相似，即使人们不相信它们是通过旅行分享的。它们是一种常见的文化现象。因此，它们具有持久的、世界性的吸引力是可以理解的。童话的持久力 "表明它们一定在解决具有重要社会功能的问题"。通过以类似的方式告知行为，童话通过创造一个大多数人可以互动的共同理解来对抗熵。

Between the Grimm Brothers and Pixar, the role of fairy tales has been explored and revisited through lenses that change as society evolves. They are not necessarily the things they once were in terms of their role in social norms. But just because they've changed doesn't mean that humans have ceased to use stories to beat back disorder. Entropy is a

law of thermodynamics, arguably the one we struggle with understanding the most. But our awareness of the higher potential for disorder is evident through our use of fairy tales to create order out of disorder.
在格林兄弟和皮克斯之间，童话的作用已经通过随着社会的发展而变化的镜头被探索和重新审视。就其在社会规范中的作用而言，它们不一定是曾经的东西。但它们的变化并不意味着人类已经停止使用故事来击退无序。熵是热力学的一个定律，可以说是我们在理解上最纠结的一个。但是，通过我们使用童话故事从无序中创造秩序，我们对无序的高潜力的认识是显而易见的。

Conclusion 结论

Nothing escapes the laws of thermodynamics. Everything is moving toward equilibrium, including people, culture, ideas, and information. Of course, total equilibrium means no life, so the place where there is no difference in anything is the place where everything rests. Thus, while pursuing difference is worthwhile and necessary, it's important to understand that any barrier you try to erect will face a relentless pressure to attain equilibrium.
没有什么能逃脱热力学定律的约束。一切都在朝着平衡的方向发展，包括人、文化、思想和信息。当然，完全的平衡意味着没有生命，所以在任何事物中没有差异的地方就是万物的安息之所。因此，虽然追求差异是值得和必要的，但重要的是要明白，你试图建立的任何障碍都将面临达到平衡的无情压力。

Therefore, it's important to remember that it takes a lot of work to maintain separation. Entropy is a similar constant. The end state of high entropy is also incompatible with life. Sensing this, we try to understand randomness and the unexplainable through stories that seem to put order back into our lives, thereby reducing entropy. Narratives are important. We use them to reduce chaos and stop us drifting too far from social order and cultural norms, which allows us to maintain our complex societies.
因此，重要的是要记住，维持分离需要大量的工作。熵是一个类似的常数。高熵的最终状态也与生命不相容。感受到这一点，我们试图通过故事来理解随机性和无法解释的东西，这些故事似乎可以把秩序放回我们的生活中，从而减少熵。叙事是很重要的。我们用它们来减少混乱，阻止我们离社会秩序和文化规范太远，这使我们能够维持我们的复杂社会。

Inertia 惯性

Starting something is hard, but so is stopping something. In physics, inertia refers to the resistance a physical object has to a change in its state of motion. Things at rest don't start moving on their own, and planets continue to circle the sun without a means of

propulsion. The phenomenon of inertia is the subject of Isaac Newton's first law of motion, which states, "An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force." If a force—for example, friction—is not present, the object will continue as it was, moving in the same velocity or remaining at rest. Left to themselves, systems resist change.
启动某件事情很难，但停止某件事情也很难。在物理学中，惯性是指一个物理物体对其运动状态的改变所具有的阻力。静止的东西不会自己开始移动，而行星在没有推进手段的情况下继续围绕太阳。惯性现象是艾萨克-牛顿第一运动定律的主题，该定律指出："静止的物体保持静止，运动的物体保持相同速度和方向的运动，除非受到不平衡力的作用。" 如果一个力--例如摩擦力--不存在，物体将继续保持原来的状态，以相同的速度运动或保持静止。如果任其自生自灭，系统会抵制变化。

Galileo discovered the principles of inertia through an experiment by setting two inclined planes against each other, almost like a skateboard halfpipe, and then rolling a ball down one of them. The clever experiment made it easy to see that the smoother the surface, the closer the ball would come to reaching its initial height on the opposite plane. From this finding, he argued that any difference in initial and final height of the ball was due to the presence of friction, an opposing force.
伽利略通过一个实验发现了惯性的原理：将两个斜面相互对立，几乎像滑板的半管，然后将一个球从其中一个斜面上滚下来。这个巧妙的实验使人们很容易看到，表面越光滑，球就越接近于在对面平面上达到其初始高度。根据这一发现，他认为球的初始和最终高度的任何差异都是由于摩擦力的存在，一种相反的力量。

In his book Principles of Philosophy, Descartes talks about inertia as well, stating that the first law of nature is that "each thing, as far as is in its power, always remains in the same state; and that consequently, when it is once moved, it always continues to move." Inertia is a useful model to try to understand some elements of our behavior, including our thinking patterns and habits. Our natural inclination to reject the new is in part normal resistance to the effort required to change. Keeping things as they are requires almost no effort and involves little uncertainty.
笛卡尔在他的《哲学原理》一书中也谈到了惯性问题，他说自然界的第一条定律是："每个事物在其能力范围内，总是保持在相同的状态；因此，当它一旦被移动，它总是继续移动。" 惯性是一个有用的模型，可以尝试理解我们行为的一些要素，包括我们的思维模式和习惯。我们拒绝新事物的自然倾向部分是对改变所需努力的正常抵抗。保持事物的原样几乎不需要任何努力，也不涉及任何不确定性。

We need force to effect change, and force requires effort. This model offers a lens to help us understand resistance to change and why we fail ourselves when we get complacent. Inertia implies that once we stop doing something, getting started again is harder than

continuing the whole time would have been. At a basic level, many brain studies have shown that the idea of multitasking is a myth. When we shift our focus from one input to another, we exert more energy and use more time to finish everything than if we would have completed one task before starting another. Inertia also helps to explain why we continue on with bad habits and why it's hard to make systematic change.
我们需要力量来实现改变，而力量需要努力。这个模型提供了一个镜头，帮助我们理解对变革的阻力，以及为什么我们在自满时自己会失败。惯性意味着，一旦我们停止做某事，再次开始就比一直坚持下去要难。在一个基本层面上，许多大脑研究表明，多任务处理的想法是一个神话。当我们把注意力从一项输入转移到另一项输入时，与我们在开始另一项任务之前完成一项任务相比，我们要花费更多的精力和时间来完成一切。惯性也有助于解释为什么我们继续保持坏习惯，以及为什么很难做出系统的改变。

Many cities continue to rely on cars for short commutes instead of implementing an infrastructure to facilitate public transportation, walking, or cycling. We stay at jobs we hate, avoid meaningful conversations with people of different opinions, and almost never change the religion our parents imposed on us at birth. All because it is easier to stay on our current path, however stagnant and unfulfilling it may be.
许多城市继续依赖汽车进行短途通勤，而不是实施基础设施来促进公共交通、步行或骑自行车。我们留在自己讨厌的工作岗位上，避免与不同意见的人进行有意义的对话，几乎从未改变我们出生时父母强加给我们的宗教。所有这些都是因为留在我们目前的道路上更容易，无论它是多么的停滞不前和不令人满意。

> For, like a mass in Newton's first law of motion, once our minds are set in a direction, they tend to continue in that direction unless acted on by some outside force.
> 因为，就像牛顿第一运动定律中的质量一样，一旦我们的思想被设定在一个方向上，它们就会继续朝着这个方向前进，除非受到某种外力的作用。"
> ——伦纳德•姆洛迪诺 Leonard Mlodinow

Once an idea gets rolling, it can be hard to stop 一旦一个想法得到发展，就很难停止

Why do some products hang around for centuries, even when better and cheaper ones come on the market? Why do others burst onto the scene with so much promise only to flame out quickly? We can use the lens of inertia to provide part of the answer to these questions. Most of the time, our consumption patterns are based on habit, not new thinking. We buy what we buy and have the preferences that we do because we've had them for a long time.
为什么有些产品在市场上存在了几个世纪，即使有更好更便宜的产品出现？为什么其他产品突然出现在舞台上，有如此大的希望，但很快就熄灭了？我们可以使用惯性的镜头来提供这些问

题的部分答案。大多数时候，我们的消费模式是基于习惯，而不是新思维。我们买我们所买的东西，有我们的偏好，因为我们已经有很长一段时间了。

When we go to the grocery store we seldom invest the energy to apply critical thinking to the products we've bought dozens of times. The longer we've been buying something the more ingrained this product is in our lives. Even if we find out it is unhealthy, we seldom switch immediately, if at all.
当我们去杂货店的时候，我们很少投入精力对我们已经买过几十次的产品进行批判性思考。我们买东西的时间越长，这个产品在我们的生活中就越根深蒂固。即使我们发现它是不健康的，我们也很少立即更换，如果有的话。

We can understand why this happens by looking at Newton's second law, relating force to acceleration, which show us that mass matters when it comes to inertia. When a force acts on an object, the object accelerates in the direction of the force. If mass stays the same, increasing force will increase acceleration. If the force on an object remains constant, increasing mass will decrease acceleration. Essentially, the greater the mass, the greater the inertia. Heavier objects require more force to accelerate or slow them down than do lighter objects.
我们可以通过研究牛顿第二定律来理解为什么会发生这种情况，该定律将力与加速度联系起来，告诉我们在涉及惯性时，质量很重要。当一个力作用在一个物体上时，该物体在力的方向上加速。如果质量保持不变，增加力会增加加速度。如果物体上的力保持不变，增加质量将降低加速度。基本上，质量越大，惯性越大。较重的物体比较轻的物体需要更多的力来加速或减速。

Momentum 势头

Imagine a train pulling into a station and screeching to a halt. The driver doesn't press the brakes when they want to stop. They do it well in advance, allowing enough time for the full length of the train, weighing hundreds or even thousands of tons, to come to a standstill. A train can't just stop moving as soon as the driver applies the brakes because of momentum. The equation for calculating momentum is p=m*v, where p is momentum, m is mass and v is velocity. When something with mass is moving, it has momentum. The greater the mass and the greater the velocity, the greater the momentum of an object.
想象一下，一列火车驶入车站后戛然而止。司机并不是在想停的时候才踩刹车的。他们提前做好准备，留出足够的时间让重达数百甚至数千吨的火车全线停住。由于动量的原因，火车不可能在司机踩下刹车后就立即停止前进。计算动量的方程式是p=m*v，其中p是动量，m是质量，v是速度。当有质量的东西在移动时，它就有动量。质量越大，速度越大，物体的动量就越大。

If you’re out for a run, it takes a lot less effort for you to stop than it does for a train because you’re lighter and slower. Doubling either the speed or the mass of an object will double its momentum. Isaac Newton’s second law of motion states that the acceleration of an object is the result of two factors: the forces acting upon it and its mass. This is in contrast to the first law of motion, which states that an object will remain at its current velocity if the forces acting on it are all balanced. So, acceleration is the product of unbalanced forces. Outside of physics, we consider something to have momentum if it is progressing in a particular direction in such a way that it would take a weighty outside force to stop it or change its direction.
如果你出去跑步，你停下来所需的努力比火车要少得多，因为你更轻更慢。将一个物体的速度或质量增加一倍，它的动量就会增加一倍。艾萨克–牛顿的第二运动定律指出，一个物体的加速度是两个因素的结果：作用在它身上的力和它的质量。这与第一运动定律相反，第一运动定律指出，如果作用在物体上的力都是平衡的，物体将保持其当前的速度。因此，加速度是不平衡力的产物。在物理学之外，我们认为，如果一个东西在一个特定的方向上前进，需要一个重量级的外力来阻止它或改变它的方向，那么它就具有动量。

The relevance of mass has analogous application in our habits. The longer we’ve been doing something, the more it has become part of both our identity and our understanding of the world. Thus, the amount of effort required to change a habit is greater proportional to the length of time we’ve had it. What is true for the individual is also true for our larger societies. The longer a product has been used by a society, the harder it is to change to a new one, even if there are obvious benefits. Let’s take a look at two products, lead and absinthe, and compare their social inertia.
质量的相关性在我们的习惯中也有类似的应用。我们做某件事的时间越长，它就越成为我们身份和对世界理解的一部分。因此，改变一个习惯所需的努力与我们拥有它的时间长度成正比。对个人而言，这一点对我们更大的社会也是如此。一个社会使用一种产品的时间越长，就越难改变为一种新的产品，即使有明显的好处。让我们看看两种产品，铅和苦艾酒，并比较它们的社会惰性。

About 2000 years ago, Marcus Vitruvius Pollio wrote On Architecture, a wide-ranging series of books, covering not only architecture, but engineering, philosophy, and medicine. He had many suggestions and observations, one of which was, “Water ought by no means to be conducted in lead pipes if we want to have it wholesome.” Before we had gunpowder, compasses, or forks, we had strong indications that we shouldn’t be exposing ourselves to a lot of lead. No one really heeded his advice. Over the next millennia, lead was added to makeup, gasoline, and paint, and it was part of many manufacturing processes, such as printing. Concerns about its side effects kept cropping up as people kept noticing a high correlation between death and exposure to lead.

大约2000年前，马库斯•维特鲁威•波利奥写了《论建筑》，这是一套内容广泛的丛书，不仅涉及建筑，还包括工程、哲学和医学。他有许多建议和意见，其中之一是："如果我们想让水变得健康，就决不应该用铅管来输送水"。在我们拥有火药、指南针或叉子之前，我们有强烈的迹象表明，我们不应该让自己暴露在大量的铅中。没有人真正听从他的建议。在接下来的几千年里，铅被添加到化妆品、汽油和油漆中，而且是许多制造过程的一部分，比如印刷。由于人们不断注意到死亡和暴露于铅之间的高度相关性，对其副作用的担忧不断出现。

Nonetheless, it was used to dilute wine, it made the pipes that carried drinking water, and it was added to face cream to help women achieve the paleness that was the social standard of beauty. In 1910, Alice Hamilton was appointed to head a survey on industrial illness in Illinois, USA. Over the next few years, she became America's leading expert on industrial toxicology, providing definitive evidence of, among other things, the dangers of lead exposure in the workplace. Despite this evidence, the American car company General Motors proceeded with the creation of leaded fuel in the 1920s. Hamilton campaigned extensively against the introduction of leaded fuel, and she and her colleagues provided an extensive overview of the toxicology of leaded gas and the dangers of lead-tainted exhaust. And yet fuel laced with lead wasn't banned in the USA until the 1980s.
尽管如此，它还是被用来稀释葡萄酒，制造输送饮用水的管道，并被添加到面霜中，以帮助妇女获得作为社会美学标准的白皙肤色。1910年，爱丽丝-汉密尔顿被任命为美国伊利诺斯州工业疾病调查的负责人。在接下来的几年里，她成为了美国领先的工业毒理学专家，为工作场所的铅暴露的危险性等提供了确切的证据。尽管有这些证据，美国汽车公司通用汽车公司还是在20世纪20年代继续制造含铅燃料。汉密尔顿开展了广泛的运动，反对引入含铅燃料，她和她的同事们对含铅气体的毒理学和被铅污染的废气的危险性进行了广泛的概述。然而，直到20世纪80年代，含铅的燃料才在美国被禁止。

Lead still crops up in other places despite all we know of its dangers. For example, lead is added to paint to prevent cracking with changes in temperature. Leaded paint is still used in many countries today to paint homes and toys even though nontoxic options are available at a similar price. The story of lead can be contrasted with that of absinthe, whose rise and fall occurred within 50 years. "Absinthe was made from a combination of plants and aromatics, including wormwood, aniseed, fennel and wild marjoram, which were first bruised and then soaked in alcohol and distilled, creating a bitter, pear-colored liqueur.
尽管我们知道铅的危险性，但它仍然出现在其他地方。例如，铅被添加到油漆中以防止因温度变化而开裂。今天，许多国家仍在使用含铅涂料来涂抹房屋和玩具，尽管无毒的选择可以以类似的价格获得。铅的故事可以与苦艾酒的故事进行对比，苦艾酒的兴衰发生在50年内。"苦艾酒是由植物和芳香剂组合而成的，包括艾草、茴香、茴香和野生马郁兰，它们首先被擦伤，然后浸泡在酒精中并进行蒸馏，形成一种苦涩的梨色利口酒。

A measure would be placed in a glass, and was then diluted with ice-cold water poured

through a sugar cube, turning the whole thing milky pale." Starting in the 1860s, absinthe became a wildly popular aperitif– an alcoholic drink taken before dinner. "In the latter half of the nineteenth century whole districts of Paris were said to smell faintly herbal between 5 and 6 p.m., a time that became known as l'heure verte ('the green hour')."
将一定量的酒放在玻璃杯中，然后用冰冷的水倒入一个方糖稀释，使整个酒变成乳白色。从19世纪60年代开始，苦艾酒成为一种疯狂流行的开胃酒--一种在晚餐前饮用的酒精饮料。"在19世纪后半叶，据说整个巴黎地区在下午5点和6点之间都有淡淡的草药味，这段时间被称为绿色时间（l'heure verte）"。

Fifty years later it was being compared to opium and being considered a major social ill. Furthermore, "in France, doctors began to suspect that it was really a poisonous drug. People were reporting hallucinations and permanent insanity." Experiments were conducted, and animals sacrificed. Then, "In Switzerland, the final straw came in 1905, when a man called Jean Lanfray killed his pregnant wife and two young daughters, Rose and Blanche, after he had been drinking absinthe. The case was dubbed 'the absinthe murders' and the drink was outlawed completely in Switzerland three years later."
50年后，它被比作鸦片，被认为是一种主要的社会疾病。此外，"在法国，医生开始怀疑它确实是一种有毒的药物。人们报告说出现了幻觉和永久性精神错乱"。人们进行了实验，并牺牲了动物。然后，"在瑞士，最后一根稻草出现在1905年，一个叫让-兰弗莱的男人在喝了苦艾酒之后，杀死了他怀孕的妻子和两个年幼的女儿罗丝和布兰奇。这起案件被称为 "苦艾酒谋杀案"，三年后苦艾酒在瑞士被完全取缔。

France followed in 1914. Within 50 years it was used, abused, and abandoned. Interestingly, "subsequent tests have shown that much of the supposed proof of absinthe's inherently deleterious effects were nonsense." It is actually no worse for you than any other alcohol of the same strength. So, on the one hand, we have lead, proposed as poisonous for 2000 years and we still use it, and on the other absinthe, whose suspected effects caused it to be taken off the market within 50 years. Lead, now proven toxic, is still kicking around in consumer products. Absinthe, absolved of all responsibility, remains unobtainable in many liquor stores. Why the difference? Obviously the reasons are complex, but the use of mental models is about the insight they provide. So, by using the lens of inertia, we can make some observations. Mass matters.
法国于1914年跟进。在50年内，它被使用，被滥用，被抛弃。有趣的是，"随后的测试表明，关于苦艾酒固有的有害影响的许多所谓证据都是无稽之谈。实际上，它对你来说并不比任何其他相同强度的酒精更糟糕。因此，一方面，我们有铅，2000年来一直被认为是有毒的，但我们仍然在使用它；另一方面，苦艾酒，其可疑的影响导致它在50年内被撤出市场。铅，现在被证明是有毒的，但仍然在消费品中游荡。被免除了所有责任的苦艾酒，在许多酒类商店仍然无法买到。为什么会有这种差别？显然，原因是复杂的，但使用心理模型是关于它们提供的洞察力。因此，通过使用惯性的镜头，我们可以做出一些观察。质量很重要。

It is much easier to apply the force to stop a light object versus a heavy one. Lead and absinthe had different societal masses. Lead performed a number of highly useful functions in multiple manufacturing processes. Absinthe got people drunk. Lead had been integrated into many other substances, and so there is also an incentive angle. The cost of containment and remedy for lead was extremely high, and people would have had to abstain from using products they found useful, not to mention the cost of retooling manufacturing systems that relied on lead. Absinthe stood on its own. Thus, it took far less effort to remove absinthe than it is taking to remove lead.
施加力量来阻止一个轻的物体和一个重的物体要容易得多。铅和苦艾酒有不同的社会质量。铅在多个制造过程中发挥了许多非常有用的功能。苦艾酒让人喝醉。铅已经被整合到许多其他物质中，因此也有一个激励的角度。对铅进行控制和补救的成本非常高，人们不得不放弃使用他们认为有用的产品，更不用说重新调整依赖铅的制造系统的成本。苦艾酒是独立存在的。因此，清除苦艾酒所花费的精力远比清除铅所花费的精力要少。

This is part of the reason why the proof of something being harmful is not always enough to produce a change in behavior. The inertia of a product, a habit, or an idea increases the longer it is around. There are countless urban legends and popular myths that have been around for a long time and have woven themselves into our understanding of the world, despite available evidence of their inaccuracy. Sometimes it can seem monumentally frustrating when reliable information doesn't seem to change an erroneous popular opinion. Using inertia as a lens helps us understand the dynamics that are involved and gives us some insights on how to tackle addressing the motion we want to change.
这就是为什么证明某样东西是有害的并不总是足以产生行为的改变的部分原因。一种产品、一种习惯或一种想法的惯性会随着它存在的时间越长而增加。有无数的城市传说和流行的神话，已经存在了很长时间，尽管有证据表明它们不准确，但它们已经融入我们对世界的理解。有时，当可靠的信息似乎不能改变错误的流行观点时，会显得非常令人沮丧。使用惯性作为一个镜头，可以帮助我们理解其中的动态，并给我们一些关于如何解决我们想要改变的动议的见解。

> For the need to think can never be stilled by allegedly definite insights of " wise men" it can be satisfied only through thinking, and the thoughts I had yesterday will satisfy this need today only to the extent that I want and am able to think them anew.
> 因为思考的需要永远不能被所谓的 "智者 "的明确见解所平息；它只能通过思考来满足，而我昨天的想法今天只能在我想要并且能够重新思考的程度上满足这种需要。
> ———汉娜•阿伦特 Hannah Arendt

What it takes to persevere 坚持下去需要什么

Inertia as a lens shows us that beliefs can become habits. Habits are entrenched behaviors, some of which are good, while others are bad. In Learning from the Octopus, Rafe Sagarin writes that belief systems have an “enormous evolutionary inertia behind them,” explaining that our capacity for belief has been one of our survival mechanisms and that this biological relevance helps explain why beliefs are so resistant to change. Thus, sometimes the inertia of our beliefs hinders us, such as when they make us blind to new opportunities.
惯性作为一个镜头告诉我们，信念可以成为习惯。习惯是根深蒂固的行为，其中一些是好的，而另一些是坏的。在《向章鱼学习》一书中，雷夫-萨加林写道，信仰体系背后有一个 "巨大的进化惯性"，他解释说，我们的信仰能力一直是我们的生存机制之一，这种生物相关性有助于解释为什么信仰会如此抗拒变化。因此，有时我们信念的惯性会阻碍我们，例如当它们使我们对新的机会视而不见。

Or when we dismiss new information or ideas because they don’t fit with what we think we know about the world. For example, the history of invention is a story of the dismissal of new ideas. From radio and the telephone, to cars, airplanes, and laptop computers, many life-changing inventions were dismissed initially as irrelevant or useless. There are many stories of people who lost out on opportunities to develop and invest in these new technologies later lamenting their lack of foresight.
或者当我们否定新的信息或想法，因为它们不符合我们对世界的认知。例如，发明的历史就是一个否定新思想的故事。从无线电和电话，到汽车、飞机和笔记本电脑，许多改变生活的发明最初都被认为是不相关或无用的。有许多故事，人们失去了开发和投资这些新技术的机会，后来感叹自己缺乏远见。

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> Inertia in War 战争中的惯性
> Inertia plays a role in warfare. Clausewitz wrote that it is easier to get well-rested men to move. Exhausted men have greater inertia so it’s harder to get them moving. Men who have had a chance to eat and sleep are easier to motivate and thus they build momentum faster.
> 惯性在战争中起到了一定的作用。克劳塞维茨写道，让休息好的人行动起来比较容易。疲惫不堪的人有更大的惯性，所以更难让他们行动。有机会吃饭和睡觉的人更容易被激励，因此他们能更快地形成动力。
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Escape Velocity 逃逸速度
Objects also have escape velocity, which is the speed they need to reach in order to break away from the gravitational force of a large body. For instance, when a space rocket is taking off, it needs to reach an extremely high speed in
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order to get away from the strong gravitational influence of the earth. As it moves further away, it can slow down a bit. This is because the gravitational force, pulling it back to earth, is no longer strong enough to overcome its kinetic energy.
物体也有逃逸速度，这是它们需要达到的速度，以便脱离大型物体的引力。例如，当太空火箭起飞时，它需要达到一个极高的速度，以摆脱地球的强大引力影响。当它走得更远时，它可以放慢一点速度。这是因为把它拉回地球的引力不再强大到足以克服其动能。

As the rocket gains altitude its fuel and kinetic energy are converted to gravitational potential energy. If the rocket is able to build enough velocity it can escape the pull of earth's gravity indefinitely even without further propulsion—this is referred to as the escape velocity and is equal to miles per second on the surface of the earth. We can relate escape velocity to an idea that comes up later in the book, that of activation energy. How much effort do we need not only to overcome resistance, but to set an object on a new path?
随着火箭高度的增加，它的燃料和动能被转化为重力势能。如果火箭能够建立足够的速度，即使没有进一步的推动力，它也可以无限期地逃避地球引力的拉扯——这被称为逃逸速度，相当于地球表面的每秒英里。我们可以将逃逸速度与本书后面提到的一个概念联系起来，即激活能。我们不仅需要多少努力来克服阻力，还需要多少努力来使一个物体走上新的道路?

The flip side is that while we often look back and shake our heads at the lack of vision, it suggests that new ideas have to prove themselves in the long haul. And given that these technologies eventually did become an indispensable part of our world, there are obviously some visionaries whose beliefs were flexible enough to lend their support in combating the inertia. Thus, the inertia of belief can also be a good thing. At the most basic level, when our beliefs have persistence we don't have to relearn everything all of the time.
反过来说，虽然我们经常回头看，对缺乏远见的人摇头，但这表明，新的想法必须在长期的过程中证明自己。而考虑到这些技术最终确实成为了我们世界不可或缺的一部分，显然有一些有远见的人，他们的信念足够灵活，在对抗惯性的过程中给予了支持。因此，信仰的惯性也可以是一件好事。在最基本的层面上，当我们的信念具有持久性时，我们就不必一直重新学习所有的知识。

Furthermore, values with strong inertia can also help us persevere through obstacles and setbacks. This does not mean that we should hold onto our beliefs blindly, unwilling to update them once we become adults. Strong beliefs can stay strong while being flexible. In fact, if we continually refine and develop them based on new information and

experiences, they can continue to support us through challenges.
此外，具有强大惯性的价值观也可以帮助我们在障碍和挫折中坚持下去。这并不意味着我们应该盲目地坚持自己的信念，不愿意在我们成年后更新这些信念。坚定的信念可以在灵活的同时保持强大。事实上，如果我们根据新的信息和经验不断完善和发展它们，它们就能继续支持我们度过挑战。

Often the stories behind new theories and invention show both aspects of the inertia of belief. The positive aspect that propels scientists and inventors to carry on the face of rejection and ridicule, and the negative aspect that fuels those reactions. The inertia of belief can make it difficult to cause real change in the world. But that same inertia can help those who are determined to cause change to hold onto their beliefs and push through.
通常情况下，新理论和新发明背后的故事显示了信念惯性的两个方面。积极的一面是推动科学家和发明家在面对拒绝和嘲笑时继续前进，消极的一面则是助长这些反应。信仰的惯性会使我们很难在这个世界上引起真正的改变。但是，这种惯性也可以帮助那些决心引起变革的人坚持自己的信念，并坚持下去。

The story of nuclear physicist Lise Meitner demonstrates this dichotomy. She started off with the deck stacked against her in terms of the strong negative social beliefs that she had to navigate. * In a more just world, she would not have had to do what she did, but her determination gave her the willingness to adapt herself to an unfair system. Lise Meitner was born in Austria in 1878. At age 23 she was the first woman admitted to the University of Vienna's physics lectures and laboratories and was the second woman to receive a PhD in physics at the university. In 1907 physicist Max Planck invited her to Berlin, where she worked for years as an unpaid research assistant.
核物理学家Lise Meitner的故事展示了这种二元对立。她一开始就面临着强烈的负面社会信念，她必须要驾驭这些信念。*在一个更公正的世界里，她本不必做她所做的事，但她的决心使她愿意让自己适应一个不公平的制度。利斯-迈特纳于1878年出生于奥地利。23岁时，她是维也纳大学物理学讲座和实验室接纳的第一位女性，也是第二位获得该大学物理学博士学位的女性。1907年，物理学家马克斯-普朗克（Max Planck）邀请她到柏林，在那里她作为无偿的研究助理工作了多年。

During this time she met Otto Hahn, with whom she would collaborate professionally for decades, and together they discovered protactinium, the element with atomic number 91 on the periodic table. The university would not allow women to do independent research, so she and Hahn had to get creative in order to pursue their ideas. As described in her biography by Patricia Rife on the Jewish Women's Archive, "At first she was an unpaid 'guest' under Hahn, but most people knew they were equals in their research team."
在这期间，她遇到了奥托-哈恩，并与他进行了数十年的专业合作，他们一起发现了元素周期表上原子序数为91的元素--镤。大学不允许女性做独立的研究，所以她和哈恩不得不发挥创造

力，以追求他们的想法。正如帕特里夏-里夫在犹太妇女档案馆的传记中所描述的那样，"起初她是哈恩手下的一个无偿'客人'，但大多数人都知道他们在研究团队中是平等的"。

Officially though, her contributions were always minimized. As Ruth Lewin Sime describes in Lise Meitner: A Life in Physics, “In every publication Hahn was first author, to which Meitner apparently did not object, even though she had done much of the work.” Despite the slights, she maintained her friendship with Hahn for the rest of her life, even becoming godmother to his only child. Eventually her work, the respect of her colleagues and her growing contribution to radiation and nuclear physics led to her being asked to create and supervise the.
虽然在官方上，她的贡献总是被最小化。正如露丝-莱文-西姆在《丽丝-迈特纳。在每份出版物中，哈恩都是第一作者，迈特纳对此显然没有异议，尽管她做了很多工作"。尽管受到轻视，她还是在余生中保持了与哈恩的友谊，甚至成为他唯一的孩子的教母。最终，她的工作、同事们的尊重以及她对辐射和核物理学越来越多的贡献，使她被要求创建并监督德皇威廉希尔官网物理科。

Physics Section of the Kaiser Wilhelm Institute for Chemistry. It was a position she held for 20 years. On being asked to establish the physics department, Meitner “took it as a sign of recognition, trust, and professional coming-of-age.” In 1919 she became a professor at the Institute, and thus was the first woman in Prussia with the title. During the 1920s and early 30s, she continued her work researching different aspects of physics. Any results achieved were the result of careful and patient work. She was the first person to observe and describe multiple transitions without the emission of radiation, and, with colleague Kurt Phillip, was “the first to identify positrons from a noncosmic source and to show, moreover, that positrons appear together with negative elements.”
她被要求创建并监督凯撒-威廉化学研究所的物理科。这是她担任的一个职位，长达20年。在被要求建立物理学系时，梅特纳 "将其视为一种认可、信任和专业上的成年的标志"。1919年，她成为该研究所的教授，从而成为普鲁士第一位拥有这一头衔的女性。在20世纪20年代和30年代初，她继续从事研究物理学的不同方面。所取得的任何成果都是仔细和耐心工作的结果。她是第一个观察和描述没有辐射发射的多重转变的人，并且与同事库尔特-菲利普一起，是 "第一个从非宇宙源识别正电子的人，而且还表明正电子与负元素一起出现"。

Her accomplishments during this time put her in “the first rank of experimental physicists.” She began to see her teaching duties expanded as she climbed the academic title hierarchy and received a series of prizes in recognition of her work. In 1933 things began to change. That year the Nazi party decreed that Jewish academics were no longer allowed to be professors. Meitner continued her research, but in 1938 fled Germany for Sweden with the assistance of legendary physicist Niels Bohr. During the war she worked in a seemingly more limited capacity at the Nobel Research Institute of Physics, living on a

small research assistant's salary, and feeling cut off from the work she had been doing in Berlin. However, it was during this time that Meitner made her most significant discovery.
她在这一时期的成就使她成为 "实验物理学家的第一等级"。随着她在学术职称上的攀升，她的教学任务开始扩大，并获得了一系列的奖项以表彰她的工作。1933年，事情开始发生变化。这一年，纳粹党颁布法令，犹太学者不再被允许担任教授。迈特纳继续她的研究，但在传奇物理学家尼尔斯-玻尔的协助下，于1938年逃离德国前往瑞典。战争期间，她在诺贝尔物理学研究所以一种看似更有限的身份工作，靠一个小小的研究助理的工资生活，并感到与她在柏林所做的工作隔绝。然而，正是在这一时期，迈特纳做出了她最重要的发现。

Hahn continued to communicate with her, detailing the results of his experiments and asking her to come up with the explanation for his results. Meitner began to ponder the data, and through an insight gained while discussing the matter with her physicist nephew Otto Frisch, put together the first explanation of nuclear fission. Her work provided the first indication of the power contained in nuclear reactions and eventually led to, among other things, the making of the atomic bomb. It was Meitner's most significant contribution to nuclear physics. Despite Meitner's work, Otto Hahn was the sole recipient of the 1944 Nobel Prize for the discovery of nuclear fission.
哈恩继续与她联系，详细介绍他的实验结果，并要求她为他的结果提出解释。迈特纳开始思考这些数据，并通过与她的物理学家侄子奥托-弗里希（Otto Frisch）讨论这一问题时获得的洞察力，对核裂变做出了第一个解释。她的工作首次表明了核反应中所包含的力量，并最终导致了原子弹的制造等。这是迈特纳对核物理学最重要的贡献。尽管有迈特纳的工作，奥托-哈恩因发现核裂变而成为1944年诺贝尔奖的唯一获奖者。

Lise Meitner was nominated times for the Nobel Prize, including three times by Niels Bohr, but was never awarded the honor. We do not have to look hard to find beliefs with incredible inertia that Meitner had to fight against. First were cultural beliefs about women, what their capabilities were, and what their place in society was. At so many turns, Meitner had to navigate prejudices about women. On everything from receiving an education to her ability to conduct research in a lab, she had to work hard to overcome the inertia she faced. In addition, being of Jewish descent in Nazi Germany meant having to deal with a mass of beliefs that had gained a frightening amount of momentum with incredible inertia.
丽丝-迈特纳曾多次被提名为诺贝尔奖候选人，包括尼尔斯-玻尔的三次提名，但从未获得这一荣誉。我们不必刻意寻找，就能找到迈特纳不得不与之抗争的具有惊人惯性的信念。首先是关于妇女的文化信仰，她们的能力是什么，以及她们在社会中的地位是什么。在许多方面，梅特纳都必须克服对妇女的偏见。从接受教育到在实验室进行研究的能力，她必须努力克服她面临的惰性。此外，作为纳粹德国的犹太后裔，意味着必须处理大量的信念，这些信念以令人难以置信的惯性获得了可怕的动力。

The political conditions in Germany were partly responsible for Otto Hahn's masking

Meitner's contributions to the discovery of nuclear fission. The remarkable aspect of Lise Meitner's story, however, is how her passion for physics propelled her through the challenges. First, it takes dedication to be a research scientist. Ruth Lewin Sime's accounts of Meitner's patience while conducting research suggests that she had total belief in her work. Not that there was a particular answer she was trying to prove, but that there was value in scientific process itself.
德国的政治条件是奥托-哈恩掩盖梅特纳对发现核裂变的贡献的部分原因。然而，丽丝-迈特纳的故事的非凡之处在于她对物理学的热情是如何推动她战胜挑战的。首先，成为一名研究型科学家需要奉献精神。露丝-莱文-西姆（Ruth Lewin Sime）对迈特纳在进行研究时的耐心的描述表明，她对自己的工作有十足的信心。不是说她要证明某个特定的答案，而是说科学过程本身就有价值。

Thus her beliefs were not a rigid dogma, but a flexible understanding that grew through investigating and discovering new ideas. It was these beliefs that likely supported her when she had to take secondary position on papers she had done most of the work on, or when she had to work in subpar lab conditions for low pay. Meitner achieved more than possibly any other woman working in physics at the time—not only the discoveries in experimental physics but also leading a department and earning widespread respect and prestige.
因此，她的信念不是僵化的教条，而是一种灵活的理解，通过调查和发现新的想法而成长。当她不得不对她所做的大部分工作的论文采取次要立场时，或者当她不得不在低工资的实验室条件下工作时，可能正是这些信念支持着她。迈特纳取得的成就可能比当时从事物理学工作的任何其他女性都要多，不仅在实验物理学方面有所发现，而且还领导一个部门，赢得了广泛的尊重和声望。

She was treated as an equal within her field, and until the Nazis came to power, she enjoyed a position as the only female physics professor in Germany. Meitner's beliefs in both physics and herself increased their inertia as her life went on, allowing her to respond to the challenges presented by the prejudice she encountered. Although she never won a Nobel, she was awarded many honorary doctorates and other prizes. In her later years she gave many talks to support women's progression in the sciences and continued her research until she was.
她在自己的领域内被平等对待，直到纳粹上台，她还享有德国唯一的女物理学教授的地位。迈特纳对物理学和她自己的信念随着她生命的延续而不断增强，使她能够应对她遇到的偏见所带来的挑战。虽然她从未获得过诺贝尔奖，但她获得了许多荣誉博士学位和其他奖项。在她的晚年，她发表了许多演讲，支持妇女在科学领域的进步，并继续她的研究，直到她去世。

She was widely respected by colleagues all over the globe and Lewin Sime writes that Meitner made friends for life wherever she went. Meitner persevered in the sense that she

continued to do what she loved despite the obstacles she faced. To other female scientists she said, “remember that science can bring both joy and satisfaction to your life.”
她受到全球各地同事的广泛尊重，Lewin Sime写道，迈特纳无论走到哪里都能交到终身的朋友。迈特纳坚持不懈的意义在于，尽管她面临着各种障碍，但她仍然坚持做她所热爱的事情。她对其他女科学家说："记住，科学可以给你的生活带来快乐和满足"。

Conclusion 结论

Energy is precious and we employ it sparingly. It’s human nature to allow the current state to remain as changing it requires us to expend energy. Getting started is the hardest part. Once something is moving in a direction, it’s much easier to keep it in motion. But once something is in motion, it’s hard to stop. The bigger the mass the more effort required.
能量是宝贵的，我们要节约使用它。让目前的状态保持下去是人类的天性，因为改变它需要我们耗费能量。开始是最难的部分。一旦某件事情朝着一个方向发展，保持它的运动就容易多了。但一旦某物处于运动状态，就很难停止。质量越大，需要的努力越多。

Friction and Viscosity 摩擦力和粘度

Friction is a force that must be overcome to achieve an outcome. There is always something trying to slow us down. While we can never eliminate the forces that impede our progress, we can work to minimize them. Like a smooth surface provides less challenge to a rolling ball, or how water is easier for a human to swim through than a krill, shaping our environment to reduce the challenges of opposing forces is a key to improving productivity. Friction is a force that opposes the movement of objects that are in contact with each other, such as the wheels of a pair of roller skates moving across the ground. For objects to move, they must overcome friction that pushes in the opposite direction.
摩擦是一种必须克服的力量，以实现一个结果。总有一些东西试图让我们慢下来。虽然我们永远无法消除阻碍我们前进的力量，但我们可以努力将它们降到最低。就像光滑的表面为滚动的球提供了较少的挑战，或者水对人来说比磷虾更容易游过，塑造我们的环境以减少对立力量的挑战是提高生产力的关键。摩擦力是一种反对相互接触的物体运动的力量，例如一双旱冰鞋的轮子在地面上移动。物体要移动，就必须克服朝相反方向推动的摩擦力。

This requires extra energy, which produces heat and sound. Smooth surfaces cause less friction than rough ones, which explains why walking on pavement is much easier and less tiring than walking on gravel. There are no frictionless surfaces, only surfaces with less or more resistance. All objects experience friction. There are two key types of friction: kinetic and static. Kinetic friction occurs when two objects are sliding past each other. This

explains why an object in motion, without consistent forces pushing it forward, will come to a halt. For example, if you place a book on a table and give it a push, it will move a bit then stop. The kinetic friction absorbs the energy you transfer to the book in the push.
这需要额外的能量，从而产生热量和声音。光滑的表面比粗糙的表面产生的摩擦力小，这就解释了为什么在人行道上行走比在碎石上行走要容易得多，也不那么累。没有无摩擦的表面，只有阻力较小或较大的表面。所有物体都有摩擦力。有两种主要的摩擦力：运动摩擦和静态摩擦。当两个物体互相滑过时，就会产生动能摩擦。这解释了为什么一个运动中的物体，如果没有持续的力量推动它前进，就会停顿下来。例如，如果你把一本书放在桌子上，然后推它一把，它就会移动一下然后停下来。动摩擦力吸收了你在推的过程中传递给书的能量。

Static friction, on the other hand, occurs when an object is stationary; it's what prevents it from moving. Although scientists have been examining friction for about 600 years, there are still gaps in our understanding. Despite some of its mysterious qualities, friction remains a useful mental model because it captures how our environment can impede our movement. Viscosity, which can be seen as the partner of friction, is the "measure of how hard it is for one layer of fluid to slide over another layer." If a liquid is hard to move it is more viscous. If it is more viscous there is more resistance. Viscosity isn't usually an issue for humans in our day-to-day lives. We have to deal with gravity and inertia, although viscosity is always present.
另一方面，静态摩擦力发生在物体静止的时候；它是阻止物体移动的原因。尽管科学家研究摩擦力已经有大约600年的历史，但我们的理解仍有差距。尽管摩擦力有一些神秘的特质，但它仍然是一个有用的心理模型，因为它能捕捉到我们的环境如何阻碍我们的运动。粘度，可以被看作是摩擦力的伙伴，是 "衡量一层液体在另一层上滑动的难度"。如果一种液体很难移动，那么它的粘性就更大。如果它更粘稠，就有更多的阻力。在我们的日常生活中，粘度对人类来说通常不是一个问题。我们必须处理重力和惯性，尽管粘性总是存在。

But for small particles, gravity and inertia become a nonissue compared to viscosity. So if you make things bigger, viscosity is less relevant. A tiny plankton moving in the ocean is going to have to struggle through the viscous water and will stop coasting forward almost as soon as it stops moving. For a whale, on the other hand, the viscosity of the water hardly registers. Its size means it can push water out of the way with ease, and capitalize on other forces such as inertia to keep forward motion. There are two important aspects to using friction and viscosity as a model. First, what is easy in one environment might be harder in another. For instance, what we can accomplish in times of peace is different than what we can accomplish in times of war. Second, we also learn that the main forces relevant to a particular situation depend on the scale you are operating at.
但是对于小颗粒来说，与粘度相比，重力和惯性就不是问题了。因此，如果你把东西变大，粘性就不那么重要了。一个在海洋中移动的微小浮游生物将不得不在粘稠的水中挣扎，几乎在它停止移动时就会停止向前滑行。另一方面，对于鲸鱼来说，水的粘性几乎没有影响。它的体型

意味着它可以轻松地将水推开，并利用其他力量，如惯性来保持向前运动。使用摩擦力和粘度作为模型有两个重要方面。首先，在一个环境中很容易的事情在另一个环境中可能会更难。例如，我们在和平时期能够完成的事情与我们在战争时期能够完成的事情是不同的。其次，我们还了解到，与某一特定情况相关的主要力量取决于你所处的规模。

Slowing the flow 减缓流动

Everything that moves has to move through something, including information. Why does some information get disseminated quickly, whereas other times it gets bogged down and seems to go nowhere? The answer often has a lot less to do with the content of the information than with the environment it has to move through. To understand just how much a communications environment can be manipulated to affect the pace of information exchange, let's take a look at Soviet Russia. By the 1980s the Soviets had created a high-viscosity communications environment that made it hard for information to flow through it. Like a goldfish trying to swim through honey, people had an unrelentingly difficult time trying to communicate information to those who might need it.
所有移动的东西都要通过一些东西来移动，包括信息。为什么有些信息能迅速传播，而其他时候却陷入困境，似乎没有任何进展？答案往往与信息的内容关系不大，而与它必须通过的环境有很大关系。为了了解通信环境在多大程度上可以被操纵来影响信息交流的速度，让我们来看看苏维埃俄国。到20世纪80年代，苏联人创造了一个高粘度的通信环境，使信息很难在其中流动。就像金鱼试图在蜂蜜中游泳一样，人们试图将信息传达给那些可能需要它的人，是一件不容易的事。

During the Cold War era, the Soviets amplified forces that negatively impacted the free flow of individual bits of information, potentially because it's easier to control things that are moving slower. The viscous information environment they created may have been useful to the state for maintaining control, but it also caused the broad scope of the Chernobyl disaster. During and after the explosion at the Chernobyl nuclear power plant in 1986, there was a lack of information getting to those affected, from citizens to supporting government departments to other countries. A lot of information was out there, but it had a hard time flowing to those who needed it because the structure of the Soviet system.
在冷战时期，苏联人扩大了对个别信息的自由流动产生负面影响的力量，可能是因为控制移动速度较慢的事物更容易。他们创造的粘稠的信息环境可能对国家保持控制是有用的，但也造成了切尔诺贝利灾难的广泛性。在1986年切尔诺贝利核电站爆炸期间和之后，从公民到支持的政府部门到其他国家的受影响者都缺乏信息。很多信息是存在的，但由于苏联系统的结构，它很难流向需要它的人。

In Chernobyl: The History of a Nuclear Catastrophe, Serhii Plokhy describes the entire

scope of the disaster. He explains that the leadership of the Soviet Union was characterized by an approach of burying the past instead of learning from it. Their complicated bureaucracy created an environment that made it very hard for correct information to get to those who needed it. This was manifested in censorship, the criminalization of sharing certain information, regular domestic spying and a total lack of empowerment of the people on the ground. Chernobyl was not the first nuclear accident in the Soviet Union. However, it was illegal for anyone to officially report on or discuss any that had happened previously, notably the multiple accidents at the nuclear power plant in Leningrad, as if by not acknowledging something, the Soviets could pretend it out of existence.
在《切尔诺贝利。一场核灾难的历史》中，Serhii Plokhy描述了这场灾难的整个范围。他解释说，苏联领导层的特点是采取埋葬过去而不是从中学习的方法。他们复杂的官僚机构创造了一种环境，使正确的信息很难到达需要它的人手中。这表现在审查制度、将分享某些信息定为犯罪、定期进行国内间谍活动以及完全没有赋予当地人民权力。切尔诺贝利不是苏联的第一次核事故。然而，任何人正式报告或讨论以前发生的任何事故都是非法的，特别是列宁格勒核电站的多起事故，似乎不承认某件事情，苏联人就可以假装它不存在了。

Because information about previous issues was suppressed, there were no lessons learned that fed into the design of the Chernobyl plant or its procedures. After the accident at Chernobyl, the pattern of zero communication continued, with nothing being reported both within the Soviet Union and to the foreign press. There were secret resolutions, and everything was classified. One consequence of this approach was that the people immediately affected—those who lived in the surrounding area—had no idea what was happening or how to protect themselves. “Intercity telephone networks had been cut, and the engineers and workers at the nuclear plant had been prohibited from sharing news of what had happened with their friends or relatives.” Information control was more important than the lives of people. How does a situation like this come to be?
由于关于以前问题的信息被压制，所以没有任何经验教训被纳入切尔诺贝利核电站的设计或其程序。切尔诺贝利事故发生后，零交流的模式仍在继续，苏联内部和外国媒体都没有报道。有秘密决议，一切都被列为机密。这种做法的一个后果是，直接受影响的人--那些住在周围地区的人--不知道发生了什么，也不知道如何保护自己。"城市间的电话网络被切断，核电站的工程师和工人被禁止与他们的朋友或亲属分享所发生的消息。" 信息控制比人的生命更重要。这样的情况是如何形成的？

There are a lot of aspects to consider, as a highly viscous information environment is not created by one factor alone. To start, there was the Soviet preoccupation with image. They didn’t want to look bad to their citizens or the West, as they believed this would weaken the Communist state. They insisted things go on as usual, including the large May Day parade in nearby Kiev, which exposed thousands to high levels of radiation. The Soviets

accused the Western media of spreading rumors about Chernobyl, and kept repeating in official reports “that everything was fine, and that the party was in control.” In addition, the Soviet mentality within the political structure was characterized by fear and a lack of accountability. Problems were pushed up the chain, because no one wanted to take responsibility and make a decision and thus have to potentially deal with the consequences of being wrong and embarrassing the government.
有很多方面需要考虑，因为一个高度粘稠的信息环境不是由一个因素单独造成的。首先，是苏联人对形象的关注。他们不想让自己的公民或西方看起来很糟糕，因为他们认为这将削弱共产主义国家的实力。他们坚持一切照旧，包括在附近的基辅举行的大型五一游行，这使成千上万的人暴露在高水平的辐射中。苏联人指责西方媒体散布关于切尔诺贝利的谣言，并在官方报告中不断重复 "一切正常，党在控制之中"。此外，政治结构中的苏联心态的特点是恐惧和缺乏问责制。问题被往上推，因为没有人愿意承担责任，做出决定，从而不得不面对错误和让政府尴尬的后果。

But at the same time, “the protocol was to bully subordinates into submission and then demand the fulfillment of unrealistic production quotas.” People couldn’t safely say, “No, we can’t get that done in the timeframe you are asking for.” With no one wanting to communicate negative information up the chain, and erroneous information being pushed down the chain, building operations like those at Chernobyl cut corners to meet unrealistic deadlines. Chernobyl itself was built on shaky foundations with questionable reactors, and with safety standards that would never have cut it in the North America or western Europe. No one in the Soviet Union seemed to want to hear accurate assessments of problems or projects.
但与此同时，"协议是欺负下属，使其屈服，然后要求完成不现实的生产配额。人们不能安全地说："不，我们不能在你要求的时间范围内完成这个任务。" 由于没有人愿意向上级传达负面信息，而错误的信息又被推到下级，像切尔诺贝利这样的建筑企业就会偷工减料，以满足不现实的最后期限。切尔诺贝利本身是建立在不稳定的基础上的，它的反应堆是有问题的，其安全标准在北美或西欧是不可能达到的。在苏联，似乎没有人愿意听到对问题或项目的准确评估。

Thus, the information that moved up and down the chain was often totally and completely fabricated. Essentially there was high viscosity for true information, whereas false information faced a low viscosity medium. Similar to fluid hitting a boundary with different viscosities, false information was disseminated further because it flowed easier. Finally, the Soviet leadership “was still deeply grounded in the Soviet tradition of secrecy and neglect for the immediate wellbeing of the people while allegedly staying focused on the greater good and a better future.” In the aftermath of the Chernobyl accident, this attitude manifested in a total lack of information sharing with those affected. Radiation levels increased while the residents of nearby Prypiat had weddings and played in the streets. Even though radiation levels were damagingly high, it took days for evacuations to start.

因此，上上下下的信息往往是完全和完全捏造的。从本质上讲，真实信息的粘度很高，而虚假信息则面临着低粘度的介质。类似于流体遇到不同粘度的边界，虚假信息被进一步传播，因为它更容易流动。最后，苏联领导层 "仍然深深地扎根于苏联的传统，即保密和忽视人民的眼前福祉，同时据称一直关注更大的利益和更好的未来"。在切尔诺贝利事故发生后，这种态度表现为完全没有与受影响的人分享信息。当附近普里皮亚特的居民举行婚礼并在街上玩耍时，辐射水平却在增加。尽管辐射水平高得惊人，但过了几天才开始疏散。

And even then, nothing true was communicated, with residents being told they would be back in their homes in three days. The Prypiat hospital, in the town where all Chernobyl workers lived, “was equipped to deal with almost anything but radioactive poisoning.” Because whether Chernobyl ever had problems or not, the Soviet leadership had already decided that radioactivity was never going to be an issue. Even though Chernobyl is in the Ukraine, the Ukrainian leadership often found out what was going on from Moscow. All of these elements combined to create a highly viscous information environment that made it near impossible to speak the truth of what was happening or to communicate it to anyone.
即使如此，也没有传达任何真实的信息，居民被告知他们将在三天内回到自己的家中。在所有切尔诺贝利工人居住的小镇上的普里皮亚特医院，"除了放射性中毒，几乎什么都能处理"。因为无论切尔诺贝利是否出现过问题，苏联领导层已经决定，放射性永远不会成为一个问题。尽管切尔诺贝利在乌克兰，但乌克兰领导层经常从莫斯科发现发生的事情。所有这些因素结合在一起，形成了一个高度粘稠的信息环境，使得人们几乎不可能说出正在发生的事情的真相，也不可能将其传达给任何人。

As Plokhy describes, “The immediate cause of the Chernobyl accident was a turbine test that went wrong. Immediately after the accident, as panic spread, the authoritarian Soviet regime imposed control over the flow of information, endangering millions of people at home and abroad and leading to innumerable cases of radiation poisoning that could otherwise have been avoided.” What is interesting is that their approach ultimately undermined Soviet goals. Many people felt betrayed by their government and pushed relentlessly for details about the accident. As these started to trickle out, outrage was displayed by many Ukrainians, which helped to fuel the Ukrainian push for independence from Moscow.
正如Plokhy所描述的，"切尔诺贝利事故的直接原因是涡轮机测试出了问题。事故发生后，随着恐慌的蔓延，专制的苏联政权立即对信息的流动进行了控制，危害了国内外数以百万计的人，导致了无数本来可以避免的辐射中毒案例。" 有趣的是，他们的做法最终破坏了苏联的目标。许多人感到被他们的政府背叛了，并无情地催促他们提供有关事故的细节。当这些细节开始流出时，许多乌克兰人表现出愤怒，这有助于推动乌克兰从莫斯科独立。

Creating greater viscosity for information flow may seem like a way to control people and protect them from difficult information, but it easily backfires. If people get an inkling

something is hidden from them, they'll push as hard as possible to find it. If they succeed, they'll pay far more attention to it than they would have done otherwise. The negative consequences that result from a lack of information sharing in situations like Chernobyl often undermine the control that a government was trying to exert in the first place.
为信息流创造更大的粘性似乎是一种控制人们和保护他们不受困难信息影响的方法，但它很容易适得其反。如果人们感觉到有什么东西被藏起来了，他们就会尽可能地努力去寻找它。如果他们成功了，他们就会比其他情况下更关注它。在像切尔诺贝利这样的情况下，由于缺乏信息共享而产生的负面后果，往往会破坏政府首先试图施加的控制。

Surface Tension 表面张力

"Viscosity matters when something small is moving through a single fluid—surface tension, its partner in the world of the small, matters at the place where two different fluids touch." The story of the measuring of surface tension is the story of an individual who persisted: one woman working in a society that made it almost impossible for a woman to move in the environment of scientific study. Agnes Pockels wanted to study physics, but at the end of the 19th century in Germany women were not allowed into the universities. Her younger brother became a physicist, sharing his textbooks and, throughout his life, advances in the discipline. At home, taking care of aging parents, she maintained her curiosity and passion as best she could in the limited setting.
"当小东西在单一流体中移动时，粘度很重要——表面张力，它在小东西世界中的伙伴，在两种不同流体接触的地方很重要。" 测量表面张力的故事是一个人坚持不懈的故事：一个女人在一个几乎不可能让女人在科学研究环境中活动的社会中工作。艾格尼丝–波克尔斯想学习物理学，但在19世纪末的德国，女性不被允许进入大学。她的弟弟成为了一名物理学家，分享他的教科书，并在他的一生中分享该学科的进展。在家里，照顾年迈的父母，她在有限的环境中尽力保持她的好奇心和热情。

She developed a tool called the Pockels trough, and "although simple, the trough was able to measure the surface tension of water under the influence of different surface concentrations of the oils and soaps she worked with." She went on to publish several papers on surface tension, essentially forming the base of the research on the concept, without ever receiving formal training and education in science. Her tool and her research were built upon by others who went on to receive awards like the Nobel prize. But her accomplishments are all the more remarkable when we consider the high viscosity of the environment in which she succeeded.
她开发了一种叫做波克尔斯槽的工具，"虽然简单，但这个槽能够测量她所使用的油和肥皂的不同表面浓度影响下的水的表面张力"。她继续发表了几篇关于表面张力的论文，基本上形成了关于这一概念的研究基础，而她从未接受过正规的科学培训和教育。她的工具和她的研究被其他人建立起来，他们后来获得了诺贝尔奖等

奖项。但是，当我们考虑到她成功的环境的高粘度时，她的成就就更加了不起了。

Trickle up innovation 涓流式创新

How else can the lens of opposing forces like we find in the Friction and Viscosity model be useful? One area is organizational effectiveness. If we think of an organization, we can appreciate that the forces that influence innovation are different for the executive team and the frontline worker. So, if the goal is to encourage more innovation on the front lines, then you need to pay attention to what encourages and limits movement in that environment, not in the C suite. The Ford Model T left two legacies: the iconic image of the beginning of the automobile age, and the mass production system. For Ford, and later GM, mass production systems were not designed to incorporate the potential for innovation at the level of the factory worker. Essentially, “the workers on the shop floor were simply interchangeable parts of the production system.” Massive amounts of inventory were kept on the floor, and problems were not fixed until the end of the line. Workers were not there to address problems or improve the system.
像我们在摩擦力和粘度模型中发现的对立力量的镜头还能有什么用？一个领域是组织效率。如果我们想到一个组织，我们可以理解，影响创新的力量对于行政团队和一线工人是不同的。因此，如果目标是鼓励在前线有更多的创新，那么你需要注意什么鼓励和限制了这个环境的运动，而不是在C套房。福特T型车留下了两个遗产：汽车时代开始的标志性形象，以及大规模生产系统。对于福特和后来的通用汽车来说，大规模生产系统的设计没有考虑到工厂工人层面的创新潜力。从本质上讲，"车间里的工人只是生产系统中可替换的部分"。大量的库存被保存在车间里，问题直到生产线结束时才被修复。工人在那里不是为了解决问题或改善系统。

They were just there to perform their repetitive task, leaving any rework or problem-solving to specialists. In the 1940s, Toyota, the Japanese car company, was struggling to survive after the war. Japanese government expectations were that financial support and success meant exports, which meant being internationally competitive. Studying the mass production system of the North American car manufacturers, Toyota knew it wouldn’t work for them. They didn’t have the initial capacity to get a machine of that size functioning. But they noticed something else. Mass production produced a lot of waste, was inefficient because it deferred the addressing of mistakes to the end of the line where they were most costly to fix, and took an exceptionally long time to change when a new production model of car came out. Toyota development guru Taiichi Ohno thought there was room for improvement.
他们只是在那里执行他们的重复性任务，把任何返工或解决问题的工作留给专家。在20世纪40年代，日本汽车公司丰田在战后正为生存而挣扎。日本政府的期望是，财政支持和成功意味着出口，这意味着具有国际竞争力。通过研究北美汽车制造商的大规模生产系统，丰田知道这

对他们来说是行不通的。他们没有最初的能力，无法让这种规模的机器运转起来。但他们还注意到了别的东西。大规模生产产生了大量的浪费，效率低下，因为它把解决错误的工作推迟到了生产线的末端，因为那里的修复成本最高，而且当一个新的汽车生产模式出现时，需要特别长的时间来改变。丰田开发大师大野泰一认为有改进的余地。

One of his insights was to focus on the environment of the frontline worker. He saw that output could be significantly affected by reducing the friction happening at that level. “If workers failed to anticipate problems before they occurred, and didn’t take the initiative to devise solutions, the work of the whole factory could easily come to a halt.” Therefore, getting more effective output from the shop floor worker was not about speeding up performance or setting higher quotas. It was about creating a smoother environment that empowered workers to engage with their work. If we want people to innovate and take initiative in real time at the ground level, then the organizational culture and structure has to be one where it is supported and safe to do so.
他的见解之一是关注一线工人的环境。他看到，通过减少发生在这一层面的摩擦，可以大大影响产量。"如果工人不能在问题发生之前预见到它们，并且不主动设计解决方案，那么整个工厂的工作就很容易停顿下来。因此，从车间工人那里获得更有效的产出，并不是为了加快业绩或设定更高的配额。而是要创造一个更顺畅的环境，使工人能够参与他们的工作。如果我们希望人们在基层实时创新和采取主动，那么组织文化和结构就必须是一个支持和安全地这样做的地方。

What creates an environment with low friction for the worker, so they are better able to move to create positive change? One of the things that Ohno noticed in the mass production system was that “none of the specialists beyond the assembly worker was actually adding value to the car. What’s more, Ohno thought that assembly workers could probably do most of the functions of the specialists and do them much better because of their direct acquaintance with conditions on the line.” A first step was to change the behavior on the line by including responsibilities like minor repairs and quality checking. Every worker was given the ability to stop the line “if a problem emerged that they couldn’t fix.”
是什么为工人创造了一个低摩擦的环境，使他们能够更好地行动起来，创造积极的变化？大野在大规模生产系统中注意到的一件事是，"除了装配工人之外，没有一个专家真正为汽车增加价值。更重要的是，大野认为装配工人可能可以完成专家的大部分职能，而且做得更好，因为他们直接熟悉生产线上的情况。" 第一步是改变生产线上的行为，包括小修和质量检查等责任。每个工人都被赋予了停止生产线的能力，"如果出现了他们无法解决的问题"。

As James P. Womack, Daniel T. Jones, and Daniel Roos explain in The Machine That Changed the World, “In striking contrast to the mass production plant, where stopping the line was the responsibility of the senior line manager, Ohno placed a cord above every

workstation and instructed workers to stop the whole assembly line immediately if a problem emerged that they couldn't fix. Then the whole team would come over to work on the problem." Pulling this "Andon cord" created a lot of immediate friction—like going from water to cement in a second—but allowed for mistakes on the line to be addressed immediately. Furthermore, the day was arranged so that time was set aside for workers to share ideas on how to improve processes. All of these changes were about reducing the friction of the worker environment in the long term.
正如詹姆斯-P-沃马克、丹尼尔-T-琼斯和丹尼尔-罗斯在《改变世界的机器》中解释的那样，"与大规模生产工厂形成鲜明对比的是，在那里，停止生产线是高级生产线经理的责任，大野在每个工作站上方都放了一根线，指示工人在出现他们无法解决的问题时立即停止整个装配线。然后整个团队就会过来解决这个问题"。拉动这根 "安东线 "产生了很多直接的摩擦，就像在一秒钟内从水变成了水泥，但却使生产线上的错误得到了立即解决。此外，这一天的安排是为工人们留出时间来分享关于如何改进流程的想法。所有这些变化都是为了长期减少工人环境的摩擦。

The result of the changes to the assembly line was a system that produced cars that needed less rework at the end. So even though "every worker can stop the line… the line is almost never stopped, because problems are solved in advance and the same problem never occurs twice." The culmination of these tangible changes made to the factory worker environment resulted in improved car quality, production efficiency and worker morale. Morale is critical to an environment that fosters innovation. In order to take risks people need to feel supported. Toyota fostered an environment on the factory floor that emphasized communication and collaboration. Workers helped each other solve problems and could switch their focus with ease depending on what the situation called for. The system developed by Ohno encouraged them to be knowledgeable about the entire process and get curious about finding solutions and efficiencies.
对装配线进行改变的结果是一个在最后需要更少返工的汽车系统。因此，即使 "每个工人都可以停止生产线.....生产线几乎从未停止，因为问题被提前解决了，同样的问题绝不会出现两次"。对工厂工人环境所做的这些切实的改变，使汽车质量、生产效率和工人士气都得到了提高。士气对于一个促进创新的环境至关重要。为了承担风险，人们需要感到得到支持。丰田公司在工厂车间培养了一种强调沟通和协作的环境。工人们互相帮助解决问题，并能根据情况的需要轻松地转换他们的注意力。大野开发的系统鼓励他们对整个流程有所了解，并对寻找解决方案和效率感到好奇。

The resulting process is called "lean" and is summed up in the following: "It transfers the maximum number of tasks and responsibilities to those workers actually adding value to the car on the line, and it has in place a system for discovering defects that quickly traces every problem, once discovered, to its ultimate cause." Paying attention to the environment of workers is a way for organizations to metaphorically keep their feet on the

ground. By “touching the territory” they can empower the people closest to the problem and reduce the friction in their organization.
由此产生的过程被称为 "精益"，并被总结为以下内容。"它把最大数量的任务和责任转移给那些真正为生产线上的汽车增加价值的工人，它有一个发现缺陷的系统，一旦发现每个问题，就迅速追踪到其最终原因。" 关注工人的环境是组织隐喻其脚踏实地的一种方式。通过 "触摸领土"，他们可以授权给最接近问题的人，减少组织中的摩擦。

Changes have to be supported up to the top, and everyone needs to recognize that the forces at higher levels, which push for things like strategy or visions, are not as relevant at the working level. It’s all fine and nice to put out messages of where a company wants to go, but it needs to make sure that the environment doesn’t have such high friction that everyone feels like they are trying to move a cement wall in order to get there. Toyota designed an environment that “provides workers with the skills they need to control their work environment and the continuing challenge of making the work go more smoothly.
变化必须得到高层的支持，每个人都需要认识到，高层的力量，即推动战略或愿景等事情的力量，在工作层面并不那么相关。发出公司想去哪里的信息是很好的，但需要确保环境不会有如此大的摩擦力，以至于每个人都觉得他们在努力移动一堵水泥墙以达到目的。丰田公司设计了一个环境，"为工人提供控制工作环境所需的技能，以及使工作更顺利地进行的持续挑战。

While the mass production plant is often filled with mind-numbing stress, as workers struggle to assemble unmanufacturable products and have no way to improve their work environment, lean production offers a creative tension in which workers have many ways to address challenges.” (Unmanufacturable here refers to having to 15 16 put together components which have flaws and which will require rework at the end.) In lean manufacturing, the environment is designed and continually improved to encourage workers to take initiative and innovate. Using the lens of friction, we can see how a recognition that what impacts the environment of a factory worker is not the same as what shapes the environment of the executive. If you want to change a situation, you have to appreciate the forces that are strongest in that particular environment.
大规模生产的工厂往往充满了令人头疼的压力，因为工人们努力组装不可制造的产品，并且没有办法改善他们的工作环境，而精益生产则提供了一种创造性的张力，工人们有很多方法来应对挑战"。(这里的不可制造指的是必须把有缺陷的部件组装起来，最后需要返工。) 在精益生产中，环境的设计和不断改进是为了鼓励工人的主动性和创新。利用摩擦力的视角，我们可以看到这样一种认识，即影响工厂工人环境的因素与影响高管环境的因素并不相同。如果你想改变一个情况，你必须了解在这个特定环境中最强大的力量。

Conclusion 结论

To achieve our aims, reducing resistance is often easier than using more force. While often

hidden, friction and viscosity work against us whenever we try and do something. To overcome resistance, we often default to using more force when simply reducing the friction or viscosity will do. Doing both is more effective than either in isolation. Friction and viscosity can also be wielded as a weapon. Rather than try and catch up to the competition with more effort, you might want to explore slowing them down by adding resistance.
为了实现我们的目标，减少阻力往往比使用更多的力量更容易。虽然常常是隐藏的，但每当我们试图做某事时，摩擦力和粘性都会对我们不利。为了克服阻力，我们往往默认使用更多的力量，而仅仅是减少摩擦力或粘度就可以了。两者同时进行比单独使用任何一种都更有效。摩擦和粘度也可以作为一种武器来使用。与其试图用更多的努力去追赶竞争对手，你可能想探索通过增加阻力来减缓他们的速度。

Velocity 速度

Velocity is often confused with speed, but the two concepts are very different. Speed is just movement; even if you are running in place, you have speed. Velocity has direction. You must go somewhere in order to have velocity. This model teaches us that it's much more important to pay attention to where you are going and not how fast you are moving. No one wants to be a hamster in a wheel, focused on moving so fast that we lose track of what we're trying to achieve. While speed ensures movement, velocity produces a result.
速度经常与速度相混淆，但这两个概念是非常不同的。速度只是运动；即使你在原地跑步，你也有速度。速度有方向。你必须去某个地方，才能有速度。这个模型告诉我们，更重要的是要注意你要去哪里，而不是你移动的速度。没有人愿意成为一个轮子里的仓鼠，专注于快速移动，以至于我们失去了对我们所要实现的目标的关注。虽然速度确保了运动，但速度产生了结果。

The concept that underpins using velocity as a model is displacement in a direction. If we take a step forward, we have velocity. If we run in place, we just have speed. Thus, our progress in a given area is not about how fast we are moving now but is best measured by how far we've moved relative to where we started. To get to a goal, we cannot just focus on being fast, but need to be aware of the direction we want to go. We calculate velocity by dividing the change in distance by the change in time. Something has a constant velocity if it is moving at a consistent speed in a straight line without changing direction. Usually a constant velocity in the right direction is the most effective strategy to get where you want to go. Too many changes in direction and you can end up going in circles.
将速度作为模型的基础概念是在一个方向上的位移。如果我们向前迈出一步，我们就有了速度。如果我们在原地跑步，我们只有速度。因此，我们在某一领域的进展不是指我们现在的速度有多快，而是最好用我们相对于开始的地方已经移动了多远来衡量。为了达到目标，我们不

能只专注于速度，而是需要意识到我们想去的方向。我们通过用距离的变化除以时间的变化来计算速度。如果一个东西在一条直线上以稳定的速度运动而不改变方向，那么它就有一个恒定的速度。通常情况下，在正确的方向上保持恒定的速度是到达你想去的地方的最有效策略。太多的方向变化，你最终可能会绕圈子。

> If a man does not know to what port he is steering, no wind is favorable to him.
> 如果一个人不知道他在转向哪个港口，那么任何风都不会对他有利。
> ——塞内加 Seneca

Kinetic and Potential Energy 动能和势能

Picture yourself throwing a ball up into the air then watching it fall back to the ground. Its flight involves two types of energy: kinetic and potential. As the ball flies through the air, it has kinetic energy. This energy is the energy from motion. This comes from the energy you transferred when you pushed it with your hand, thereby exerting an unbalanced force upon it. When the ball falls, it transfers the kinetic energy to the ground. Kinetic energy is a function of velocity. When the ball is up in the air, it has the potential energy of its position.

想象一下你把一个球扔到空中，然后看着它落回地面。它的飞行涉及两种类型的能量：动能和势能。当球在空中飞行时，它具有动能。这种能量是来自运动的能量。这来自于你用手推它时转移的能量，从而对它施加了一个不平衡的力。当球落下时，它将动能转移到地面上。动能是速度的一个函数。当球在空中时，它有其位置的势能。

This energy is considered stored and exists as a result of the force, gravity, that pushes against it toward the ground. The higher it is, the greater the potential energy. Potential energy may be gravitational or elastic—either due to an object being raised or stretched. The kinetic energy of an object is relative to what the other objects are doing in the environment. The ball will have more kinetic energy relative to your friend sitting in a lawn chair watching you throw it but will have almost none relative to the dog that is chasing after it. Potential energy, on the other hand, is completely independent of the movement of other objects in the environment. When you throw that ball in the air, you can calculate the potential energy regardless of how fast or slow anything else around you is moving.

这种能量被认为是储存起来的，是由于重力的作用而存在的，重力将它推向地面。它越高，势能就越大。势能可能是重力的，也可能是弹性的--要么是由于物体被提升，要么是由于被拉伸。一个物体的动能是相对于其他物体在环境中的作用而言的。相对于坐在草坪椅子上看你扔球的朋友来说，球会有更多的动能，但相对

于正在追赶它的狗来说，几乎没有。另一方面，势能则完全与环境中其他物体的运动无关。当你把球扔到空中时，你可以计算出势能，而不管你周围其他物体的运动速度有多快或多慢。

Faster to the goal 更快到达目标

Napoleon became famous for his emphasis on speed toward a goal in the context of his military campaigns. "'The strength of the army', he stated, 'like power in mechanics, is the product of multiplying the mass by the velocity.'" His desire to move faster in his planned direction helped him win many battles and changed how enemies were able to respond. His rewriting of battle tactics to achieve velocity ultimately influenced military strategy. This speed was literal—he moved his troops at an unprecedented pace. But the speed was toward a goal. Faster troop movement was a part of his overall strategy. We can understand how his ability to move his troops faster contributed to his successes when we look at his Italian campaign, which was early in his career and exemplified the velocity-based approach which continued throughout his life.
拿破仑在其军事行动中因强调向目标前进的速度而闻名。他说："军队的力量"，"就像机械学中的力量一样，是质量乘以速度的产物"。他希望按照自己计划的方向更快地行动，这帮助他赢得了许多战役，并改变了敌人的应对方式。他为实现速度而改写的作战战术最终影响了军事战略。这种速度是字面上的，他以前所未有的速度移动他的部队。但这种速度是为了实现一个目标。更快的部队移动是他整体战略的一部分。当我们看到他的意大利战役时，我们就能理解他加快部队移动的能力是如何促成他的成功的，那是在他职业生涯的早期，是以速度为基础的方法的典范，这种方法贯穿了他的一生。

As Adam Zamoyski explains in Napoleon: A Life, when he was just 26, Napoleon led a campaign in Italy against the Austrians. It was his first as the commander-in-chief of an army and was actually his first independent command in the field. He went into the Italian campaign as an unknown quantity in the French Republic and came out as a celebrated leader and defender of France. He achieved this by employing new and unexpected tactics, many inspired by the principle of velocity. Napoleon made velocity one of his core principles of battle. In Italy, his army was not the strongest nor the best trained, and thus superior movement was a battle tactic. "Bonaparte needed to keep up the momentum so that neither of his opponents had time to strike back." The effects of investing in velocity weakened the enemy by not giving them time to adjust.
正如亚当-扎莫伊斯基在《拿破仑。正如亚当-扎莫伊斯基在《拿破仑：人生》中解释的那样，拿破仑年仅26岁时，在意大利领导了一场针对奥地利人的战役。这是他第一次作为军队的总司令，实际上也是他第一次在战场上独立指挥。他作为法兰西共和国的一个无名小卒参加了意大利战役，并作为一个著名的领导人和法国的保卫者出场。他通过采用新的和出乎意料的战术实现了这一目标，其中许多是受到速度原则的启发。拿破仑将速度作为他的核心作战原则之一。

在意大利，他的军队不是最强大的，也不是训练有素的，因此，优势运动是一种战斗策略。"波拿巴需要保持势头，使他的对手都没有时间反击"。投资于速度的效果通过不给敌人调整的时间而削弱了他们。

Moving fast toward his objectives actually obviated potential obstacles, because the Austrians didn't have time to put any up. The pace of his troops was unprecedented at the time. Even barefoot or poorly clothed, they would move fast. There are records of one division covering 80 km in 36 hours. Another stretch of four days saw his troops fight three battles and cover 90 km. In Napoleon: A Life, Andrew Roberts writes: "The sheer tempo of the operations ensured that he always kept the initiative, bowling unstoppably along a narrow valley gorge replete with places where the Austrians should have been able to slow or halt him." Part of what allowed him to move fast while on this campaign was "a profound study of the history and geography of Italy before he ever set foot there [and] his willingness to experiment with other's ideas."
朝着他的目标快速前进，实际上避免了潜在的障碍，因为奥地利人没有时间来设置任何障碍。他的部队的速度在当时是史无前例的。即使是赤脚或衣衫不整，他们也能快速前进。有记录显示，一个师在36小时内走了80公里。在另一段四天的时间里，他的部队打了三场战役，行程90公里。在《拿破仑。安德鲁-罗伯茨（Andrew Roberts）写道："纯粹的行动节奏确保了他始终保持主动，沿着狭窄的山谷峡谷势如破竹地前进，奥地利人本应可以减缓或阻止他。让他在这场战役中快速行动的部分原因是 "在他踏上意大利之前对那里的历史和地理的深刻研究[以及]他愿意尝试别人的想法"。

He developed expertise of the territory which gave him flexibility, and he chose his path so as to maintain as constant a velocity as possible. In order to move with velocity, Napoleon also needed to get others to move at the same pace. He was very involved in the lives and welfare of his troops, partly to inspire them to push themselves to meet the tempo he wanted to move at. He employed various tactics to achieve this. First, "his treatment of the troops under his command had been designed from the start not only to make them more effective as fighting men, but also to turn them into his men." By "giving them victory and talking to the men as equals," he boosted their self-esteem by making them feel they were achieving what other men and armies could not. They admired Napoleon and 3 4 5 6 7 completely bought into his vision.
他发展了对该地区的专业知识，这使他具有灵活性，他选择了自己的道路，以便尽可能保持恒定的速度。为了保持速度，拿破仑还需要让其他人也以同样的速度前进。他非常关心他的部队的生活和福利，部分原因是为了激励他们推动自己，以满足他想要的行动节奏。他采用了各种策略来实现这一目标。首先，"他对他指挥的部队的待遇从一开始就旨在不仅使他们作为战斗人员更加有效，而且使他们成为他的手下"。通过 "给予他们胜利，并与他们平等对话"，他提高了他们的自尊心，让他们觉得自己正在实现其他男人和军队无法实现的目标。他们钦佩拿破仑，并完全接受了他的观点。

Velocity became a group goal. They all wanted to move quickly, seeing it as integral to victory. Second, he issued clear and simple instructions. Not only did he come up with brilliant battlefield strategy, but he seemed to instinctively understand that in order for a strategy to work, it must be communicated in a way that could be understood and executed. The more time people spend decoding complex instructions, the slower they will move in the direction you need them to go. And since strategy can often get lost in movement and in the complexity of battle, he knew that clear communication would encourage velocity. In trying to increase your velocity, it's important to recognize and account for the factors that can limit it. For Napoleon, there were limitations on how fast he could move.
速度成为一个团体的目标。他们都想快速行动，认为这对胜利是不可或缺的。第二，他发出了清晰而简单的指令。他不仅想出了出色的战场战略，而且他似乎本能地理解，为了使一项战略发挥作用，必须以一种能够被理解和执行的方式来传达它。人们花在解码复杂指令上的时间越多，他们朝着你需要的方向前进的速度就越慢。而且，由于战略经常会在运动和复杂的战斗中迷失，他知道清晰的沟通会鼓励速度。在试图提高你的速度时，重要的是要认识到并考虑到能够限制速度的因素。对拿破仑来说，他的行动速度受到了限制。

Some within his control, such as camp followers, of which he seriously reduced the number, and others outside his control, such as weather. But part of the reason he could move faster was that the existence and condition of roads had improved during the previous century. His tempo also depended on supply requirements keeping pace. But where he could jettison baggage or weight, he did. His troops "didn't sleep in tents at night because the armies marched so rapidly they could not have carted with them all the requisite baggage." Frequently his "army had advanced so far that it was running out of supplies." Thus, "one of the reasons he maintained such a fluid campaign was that he had no resources for anything else."
有些是在他的控制范围内，比如营地的追随者，他严重减少了追随者的数量；有些是在他的控制范围之外，比如天气。但他能走得更快的部分原因是，在上个世纪，道路的存在和状况都有所改善。他的节奏也取决于供应需求的跟上。但只要他能放弃行李或重量，他就会这样做。他的部队 "晚上不在帐篷里睡觉，因为军队行军速度太快，他们不可能把所有必要的行李都运走"。他的 "军队经常前进得如此之远，以至于物资匮乏"。因此，"他保持如此流畅的战役的原因之一是，他没有资源做其他事情"。

Our understanding of velocity is incomplete if we don't understand what it is not. For Napoleon, increasing the pace of engagement to improve his velocity worked numerous times in many of his campaigns, but it proved to have limits. Direction at all costs actually undermined his ability to achieve military success in some cases. Napoleon's impatience during one battle of the Italian campaign, at Cosseria, "cost the French at least 600 and

possibly as many as 1000 casualties."
如果我们不了解速度不是什么，我们对速度的理解就不完整。对拿破仑来说，在他的许多战役中，增加次交战的速度以提高他的速度的做法多次奏效，但事实证明它有局限性。不惜一切代价的指挥在某些情况下实际上损害了他取得军事成功的能力。拿破仑在意大利战役的一场战役中，在科塞里亚的急躁情绪，"使法国人至少损失了600人，可能多达1000人的伤亡"。

And nowhere was the limitation of emphasis on velocity more evident than his foray into Russia in 1812. The distance from Paris to Moscow is about 2,490km. This is over twice the distance from Paris to Rome or Paris to Vienna. It was further than Napoleon had ever gone in a military campaign by far, and one he embarked on with one of the largest armies the world had seen. He employed his usual tactics to accomplish his goal of taking Moscow which was understandable for two reasons. One, they had worked before.
而强调速度的局限性最明显的莫过于他在1812年对俄罗斯的进军。从巴黎到莫斯科的距离约为2,490公里。这是巴黎到罗马或巴黎到维也纳距离的两倍多。这是拿破仑迄今为止在军事行动中走得最远的一次，而且是他带着世界上见过的最大的军队之一开始的一次行动。他采用了他惯用的战术来实现他攻占莫斯科的目标，这是可以理解的，原因有二。第一，这些战术以前就很有效。

Two, the maintenance of such a large force so far from home was both exceptionally costly and difficult. The campaign also needed a quick resolution because they did not have the supplies and necessary infrastructure for a long campaign through many months of a Russian winter. However, one of the complexities of velocity is that, because direction is paramount, size sometimes compromises our velocity. If we have to adjust our direction, the bigger we are, the harder this is to do.
第二，在离家这么远的地方维持这样一支庞大的部队，既耗资巨大，又十分困难。这场战役也需要快速解决，因为他们没有物资和必要的基础设施，无法在俄罗斯冬季的几个月里进行长期作战。然而，速度的复杂性之一是，由于方向是最重要的，规模有时会影响我们的速度。如果我们必须调整我们的方向，我们越大，就越难做到这一点。

For Napoleon on his way to Moscow, the tactics of speed ultimately undermined his velocity. Because he gave up so much in order to go fast, he didn't have the resources to adjust when the route to Russia became treacherous for both his army and his objectives. Writing about the campaign, Clausewitz notes that 11 Napoleon lost one-third of his army before Smolensk, and another third before Moscow. Disease, starvation, and thirst all culled the ranks of both the soldiers and the horses. And that was just on the way there.
对拿破仑来说，在前往莫斯科的路上，速度的战术最终破坏了他的速度。因为他为了追求速度而放弃了很多东西，所以当通往俄国的路线对他的军队和他的目标都变得险恶时，他没有资源来调整。克劳塞维茨在写到这场战役时指出，11拿破仑在斯摩棱斯克前损失了三分之一的军队，在莫斯科前又损失了三分之一。疾病、饥饿和干渴都使士兵和马匹的数量减少。而这还只

是在去的路上。

Napoleon got to Moscow, but with 90,000 men instead of the at least 400,000 he started with. Clausewitz suggests that “with more precaution and better regulations as to subsistence, with more careful consideration of the direction of his marches, which would have prevented the unnecessary and enormous accumulation of masses on one and the same road, he would have obviated the starvation which attended his advance from its outset and have preserved his army in a more effective condition.”
拿破仑到了莫斯科，但只有90,000人，而不是他开始时的至少40万人。克劳塞维茨认为，"如果在生活方面有更多的预防措施和更好的规定，更仔细地考虑他的行军方向，这将防止在同一条路上不必要地大量集结，他将避免从一开始就伴随着他的前进的饥饿，并使他的军队保持在一个更有效的状态。

The goal was not to reach Moscow. The goal was to occupy Russia and force them into agreement of French superiority. And here Napoleon failed. He did not have the manpower to follow the Russians farther into their territory, and he had no plans to attend to his army in retreat. He lost thousands more on the horrific journey trying to get back home. In this sense, Napoleon’s planning was inadequate, which resulted in much speed but in little real territory covered. He was unable to adjust and adapt to the conditions he encountered and the evolving Russian strategy.
目标不是到达莫斯科。目标是占领俄国，迫使他们同意法国的优势。在这里，拿破仑失败了。他没有足够的人力跟随俄国人深入他们的领土，他也没有计划照顾他撤退中的军队。在试图返回家园的可怕旅程中，他又损失了数千人。从这个意义上说，拿破仑的计划是不充分的，这导致他的速度很快，但真正覆盖的领土很少。他无法调整和适应他所遇到的条件和不断变化的俄罗斯战略。

Going back to the starting line is never fun. It’s even less fun when you end up with less than you started with the last time. Despite covering so many kilometers, Napoleon ended up back where he started only with fewer troops and a reputational hit. If anything, this increased his velocity in another direction, toward the day when France no longer respected or wanted his leadership.
回到起跑线从来都不是一件有趣的事。当你最终得到的东西比你上次开始的时候还要少时，那就更不好玩了。尽管走了这么多公里，拿破仑最终还是回到了他开始的地方，只是带着更少的部队和名誉上的打击。如果有的话，这增加了他在另一个方向的速度，朝着法国不再尊重或想要他的领导的那一天。

In your own life, if you think of the ground you need to cover to achieve your goal, the speed at which you move in that direction is not the only factor, because time is not the only component of success. When someone says they’d like to be debt free by 40, they

can increase the speed in that direction by making certain financial choices. There are, however, certain implications. They probably want to be debt free while maintaining their important relationships, not committing any crimes, and being healthy enough at the end to enjoy it. Figuring out how to improve your velocity must take into account the full scope of what you want arrival at your destination to look like. Better go the right direction slowly than the wrong direction with speed.
在你自己的生活中，如果你想到你需要覆盖的地方以实现你的目标，你向这个方向移动的速度不是唯一的因素，因为时间不是成功的唯一组成部分。当有人说他们想在40岁之前实现无债一身轻，他们可以通过做出某些财务选择来提高这个方向的速度。不过，这也有一定的影响。他们可能希望在无债的同时，保持他们重要的关系，不犯任何罪行，并在最后有足够的健康来享受它。弄清楚如何提高你的速度必须考虑到你希望到达目的地的全部范围。最好是慢慢地走正确的方向，而不是用速度走错误的方向。

Eye on the prize 注视着奖品

A snapshot of the career decisions of Mae West s another lesson in direction over speed. Early in her career, West realized that she needed more control over what she was appearing in if she wanted to achieve the success she desired. So she put effort into the other components of a production beyond acting. “The transition from struggling performer to creator, producer, and star of her own scripts came slowly, and required a major mobilization; getting there took concentrated energy, belief in her own abilities, sweat, and wellworked connections.”
对梅-韦斯特的职业决定的简要介绍，是对方向大于速度的另一个教训。在她职业生涯的早期，韦斯特意识到，如果她想取得她所期望的成功，她需要更多地控制她所出现的东西。因此，她把精力投入到表演之外的其他部分。"从苦苦挣扎的表演者到自己剧本的创作者、制片人和明星的转变是缓慢的，需要进行重大的动员；要达到这个目的需要集中精力，相信自己的能力，付出汗水，并建立良好的关系。

West seemed to be totally devoted to her goals. She turned down scripts she thought were a step backward or portrayed women in a way that didn’t complement the image she was creating. She reworked her roles until they were completely her own, until they couldn’t have been played by anyone other than Mae West: She went out very little. In the classic age of the speakeasy, a place she made much use of in her stage material, she was hardly ever reported to be in one or photographed there. She figured rarely in the gossip columns except for obvious publicity purposes. She did not frequent nightclubs or premieres, except her own. The reason seems to be that when not on stage, she was working. West was a writer. West wrote, co-wrote, or significantly modified almost everything she appeared in.
韦斯特似乎完全致力于她的目标。她拒绝了她认为是退步的剧本，或以一种不能补充她所创造

的形象的方式来描绘女性。她重新设计她的角色，直到它们完全属于她自己，直到它们不可能由梅-韦斯特以外的人扮演。她很少外出。在经典的地下酒馆时代，她在舞台材料中经常使用这个地方，但据说她几乎没有去过那里，也没有在那里拍过照片。除了明显的宣传目的，她很少出现在八卦专栏中。她不常去夜总会或首映式，除了她自己的夜总会。原因似乎是，当不在舞台上时，她在工作。韦斯特是个作家。韦斯特撰写、共同撰写或大幅修改她出演的几乎所有作品。

She came up with the classic one-liners for which she is still famous—like “Goodness had nothing to do with it, dearie,” and “When caught between two evils I generally like to take the one I never tried before.” Starting on the stage, then moving into film, she was one of the few actresses at the time who worked and was successful outside the Hollywood studio system. She kept control of her persona and thus her career. In 1935 she earned more than any other female in the world, and the most in total earnings in the United States second only to media tycoon William Randolph Hearst. She approached her career focused on the long game. She knew the direction she was headed and made decisions to increase her velocity in that direction.
她想出了一些经典的单口相声，这些单口相声至今仍很有名，如 "善良与否与此无关，亲爱的"，以及 "当在两难之间，我一般喜欢选择我以前从未尝试过的那一种"。从舞台开始，然后进入电影，她是当时少数几个在好莱坞制片厂系统之外工作并获得成功的女演员之一。她一直控制着自己的角色，从而控制着她的事业。1935年，她的收入超过了世界上任何其他女性，在美国总收入中仅次于媒体大亨威廉-伦道夫-赫斯特。她对待自己的职业生涯专注于长期游戏。她知道自己的方向，并做出决定以提高她在这个方向上的速度。

Conclusion 结论

Velocity challenges us to think about what we can do to put ourselves on the right vector, to find a balance between mass and speed to move in the direction of our goals. Gains come from both improving your tactics and being able to adjust to and respond to new information. No one wants to rush around, filling up their days with tasks and duties, then look up in twenty years and be in exactly the same place. We want to move somewhere so we can look back and identify the territory we’ve covered.
速度挑战我们去思考我们能做什么来使自己处于正确的矢量上，在质量和速度之间找到一个平衡点，以便向我们的目标方向前进。收益来自于改善你的战术和能够调整和回应新的信息。没有人愿意匆匆忙忙，用任务和职责填满他们的日子，然后在20年后抬头一看，却发现自己处于完全相同的地方。我们希望在某个地方移动，这样我们就可以回顾并确定我们所覆盖的领域。

This is why having a direction is so important: it lets us evaluate the usefulness of what we are doing by giving us a measurement of where we want to go. Velocity also reminds us how important it is to be able to adjust our tactics to continue toward our direction.

Sometimes this might mean being smaller, so we don't have to apply resources to multiple and often competing directions. It easier to redirect a canoe than a battleship. Being able to move in the right direction is a lot more useful than going fast in the wrong one.
这就是为什么有一个方向是如此重要：它让我们评估我们正在做的事情是否有用，给我们一个衡量我们想去的地方。速度也提醒我们，能够调整我们的战术以继续朝着我们的方向前进是多么重要。有时，这可能意味着要做得更小，这样我们就不必将资源用于多个往往相互竞争的方向。调整独木舟的方向比调整战舰的方向更容易。能够朝着正确的方向前进比在错误的方向上快速前进要有用得多。

Leverage 杠杆

There are three main types of physical levers
物理杠杆主要有三种类型：

* Force/Fulcrum/Weight, such as using a crowbar to open a door.
力/支点/重量，如用撬棍开门。
* Fulcrum/Weight/Force, such as a wheelbarrow.
支点/重量/力量，如手推车。
* Fulcrum/Force/Weight, like a baseball bat.
支点/力/重量，如棒球棒。

This third one is a bit counterintuitive, because you have to put in more energy than you would just lifting the weight, and we usually use levers for the opposite reason. However, you get the weight to move a longer distance in return.
这第三个有点违反直觉，因为你必须投入更多的能量，而不是仅仅举起重量，我们通常使用杠杆的原因正好相反。然而，作为回报，你可以让重量移动更长的距离。

Leverage is achieving results significantly greater than the force you put in. Isn't this what we all want in life?
杠杆作用是指取得明显大于你所投入的力量的结果。这不正是我们所有人在生活中想要的吗？

Think of written language: a way to leverage what people have learned in the past so that we don't have to relearn everything from scratch with each new generation. Or consider standardization of processes, which gives companies leverage over people by making them easier to replace. Levers are everywhere, once you start looking for them. People

who think that simply working hard is the path to financial wealth are mistaken. You need to leverage your judgment as well. This requires both hard work and opportunity.
想想书面语言：一种利用人们过去所学的方法，这样我们就不必在每一代人身上从头开始重新学习一切。或者考虑一下流程的标准化，它通过使人更容易被替换而给公司带来杠杆作用。只要你开始寻找，杠杆就无处不在。那些认为简单地努力工作就是通往金融财富的道路的人是错误的。你也需要利用你的判断力。这既需要努力工作，也需要机会。

Once you have judgment, you want to continue to leverage it in order to decrease the amount of effort needed to achieve your goals. A good place to begin understanding the concept of leverage is the etymology of the word. We can trace its origins back to the Proto-Indo-European legwh, which described something light, agile, or easy. From this, the Latin levare formed, referring to something that was “not heavy.” But the word was absorbed into English in the 14th century from Old French, where levier referred to raising something. In essence, leverage refers to making something light by raising it in a specific manner—using a lever.
一旦你有了判断力，你要继续利用它，以减少实现你的目标所需的努力量。开始理解杠杆概念的一个好地方是这个词的词源。我们可以把它的起源追溯到原印欧语的legwh，它描述了一些轻巧、敏捷或容易的东西。由此形成了拉丁文的levare，指的是 "不重 "的东西。但这个词在14世纪被吸收到英语中，来自古法语，其中levier指的是提高某种东西。从本质上讲，杠杆指的是通过以一种特定的方式--使用杠杆--使某物变轻。

Archimedes is credited with establishing the concept of leverage, over 2,000 years ago. He famously stated that given a lever long enough, and enough distance, he could lift the earth. However, the Peripatetic school, the followers of Aristotle, wrote of levers before the birth of Archimedes. In Mechanica, a work believed to have been written by members of this school of thought, they state: For since under the impulse of the same weight the greater radius from the center moves the more rapidly, and there are three elements in the lever, the fulcrum, that is the cord or center, and the two weights, the one which causes the movement, and the one that is moved: now the ratio of the weight moved to the weight moving it is the inverse ratio of the distances from the center. Now, the greater the distance from the fulcrum, the more easily it will move.
阿基米德被认为是在2000多年前确立了杠杆的概念。他有句名言：只要有一个足够长的杠杆和足够长的距离，他就能把地球举起来。然而，亚里士多德的追随者Peripatetic学派在阿基米德诞生之前就写过关于杠杆的文章。在《机械论》（Mechanica）这部被认为是由这一学派的成员所写的作品中，他们指出："。因为在相同重量的推动下，离中心越远的地方移动得越快，而杠杆中有三个要素，支点，也就是绳索或中心，以及两个重物，一个是引起运动的重物，一个是被移动的重物：现在，被移动的重物与移动的重物之比是离中心的距离的反比。现在，离支点的距离越大，它就越容易移动。

Used to great effect for thousands of years, levers enable the gain of disproportionate strength. For example, the ancient Egyptians used levers to lift stones weighing up to 100 tons in order to build the pyramids and obelisks. Many of humanity's tools, used for centuries all over the world, incorporate leverage—scissors, pliers, door handles, wheelbarrows, fishing rods, and more. Levers are one of our simplest, yet greatest, inventions. Leverage unleashes the potential of what we can do. When we all had sticks, the variation in productivity wasn't much. Small changes in individual performance didn't have significant absolute impacts.
几千年来，杠杆的使用取得了巨大的效果，它使人们能够获得不成比例的力量。例如，古埃及人用杠杆举起重达100吨的石头，以建造金字塔和方尖碑。世界各地使用了几个世纪的许多人类工具都包含杠杆--剪刀、钳子、门把手、手推车、鱼竿等等。杠杆是我们最简单而又最伟大的发明之一。杠杆释放了我们能做的事情的潜力。当我们都有棍子的时候，生产力的变化并不大。个人业绩的微小变化并没有产生重大的绝对影响。

It wasn't until we developed tools that allowed us to leverage small changes in individual performance that we started to see a lot of variation in productivity. To take that further, if technology increasingly promotes variation in individual performance, then we can expect the gap between the most productive and least productive people in a society to increase over time.
直到我们开发了工具，使我们能够利用个人业绩的微小变化，我们才开始看到生产力的大量变化。进一步说，如果技术越来越多地促进了个人业绩的变化，那么我们可以预期，随着时间的推移，社会中生产力最高的人和生产力最低的人之间的差距会加大。

Understanding where you have leverage 了解你在哪里有杠杆作用

Levers provide leverage. In human interactions, these levers are not purely physical, but instead items or ideas that have a shared, common value. Leverage itself is amoral—neither good nor bad. When the term leverage comes up in day-to-day conversation, it sometimes has a negative connotation—as if having it allows you to manipulate a situation to your advantage. Leverage is not, however, about manipulation. It's about influence.
杠杆提供了杠杆作用。在人际交往中，这些杠杆不是纯粹的实物，而是具有共享的、共同价值的物品或想法。杠杆本身是无道德的--既不是好也不是坏。当杠杆一词在日常对话中出现时，它有时会有一个负面的含义--就好像拥有它可以让你操纵一个对你有利的情况。然而，杠杆不是关于操纵的。它是关于影响。

Think of negotiations, where having the leverage increases the chances that you will get your desired outcome. We are taught that by applying pressure in the right place you make it attractive for the other party to move in your direction: It often doesn't take much force if the leverage is substantial enough. And really, the best way to have leverage in any

deal is to not need the deal at all.
想一想谈判，拥有杠杆就会增加你得到你想要的结果的机会。我们被教导说，通过在正确的地方施加压力，你会使对方朝你的方向发展，从而产生吸引力。如果杠杆作用足够大，往往不需要太多的力量。事实上，在任何交易中拥有筹码的最好方法是根本不需要交易。

Knowing how much pressure to apply in any given situation is critical. Too much pressure breaks the metaphorical lever or takes you out of win-win. No one wants to be forced to do something, and if they are, they won't think kindly of you which can hurt you in the future. Too little pressure and you might not achieve your objective. Leverage should be applied with conscious thought as to when it's helping you achieve your aims and when iit's hurting your ability to do so. Roger J. Volkema, in his book aptly titled Leverage, explains two of the principles of leverage in negotiations.
知道在任何情况下要施加多大的压力是至关重要的。太多的压力会破坏比喻中的杠杆，或者使你脱离双赢。没有人愿意被强迫做某事，如果他们被强迫做某事，他们就不会对你有好感，这会在将来伤害你。压力太小，你可能无法实现你的目标。在运用杠杆时，应该有意识地考虑它何时能帮助你实现你的目标，何时会伤害你实现目标的能力。Roger J. Volkema在他那本名为《杠杆》的书中，解释了谈判中杠杆的两个原则。

The first is that leverage in human interactions is based on perceptions and second that it is a social or relational construct. What this means is that for something to be leverage, everyone has to have roughly the 1 same perception of its value, and this is going to be dependent on social context. It isn't any good to say, "I'm going to give you this box if you agree to my terms" if the other person doesn't associate any value with that box. Furthermore, the power of leverage changes. You cease to have leverage if the other party walks away from the exchange. Leverage is not a binary; something you either have or don't have.
首先，人类互动中的杠杆作用是基于感知的，其次，它是一种社会或关系的构建。这意味着，要想成为杠杆，每个人都必须对其价值有大致相同的认识，而这将取决于社会环境。如果你说"如果你同意我的条件，我就给你这个盒子"，而另一个人并没有把这个盒子与任何价值联系起来，那就没有任何好处。此外，筹码的力量也会改变。如果另一方退出交易，你就不再有杠杆作用了。杠杆不是一个二进制的东西，你要么有，要么没有。

Some people may use their leverage to get X. Some people may have the same leverage and use it to get X, Y, and Z. In order to use leverage to maximize your return, you need to figure out its potential and wield it wisely.
有些人可能利用他们的杠杆来获得X。有些人可能拥有同样的杠杆，并利用它来获得X、Y和Z。为了利用杠杆来最大化你的回报，你需要弄清楚它的潜力，并明智地挥舞它。

Applying leverage where it counts 在重要的地方应用杠杆作用

In a situation of true leverage, the lever does most of the work, not the application of force. When it comes to leverage, we want to know three things:
在真正的杠杆情况下，杠杆做了大部分的工作，而不是施力。说到杠杆作用，我们要知道三件事。

1. How do I know when I have it?
   我怎么知道我什么时候拥有它？

2. Where and when should I apply it?
   我应该在什么地方和什么时候使用它？

3. How do I keep it?
   我如何保持它？

If we can figure these out, we can have significant power over the forces acting against us. Reading any history seems to suggest that humans naturally grasp the principles of leverage.
如果我们能弄清楚这些问题，我们就能对反对我们的力量拥有巨大的力量。阅读任何历史似乎都表明，人类自然地掌握了杠杆原理。

Attaining and holding on to power seems to be a species pastime, and leverage crops up as much as solitary force. Conquering may often be about sheer numbers or, increasingly, asymmetry in technology, but no matter the path to victory, most conquerors extract ongoing leverage over the conquered. They do this through the distribution of land and holdings, payments and reparations, and sometimes marriage contracts (which are less used today but shaped, for example, the borders in most of western Europe for centuries).
获得和掌握权力似乎是人类的一种消遣，而杠杆作用和单独的力量一样多。征服往往是关于纯粹的数量，或者越来越多的技术不对称，但无论通往胜利的道路如何，大多数征服者都会对被征服者不断施加影响。他们通过土地和财产的分配、付款和赔偿，有时还有婚姻契约（这种契约在今天较少使用，但在几个世纪中塑造了西欧大部分地区的边界）来做到这一点。

These acts themselves, meant to protect and insulate the conquerors from the conquered, often sow the seeds of future destruction. We can learn a lot about leverage by looking at someone who had no access to solitary force and who had to rely completely on leverage to attain and maintain power: Eleanor of Aquitaine. Queen of France and then England in the 12th century, she * achieved a remarkable amount of power and influence through leverage. Eleanor was born to the Duke of Aquitaine, ruler of a territorial principality in what is now France. At the time, rulers of duchies in France were at least as powerful as the

King of France, who really only ruled over a small territory around Paris.
这些行为本身是为了保护和隔离征服者与被征服者，但却常常播下了未来毁灭的种子。我们可以通过观察一个无法获得单独武力、不得不完全依靠杠杆作用来获得和维持权力的人来了解杠杆作用：阿基坦的埃莉诺。在12世纪，她是法国和英国的女王，通过杠杆作用获得了巨大的权力和影响力。埃莉诺是阿基坦公爵所生，他是现在法国境内一个领土公国的统治者。在当时，法国公国的统治者至少和法国国王一样强大，而法国国王实际上只统治着巴黎周围的一小块领土。

Aquitaine was a large and prosperous territory during Eleanor's life, encompassing rich farmland, a dozen ports that facilitated both local and overseas trade, and an important manufacturing center for helmets. The towns were thriving, business was booming, and the activities of the region provided the ruling family with a lot of money. These factors meant that the ruler of the duchy wielded considerable power in the region. Due to the death of her brother, and because Aquitaine custom allowed women to inherit, Eleanor became ruler of the duchy.
在埃莉诺的一生中，阿基坦是一个庞大而繁荣的领土，包括丰富的农田、十几个促进本地和海外贸易的港口，以及一个重要的头盔制造中心。城镇繁荣，生意兴隆，该地区的活动为统治者家族提供了大量的资金。这些因素意味着该公国的统治者在该地区拥有相当大的权力。由于她哥哥的去世，以及阿基坦的习俗允许妇女继承遗产，埃莉诺成为公国的统治者。

The ability of a woman to inherit a duchy was not consistent across the region. Ralph V. Turner explains in Eleanor of Aquitaine that "Once a part of the ancient Roman province of Gaul, Aquitaine still preserved in Eleanor's childhood customs surviving from Roman rule that guaranteed women greater freedom than those in northern Europe enjoyed." An unofficial east/west line ran through France, with Aquitaine being in the south and Paris and London being in the north. Therefore, Eleanor's expectations of her right to rule were not consistent with all of her contemporaries.
妇女继承公国的能力在整个地区并不一致。拉尔夫-V-特纳在《阿基坦的埃莉诺》中解释说："阿基坦曾经是古罗马高卢省的一部分，在埃莉诺的童年时代仍然保留着罗马统治时期遗留下来的习俗，保证妇女比北欧的妇女享有更大的自由。" 一条非官方的东西线贯穿法国，阿基坦位于南部，巴黎和伦敦位于北部。因此，埃莉诺对自己的统治权的期望与她同时代的所有人都不一致。

We can think of Aquitaine as Eleanor's lever, the tool she used to move kings. Through her marriages to two kings, and as the mother of three more, Eleanor used Aquitaine to wield an exceptional amount of influence for a woman in the Middle Ages. To even be the Duchess of Aquitaine, Eleanor first had a little bit of luck. The fact that a woman could inherit, and that even in marriage it would always be her property and not her husband's, was the lucky element. The power accorded to aristocratic women was beginning to

change, and a couple of hundred years later such clear ownership by a woman in Aquitaine would have been less likely.
我们可以认为阿基坦是埃莉诺的杠杆，是她用来调动国王的工具。通过与两位国王的婚姻，以及作为另外三位国王的母亲，埃莉诺利用阿基坦为中世纪的女性发挥了巨大的影响力。要成为阿基坦公爵夫人，埃莉诺首先要有一点运气。一个女人可以继承财产，而且即使是在婚姻中也永远是她的财产而不是她丈夫的财产，这就是幸运的因素。赋予贵族妇女的权力开始发生变化，几百年后，在阿基坦地区，妇女拥有如此明确的所有权是不可能的。

So Eleanor's leverage was initially obtained by the circumstances of her birth. However, Eleanor aimed to use her inheritance to the fullest. She saw herself as a queen-duchess, descended from the Carolingian rulers, and was determined to take a visible leadership role. Turner writes that "a major aspect of her nature was a pursuit of power," an attitude out of step with the role women were expected to play in the Middle Ages. Being the Duchess of Aquitaine automatically came with some leverage, a small amount that could have easily been deployed and spent making a good marriage.
因此，埃莉诺的筹码最初是通过她的出生环境获得的。然而，埃莉诺的目标是最充分地利用她的继承权。她把自己看作是卡洛林王朝统治者的后裔，并决心发挥明显的领导作用。特纳写道，"她天性中的一个主要方面就是追求权力"，这种态度与中世纪女性被期望扮演的角色格格不入。作为阿基坦公爵夫人，她自动拥有了一些筹码，这些筹码本来可以很容易地被部署和用于建立一个好的婚姻。

Eleanor was unusual because throughout her life she used her birthright to try to achieve increasing power and influence over the affairs of France and England. She used Aquitaine to give herself a voice and role in the affairs of the time, to a degree and impact that was extremely rare for a woman in the Middle Ages. By the usual customs of the time, when Eleanor married, her husband would govern Aquitaine, but the territory itself would always belong to her. Thus, in order to keep influence in and over her territory, she had to keep influence over her husband. She first married Louis, who became King of France. Her father had made her future father-in-law her protector and charged him with seeing to her marriage.
埃莉诺是不寻常的，因为在她的一生中，她利用她与生俱来的权利，试图对法国和英国的事务取得越来越大的权力和影响。她利用阿基坦让自己在当时的事务中拥有话语权和角色，其程度和影响在中世纪的女性中极为罕见。按照当时的惯例，埃莉诺结婚后，她的丈夫将统治阿基坦，但领土本身却永远属于她。因此，为了保持对其领土的影响力，她必须保持对其丈夫的影响力。她首先嫁给了路易，后者成为法国国王。她的父亲让她未来的公公做她的保护人，并责成他为她的婚姻把关。

The ailing French king chose his son Louis for 5 Eleanor, and less than a month after her marriage, Eleanor became Queen of France. Ralph Turner writes that "the marriage of

Eleanor and Louis VII would prove to be a trial for both, bringing the couple little happiness." Furthermore, Louis VII was focused on religious conflicts and devoted his time and money to unsuccessful Crusades instead of focusing on consolidating his power in France. After many years, Eleanor chose to exit that marriage. In part, she left Louis because she felt that he could not help her effectively keep control over Aquitaine, which was "a confusing collection of a dozen or so counties." Keeping the duchy together required firm control and constant maintenance, which Louis was too distracted by his other pursuits to provide. When her marriage to Louis ended, she retained ownership of Aquitaine. She remarried Henry, Duke of Normandy, who became also Henry II, King of England, because she likely hoped that he had a forceful enough personality to help her exercise leadership in Aquitaine. Ownership and control are different things.
患病的法国国王为5埃莉诺选择了他的儿子路易，在她结婚后不到一个月，埃莉诺就成为了法国女王。拉尔夫-特纳写道："事实证明，埃莉诺和路易七世的婚姻对两人来说都是一种考验，给这对夫妇带来的幸福并不多"。此外，路易七世专注于宗教冲突，将时间和金钱用于不成功的十字军东征，而不是专注于巩固他在法国的权力。多年之后，埃莉诺选择了退出这段婚姻。在某种程度上，她离开路易是因为她觉得他不能帮助她有效地保持对阿基坦的控制，而阿基坦是 "十几个县的混乱集合"。保持公国的统一需要坚定的控制和持续的维护，而路易却因为其他的追求而心不在焉，无法做到这一点。当她与路易的婚姻结束时，她保留了对阿基坦的所有权。她与诺曼底公爵亨利再婚，亨利二世也成为了英格兰国王，因为她可能希望他有足够强大的个性来帮助她在阿基坦行使领导权。所有权和控制权是两码事。

All indications were that Henry might be able to govern the large, rebellious area much better than Louis. "In an act almost unheard of in her time, Eleanor acted independently without consulting her kin or other counselors." It was probably the value and prestige of Aquitaine that sold Henry on the marriage—it was a large territory that generated a large income for its ruler. Also, being large, it also had a population that could be drawn on to help fight battles elsewhere. Despite her unhappiness and disappointment, it was a bold and risky move to push for the annulment of a marriage to the King of France. Without the security of marriage, Eleanor and her lands would be vulnerable.
所有的迹象都表明，亨利可能会比路易更好地治理这个庞大的、叛乱的地区。"在她那个时代几乎闻所未闻的行为中，埃莉诺独立行事，没有咨询她的亲属或其他顾问。" 可能是阿基坦的价值和声望让亨利对这桩婚姻产生了兴趣--它是一块很大的领土，为统治者带来了大量的收入。另外，由于面积大，它的人口也可以被用来帮助其他地方的战斗。尽管她感到不快和失望，但推动废除与法国国王的婚姻是一个大胆而冒险的举动。没有婚姻的保障，埃莉诺和她的土地会很脆弱。

So why do it? One of the reasons was that Aquitaine and her legacy there were extremely important to her. "As she grew up, she absorbed her dynasty's sense of its dignity as successors to Carolingian royalty," and Eleanor devoted her life to preserving the legacy of

her ancestors. Knowing that she had to rely on a husband to actually govern, Eleanor chose the future Henry II of England, who she believed had a better chance of maintaining control of the territory. Aquitaine would cease to be valuable if she no longer had control over it. Many years later, in an effort to preserve Aquitaine as a separate entity from either the English or French crowns, Eleanor named her son Richard as Duke of Aquitaine.
那么为什么要这样做呢？其中一个原因是，阿基坦和她在那里的遗产对她来说极为重要。"随着她的成长，她吸收了她的王朝作为卡洛林王朝皇室继承人的尊严感，"埃莉诺将她的一生献给了维护她祖先的遗产。埃莉诺知道她必须依靠丈夫来实际治理，她选择了未来的英格兰亨利二世，她认为他更有可能保持对领土的控制。如果她不再控制阿基坦，它就不再有价值了。许多年后，为了保持阿基坦作为一个独立于英国或法国王室的实体，埃莉诺任命她的儿子理查德为阿基坦公爵。

There was a lot of custom behind this, as for many years he was the second son, and thus it was normal for him to inherit the property of his mother. But Eleanor also invested a lot in her relationship with Richard, most significantly backing him in his fight with his father for the English crown, so that she could maintain some degree of control over what happened to and in the duchy. She did not, however, rely solely on her relationships with her husbands and son to maintain influence. Throughout her life, Eleanor spent much time in Aquitaine. She developed relationships with the nobles, the church representatives, and the people. She financially supported many building projects, such as the abbey at Fontevraud, and took an interest in seemingly small affairs, settling minor disputes among the minor nobles in Aquitaine.
这背后有很多习俗，因为多年来他都是次子，因此他继承母亲的财产是正常的。但埃莉诺在与理查德的关系上也投入了很多，最重要的是在他与父亲争夺英国王位的斗争中支持他，这样她就能在一定程度上控制公国的情况。然而，她并没有完全依靠她与丈夫和儿子的关系来维持影响力。在她的一生中，埃莉诺花了很多时间在阿基坦地区。她与贵族们、教会代表和人民建立了关系。她在经济上支持许多建筑项目，如丰特弗洛（Fontevraud）的修道院，并对看似小的事务感兴趣，解决了阿基坦小贵族之间的小纠纷。

Neither her husband Henry nor her son Richard were well regarded by the people of Aquitaine, and fights and rebellions were always breaking out as the perception was that the kings of England were simply 9 using Aquitaine to further their own royal interests. Especially in her later years, Eleanor sought to undo, or at least mitigate, the effects of the harsh rule of her husband and son. Consequently, she attained and maintained significant influence in her territory, in no small part because she chose to live there and become active in the politics of the region. The story of Henry and his sons is legendary. The stuff of plays and movies, their hatred of each other, distrust, and disloyalty brought total disarray to western Europe.
她的丈夫亨利和儿子理查德都不被阿基坦人民看好，战斗和叛乱总是爆发，因为人们认为英格

兰的国王们只是利用阿基坦来促进自己的皇家利益。特别是在她的晚年，埃莉诺试图消除，或至少减轻她丈夫和儿子的严酷统治的影响。因此，她在自己的领地上获得并保持了巨大的影响力，这在很大程度上是因为她选择住在那里并积极参与该地区的政治。亨利和他的儿子们的故事是传奇性的。作为戏剧和电影的素材，他们之间的仇恨、不信任和不忠诚给西欧带来了彻底的混乱。

The family indulged in constant fighting and rebellion over who would become king. Eleanor supported her sons against their father and ended up a prisoner of her husband for 15 years. Territories are not objects. They are dynamic spaces filled with people interacting in complex systems. With all of their fighting, Henry and his sons never seemed to comprehend what Eleanor intuitively understood: land can only be used as leverage if the people living in it are supportive of your leadership. Leading requires followers. As the empire her husband Henry built, combining English territory and large swaths of what is now France, started to collapse due to the total dysfunction of the family, Eleanor began to be concerned over her legacy.
为了争夺谁将成为国王，这个家族沉溺于不断的争斗和叛乱中。埃莉诺支持她的儿子们反对他们的父亲，并最终成为她丈夫的俘虏长达15年。领土不是物体。它们是充满了人们在复杂系统中互动的动态空间。在所有的争斗中，亨利和他的儿子们似乎从未理解埃莉诺凭直觉所理解的东西：只有当生活在土地上的人们支持你的领导时，土地才能被用作杠杆作用。领导需要追随者。当她丈夫亨利建立的帝国，结合了英国领土和现在法国的大片土地，由于家族的完全失调而开始崩溃时，埃莉诺开始担心她的遗产。

She wanted Aquitaine to continue to be ruled by her offspring, carrying the line of leadership forward, and “she was resolutely opposed to seeing it lose its separate identity, absorbed into the domains of either of her two husbands.” After Richard died, her son John ascended to the throne of England. He turned out to not be the best leader, angering many of 10 11 his subjects and managing to forever compromise royal authority in England by signing the Magna Carta, but in terms of preserving the family legacy, he was the best she had. All of her other sons had died. So “Eleanor traversed her duchy issuing charters confirming properties and privileges in an attempt to win her subjects over to John’s side.”
她希望阿基坦能继续由她的后代统治，将领导层向前推进，"她坚决反对看到它失去独立的身份，被吸收到她两个丈夫的领地中"。理查德死后，她的儿子约翰登上了英格兰的王位。他并不是最好的领导人，他激怒了许多臣民，并通过签署《大宪章》永远损害了皇家在英格兰的权威，但就保护家族遗产而言，他是她拥有的最好的人选。她的其他儿子都已去世。因此，"埃莉诺走遍了她的公国，发布了确认财产和特权的特许状，试图将她的臣民争取到约翰一边"。

She was in her 70s at this time, and it was important to her to pass on the leverage that was Aquitaine to her son. This she accomplished before she died in 1204, at the remarkable

age of 80. What are some of the ideas about leverage we can learn from Eleanor of Aquitaine's story? First, don't sell yourself short and underestimate the value of your leverage. It seems that right from the beginning, Eleanor was clear about the value of Aquitaine to both the French and English kings. She knew that the resources the region provided could significantly augment the power of whichever monarch controlled it. Second, keep other people wanting what you have. For leverage to exist, all parties must perceive its value.
这时她已经70多岁了，对她来说，把阿基坦的杠杆作用传给儿子是很重要的。她在1204年去世前完成了这个任务，当时她已经80岁了。我们可以从阿基坦的埃莉诺的故事中学习到哪些关于杠杆的想法？首先，不要低估自己，不要低估你的杠杆价值。似乎从一开始，埃莉诺就很清楚阿基坦对法国和英国国王的价值。她知道，该地区提供的资源可以大大增强控制它的任何一个君主的权力。第二，让其他人对你拥有的东西保持渴望。要使杠杆作用存在，各方都必须认识到其价值。

Throughout her life, Eleanor worked to maintain the value of Aquitaine. She invested money and time there in building infrastructure and reducing conflict. She knew that if Aquitaine became too unruly, it wouldn't be attractive to a monarch seeking to augment their kingdom. Furthermore, she seemed to understand that a prosperous Aquitaine would continue to give the region leverage in geopolitical affairs after her death. Third, understand when you can use your leverage and when you can't. Eleanor used her leverage to have choice in marriage, to influence leadership and succession in England and France, to 12 carve out independence from her husbands, and to build her own legacy.
在她的一生中，埃莉诺努力保持阿基坦地区的价值。她在那里投入资金和时间，建设基础设施，减少冲突。她知道，如果阿基坦变得太不守规矩，它对寻求扩大王国的君主就没有吸引力。此外，她似乎明白，一个繁荣的阿基坦将在她死后继续为该地区提供地缘政治事务的筹码。第三，了解什么时候可以使用你的筹码，什么时候不可以。埃莉诺利用她的筹码来选择婚姻，影响英国和法国的领导权和继承权，从她的丈夫们手中夺取独立，并建立自己的遗产。

She also seemed to know, however, when the resources and power of Aquitaine were not enough to change her situation. Perhaps the best example of her awareness of the limitations of her leverage was when she was imprisoned by her husband Henry for 15 years. She could not use Aquitaine to give anyone enough power to free her, so she did not sacrifice her territory in a wasted effort to escape.
然而，她似乎也知道，阿基坦的资源和权力何时不足以改变她的处境。也许她意识到自己杠杆作用的局限性的最好例子是她被丈夫亨利囚禁了15年的时候。她无法利用阿基坦给任何人足够的权力来释放她，所以她没有牺牲自己的领地来白白地逃跑。

The dark side of leverage 杠杆的黑暗面

When wielded smartly leverage can help you achieve better outcomes. And who doesn't want that? However, just because you have leverage doesn't mean you should employ it. As we will see, there is a darker side to leverage, namely when it is employed to the maximum all of the time. When leverage becomes entrenched systematically it becomes more like the application of tyranny. This has happened more than a few times in history, including the 20th-century coal company towns in West Virginia.
如果巧妙地运用杠杆，可以帮助你取得更好的结果。谁不希望这样呢？然而，你拥有杠杆并不意味着你应该运用它。正如我们所看到的，杠杆有其黑暗的一面，即当它一直被运用到最大限度时。当杠杆成为系统性的根深蒂固的时候，它就更像是暴政的应用。这种情况在历史上不止发生过几次，包括20世纪西弗吉尼亚州的煤炭公司城镇。

When technological development allowed coal to be easily transported out of the West Virginia hills, coal operators bought up extensive land in the state. Coal became the most significant economic resource in the state by far. Coal operations required workers, and these miners lived in company towns. With no other industries or big cities nearby to offer alternatives, coal operators used their initial leverage to give themselves an exceptional amount of control over the both lives of their workers and the state in which the companies operated.
当技术的发展使煤炭可以很容易地运出西弗吉尼亚州的山丘时，煤炭运营商在该州买下了大量的土地。到目前为止，煤炭成为该州最重要的经济资源。煤炭业务需要工人，这些矿工住在公司的城镇。由于附近没有其他行业或大城市可供选择，煤炭经营者利用他们最初的杠杆作用，使自己对工人的生活和公司经营的州有了极大的控制。

The company towns were effectively isolated from the rules and norms that prevailed in the rest of the country. Inhabitants did not own their houses or the land they were built on and could be kicked out with no notice. Workers were paid in "coal scrip," a proprietary currency unique to each operation that could only be spent in the company store. There was no mayor or local political officials to represent the residents. Information was controlled. Any media the company didn't approve of was banned, and the postmaster, a company employee, could read all incoming and outgoing mail.
公司的城镇实际上与全国其他地方的规则和规范相隔绝。居民并不拥有他们的房屋或土地，可以在没有通知的情况下被赶走。工人的工资以 "煤票 "支付，这是一种针对每项业务的专有货币，只能在公司的商店中使用。没有市长或地方政治官员来代表居民。信息被控制。任何公司不认可的媒体都被禁止，邮政局长是公司雇员，可以阅读所有进出的邮件。

The issue of coal scrip in particular was a significant point of leverage. As David Corbin explains in Life, Work, and Rebellion in the Coal Fields, not only did it require that workers buy all their goods from the company store, but it allowed the coal operators to

completely control the value of the work being performed. Wages were essentially recouped depending on the needs of the company, because the company store, being a monopoly, could charge whatever it wanted. In this way too any wage increases were immediately negated by corresponding price increases in the store.
特别是煤票的问题是一个重要的筹码。正如大卫-科尔宾在《煤田的生活、工作和叛乱》中解释的那样，它不仅要求工人从公司的商店购买他们的所有商品，而且允许煤炭经营者完全控制所从事工作的价值。工资基本上是根据公司的需要来收回的，因为公司商店作为一个垄断机构，可以随意收费。这样一来，任何工资的增加都立即被商店相应的价格上涨所抵消。

The control exercised by a company operator over the town inhabitants gave the company access to further points of leverage. Ballots for state elections were inspected by mine guards, so miners effectively had to vote for the interest of the company, and coal companies controlled county court and jury appointments. This leverage was used to exploit loopholes in safety, child labor, compensation, and even criminal laws, or even to disregard the laws altogether.
公司经营者对城镇居民的控制使公司有了更多的筹码。州选举的选票由矿区警卫检查，因此矿工实际上不得不为公司的利益投票，煤炭公司控制着县法院和陪审团的任命。这种杠杆作用被用来钻安全、童工、赔偿、甚至刑事法律的空子，甚至完全无视这些法律。

In 1913, a U.S. congressman from Wisconsin toured the coal fields of West Virginia and reported that “one cannot imagine the power of the mining companies. … It elects senators and judges. It owns both the Republican and Democratic parties in the state. All laws are made to suit the mine owners. All the judges are elected through their influence, even up to the judges of the Supreme Court.”
1913年，一位来自威斯康星州的美国国会议员参观了西弗吉尼亚州的煤田，并报告说："人们无法想象采矿公司的权力。.....它选出了参议员和法官。它拥有该州的共和党和民主党。所有的法律都是为适应矿主而制定的。所有的法官都是通过他们的影响选出来的，甚至到了最高法院的法官。"

How can one act against this kind of exceptional leverage? Often it’s only through widespread collective action that aggregates small amounts of power until enough is pooled so that there exists counter-leverage. Think strikes and unions. One person walking out on the job may not change much, but if everyone does, significantly more leverage is available to be exercised. Eventually, after brutal labor disputes, the miners of West Virginia formed and participated in unions. Before that, however, individuals still had some basic degree of leverage.
如何才能对这种特殊的杠杆作用采取行动？通常情况下，只有通过广泛的集体行动，聚集少量的力量，直到汇集足够的力量，从而存在反杠杆。想想罢工和工会。一个人离开工作岗位可能不会有什么改变，但如果每个人都这样做，就会有更多的杠杆可供行使。最终，在残酷的劳资

纠纷之后，西弗吉尼亚州的矿工形成并参加了工会。然而，在此之前，个人仍然有一些基本程度的杠杆作用。

They could choose to walk away, exercising their ability to be geographically mobile. And many coal workers and their families supplemented their coal scrip income through cash from farming, gardening, and selling homemade alcohol, which gave them a small measure of independence from the coal companies. The leverage you have may not always be the leverage you want, but chances are, if you look, you will find you have some somewhere.
他们可以选择离开，行使他们在地理上流动的能力。许多煤炭工人和他们的家庭通过耕种、园艺和出售自制酒的现金来补充他们的煤券收入，这使他们在一定程度上可以独立于煤炭公司。你所拥有的筹码不一定是你想要的筹码，但有可能，如果你看看，你会发现你在某处拥有一些筹码。

Conclusion 结论

As powerful as leverage can be, we need to be deliberate about using it. Good ideas taken too far often cause unanticipated consequences. Wielding leverage to maximum effect all of the time, as the West Virginia mine owners did, sows the seeds of ongoing unrest that undermine one's ability to be truly effective.
尽管杠杆作用很强大，但我们在使用它时需要慎重。好的想法走得太远往往会造成意想不到的后果。像西弗吉尼亚州的矿主那样，一直发挥杠杆的最大作用，就会埋下持续动荡的种子，破坏一个人真正有效的能力。

No one wants to feel exploited, and those who are never give their loyalty or their best work. Leverage is best paired with reciprocity—building in win-win thinking helps you keep your leverage sustainable and achieve better, longer lasting, outcomes.
没有人愿意感到被剥削，而那些被剥削的人永远不会付出他们的忠诚或他们最好的工作。杠杆作用最好与互惠相配，在双赢的思维中建立，有助于你保持你的杠杆作用的可持续性，并实现更好、更持久的结果。

Chemistry 化学

> Science and everyday life cannot and should not be separated.
> ———Rosalind Franklin 罗莎琳•富兰克林

Activation Energy 活化能量

Activation energy is needed for everything from getting up in the morning to revolutions. It's the ingredient that starts a reaction, breaking apart the current state of affairs and transforming it into something new. When we have enough activation energy, we have the power to finish a reaction, achieving a sustainable result. We know the amount of activation energy is correct when enough new connections form that it becomes impossible to revert back to the way we were. In chemistry, activation energy is the energy that must be delivered to a chemical system in order to initiate a reaction, breaking bonds so that new ones can form. Molecules must collide to react, and movement speeds up when temperature increases. All chemical reactions have a required activation energy, but there is a range. We start with an increase in temperature, which leads to an increase in molecular velocity, resulting in an increase of the frequency of molecular collisions. The more collisions, the more chances of having sufficient energy to produce a reaction.
从早晨起床到革命，一切都需要激活能量。它是启动反应的成分，打破目前的状态并将其转化为新的东西。当我们有足够的活化能时，我们就有能力完成一个反应，实现一个可持续的结果。当有足够多的新联系形成，以至于不可能再恢复到原来的状态时，我们就知道激活能的数量是正确的。在化学中，活化能是为了启动反应而必须传递给化学系统的能量，打破键，以便形成新的键。分子必须碰撞才能发生反应，温度升高时运动速度加快。所有化学反应都有一个所需的活化能，但有一个范围。我们从温度的增加开始，这导致分子速度的增加，从而导致分子碰撞频率的增加。碰撞越多，有足够能量产生反应的机会就越多。

Naturally, then, reactions requiring greater activation energy usually proceed slower. The inputted energy, usually in the form of heat, breaks the bonds of the reactant molecules and increases their speed, thereby increasing their rate of collision. The state in between the initial and final stages of chemical reactions is the high-energy, unstable transition state. Because the transition state is unstable, the molecules don't stay there long—they quickly proceed to the next step of the chemical reaction without requiring any further input of energy.
那么自然地，需要更大活化能的反应通常进行得比较慢。输入的能量，通常以热的形式，打破了反应物分子的键，增加了它们的速度，从而提高了它们的碰撞率。在化学反应的初始阶段和最后阶段之间的状态是高能的、不稳定的过渡态。由于过渡态是不稳定的，分子不会在那里停留很长时间--它们很快就会进入化学反应的下一个步骤，而不需要再输入任何能量。

Without an initial input of sufficient energy, however, the molecules stay the same and a reaction does not occur. In some cases, this is positive, as without the requirement for activation energy our world would be a chemically unstable place. For example, we would be at serious risk if propane combustion occurred spontaneously at room temperature or if the hydrogen and oxygen in air had sufficient activation energy to yield water.
然而，如果没有足够能量的初始输入，分子就会保持不变，反应就不会发生。在某些情况下，

这是积极的，因为如果没有活化能的要求，我们的世界将是一个化学上不稳定的地方。例如，如果丙烷燃烧在室温下自发发生，或者如果空气中的氢和氧有足够的活化能产生水，我们就会面临严重的风险。

Activation energy is part of our daily lives. We heat eggs to reform bonds into a cooked product. We boil water to make our tea, reforming some of the molecules into a gas in the process. One of the most important aspects of activation energy is that you need enough of it to power a reaction through to its conclusion. We all know that one sheet of newspaper won't start a fire in our fireplace. It looks like a real fire for about ten seconds. Then it burns out, and we're left staring at the minimally charred logs we've stacked in the grate. What we need is enough paper to get those logs burning. We pile it in. We add kindling, smaller pieces of wood that will sustain the reaction until the big pieces really take off.
活化能是我们日常生活的一部分。我们加热鸡蛋，使其重新结合成熟食产品。我们煮水泡茶，在这个过程中把一些分子改造成气体。活化能最重要的一个方面是，你需要足够的活化能来推动一个反应的完成。我们都知道，一张报纸不会在我们的壁炉里起火。它看起来像一个真正的火，大约有十秒钟。然后它就烧完了，我们就只能盯着我们堆在炉排上的极少的焦木了。我们需要的是足够的纸来让这些原木燃烧。我们把它堆进去。我们加入火种，小块的木头，以维持反应，直到大块的木头真正起飞。

We touch the match to the paper in a few different places. And we monitor and adjust the logs for optimal exposure to the flames and sufficient oxygen flow until the reaction takes hold and things are burning nicely. Sustaining significant change requires the same effort. You have to plan for not only the initial flame, but all the energy required to get and sustain the fire you want.
我们在几个不同的地方将火柴与纸接触。我们监测和调整原木，使其最佳地暴露在火焰中，并有足够的氧气流动，直到反应得到巩固，事情得到很好的燃烧。维持重大变革需要同样的努力。你不仅要计划最初的火焰，还要计划获得和维持你想要的火焰所需的所有能量。

Energy and Climate 能量与气候

The concept of activation energy comes in large part from the Swedish chemist Svante Arrhenius (1859–1927) He proposed the Arrhenius equation, which calculates the relationship between temperature and reaction rates. In the simplest terms, the equation shows us that higher temperatures lead to faster reaction rates because the molecules of the reactants involved have more energy.
活化能的概念在很大程度上来自瑞典化学家Svante Arrhenius（1859–1927），他提出了Arrhenius方

程，计算了温度和反应速率之间的关系。在最简单的术语中，该方程告诉我们，更高的温度导致更快的反应速率，因为所涉及的反应物的分子有更多的能量。

They move around more, having more collisions with greater force. Arrhenius realized that reactions cannot happen without a minimum level of activation energy. Oddly, no one had codified this intuitive idea before. People have known for millennia that higher temperatures make things happen faster—hence food kept somewhere cool lasts longer than food left out in the sun. For physical chemists, the Arrhenius equation is of great importance, because it helps calculate the amount of activation energy required for different reactions to occur at the desired rate.
它们在周围移动更多，有更多的碰撞，力量更大。阿伦纽斯意识到，如果没有最低水平的活化能，反应就无法发生。奇怪的是，以前没有人把这个直观的想法编成法典。几千年来，人们已经知道，较高的温度会使事情发生得更快——因此，放在阴凉处的食物比放在太阳下的食物更持久。对于物理化学家来说，阿伦纽斯方程非常重要，因为它有助于计算出不同反应以所需速度发生所需的活化能。

But his eponymous equation arguably wasn't Arrhenius's greatest contribution to science. He was also the first person to establish the link between atmospheric CO2 levels and global temperatures as part of an attempt to understand the cause of ice ages. While he wasn't the first to posit the connection, he was able to calculate the relationship. Double the atmospheric CO2 levels and temperatures rise by 5–6°C, probably more like 2–3°C per modern estimates. Arrhenius even recognized the possible role of fossil fuel burning, except 1 he didn't see it as much of a threat, figuring that later generations would just have nicer weather to look forward to.
但他的同名方程可以说并不是阿伦纽斯对科学的最大贡献。他也是第一个在大气中的二氧化碳水平和全球温度之间建立联系的人，这是试图了解冰期原因的一部分。虽然他不是第一个提出这种联系的人，但他能够计算出这种关系。大气中的二氧化碳水平增加一倍，气温就会上升5–6摄氏度，根据现代的估计，可能更像是2–3摄氏度。阿伦纽斯甚至认识到了化石燃料燃烧的可能作用，只是他不认为这是一个很大的威胁，认为后世的人只是有更好的天气可以期待。

Finishing what you start 完成你开始的事情

In trying to achieve lasting change, forming new bonds is critical. If the new bonds don't form, the reaction will not complete and the old whatever will return. The activation energy you employ must move reformation of bonds along to such an extent that it becomes hard, if not impossible, to revert to the way things were. Successful reactions demand a new way of doing things. The bigger and more challenging an action is, the more

activation energy required. And it's important to remember that the buildup to doing something is part of the activation energy required –this build up includes everything on the camel, not just the straw.
在试图实现持久的变化时，形成新的纽带是至关重要的。如果新的键没有形成，反应就不会完成，旧的东西就会回来。你所使用的活化能必须使键的重新形成达到这样一种程度，即如果不是不可能的话，也很难恢复到事情的原样。成功的反应需要一种新的做事方式。一个动作越大，越有挑战性，所需的激活能量就越多。重要的是要记住，做某件事的积累是所需激活能的一部分--这种积累包括骆驼身上的一切，而不仅仅是稻草。

Figuring out the right amount of activation energy is pertinent to quitting some addictions. It's not just the moment you decide to quit, it's everything that had to happen, every crisis you had to face, in order to enact that decision. When considering how much activation energy will be required to finally stop the negative behavior, you likely need enough energy to propel the action through the breaking of your current bonds that facilitate addiction through to building new bonds that are completely different.
弄清楚适量的激活能量对戒除一些瘾症是很有意义的。它不仅仅是你决定戒烟的那一刻，它是为了颁布这一决定而不得不发生的一切，你不得不面对的每一个危机。当考虑到最终停止消极行为需要多少激活能量时，你可能需要足够的能量来推动这一行动，通过打破你目前促进成瘾的纽带，建立完全不同的新纽带。

Evaluating both your internal and external environment to identify the situations and suggestions that compel you to want to re-engage in the addiction is an important step. These are triggers, and they require energy to resist, and so you must try to change them up. Otherwise, with no new structure to replace the old one, the old bonds will reform. Change that doesn't last is easy. Where a lot of people miss the mark on what is required to produce real change is figuring out the initial investment of energy needed to not only start the reaction, but to finish it.
评估你的内部和外部环境，以确定迫使你想重新参与成瘾的情况和建议是一个重要步骤。这些都是诱因，它们需要能量来抵制，因此你必须尝试改变它们。否则，由于没有新的结构来取代旧的结构，旧的束缚会重新形成。不持久的改变很容易。很多人对产生真正变化所需要的东西失之交臂，就是要弄清楚不仅要开始反应，而且要完成反应所需的初始能量投资。

When we don't put in enough activation energy, we fail to produce the results we want. After enough attempts, this failure is discouraging. We think we are doomed to fail or the situation is impossible to change. We rarely consider if we are putting in enough effort to support the formation of a new structure when the old one breaks apart. The reason why so many revolutions fail is that it takes a completely different set of skills to fight than to govern. Most revolutions focus on the energy needed to break apart the existing structure.
当我们没有投入足够的激活能量时，我们就无法产生我们想要的结果。经过足够的尝试，这种

失败是令人沮丧的。我们认为我们注定要失败，或者情况不可能改变。我们很少考虑当旧的结构破裂时，我们是否投入了足够的努力来支持新结构的形成。如此多的革命之所以失败，是因为战斗和治理需要一套完全不同的技能。大多数革命的重点是打破现有结构所需的能量。

In most cases the energy requirement to start change is not insignificant: Physical strength in terms of weapons, and ideological strength in terms of support from a significant amount of people. If you were planning a revolution, these two requirements are likely the two areas you would focus on. Who needs to be removed, and where do my opportunities to facilitate that lie? How much firepower and how many supporters do I need? The activation energy required to start the reaction must take leadership changes and weapons capacity into account. But the model of activation energy suggests that you can't stop there because removing the leadership is not the full reaction.
在大多数情况下，开始变革所需的能量并非微不足道。在武器方面的体力，以及来自大量民众支持的意识形态力量。如果你在计划一场革命，这两项要求很可能是你会关注的两个领域。谁需要被清除，以及我促进这一点的机会在哪里？我需要多少火力和多少支持者？启动反应所需的激活能量必须考虑到领导层的变化和武器能力。但激活能量的模型表明，你不能止步于此，因为去除领导层并不是全部的反应。

Revolutions are aimed at changing the structure of a society, so the planning must involve the steps needed to make that happen. Therefore, you also must anticipate what's required to form a new structure once you break the old one apart. How do you keep the support of the people? What can you put in place that will allow your revolutionary goals to cement themselves? And how long will it take? Everything you need to do, right to the end of your goals, is the real activation energy required to finish the reaction.
革命的目的是改变一个社会的结构，所以计划必须涉及实现这一目标所需的步骤。因此，你也必须预料到，一旦你把旧的结构打散，需要什么来形成新的结构。你如何保持人民的支持？你可以设置什么，使你的革命目标得以巩固？而这需要多长时间？你需要做的一切，就在你目标的最后，是完成反应所需的真正激活能量。

Success isn't going to happen overnight. Plan for the amount of energy required to see you through to the end. Let's look at an example of an actual revolution to explore the idea of creating sustained change. Burkina Faso is a small, landlocked country in western Africa. Formerly a French colony, it became independent from France in 1960. Then called Upper Volta, it nonetheless was dependent on French support. Thomas Sankara was a revolutionary in Upper Volta in the 1980s. He was born and raised there and grew up solidly middle class in a country that was quite poor, doing military service that took him around his country. He witnessed firsthand the detrimental effects of the existing political leadership on his country.
成功不可能在一夜之间发生。计划一下，需要多少能量才能让你坚持到最后。让我们看一个实

际革命的例子来探讨创造持续变化的想法。布基纳法索是非洲西部的一个内陆小国。它以前是法国的殖民地，于1960年从法国独立。当时被称为上沃尔特，但它仍然依赖法国的支持。20世纪80年代，托马斯-桑卡拉是上沃尔特的一名革命者。他在那里出生和长大，在一个相当贫穷的国家里成长为坚实的中产阶级，服兵役时在全国各地跑。他亲眼目睹了现有政治领导层对他的国家造成的有害影响。

He developed into a revolutionary motivated by the suffering and corruption he saw and what he believed was the vulnerability created by his country's dependence on the West. He helped stage a successful coup, changed the name of the country and then led it for four years. His story, and the story of those years in Burkina Faso, teaches us a lot about the effort required to sustain change. Sankara recognized that bringing down the existing government would not be enough to implement sweeping changes, including increasing literacy and the availability of education and health services.
他看到的苦难和腐败，以及他认为他的国家对西方的依赖所造成的脆弱性，促使他发展成为一名革命者。他帮助发动了一场成功的政变，改变了国家的名称，然后领导国家四年。他的故事，以及那些年在布基纳法索的故事，告诉我们很多关于维持变革所需的努力。桑卡拉认识到，打倒现有的政府并不足以实施全面的变革，包括提高识字率和教育及卫生服务的可用性。

As Ernest Harsch chronicles in Thomas Sankara: An African Revolutionary, he did not join earlier coups because he didn't see them as being able to address the systemic corruption and inequality in Burkina Faso. Sankara, and the junior officers in the military who supported him, wanted to wait until they were "strong enough to decisively influence events."
正如欧内斯特-哈施在《托马斯-桑卡拉。一位非洲革命家》中记载，他没有加入早期的政变，因为他认为这些政变无法解决布基纳法索的系统性腐败和不平等问题。桑卡拉，以及支持他的军队中的下级军官，希望等到他们 "足够强大，能够决定性地影响事件"。

We can think of Sankara as planning his revolution by determining how much activation energy is required to see through a reaction to its end. In any revolution, it is not enough to take apart the current system because in the absence of anything to replace it, the same problems, such as corruption or disenfranchisement, are likely to reassert themselves.
我们可以认为桑卡拉是在计划他的革命，确定需要多少激活能量才能看透一个反应到结束。在任何革命中，仅仅拆开现行制度是不够的，因为在没有任何东西可以取代它的情况下，同样的问题，如腐败或被剥夺权利，很可能会重新出现。

There were multiple revolution examples from the 20th century he could have studied, from Cuba to Chile, to provide insight on the preparation required to build a new political, economic, and social infrastructure. In addition, Sankara obviously learned from the ongoing political unrest in his country. From 1960 to 1982 there were multiple coups and

power changes. Tensions between military and civilian leadership, as well as pressures from labor unions to droughts, led to social unrest and power struggles.
他可以研究20世纪的多个革命案例，从古巴到智利，以提供关于建立新的政治、经济和社会基础设施所需的准备工作的洞察力。此外，桑卡拉显然从他的国家正在发生的政治动荡中吸取了经验。从1960年到1982年，发生了多次政变和权力更迭。军事和文职领导之间的紧张关系，以及来自工会和干旱的压力，导致了社会动荡和权力斗争。

Sankara eventually joined a coup that had widespread popular support and became president of Burkina Faso from 1983 to 1987. His four years as leader were spent trying to lay out enough kindling and light enough flames that eventually the fire of his vision would become self-sustaining. “Sankara… did not waste time. He soon outlined the broad sweep of his revolutionary vision: an overhauled state to serve the interests of all citizens; the elimination of ignorance, illness, and exploitation; and the development of a more productive economy to reduce hunger and improve living conditions.”
桑卡拉最终加入了一场得到民众广泛支持的政变，并在1983年至1987年期间成为布基纳法索的总统。他在担任领导人的四年中，努力铺设足够的火种，点燃足够的火焰，最终使他的愿景之火能够自我维持。"桑卡拉.....没有浪费时间。他很快就勾勒出他的革命愿景的广阔范围：全面改革国家，为所有公民的利益服务；消除无知、疾病和剥削；发展更有生产力的经济，减少饥饿，改善生活条件"。

He empowered local leaders to take on his vision and pushed hard for the equality of women in Burkina Faso society by outlawing female genital mutilation and forced marriage, and by being the first African leader to appoint women to major cabinet positions. Health clinics and schools were built at a rapid pace all over the country, most often by volunteers inspired by his sincerity in wanting to genuinely transform Burkinabe society to the betterment of all. He instituted a successful nationwide literacy campaign and mass vaccinations.
他授权地方领导人实现他的愿景，并通过取缔女性生殖器切割和强迫婚姻，以及成为第一位任命女性担任主要内阁职务的非洲领导人，大力推动布基纳法索社会的妇女平等。全国各地的卫生所和学校迅速建立起来，这往往是由志愿者在他想真正改造布基纳法索社会以改善所有人的诚意的激励下进行的。他成功地开展了全国性的扫盲运动和大规模的疫苗接种。

All of these initiatives were part of the activation energy required to build a new social and political system. Sankara wanted to build a country that was self-reliant, and he rejected foreign aid on the opinion that “he who feeds you, controls you.” He organized extensive land redistribution to peasant farmers and more than doubled the annual wheat production in three years. Sankara tried to inspire those around him to buy into and work toward building the new structure. “Those who worked with the president learned that by aiming for the seemingly unattainable, they were able to accomplish much more than they

had ever dreamed—they could push the boundaries of what was possible."
所有这些举措都是建立一个新的社会和政治制度所需的激活能量的一部分。桑卡拉希望建立一个自力更生的国家，他拒绝外国援助，认为 "谁养活你，谁就控制你"。他组织了广泛的土地重新分配给农民，并在三年内将小麦年产量提高了一倍多。桑卡拉试图激励他周围的人接受并努力建设新的结构。"与总统一起工作的人了解到，通过瞄准看似无法实现的目标，他们能够完成比他们梦想中更多的事情--他们可以突破可能的界限"。

Sankara tried to put practices in place as if his new system was already mature and the manifestation of all these changes was guaranteed. He took a gamble. Part of the activation energy required for a successful reaction is that you have to be determined to see it through to the end. You must be committed to your reaction. Sankara put in reforms "to encourage Burkinabe to become more responsible for managing land in a rational way and for preserving the environment more generally. 'One cannot imagine the development of agriculture and an increase it its productivity without a program for the regeneration and conservation of nature,' he said." This was 1985, and sustainability wasn't even an issue of importance yet in North America.
桑卡拉试图将各种做法落实到位，仿佛他的新系统已经成熟，所有这些变化的表现都有保证。他赌了一把。一个成功的反应所需的激活能量的一部分是，你必须有决心把它坚持到底。你必须致力于你的反应。桑卡拉投入了改革，"鼓励布基纳法索人更加负责任地合理管理土地，更加普遍地保护环境。他说："如果没有一个再生和保护自然的计划，我们无法想象农业的发展和生产力的提高"。这是1985年，可持续发展在北美甚至还不是一个重要的问题。

Thomas Sankara, however, was trying to position Burkina Faso as if the country was at the beginning of a great developmental flourishing. He owned his vision. He may have been right in many ways about the activation energy needed to create and sustain a new, stable, system. The efforts he put forth, the people he engaged, the staggering improvements he led in four years are testament that he really did try to get the requirements right. However, what he seems to have misjudged was how much of that activation energy had to be provided by the people themselves.
然而，托马斯-桑卡拉正试图将布基纳法索定位为一个伟大的发展繁荣的开端。他拥有自己的愿景。他可能在很多方面都是对的，他认为创造和维持一个新的、稳定的系统需要激活能量。他所做的努力，他所接触的人，他在四年内所领导的惊人的改进，都证明他确实在努力把要求做好。然而，他似乎错误地估计了这种激活的能量有多少是必须由人民自己提供的。

As with any sweeping political change, not everyone buys in right away. Change often scares people. It's only natural to try and preserve the status quo. Not surprisingly, there was some opposition to Sankara's new policies. His reaction was to repress opposition instead of addressing frustrations by modifying his plans or compromising with other political groups. He instituted tribunals that tried people for crimes without credible

evidence, and “when the nation’s schoolteachers went on strike, Sankara dismissed all of them.”
与任何全面的政治变革一样，不是每个人都能马上接受。变化往往使人们感到害怕。试图保持现状是很自然的。毫不奇怪，有一些人反对桑卡拉的新政策。他的反应是镇压反对派，而不是通过修改计划或与其他政治团体妥协来解决挫折感。他建立的法庭在没有可靠证据的情况下对人们进行审判，"当全国的学校教师进行罢工时，桑卡拉解雇了所有的教师"。

Reactions like these undermined his longterm goals; it’s hard to improve education without teachers. They also caused loss of support for his leadership. The problem with having an uncompromising stance was it didn’t give people who might have been skeptical the chance to find common ground. In Burkina Faso, “Sankara was so committed to achieving his ideals he was unwilling to give them enough time to ripen in his people.” Without widespread commitment by a population, it is hard to make significant political and social changes in a country.
像这样的反应破坏了他的长期目标；没有教师就很难改善教育。它们还导致他的领导层失去了支持。采取不妥协的立场的问题是，它没有给那些可能持怀疑态度的人以找到共同点的机会。在布基纳法索，"桑卡拉是如此致力于实现他的理想，他不愿意给他们足够的时间在他的人民中成熟起来"。如果没有民众的广泛承诺，就很难在一个国家进行重大的政治和社会变革。

Sankara didn’t get the time to possibly course correct. He was assassinated in 1987, and the reactions he started were not yet stable enough to continue on their own. Burkina Faso was taken over by the old order who valued corruption and concentrated wealth in the hands of a few. In reaching for goals that were beyond the dreams of most, Sankara expended enough activation energy to have a very interesting, although not likely planned, success: a legacy. His vision continues to inspire people today. As Harsch explains, “So what was left of Sankara’s revolution?
桑卡拉没有得到可能纠正方向的时间。他在1987年被暗杀，而他开始的反应还没有稳定到可以自行继续。布基纳法索被重视腐败和将财富集中在少数人手中的旧秩序所接管。在达到超出大多数人梦想的目标时，桑卡拉消耗了足够的激活能量，获得了非常有趣的、虽然不可能是计划中的成功：遗产。他的愿景今天仍在激励着人们。正如哈斯解释的那样，"那么桑卡拉的革命留下了什么？

The most obvious answer is: the memory of the man, and the ideas he so passionately defended.” His legacy continues today. "Whether at anniversary commemorations or on other occasions, it has not been uncommon to see young people across West Africa wearing Sankara t-shirts. Activists can readily find his words…and musicians from Mali, Senegal, and Burkina Faso have released popular songs and videos sampling passages from Sankara’s speeches.” In Senegal, youths go to rallies wearing t-shirts with Sankara’s image and the words “I’m still here.”

最明显的答案是：对这个人的记忆，以及他如此热情地捍卫的思想"。他的遗产延续至今。"无论是在周年纪念活动还是在其他场合，在西非各地看到年轻人穿着桑卡拉的T恤衫并不鲜见。活动家们可以很容易地找到他的话语.....马里、塞内加尔和布基纳法索的音乐家们发布了流行歌曲和视频，取材自桑卡拉的演讲段落。" 在塞内加尔，青年们穿着印有桑卡拉形象和 "我还在这里 "字样的T恤衫去参加集会。

Sankara likely would have preferred to have many more years to try to carry out his vision, but it does show that investing energy in change can sometimes produce surprising reactions. Ultimately there wasn't enough energy for him to produce a stable, prosperous Burkina Faso, but "because he embodied and defended causes that resonate today among the world's oppressed," he was able to produce a stable legacy. And that is quite remarkable.
桑卡拉很可能希望有更多的时间来尝试实现他的愿景，但这确实表明，将精力投入到变革中有时会产生令人惊讶的反应。最终，他没有足够的能量产生一个稳定、繁荣的布基纳法索，但"由于他体现并捍卫了今天在世界受压迫者中产生共鸣的事业，"他能够产生一个稳定的遗产。这是很了不起的。

Putting the brakes on backsliding 为倒退踩刹车

What is the activation energy required to go from being a poor country to a rich one? What is required to achieve sustainable economic development at a level that a downturn will not put you back to the beginning? In the book How Asia Works, Joe Studwell examines the underpinnings of the success of the economies of Japan, South Korea, and Taiwan, and the failures of Indonesia, Philippines, and Thailand.
从穷国到富国所需的激活能量是什么？要实现可持续的经济发展，使衰退不会使你回到起点，需要什么？在《亚洲如何运作》一书中，Joe Studwell研究了日本、韩国和台湾经济成功的基础，以及印度尼西亚、菲律宾和泰国的失败。

All these countries have experienced periods of intense growth, but only the first three were able to turn that growth into a sustainable system that could weather downturns and challenges. The key to activation energy is to evaluate how much do you need to see the reaction through to its conclusion. At what point have you gone far enough that you can't go back?
所有这些国家都经历了激烈的增长期，但只有前三个国家能够将这种增长转化为一个可持续的系统，能够经受住衰退和挑战。激活能量的关键是评估你需要多少能量才能将反应进行到底。在什么时候，你已经走得足够远，不能再回头了？

In the book, Studwell argues that there were "three critical interventions" that Japan, South Korea and Taiwan undertook to achieve sustainable economic development. They first

maximized output from agriculture; next each country directed investment and entrepreneurs toward manufacturing; and finally all had financial policies that supported both of these things. Thus these three countries applied an integrated approach that "changed the structures of their economies in a matter that made it all but impossible to return to an earlier stage of development."
在这本书中，Studwell认为，日本、韩国和台湾为实现可持续经济发展采取了 "三项关键干预措施"。他们首先最大限度地提高了农业产出；接下来，每个国家都将投资和企业家引向制造业；最后，所有的金融政策都支持这两件事。因此，这三个国家采用了一种综合的方法，"改变了他们的经济结构，使之几乎不可能再回到早期的发展阶段。"

As Studwell explains, "the vehicle for the change was a series of land reform programs to take available agricultural land and to divide it up on an equal basis (once variation in land quality was allowed for) among the farming population. This, backed by 12 government support for rural credit and marketing institutions, ergonomic training and other support services, created a new type of market."
正如Studwell所解释的，"改变的工具是一系列的土地改革计划，将现有的农业用地，在平等的基础上（一旦考虑到土地质量的变化）分配给农业人口。在政府对农村信贷和营销机构、工效培训和其他支持服务的12项支持下，这创造了一个新型的市场。

Once these agricultural policies were firmly established and their productivity manifested in economic improvement, the governments of Japan, South Korea, and Taiwan set up policies aimed at boosting manufacturing. In order to create long-term productivity in the manufacturing sector, firms were rewarded for their success as exporters.
一旦这些农业政策牢固确立，其生产力体现在经济改善上，日本、韩国和台湾的政府就制定了旨在促进制造业的政策。为了创造制造业的长期生产力，企业因其作为出口国的成功而受到奖励。

Firms that didn't measure up to this global competition were culled. Financial policy in Japan, South Korea and Taiwan was designed to support the agricultural and manufacturing policies. In summary, "Finance policy in northeast Asia recognized the need to support small, high-yield farms in order to maximize aggregate farm output rather than maximizing returns on cash invested via larger, 'capitalist' farms. And finance policy recognized the need in industry to defer profits until an adequate industrial learning process had taken place. In other words, financial policy frequently accepted low near-term returns on industrial investments in order to guild industries capable of producing high returns in the future."
那些不能适应这种全球竞争的公司被淘汰了。日本、韩国和台湾的金融政策是为了支持农业和制造业政策。总之，"东北亚的金融政策认识到有必要支持小型高产农场，以最大限度地提高农场的总产量，而不是通过较大的'资本主义'农场实现现金投资的最大回报。而金融政策认识

到，在工业领域需要推迟利润，直到发生了充分的工业学习过程。换句话说，金融政策经常接受工业投资的近期低回报，以保护未来能够产生高回报的产业。

Conversely, the Asian countries that were developing at the same time but did not follow these agricultural interventions had long periods of impressive growth, but they were unable to sustain it. With no real land reform in Indonesia, the Philippines, and Thailand, agriculture output was dampened because landlords made more money renting plots than making investments to increase yields, and families had no incentive to maximize the outputs on the land they didn't own. In terms of manufacturing, these countries allowed firms to focus solely on the easier sell to domestic markets, which removed the incentives for knowledge transfer and technological development.
相反，同时发展但没有遵循这些农业干预措施的亚洲国家有很长一段时间的惊人增长，但他们无法维持这种增长。在印度尼西亚、菲律宾和泰国，由于没有真正的土地改革，农业产出受到了抑制，因为地主租用土地比投资提高产量赚得更多，而家庭也没有动力将他们不拥有的土地的产出最大化。在制造业方面，这些国家允许企业只专注于更容易卖给国内市场，这消除了知识转让和技术发展的激励。

And, of course, financial policy in each country supported these approaches of no land reform and little to no exports, focusing instead on consumer lending. Studwell explains, "The best banking returns in the East Asian region are produced in the region's most backward countries –The Philippines, Indonesia and Thailand." Short-term focus on banking profits did not create sustainable growth reactions in these developing countries.
当然，每个国家的金融政策都支持这些没有土地改革和几乎没有出口的做法，而是把重点放在消费者贷款上。Studwell解释说："东亚地区最好的银行业回报是在该地区最落后的国家--菲律宾、印度尼西亚和泰国产生的。" 对银行业利润的短期关注并没有在这些发展中国家产生可持续的增长反应。

Therefore, when times were good, growth was possible, but when financial crisis hit, those that had not substantially transformed their economies were unable to deal with the challenges. Growth stalled in Thailand, Indonesia, and the Philippines, and the populations went back to being poor. Their policies did not have enough activation energy to complete their economic development.
因此，当形势好的时候，增长是可能的，但当金融危机来临时，那些没有对其经济进行实质性转型的国家无法应对挑战。泰国、印度尼西亚和菲律宾的增长停滞不前，人口又回到了贫困状态。他们的政策没有足够的激活能量来完成他们的经济发展。

To be clear, it wasn't all smooth sailing for Japan, South Korea, and Taiwan when they started to implement their policy changes. Some business were winners and became internationally popular, like Toyota and Nikon, but there were also losers. Some

international relations were strained. There was no overnight success, and the general population had to sacrifice short-term returns for the long-term national interest. However, managing the difficulties is part of getting to the finish line of a reaction.
说白了，日本、韩国和台湾在开始实施政策改革时，也并非一帆风顺。一些企业是赢家，在国际上变得很受欢迎，如丰田和尼康，但也有输家。一些国际关系变得紧张。没有一夜之间的成功，普通民众不得不为长期的国家利益牺牲短期的回报。然而，管理这些困难是到达反应终点的一部分。

The point here is not that there is a prescription for the exact amount of activation energy needed to fundamentally transform a nation's economy. As Studwell explains, "Different economics [are] 16 appropriate to different stages of development." Instead, recognize that reactions do have an activation energy, and you have a greater chance of success when you consider what is needed to bring about not just the start, but the conclusion of a reaction.
这里的重点不是说有一个从根本上改变一个国家的经济所需的激活能量的确切数量的处方。正如Studwell所解释的，"不同的经济学[是]16个适合于不同的发展阶段。" 相反，认识到反应确实有一个激活能量，当你考虑到需要什么来实现一个反应的开始和结束时，你有更大的成功机会。

The arguments Studwell sets out are not about how countries can maintain healthy development, but are rather an idea of how to "become rich in the first place." Land reforms and protectionism in developing industry are not long-term policy positions—they are instead short-term components of the activation energy required to bring about sustainable growth. In making the case for effective development in Japan, South Korea, and Taiwan, Studwell writes, "There is no significant economy that has developed successfully through policies of free trade and deregulation from the get-go. What has always been required is proactive interventions—the most effective of them in agriculture and manufacturing—that foster early accumulation of capital and technological learning."
斯图德威尔提出的论点不是关于国家如何保持健康发展，而是关于如何 "首先变得富有 "的想法。土地改革和发展中工业的保护主义不是长期的政策立场--相反，它们是实现可持续增长所需的激活能量的短期组成部分。在论证日本、韩国和台湾的有效发展时，Studwell写道："没有一个重要的经济体从一开始就通过自由贸易和放松管制的政策成功发展。始终需要的是积极主动的干预--其中最有效的是农业和制造业--促进资本的早期积累和技术学习。"

Conclusion 结论

Creating lasting change is harder than creating change. Don't underestimate the activation energy required to not only break apart existing bonds, but to create new, strong ones. Some reactions are not quick, and all take some degree of effort.

创造持久的变化比创造变化更难。不要低估所需的激活能量，不仅要打破现有的联系，而且要创造新的、强大的联系。有些反应并不迅速，而且都需要一定程度的努力。

Trying to accurately estimate the activation energy required means you're less likely to quit too early. You won't run out of gas on the way up the hill or stop supporting a team during its transition phase.
试图准确估计所需的活化能意味着你不太可能过早放弃。你不会在上山的路上耗尽汽油，也不会在一个团队的过渡阶段停止支持。

If you have enough activation energy, reactions will keep going, finishing what was started and forming new bonds that will then take a significant reinvestment of activation energy to break. Real change takes effort. Invest more than you think you need to, and you just might get there.
如果你有足够的激活能，反应将继续进行，完成已经开始的事情，并形成新的结合，然后需要大量的激活能再投资才能打破。真正的改变需要努力。投入比你认为需要的更多，你就可能达到目的。

Catalysts 催化剂

Catalysts accelerate change. While they cannot make a reaction happen that would normally not, they can significantly reduce the time required for change to occur. Finding the right catalyst is critical. No single substance increases the rate of all reactions. Because different reactions have different activation energies, there are many different catalysts. The final important feature of catalysts is that they are not consumed by the reaction.
催化剂加速变化。虽然它们不能使通常不会发生的反应发生，但它们可以大大减少变化发生所需的时间。找到合适的催化剂是关键。没有一种物质能提高所有反应的速度。因为不同的反应有不同的活化能，所以有许多不同的催化剂。催化剂的最后一个重要特征是，它们不会被反应消耗掉。

They can be removed and used again, making them extremely useful. The mechanisms through which catalysts work are relatively simple in theory. By creating alternative pathways for the reaction to occur, more of the reactant particles have enough energy. The reaction is then faster, safer, and, in industrial contexts, cheaper. Catalysts are everywhere, even if they might not be obvious.
它们可以被移除并再次使用，这使它们非常有用。催化剂的工作机制在理论上是相对简单的。通过为反应的发生创造替代路径，更多的反应物粒子有足够的能量。然后，反应就会更快、更安全，而且在工业背景下更便宜。催化剂无处不在，即使它们可能并不明显。

Many everyday products—including bread, paper, yogurt, and detergent—are manufactured with help from catalysts. Inside our bodies, catalysts facilitate processes ranging from movement to digestion. A common example of catalysts making our lives easier is in the catalytic converters of diesel or gasoline-fueled cars. Exhaust fumes from these cars contain toxic products, including carbon monoxide. Released into the atmosphere, the products have a myriad of harmful effects, including exacerbating respiratory conditions.
许多日常用品--包括面包、纸张、酸奶和洗涤剂--都是在催化剂的帮助下制造的。在我们的身体里，催化剂促进了从运动到消化的各种过程。催化剂使我们的生活更容易的一个常见例子是在柴油或汽油燃料汽车的催化转换器。这些汽车的废气含有有毒产品，包括一氧化碳。释放到大气中，这些产品有无数的有害影响，包括加剧呼吸系统疾病。

To minimize this, catalytic converters contain catalysts that turn exhaust fumes into less harmful gases. It is probable that people first discovered catalysis when alcohol was invented, although there was likely no specific term for it or understanding of the related mechanisms. Alcohol is one of humanity's oldest inventions and is unusual in that its popularity has spanned cultures, nations and religions. We naturally do not know who first discovered how to make alcohol, but the earliest known evidence of its production dates back as far as 10,000 years ago.
为了最大限度地减少这种情况，催化转换器含有催化剂，将废气转化为危害较小的气体。很可能人们在发明酒精时首次发现了催化作用，尽管当时可能没有具体的术语，也没有对相关机制的理解。酒精是人类最古老的发明之一，它的流行跨越了文化、国家和宗教，这一点很不寻常。我们自然不知道是谁首先发现了如何制造酒精，但已知最早的酒精生产证据可以追溯到1万年前。

Fermentation was likely discovered even further back than that; we just don't have an archaeological record. The catalyst in alcohol production is yeast. Alongside alcohol, the discovery of soap also employed catalysts, combining fats with alkaline substances, or bases, to make a useful substance for cleaning. In the ensuing millennia, people discovered numerous ways of using catalysts. Serious study began in the 18th century with the work of Elizabeth Fulhame. Through extensive experimentation, Fulhame discovered that most oxidation reactions cannot occur in the absence of water.
发酵被发现的时间可能比这更早；我们只是没有考古记录。酒精生产的催化剂是酵母。除了酒精，肥皂的发现也采用了催化剂，将脂肪与碱性物质或碱结合起来，制成一种用于清洁的有用物质。在随后的几千年里，人们发现了许多使用催化剂的方法。认真的研究开始于18世纪伊丽莎白-福尔哈姆的工作。通过广泛的实验，Fulhame发现，大多数氧化反应在没有水的情况下不能发生。

She also noted that the water involved appeared to be regenerated and not be used up in

the process. Fulhame is an extraordinary figure in the history of science, in part for the forward-thinking nature of her work and in part for being one of the first women to make a substantial contribution to a field. For the latter reason, many of her peers refused to accept her work.
她还注意到，所涉及的水似乎是再生的，而不是在这个过程中被耗尽。福尔哈姆是科学史上的一个非凡人物，部分原因是她的工作具有前瞻性，部分原因是她是对某一领域做出实质性贡献的第一批女性之一。由于后者的原因，她的许多同行拒绝接受她的工作。

Time has shown her to be correct, and the impact of her discoveries is hard to overstate. Several decades later, chemist Jons Jacob Berzelius coined the term “catalysis” and syndicated the work of numerous earlier researchers into a coherent theory. By the end of the 19th century, researchers had a workable understanding of catalysis, which Wilhelm Ostwald defined as substances that speed up reactions.
时间表明她是正确的，而她的发现的影响是难以夸大的。几十年后，化学家Jons Jacob Berzelius创造了 "催化 "一词，并将众多早期研究人员的工作联合起来，形成一个连贯的理论。到19世纪末，研究人员对催化作用有了可行的理解，威廉-奥斯特瓦尔德将其定义为加速反应的物质。

Ostwald believed that there was no chemical reaction that could not be improved through catalysts. When the Industrial Revolution began, people soon realized the potential for using catalysts in manufacturing, with a number of patents filed. Financial gain proved to be a powerful incentive for those researching catalysis, which is probably why there were so many advancements in a relatively short time. Although the science continues to advance, we lack a comprehensive definition of how many catalysts actually work—a challenge for future scientists to uncover. Catalysts are the unsung heroes of the many processes that they make faster, cheaper, and safer.
奥斯特瓦尔德认为，没有什么化学反应是不能通过催化剂来改善的。当工业革命开始时，人们很快意识到在制造业中使用催化剂的潜力，并申请了许多专利。事实证明，经济利益对研究催化的人来说是一种强大的激励，这可能就是为什么在相对较短的时间内有这么多进步的原因。尽管科学在继续进步，但我们缺乏对许多催化剂实际工作情况的全面定义--这是未来科学家要揭开的挑战。催化剂是许多过程中的无名英雄，它们使过程更快、更便宜、更安全。

> Catalysis…is is to chemical reactions what civil engineering is to the Alps: you do not need to cross the mountain passes to get to the Mediterranean, you can pass through the Simplon Tunnel.
> 催化.....对化学反应来说，就像土木工程对阿尔卑斯山一样：你不需要穿过山口就能到达地中海，你可以通过辛普隆隧道。
> ———拉尔斯•奥尔斯特罗 Lars Ohrström

The first internet 第一个互联网

Catalysts are not required for a reaction to occur, but they make things easier. Having them means that there are more possible starting conditions for reactions. Like all models from the physical world, they are value neutral. Catalysts can just as easily speed up the occurrence of negative reactions as of positive ones. Once you start looking for catalysts, you see them everywhere; like the printing press, which significantly sped up the learning process.
催化剂不是发生反应的必要条件，但它们使事情变得更容易。拥有它们意味着有更多可能的反应起始条件。像所有来自物理世界的模型一样，它们是价值中立的。催化剂可以很容易地加快消极反应的发生，也可以加快积极反应的发生。一旦你开始寻找催化剂，你就会发现它们无处不在；就像印刷机，它大大加快了学习过程。

If attaining knowledge is thought of as a reaction, then prior to the printing press this reaction required comparatively huge activation energy to get started. Handwritten books were rare and the purview of a very small section of society. Getting access to them was complicated—you needed the time and the means to seek them out. In order to learn, scholars would have to wander from scriptorium to scriptorium, hunting down one of Aristotle's or Euclid's works. In addition, they couldn't rely on the integrity of what they were reading—hand copying lent itself to errors and embellishment, and books were sometimes erased so the parchment could be reused.
如果把获得知识看作是一种反应，那么在印刷术之前，这种反应需要相对巨大的激活能量才能开始。手写的书很稀少，只属于社会的一小部分。获得这些书籍是很复杂的，你需要时间和手段来寻找它们。为了学习，学者们不得不从一个书房到另一个书房，寻找亚里士多德或欧几里德的作品。此外，他们不能依赖他们所读内容的完整性--手抄本本身就存在错误和修饰，而且书本有时会被擦掉，以便羊皮纸可以重新使用。

For medieval scholars, the older a manuscript was, the more likely it was to be accurate. The printing press acted as a catalyst to accelerate the process of obtaining knowledge. There was now a repeatable process for copying knowledge: books. These books were cheaper and faster to make than the old manuscripts, and thus were more widely available.
对于中世纪的学者来说，一份手稿越古老，就越有可能是准确的。印刷机作为一种催化剂，加速了获取知识的过程。现在有了一个复制知识的可重复过程：书籍。这些书比以前的手稿更便宜、更快捷，因此可以更广泛地获得。

Knowledge now required less time and money to obtain— effectively like lowering the activation energy. The printing press increased knowledge because it broadened the conditions in which the reaction could occur. There were more pathways to learning and

for accessing information.
现在获得知识需要更少的时间和金钱--有效地降低了活化能。印刷机增加了知识，因为它扩大了反应可能发生的条件。有更多的学习和获取信息的途径。

Unexpected consequences 意想不到的后果

Social catalysts can take on unexpected forms. Consider the Black Death, which swept the world for several centuries, peaking in the 14th century. The epidemic was tragic, wiping out hundreds of millions of people. Yet it also proved to be a powerful catalyst for social, religious, economic, and cultural change. Though we can't know if these changes would have happened anyway and it is only the distance of time that enables us to find anything positive in it, it seems that the Black Death was the beginning of many elements of the society we now live in.
社会催化剂可以采取意想不到的形式。考虑一下黑死病，它席卷了世界几个世纪，在14世纪达到顶峰。这一流行病是悲剧性的，消灭了数亿人。然而，它也被证明是社会、宗教、经济和文化变革的强大催化剂。尽管我们无法知道这些变化是否无论如何都会发生，而且只有时间的距离才能让我们从中找到积极的东西，但黑死病似乎是我们现在生活的社会的许多元素的开始。

The precise origins of the Black Death are unlikely to ever be known, but we do know how it spread. Animals, in particular rats, carried fleas infected with the plague bacteria when they climbed aboard ships sailing around the world. The fleas then jumped onto humans, bit them, and infected them with the Black Death. In the 1340s, the trading routes that were bringing Europe new wealth and opportunities brought it something more sinister.
黑死病的确切起源不太可能被知道，但我们确实知道它是如何传播的。动物，特别是老鼠，当它们爬上在世界各地航行的船只时携带了感染了鼠疫细菌的跳蚤。然后跳蚤跳到人类身上，咬他们，并使他们感染了黑死病。在1340年代，为欧洲带来新的财富和机会的贸易路线带来了更邪恶的东西。

With no knowledge of what was causing this devastating disease, people continued to move and trade, spreading the plague further and further afield. As time progressed and more and more people died, society began to change. Old systems of labor collapsed with so few people left to work. Workers could demand more money because they were less replaceable. As wages rose, rents fell as landlords realized, to their chagrin, that they possessed more land than there was demand for.
由于不知道是什么导致了这种毁灭性的疾病，人们继续移动和交易，使瘟疫在更远的地方传播。随着时间的推移，越来越多的人死亡，社会开始发生变化。由于剩下的工作人数太少，旧的劳动系统崩溃了。工人可以要求更多的钱，因为他们不那么容易被取代。随着工资的提高，地主们意识到他们拥有的土地超过了需求，因而租金下降，这让他们感到很沮丧。

Survivors were considerably better off, and increased social mobility enabled even the poorest people to rise in society and earn more money. New industries bloomed to meet their needs, as those who once struggled to survive now had disposable income. Land became cheap and labor became expensive. With fewer workers, people developed labor-saving technology to make farming more efficient. The overall effect was a restructuring of society to be more equal.
幸存者的生活大大改善，社会流动性的增加使最贫穷的人也能在社会中崛起，赚取更多的钱。新的产业蓬勃发展以满足他们的需求，因为那些曾经为生存而挣扎的人现在有了可支配的收入。土地变得便宜，劳动力变得昂贵。由于工人减少，人们开发了节省劳动力的技术，使农业更有效率。总的效果是社会重组，变得更加平等。

While the Christian church had long dominated society, the Black Death weakened its grip for two reasons: people found it difficult to reconcile the tragedy they saw with religious teachings, and the numbers of priests and religious leaders shrunk. Those in religious orders died in the same numbers as anyone else. In the cultural gap created, new ideas emerged and led to the Renaissance.
虽然基督教会长期以来一直主宰着社会，但黑死病削弱了它的控制力，原因有二：人们发现很难将他们看到的悲剧与宗教教义相协调，而牧师和宗教领袖的数量也在减少。修道士的死亡人数与其他人一样多。在所产生的文化差距中，新的思想出现了，导致了文艺复兴。

While European culture had stagnated for centuries, the weakening of the church enabled dramatic advancements in science and significant changes in the topics pursued in literature and poetry. People did not become less religious, and the church remained at the heart of society, but with changing sensibilities. The Black Death may have led to improved conditions for women, who began to enter the workforce in new ways, particularly in industries such as brewing.
虽然欧洲文化已经停滞了几个世纪，但教会的削弱使科学取得了巨大的进步，文学和诗歌所追求的主题也发生了重大变化。人们并没有变得不那么虔诚，教会仍然是社会的核心，但情感却在不断变化。黑死病可能导致了妇女条件的改善，她们开始以新的方式进入劳动力市场，特别是在酿酒等行业。

Women also began marrying later in life. Medicine also changed. After only making minor improvements for centuries and relying on humoral theory, it became apparent that old ideas surrounding the human body were incorrect, and doctors moved toward research based on observation. Subsequent generations likely lived longer, perhaps because only the strongest survived to pass on their genes.
妇女也开始晚婚。医学也发生了变化。在几个世纪以来只做了一些小的改进并依赖于体液理论之后，人们发现围绕人体的旧观念是不正确的，医生们开始转向基于观察的研究。后来的几代人可能活得更久，也许是因为只有最强壮的人才能活下来，把他们的基因传下去。

The Black Death was a catalyst for change in almost every area of society. Although these changes may have happened anyway, the epidemic sped them up. As Peter Frankopan writes in The Silk Roads, “And yet, despite the horror it caused, the plague turned out to be a catalyst for social and economic change that was so profound that far from marking the death of Europe, it served as its making.”
黑死病是社会几乎每个领域变革的催化剂。尽管这些变化可能已经发生，但流行病加速了它们。正如彼得-弗兰克潘在《丝绸之路》中写道："然而，尽管它造成了恐怖，瘟疫却成为社会和经济变革的催化剂，这种变革是如此深刻，以至于它远没有标志着欧洲的死亡，而是成为它的创造者。

The changes were not evenly distributed and not all of the survivors enjoyed the same benefits. By and large, however, the Europe that emerged from the tragedy was an entirely different place. As populations recovered, European society continued to evolve. Although the immediate economic gains faded, some of the new structures were there to stay. Catalysts lead to change.
这些变化并不是平均分配的，也不是所有的幸存者都享有同样的好处。然而，总的来说，从这场悲剧中走出来的欧洲是一个完全不同的地方。随着人口的恢复，欧洲社会继续发展。虽然眼前的经济收益消失了，但一些新的结构却一直存在着。催化剂导致了变化。

The right catalyst makes an endeavor that once seemed impossible simple. It need not only be about wide, systemic changes, like those described above. There are many smaller catalysts that we encounter in our everyday lives. Getting out of breath while walking up a flight of stairs might be the catalyst for someone to start exercising. Reaching a significant birthday might prompt someone to make a career change. A health scare may push someone to improve their habits. For many people, unpleasant events, such as getting fired or rejected, prove to be catalysts for tremendous personal growth.
正确的催化剂使曾经看起来不可能的努力变得简单。它不需要只涉及广泛的、系统性的变化，如上面描述的那些。在我们的日常生活中，有许多较小的催化剂，我们会遇到。走楼梯时气喘吁吁可能是某人开始锻炼的催化剂。达到一个重要的生日可能促使某人做出职业改变。健康恐慌可能促使某人改善他们的生活习惯。对许多人来说，不愉快的事件，如被解雇或被拒绝，被证明是巨大的个人成长的催化剂。

The comfort of a king 国王的舒适

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Autocatalysis 自催化作用
When the outputs of a reaction are the same catalysts needed to start it, the
reaction becomes self-sustaining. This is called autocatalysis. In terms of
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harnessing the power of catalysts, producing an autocatalytic reaction is the gold standard. How many things in life do we wish could continue on their own for an extended period of time, without constantly needing the input of our energy?
当一个反应的产出与启动它所需的催化剂相同时，该反应就会变得自我维持。这就是所谓的自催化作用。在利用催化剂的力量方面，产生自催化反应是黄金标准。在生活中，有多少事情我们希望能够在较长的时间内自行继续，而不需要不断地需要我们的能量输入？

The endorsement of the rich, famous, or respected can act as a catalyst in the evolution of cultural norms. Society evolves. Over time, we change our sensibilities and preferences, our notions of acceptable behavior, even our concepts of what it means to be human. The forces that influence these changes come from a variety of sources. Innovations in technology allow for different means of organization whose effects ripple through society, or geopolitical changes that require different functions from citizens, and thus serve to create new perceptions of roles in society. Sometimes these developments stagnate, not having enough energy to produce systemic change. Other times, seemingly innocuous changes are embraced by opinion leaders, who become, in effect, catalysts speeding up the adoption of the changes in society.
富人、名人或受人尊敬的人的认可可以在文化规范的演变中起到催化剂的作用。社会在不断发展。随着时间的推移，我们改变了我们的感觉和喜好，我们对可接受行为的概念，甚至我们对做人的概念。影响这些变化的力量来自于各种不同的来源。技术的创新允许不同的组织方式，其影响波及整个社会，或者地缘政治的变化要求公民发挥不同的功能，从而有助于创造对社会角色的新认识。有时，这些发展停滞不前，没有足够的能量来产生系统性的变化。其他时候，看似无害的变化被意见领袖所接受，他们实际上成为催化剂，加速了社会对变化的采纳。

Louis XV of France was just such a person. Going into the 18th century in France, and Europe in general, homes were decorated to show off one's wealth and possessions. They weren't private sanctuaries, but rather public displays of status. By the mid18th century the home as a public space had changed. Homes became designed for comfort and intimacy.
法国的路易十五就是这样一个人。进入18世纪，在法国和整个欧洲，家庭的装饰是为了炫耀自己的财富和财产。它们不是私人的圣殿，而是地位的公开展示。到了18世纪中期，作为公共空间的家已经发生了变化。家里的设计变得更加舒适和亲密。

We went from straightbacked wooden chairs to padded sofas, and public privies to private flush toilets. It was incredible, and now most of us couldn't conceive of going back. Thus, we all owe a small debt to Louis XV for embracing the desire to have a comfortable home. Part of the change to seeing the home as a private space was a result of larger social changes that were occurring.

我们从直背木椅到软垫沙发，从公共厕所到私人冲水马桶。这是令人难以置信的，而现在我们中的大多数人都无法想象会回到过去。因此，我们都欠路易十五一个小小的人情，因为他接受了拥有一个舒适家园的愿望。把家看作是一个私人空间的变化，部分原因是当时发生的更大的社会变化。

The upper classes were moving around less due to more stable political situations. Technological advancement was booming, leading to a new look at things like indoor plumbing and central heating. And, perhaps most importantly, the Enlightenment was developing, placing emphasis on individual liberty and the sharing of knowledge and ideas.
由于政治局势更加稳定，上层阶级的流动也在减少。技术进步正在蓬勃发展，导致人们对室内管道和中央供暖等事物有了新的认识。而且，也许最重要的是，启蒙运动正在发展，强调个人自由以及知识和思想的共享。

One of the products of these changes was the French royalty no longer wanted to be uncomfortable at the palace. During his reign, Louis XV transformed Versailles from an uncomfortable and public space to a place that reflected the desire of individuals to live in a place they could also enjoy. He created almost a parallel palace of interior rooms where he, his family, and close confidantes could exist outside of the public eye.
这些变化的产物之一是法国皇室不再希望在皇宫里呆得不舒服。路易十五在位期间，将凡尔赛宫从一个不舒服的公共空间改造成了一个反映个人对生活在一个他们也能享受的地方的渴望的地方。他几乎创造了一个由室内房间组成的平行宫殿，在那里他、他的家人和亲信们可以在公众视野之外生存。

He replaced wooden footstools with legions of sofas and armchairs and made it perfectly acceptable for intimate acquaintances to sit in the presence of the king. In his private rooms he was just Louis. He installed indoor plumbing and flush toilets in their own private rooms. For the first time guests at Versailles didn't have to relieve themselves in the hallways. Bedrooms were no longer places where anyone could wander through.
他用大量的沙发和扶手椅取代了木质脚凳，让亲密的熟人坐在国王面前也是完全可以接受的。在他的私人房间里，他就是路易。他在他们自己的私人房间里安装了室内管道和抽水马桶。凡尔赛的客人们第一次不用在走廊里解手了。卧室不再是任何人都可以随意进出的地方了。

Rooms were smaller and had specific functions. In short, Louis XV put in place many aspects of the modern home. Importantly, Louis didn't invent any of these things. He was greatly influenced by the sensibilities of his father's mistress, the Marquise de Montespan, who started some of the changes at Versailles, and his own mistress, the Marquise de Pompadour, who embraced the notions of comfort and privacy.
房间更小，而且有特定的功能。简而言之，路易十五将现代住宅的许多方面都落实到位了。重

要的是，路易并没有发明任何这些东西。他受到了他父亲的情妇孟德斯潘侯爵夫人和他自己的情妇蓬巴杜侯爵夫人的影响，前者开始了凡尔赛的一些变革，后者则接受了舒适和隐私的概念。

They, in turn, were influenced by the changes and developments happening in society around them. Therefore it is quite possible that the widespread acceptance of the standards of comfort and privacy would have come to pass anyway. But, as Joan DeJean writes in The Age of Comfort, “The invention of modern comfort was a vast, and vastly costly, 5 6 enterprise, one that transformed first the look of royal residences and then the cityscape of Paris, and did so, furthermore, in fastforward mode, so rapidly that contemporaries kept repeating that it was all happening as if by magic.”
他们又受到了周围社会变化和发展的影响。因此，无论如何，广泛接受舒适和隐私的标准是很有可能实现的。但是，正如琼-德让（Joan DeJean）在《舒适时代》中写道："现代舒适的发明是一项巨大的、耗资巨大的事业，它首先改变了皇家住宅的外观，然后改变了巴黎的城市景观，而且是以快速的方式进行的，速度如此之快，以至于同时代的人不断重复说，这一切就像魔术一样。

Early adoption by Louis XV and the royalty made comfort desirable and cheaper. The more people who wanted comfort, the more who bought into comfort, the more the prices lowered. This created a feedback loop where comfortable elements for the home became accessible to more and more people. Louis XV helped to make comfort both socially acceptable and financially affordable.
路易十五和皇室成员的早期采用，使舒适度变得令人向往和便宜。想要舒适的人越多，购买舒适的人就越多，价格就越低。这就形成了一个反馈回路，越来越多的人可以接触到家庭中的舒适元素。路易十五帮助使舒适在社会上被接受，在经济上也能负担得起。

Conclusion 结论

Catalysts accelerate reactions that are capable of occurring anyway. They decrease the amount of energy required to cause change, and in the process make possible reactions that might not have occurred otherwise. People and technologies often act as catalysts, increasing the pace of social change and development.
催化剂加速了那些无论如何都能发生的反应。它们减少了引起变化所需的能量，并在这个过程中使原本可能不会发生的反应成为可能。人和技术经常充当
催化剂，提高社会变革和发展的速度。

Alloying 合金化

Alloying can be a powerful process because it combines components in specific combinations to produce a substance that can achieve what the individual elements cannot. An alloy is a mixture, either in solution or compound, of two or more metals, or a metal and a nonmetal. Alloying, then, describes the process of creating an alloy. Alloying is done in order to synthesize a product with unique properties, such as greater strength, anticorrosion, service life, and improve performance. Alloying has greatly impacted the lives of humans.
合金可以是一个强大的过程，因为它以特定的组合来产生一种物质，可以实现单个元素无法实现的目标。合金是两种或多种金属，或一种金属和一种非金属的混合物，可以是溶液或化合物。那么，合金就描述了创造一种合金的过程。进行合金化是为了合成一种具有独特性能的产品，如更大的强度、防腐、使用寿命和改善性能。合金对人类的生活产生了巨大影响。

The Sumerians, for example, developed bronze made of 90% copper and 10% tin which made the resulting material harder and more chemically resistant than either pure copper or pure tin. Creating tools and weapons from bronze instead of copper allowed them to rule over their neighbors. Bronze was also effectively used by Asians during the Bronze Age.
例如，苏美尔人开发了由90%的铜和10%的锡组成的青铜，这使得所产生的材料比纯铜或纯锡更坚硬，更耐化学腐蚀。用青铜而不是铜制造工具和武器使他们能够统治他们的邻居。在青铜时代，亚洲人也有效地使用了青铜。

Copper mines in Asia produced a different quality of bronze than those found in other parts of the world. For this reason, they were able to make better musical instruments, mirrors, tools, and weapons during that time. Another important alloy in history is steel, which is still the most widely produced metal. Persians initiated the Iron Age by developing carbon steel in the 16th century BCE. The combination of iron and carbon results in steel, which is much harder than pure iron. The hardness of steel led to improved agricultural tools and weapons.
亚洲的铜矿生产的青铜质量与世界其他地区的不同。由于这个原因，他们在那个时期能够制造更好的乐器、镜子、工具和武器。历史上另一种重要的合金是钢，它仍然是生产最广泛的金属。波斯人在公元前16世纪通过开发碳钢开启了铁器时代。铁和碳的结合产生了钢，它比纯铁要硬得多。钢的硬度导致了农业工具和武器的改进。

The addition of metals such as magnesium, nickel, and chromium to carbon steel adds further characteristics to the alloy. These additives give the steel different properties, such as being stainless, and wear or corrosion resistant. Not every combination of elements produces a better, more useful alloy, but when you find one that works, the results can allow you to accomplish things previously out of reach. “In the first 4,000 years or so of steel making, the early chemists and metallurgists had no real idea what they were doing,

and thus found it very difficult to optimize their processes.
在碳钢中加入镁、镍和铬等金属，进一步增加了合金的特性。这些添加剂赋予钢不同的特性，如不锈、耐磨损或耐腐蚀。不是每一种元素的组合都能产生更好、更有用的合金，但当你找到一种有效的合金时，其结果可以让你完成以前无法实现的事情。"在最初4000年左右的炼钢过程中，早期的化学家和冶金学家并不真正了解他们在做什么，因此发现非常难以优化他们的工艺。

Add to this difficulty the large and very diverse selection of iron ores found in nature—frequently with phosphorus and silicon atoms causing a nuisance—and you may appreciate some of the complexity of the problem. Simply copying a successful procedure might not give a satisfactory product with iron ore from another mine." However, they kept at it, giving themselves and their societies new opportunities for growth and development. With a successful alloy, one plus one can truly equal ten.
除了这个困难之外，在自然界中发现了大量的、非常多样化的铁矿石--经常有磷和硅原子造成困扰--你可能会理解这个问题的一些复杂性。简单地复制一个成功的程序，用另一个矿的铁矿石可能不会得到令人满意的产品。" 然而，他们一直在做，给自己和社会带来了新的成长和发展机会。有了成功的合金，一加一才能真正等于十。

The application of this model is relevant to everything from building teams to knowledge. Medicine is one field where the concept of alloying comes in to play. Sometimes, a combination of two or more drugs can have a greater benefit than each drug individually. For example, chemotherapy drugs can be so toxic that they are almost certain to produce potentially fatal side effects.
这个模型的应用与从建立团队到知识的一切都相关。医学是合金化概念发挥作用的一个领域。有时，两种或更多药物的组合可以比每种药物单独使用有更大的好处。例如，化疗药物的毒性很大，几乎肯定会产生潜在的致命的副作用。

But combining them with another drug that reduces the impact of the side effects can make the treatment effective. In other cases, a chemotherapy drug may only be designed to target a particular biochemical pathway. If used in isolation, the cancer cells may simply develop resistance and use alternate pathways, rendering the drugs useless.
但将它们与另一种能减少副作用影响的药物相结合，可以使治疗有效。在其他情况下，一种化疗药物可能只被设计为针对一个特定的生化途径。如果单独使用，癌细胞可能会产生抗药性并使用其他途径，使药物失去作用。

Combining drugs that target different pathways leads to a drastically higher chance of destroying a tumor or halting its growth. In our lives, we often have one significant skill but don't have the other skills necessary to get the most out of it. We need to partner with those who do, forming an alloy that is greater than the sum of its parts. When we're

building something from scratch, we need to consider both the raw materials and how they mix together.
将针对不同途径的药物结合起来，摧毁肿瘤或阻止其生长的机会就会大大增加。在我们的生活中，我们经常拥有一项重要的技能，但却没有其他必要的技能来发挥它的最大作用。我们需要与那些有能力的人合作，形成一种大于其各部分之和的合金。当我们从头开始建造一些东西时，我们需要同时考虑原材料和它们如何混合在一起。

A team where everyone has good ideas and nothing else won't be as strong as a team that also includes someone who has an eye for which ideas are worth pursuing and the skills to make them a reality.
一个每个人都有好的想法而没有别的想法的团队，不会像一个还包括一个对哪些想法值得追求有眼光的人和使其成为现实的技能的团队那样强大。

How two men beat an army 两个人如何打败一支军队

Two people working together and combining skills can give them abilities greater than either one has alone. The War of 1812, between the British and the American Republic, was fought along the border of what is now Canada and the United States.
两个人一起工作，结合技能，可以使他们的能力超过任何一个人单独拥有的能力。英国和美国共和国之间的1812年战争，是沿着现在的加拿大和美国的边界进行的。

The British were trying to protect the remainder of their North American interests after having lost to the Americans in the War of Independence. The Americans were looking to ideally get the British out of North America completely or at least obtain a bargaining chip for their ongoing negotiations regarding British naval behavior. Canada was of interest on account of abundant resources and a small settled population.
英国人在独立战争中输给美国人后，正试图保护他们在北美的剩余利益。美国人希望最好能将英国人完全赶出北美，或者至少为他们正在进行的关于英国海军行为的谈判获得一个筹码。加拿大因其丰富的资源和少量定居人口而受到关注。

The British, however, were embroiled in war with France, and so their North American territory was imperial priority number two. Therefore, only a fraction of their potential resources was devoted to stopping the Americans. It was apparent to those on the ground in Canada that some creative thinking was required. The Americans thought taking Canada would be the equivalent of taking a walk.
然而，英国人正陷入与法国的战争中，因此他们的北美领土是帝国的第二优先事项。因此，他们只有一小部分潜在的资源被用于阻止美国人。对加拿大当地的人来说，显然需要一些创造性的思维。美国人认为占领加拿大就相当于散步。

The land was vast, and the people willing to defend it were few in comparison. They were not expecting much of a challenge. So it was to their great surprise that the critical position of Fort Detroit was surrendered to the British without any actual fighting. How this came to pass was on account of two men, who were able to achieve together what they could not as individuals.
加拿大土地辽阔，而愿意保卫它的人相对较少。他们没有想到会有什么挑战。因此，令他们非常惊讶的是，底特律堡的关键位置在没有任何实际战斗的情况下就向英国人投降了。这一切是由于两个人而实现的，他们能够共同实现他们个人所不能实现的目标。

Tecumseh was a Shawnee chief and leader of the native confederacy. His “consuming passion was the establishment of a native state on American territory.” His war was not the one of 1812, but a separate effort to secure native territory. Major-General Isaac Brock had spent his career with the British army, and although he would have preferred a posting in France to Canada, he staunchly defended British interests there. As James Laxer writes in Tecumseh & Brock: The War of 1812, “their backgrounds and life experience could not have been more different.”
特库姆塞是肖尼族的酋长，也是本土联盟的领导人。他 "最大的热情是在美国领土上建立一个土著国家"。他的战争不是1812年的战争，而是为确保本土领土而进行的单独努力。艾萨克-布洛克少将的职业生涯是在英国军队中度过的，尽管他更愿意在法国任职而不是在加拿大，但他坚定地捍卫英国在那里的利益。正如詹姆斯-拉克斯在《特库姆塞和布洛克》一书中写道。1812年的战争》中写道，"他们的背景和生活经历不可能有更大的不同"。

When the Americans declared war, these men realized that an alliance with each other gave them an improved chance of success. For Brock, Tecumseh brought experienced warriors and an extensive knowledge of the territory. For Tecumseh, an alliance with the British was important to check American control of land on the continent. In Brock, he also found an ally to his goal of a native state. “Tecumseh and Brock understood each other.
当美国人宣战时，这些人意识到，彼此之间的联盟给他们带来了更大的成功机会。对布洛克来说，特库姆塞带来了经验丰富的战士和对该地区的广泛了解。对特库姆塞来说，与英国人结盟对于遏制美国人对大陆土地的控制非常重要。在布洛克身上，他也找到了一个实现他建立本土国家目标的盟友。"特库姆塞和布洛克相互理解。

Together, they could do what neither could do alone.” Both men felt that the upper hand would be gained by going on the offensive. So they set their sights on Fort Detroit. Working together to employ a brilliant psychological assault on the American fort, they managed to take it without any actual fighting. Brock and Tecumseh coordinated their efforts to give the impression there were thousands more Native Americans waiting to fight at Fort Detroit than there were.
在一起，他们可以做任何一个人都做不到的事情"。两人都认为，通过进攻可以占得先机。因

此，他们把目光投向了底特律堡。他们合作对美国人的堡垒进行了一次出色的心理攻击，在没有任何实际战斗的情况下成功地拿下了它。布洛克和特库姆塞协调他们的努力，让人觉得在底特律要塞等待战斗的美国原住民比实际情况多出数千人。

Brock played on the fear of Native Americans held by the American commander of the fort, and Tecumseh used his men to provide a calculated visual manipulation. When the Americans rode out with the white flag, neither had lost any men. The capture of Fort Detroit in an almost completely bloodless battle took the Americans by surprise. “During the battle for Detroit, Tecumseh and Brock reinforced each other’s strengths, marrying the speed and flexibility of the native force to the firepower and solidity of the British regulars.
布洛克利用堡垒的美国指挥官对美国原住民的恐惧，而特库姆塞则利用他的手下提供一个精心策划的视觉操纵。当美国人举着白旗骑马离开时，双方都没有损失任何人员。在一场几乎完全不流血的战斗中夺取底特律堡，让美国人大吃一惊。"在争夺底特律的战斗中，特库姆塞和布洛克加强了彼此的实力，将本土部队的速度和灵活性与英国正规军的火力和坚固性相结合。

That potent combination proved lethal for the cumbersome Americans and their shaky commanders. The consequence was a victory that should not have been won.” Both men would continue to fight for what they believed in, and these causes would claim the lives of both within a year. The British succeeded in keeping the Americans out of Canadian territory, building on the successful tactics at Fort Detroit. When the end of the war was negotiated, and with neither Tecumseh nor Brock present, British support for native territory in America was not included in the treaty.
事实证明，这种强有力的组合对于笨重的美国人和他们不稳定的指挥官来说是致命的。其结果是一场不应该赢得的胜利"。两个人都将继续为他们的信仰而战，而这些事业将在一年内夺走两人的生命。英国人在底特律堡的成功战术基础上，成功地将美国人挡在了加拿大领土之外。当战争结束时，在特库姆塞和布洛克都不在场的情况下，英国对美洲本土领土的支持没有被列入条约中。

Knowledge, the ultimate alloy 知识，最终的合金

When we reflect on our knowledge, we recognize that it has component parts. At the very least, we can easily appreciate that there is knowledge we have gained from direct experience, and knowledge we have gained from theory, like that from books. Knowledge about when a stove is hot is often gained firsthand in our early years, but how that heat is produced is something we later learn in a science textbook. Furthermore, most of us appreciate that to only learn from others, or to only credit that which is gained from direct experience would both be functionally useless.
当我们反思我们的知识时，我们认识到它有组成部分。至少，我们可以很容易地理解，有我们从直接经验中获得的知识，也有我们从理论中获得的知识，比如从书本中获得的知识。关于炉

子什么时候是热的知识往往是我们早年获得的第一手资料，但热量是如何产生的，则是我们后来在科学课本上学到的东西。此外，我们大多数人都知道，只从别人那里学习，或只相信从直接经验中获得的知识，在功能上都是无用的。

A scenario in which you could only learn from one or the other would not produce the alloy we call knowledge. Theoretical learning cannot prepare you to understand all the nuances of your particular life, such as your partner or the dynamics of your team. And if you relied solely on your own experiences to learn, you would be condemned to repeat the mistakes of others, which is extremely ineffective. Theory and experience together create knowledge, and both serve to augment and advance the capabilities of the other.
如果你只能从一个人身上学习，就不会产生我们称之为知识的合金。理论学习无法让你准备好理解你特定生活中的所有细微差别，例如你的伙伴或你团队的动态。而如果你仅仅依靠自己的经验来学习，你将注定要重复别人的错误，这是极无效的。理论和经验共同创造了知识，两者都是为了增强和推进对方的能力。

Experience can trigger the updating of theory, and the validation or application of theory can trigger new experiences. The alloy that is knowledge can further be conceptualized with more complexity. Aristotle discussed five components of knowledge. “They are what we today would call science or scientific knowledge (episteme), art or craft knowledge (techne), prudence or practical knowledge (phronesis), intellect or intuitive apprehension (nous) and wisdom (sophia).”
经验可以引发理论的更新，而理论的验证或应用可以引发新的经验。作为知识的合金可以进一步被概念化，更加复杂。亚里士多德讨论了知识的五个组成部分。"它们就是我们今天所说的科学或科学知识（episteme），艺术或工艺知识（techne），审慎或实践知识（phronesis），智力或直觉理解（nous）和智慧（sophia）。

These components of knowledge were not mutually exclusive; they reflect the understanding of how much knowledge we bring to bear on any given situation. When driving, we understand the rules of the road and how to operate the machine. We further understand how road conditions are likely to impact our drive, both in terms of the vehicle handling and time of journey. We also factor in how other drivers are likely to respond in the variety of circumstances we could possibly face as we progress to our destination.
知识的这些组成部分并不相互排斥；它们反映了对我们在任何特定情况下带来多少知识的理解。开车时，我们了解道路的规则和如何操作机器。我们进一步了解道路状况可能对我们的驾驶产生的影响，包括车辆的操作和旅程的时间。我们还考虑到在我们到达目的地时可能面临的各种情况下，其他司机可能会如何应对。

The sources of our knowledge are varied. To really explain knowledge as an alloy, something that is strengthened when we mix certain components in, we can look at the life

of Leonardo da Vinci. In Walter Isaacson's account, he explains that Leonardo was able to conceive of things in an extraordinary way leading him to discover or validate concepts that were often hundreds of years ahead of his time. Leonardo was curious; he wanted to know how the world worked and why.
我们的知识来源是多种多样的。为了真正解释知识是一种合金，当我们把某些成分混合在一起时，它就会得到加强，我们可以看看达芬奇的生活。在沃尔特-艾萨克森的叙述中，他解释说，莱昂纳多能够以一种非同寻常的方式构思事物，导致他发现或验证了往往比他的时代领先数百年的概念。莱昂纳多很好奇；他想知道世界是如何运作的，以及为什么。

He also possessed and honed the skill of intense observation, studying birds and plant stems for hours, or making extensive notes and drawings on eddies of water and optics. He would observe a phenomenon, make a guess as to the principles behind it, and seek to validate those through further observation. Leonardo was willing to challenge accepted truths, seeking to understand them by questioning them. "His lack of reverence for authority and his willingness to challenge received wisdom would lead him to craft an empirical approach for understanding nature that foreshadowed the scientific method developed more than a century later by Bacon and Galileo."
他还拥有并磨练了强烈的观察能力，对鸟类和植物茎干进行了长达数小时的研究，或对水的涡流和光学做了大量的笔记和绘画。他观察一种现象，猜测其背后的原理，并试图通过进一步观察来验证这些原理。莱昂纳多愿意挑战公认的真理，通过质疑来寻求对它们的理解。"他缺乏对权威的敬畏，愿意挑战公认的智慧，这使他精心设计了一种理解自然的经验方法，预示着一个多世纪后由培根和伽利略开发的科学方法。

He was mainly self-taught, having had almost no formal schooling, but he recognized the value of learning from the * 7 8 experiences of others. A quote from one of his journals reads, "Get the master of arithmetic to show you how to square a triangle.…Ask Benedetto Protinari by what means they walk on the ice in Flanders…Get a master of hydraulics to tell you how to repair a lock, canal and mill in the Lombard manner" These notes suggest that no one has the time to do everything, and the alloy that is our knowledge must contain what we can learn from others.
他主要是自学成才，几乎没有接受过正规的学校教育，但他认识到从别人的经验中学习的价值 * 7 8。在他的一本日记中，有这样一段话："让算术大师告诉你如何摆平一个三角形....，问问Benedetto Protinari他们在佛兰德斯的冰面上是用什么方法行走的.....让水力学大师告诉你如何用伦巴第方式修理水闸、运河和磨坊。"这些笔记表明，没有人有时间去做所有事情，而作为我们知识的合金必须包含我们可以从别人那里学到的东西。

Leonardo also readily combined knowledge from different disciplines, his understanding of nature informing his art, or his theatrical experiences pushing him to understand more about optics. His interdisciplinary approach strengthened his knowledge by giving it a

varied practicality and usefulness. “Thus, Leonardo became a disciple of both experience and received wisdom. More important, he came to see that the progress of science came from a dialogue between the two.
莱昂纳多也很容易将不同学科的知识结合起来，他对自然的理解为他的艺术提供了信息，或者他的戏剧经验促使他了解更多的光学知识。他的跨学科方法加强了他的知识，使之具有不同的实用性和有用性。"因此，莱昂纳多成为了经验和公认智慧的弟子。更重要的是，他看到了科学的进步来自于两者之间的对话。

That in turn helped him realize that knowledge also came from a related dialogue: that between experiment and theory.” In building our knowledge, the environment we are in plays a huge part, as it is the source of our experiences. For this component, Leonardo was lucky, because he was born at a time and place that valued the mixing of ideas from different disciplines.
这反过来又帮助他认识到，知识也来自一个相关的对话：实验和理论之间的对话"。在建立我们的知识时，我们所处的环境起着巨大的作用，因为它是我们经验的来源。对于这一部分，莱昂纳多是幸运的，因为他出生在一个重视不同学科的思想混合的时代和地方。

In 15th century Florence there were others who brought multidisciplinary thinking to design and creativity. “This mixing of ideas from different disciplines became the norm as people of diverse talents intermingled. Silk makers worked with goldbeaters to create enchanted fashions. Architects and artists developed the science of perspective. Shops became studios.
在15世纪的佛罗伦萨，还有一些人将多学科的思维带到了设计和创意中。"这种来自不同学科的想法的混合成为了一种常态，因为具有不同才能的人相互融合在一起。丝绸制造商与淘金者合作，创造出令人着迷的时装。建筑师和艺术家发展了透视学。商店变成了工作室。

Merchants became financiers. Artisans became artists.” There is a role for discussion and communication in developing one’s knowledge. Sharing knowledge is a part of how you test it, seeing how much stronger your alloy really is after you’ve added some new information. Imagination can drive curiosity, as was the case for Leonardo, and is an important component of the knowledge alloy.
商人成为金融家。工匠成为艺术家"。在发展一个人的知识方面，讨论和交流是有作用的。分享知识是你如何测试它的一部分，看看在你添加了一些新的信息之后，你的合金到底有多强。想象力可以推动好奇心，就像莱昂纳多那样，是知识合金的一个重要组成部分。

Imagining what can be drives you to validate what actually exists and then to apply the investigative rigor to see if you can bridge the two. Leonardo was exemplary in this respect. “His uncanny ability to engage in the dialogue between experience and theory made him a prime example of how acute observations, fantastic curiosity, experimental

testing, a willingness to question dogma, and the ability to discern patterns across disciplines can lead to great leaps in human understanding.”
想象可以促使你去验证实际存在的东西，然后运用调查的严谨性，看看你是否可以将两者联系起来。莱昂纳多在这方面堪称典范。"他在经验和理论之间进行对话的不可思议的能力使他成为一个最好的例子，说明敏锐的观察力、奇妙的好奇心、实验测试、质疑教条的意愿以及辨别跨学科模式的能力如何能够导致人类理解的巨大飞跃。"

We start with what we get in terms of genetics and environment, but at a certain point we take over control of what we can become. Understanding that knowledge is an alloy of experience and theory that can be further strengthened with elements of curiosity, imagination and sharing gives us the ability to develop it as a true source of power in our lives.
我们从遗传和环境方面得到的东西开始，但在某一点上，我们接管了对我们能成为什么的控制。理解知识是经验和理论的合金，可以通过好奇心、想象力和分享等元素进一步加强，使我们有能力将其发展为我们生活中的真正力量源泉。

Disproportional Wear and Tear 不成比例的磨损

What works for one part of the system doesn’t necessarily work for all of it. In a mechanical system, when one part is subjected to significantly more wear and tear, it makes sense to coat it with a strong alloy that will minimize the damage in proportion to the wear and tear on the rest of the system. You don’t want to have to stop production for the frequent replacement of just one bit.
对系统的一个部分有效的东西不一定对所有的系统都有效。在一个机械系统中，当一个部分受到明显更多的磨损时，给它涂上坚固的合金是有意义的，这将使损坏程度与系统其他部分的磨损程度成正比。你不希望因为频繁更换一个位子而不得不停止生产。

Leonardo also played a role in the development of an alloy in the original, chemical sense. He “was also the first person to record the best mix of metals to produce an alloy that reduces friction. It should be ‘three parts of copper and seven of tin, melted together,’ which was similar to the alloy he was using to make mirrors. ‘Leonardo’s formula gives a perfectly working anti-friction composition,’ wrote Ladislao Reti, the historian of technology who played a role in discovering and publishing the Madrid Codices of Leonardo’s work in 1965.
莱昂纳多在开发原始的、化学意义上的合金方面也发挥了作用。他 "也是第一个记录产生减少摩擦的合金的最佳金属组合的人。它应该是'三份铜和七份锡，融化在一起，'这与他用来制造镜子的合金相似。莱昂纳多的公式给出了一个完美的抗摩擦成分，"技术史学家Ladislao Reti写道，他在1965年发现和出版莱昂纳多作品的马德里抄本中发挥了作用。

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Once again, Leonardo was about three centuries ahead of his time. The first
antifriction alloy is usually credited to the American inventor Isaac Babbitt,
who patented an alloy containing copper, tin, and antimony in 1839."
再一次，莱昂纳多领先于他的时代大约三个世纪。第一种抗磨合金通常归功于美国发明家艾萨克-巴比特，他
在1839年为一种含有铜、锡和锑的合金申请了专利。"
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Conclusion 结论

Alloying is about increasing strength through the combination of elements. One plus one can really equal ten. Consider a person possessing deep engineering skills with an ability to explain ideas clearly. Surely they are more valuable than someone with just the engineering skills. Now add empathy, humility, resilience, and drive. Now this person is incredibly valuable.
合金是指通过元素的组合来增加强度。一加一真的可以等于十。考虑到一个拥有深厚的工程技能并有能力清楚地解释想法的人。当然，他们比只拥有工程技能的人更有价值。现在再加上同理心、谦逊、坚韧和动力。现在，这个人就有了难以置信的价值。

Combining a deep specialized knowledge in a domain with a broader understanding of the rules that govern the physical world is a rare combination that saves you time, money, and problems. If you can find people to partner with who can complement and augment your skills to create even more capabilities, then so much the better.
将某一领域的深厚专业知识与对支配物理世界的规则的更广泛的理解结合起来，是一种罕见的组合，可以为你节省时间、金钱和问题。如果你能找到与你合作的人，他们可以补充和增强你的技能，创造更多的能力，那么就更好了。

Biology 生物

> A totally blind process can by definition lead to anything; it can even lead to vision itself.
> 根据定义，一个完全盲目的过程可以导致任何东西；它甚至可以导致视觉本身。
> ——–雅克•莫诺 Jaques Monod

Evolution Part One: Natural Selection and Extinction 自然选择和灭绝

> Organisms in nature have survived and thrived for billions of years because they have one powerful trait at their disposal—they are adaptive.
> 自然界中的生物体之所以能够生存和发展了数十亿年，是因为它们拥有一个强大的特性--它们

> 具有适应性。
> ——雷夫•萨加林 Rafe Sagarin

Evolution is a powerful mental model because it explains success and failure, the relationship between the environment and the individual, and why you had better plan for constant change. There are so many valuable applications of this concept, we have broken it down in two chapters. The first, Evolution Part One, looks at natural selection and extinction. We show how environmental pressures shape groups, spurring them to evolve or die out. The second chapter goes into more detail on ways to adapt to the inevitable changes we face. Evolution as a mental model can be summed up as “adapt or die.” We think, however, it is important to understand not only how we can adapt, but what it is we are responding to when we do. Looking at natural selection and extinction together pushes us to consider the parameters that we must evolve in. We either respond to the changing demands of our environment, or we die out. Natural selection further teaches us that optimization for our environment is an ongoing and dangerous process.
进化是一个强大的心理模型，因为它解释了成功和失败，环境和个人之间的关系，以及为什么你最好为不断的变化做好计划。这个概念有很多有价值的应用，我们把它分成了两章。第一章，进化论第一部分，关注自然选择和灭绝。我们展示了环境压力如何塑造群体，刺激它们进化或消亡。第二章更详细地介绍了适应我们面临的不可避免的变化的方法。进化作为一种心理模式可以被总结为 "适应或死亡"。然而，我们认为，重要的是不仅要了解我们如何适应，而且要了解我们在适应时要应对的是什么。把自然选择和灭绝放在一起看，促使我们考虑我们必须在哪些参数中进化。我们要么回应我们环境不断变化的需求，要么就会消亡。自然选择进一步告诉我们，对环境的优化是一个持续而危险的过程。

We are constantly trying to obtain advantages that will increase our chances of survival and avoid extinction as a species. The word selection can be confusing, because its common usage implies choice: I’m selecting this over that. In reality, the concept means that the more favorable a trait is for a particular environment, the higher the chance of that organism living long enough to procreate.
我们不断地试图获得优势，以增加我们的生存机会，避免作为一个物种灭绝。选择这个词可能令人困惑，因为它的普通用法意味着选择：我选择这个而不是那个。实际上，这个概念的意思是，一个特质对一个特定的环境越有利，这个生物体活得足够长以繁殖的机会就越大。

Biologist Geerat J. Vermeij describes it as “nonrandom elimination.” Charles Darwin spent decades studying the natural world, and he was one of the first to make the observation that nature played a significant role in shaping all organisms. As each generation contends with its environment, the struggle for the resources needed for survival means that any traits that promote survival will likely get passed on.
生物学家Geerat J. Vermeij将其描述为 "非随机淘汰"。查尔斯-达尔文花了几十年时间研究自然

界，他是最早提出自然界在塑造所有生物体方面发挥重要作用的观察者之一。当每一代人与环境抗争时，对生存所需资源的争夺意味着任何促进生存的特征都可能得到传承。

Thus, over time, the frequency of traits within a population changes as a response to environmental conditions. This is the definition of natural selection. Natural selection “is very much about advantages in the here and now, not in the distant future. Traits conferring long-term advantages emerge because they also work well in the lives of individuals and produce positive feedbacks.”
因此，随着时间的推移，人口中的性状频率会发生变化，作为对环境条件的反应。这就是自然选择的定义。自然选择 "在很大程度上是关于此时此刻的优势，而不是在遥远的未来。赋予长期优势的性状之所以出现，是因为它们在个人的生活中也很有效，并产生正反馈。"

For a mutation to be successful, it can’t negatively impact an organism’s ability to survive at that time. Natural selection does not preserve changes that may be useful in the future. It preserves changes that are useful now. For example, slow zebras are the ones who are eaten by the lions. The faster ones survive and reproduce. Over time, the entire zebra population becomes faster.
一个突变要想成功，它不能对生物体当时的生存能力产生负面影响。自然选择并不保留那些在未来可能有用的变化。它保存的是现在有用的变化。例如，缓慢的斑马是被狮子吃掉的。速度较快的斑马则生存下来并进行繁殖。随着时间的推移，整个斑马群体变得更快。

A key element of natural selection then is the beneficial traits that are selected for by the environment increases the survival potential of the species. We can also apply an inversion lens, demonstrating that any adaptive response that is not useful will be selected against. As Rafe Sagarin notes in Learning from the Octopus, goes on to note, “Natural selection is an incredibly simple process requiring just three simple elements—variation between individuals, environmental conditions that favor or select certain variants over others, and a means to reproduce those variants that are better suited to the environment.”
那么，自然选择的一个关键因素就是被环境选择的有益特征增加了物种的生存潜力。我们还可以应用一个反转镜头，证明任何没有用的适应性反应都会被选择出来反对。正如雷夫-萨加林在《向章鱼学习》中指出，"自然选择是一个令人难以置信的简单过程，只需要三个简单的元素--个体之间的变异，有利于或选择某些变体而不是其他变体的环境条件，以及繁殖那些更适合环境的变体的手段"。

There are many ways to be successful in any given environment. It is not only the most successful trait that will reproduce in successive populations, but the entire upper echelon of successful traits. We can imagine that it’s not only the faster zebras who will be more likely to reproduce, but also zebras that have a more powerful kick or better eyesight. One of the key elements to selecting for positive traits is that they have to be repeatable.

在任何给定的环境中，有许多方法可以获得成功。不仅是最成功的性状会在连续的种群中繁殖，而且是整个成功性状的上层梯队。我们可以想象，不仅是速度更快的斑马会更容易繁殖，而且还有那些踢得更有力或视力更好的斑马。选择积极性状的关键因素之一是，它们必须是可重复的。

Either the genetic mutation or the learning must be able to be passed on to the next generation. If adaptive behaviors can be used and developed in a successive series of situations to increase the fitness of the individual, and the species, those behaviors will be selected for.
无论是基因突变还是学习必须能够传给下一代。如果适应性行为能够在一系列连续的情况下被使用和发展，以提高个体和物种的生存能力，这些行为将被选择。

> New circumstances tend to be calamitous for an economic unit if they are either very large or very rare relative to the size and lifespan of that unit.
> 如果新情况相对于一个经济单位的规模和寿命来说非常大或非常罕见，那么这些新情况对该单位来说往往是灾难性的。
> ——盖拉特•维梅伊 Geerat Vermeij

Every biological behavior and feature exists for the same reason: to survive long enough to reproduce and therefore avoid extinction. All living things are out to ensure the survival of their species. Organisms must adapt in order to not go extinct. The vast majority of the species that have existed on earth since life first emerged are now extinct.
每一种生物行为和特征的存在都是为了同一个原因：为了生存足够长的时间来繁殖，从而避免灭绝。所有生物都是为了确保其物种的生存。生物体必须适应，以避免灭绝。自从生命首次出现以来，地球上存在的绝大多数物种现在都已经灭绝了。

In biology, extinction is defined as the moment when the last member of a species dies. For example, the last passenger pigeon, Martha, died in captivity in 1914. But the point where there is no possibility of a species surviving tends to occur earlier, when the population density of a species is below the threshold necessary to keep itself away from extinction, a set of circumstances known as Allee effects.
在生物学上，灭绝被定义为一个物种的最后一个成员死亡的时刻。例如，最后一只客鸽玛莎在1914年死于人工饲养。但一个物种不可能存活的时刻往往发生得更早，当一个物种的人口密度低于使其远离灭绝所需的阈值时，这一系列情况被称为阿利效应。

A species may also become extinct in the wild when the only survivors are in captivity and would be unlikely to repopulate their natural habitat if released. With too few individuals remaining, breeding may be impossible. This may occur because a species has died out by itself, or it may be the result of the activity of another species, as was the case with

passenger pigeons.
一个物种也可能在野外灭绝，当唯一的幸存者被圈养，如果被释放就不可能在其自然栖息地重新繁殖。由于剩下的个体太少，繁殖可能是不可能的。这可能是因为一个物种自己灭绝了，也可能是另一个物种活动的结果，如客鸽的情况。

Once numbered in the billions, this species was entirely wiped out by human hunting within a few decades. We can't ever identify the precise cause of an extinction. The influences are always complex and unique to the situation. Often, we can only infer causes from outcomes. In addition, extinctions are not always rapid. Sometimes they take place in increments over millennia.
这个物种的数量曾经达到数十亿，但在几十年内就被人类的捕杀完全消灭了。我们永远无法确定灭绝的确切原因。影响因素总是很复杂，而且是独特的情况。通常，我们只能从结果中推断出原因。此外，物种灭绝并不总是迅速的。有时，它们会在数千年内逐步发生。

We do, however, know the most common causes. One cause is competition. A species may die out because it must compete with a better adapted rival. Two species requiring the exact same resources cannot coexist in the same area. The successful introduction of alien species sometimes leads to the extinction of native ones. Unable to adapt fast enough, the native species is deprived of the resources it needs.
然而，我们确实知道最常见的原因。一个原因是竞争。一个物种的消亡可能是因为它必须与一个适应性更好的对手竞争。两个需要完全相同资源的物种不能在同一地区共存。外来物种的成功引入有时会导致本地物种的灭绝。由于无法快速适应，本地物种被剥夺了它所需要的资源。

Another cause, and one of the most common, is a change in environment. This could be due to climate change, deforestation, a volcanic eruption or anything significantly disruptive. To confuse matters, extinctions don't occur in isolation. Ecosystems are full of complex, nonlinear interdependencies. When one species dies out, it may take others with it.
另一个原因，也是最常见的原因之一，是环境的变化。这可能是由于气候变化、森林砍伐、火山爆发或任何明显的破坏性事件。让人困惑的是，灭绝并不是孤立地发生的。生态系统充满了复杂的、非线性的相互依赖关系。当一个物种灭绝时，它可能会带着其他物种一起灭亡。

Sometimes, the interrelationships are straightforward. If a prey species goes extinct, it's logical for its main predator to do likewise if it lacks alternatives. Or the interrelationship may be less direct. If a predator goes extinct, its prey may be able to breed in greater numbers. This can put a strain on its own prey and drive this prey to extinction. Thus, we cannot predict the outcome of an extinction.
有时，这种相互关系是直接的。如果一个猎物物种灭绝了，它的主要捕食者如果缺乏替代品，那么它也会这样做，这是合乎逻辑的。或者，这种相互关系可能不那么直接。如果一个捕食者

灭绝了，它的猎物可能会有更多数量的繁殖。这可能会给它自己的猎物带来压力，并将这种猎物推向灭绝。因此，我们无法预测灭绝的结果。

A further issue with classifying extinction is that it means we must be able to classify a distinct species. It can be hard to define what constitutes a species. If a dog interbreeds with a coyote, for example, is that a new species? We are far from identifying or even discovering all the species on this planet. Many have gone extinct without us ever knowing they existed in the first place.
对灭绝进行分类的另一个问题是，它意味着我们必须能够对一个独特的物种进行分类。定义什么是一个物种可能是很难的。例如，如果一只狗与一只土狼杂交，这是不是一个新的物种？我们还远远没有识别甚至发现这个星球上的所有物种。许多物种已经灭绝了，而我们却不知道它们当初的存在。

There are an estimated 10 million distinct species, of which fewer than 20% have been catalogued. In any system, it's natural for parts to continuously wear and need replacing. This is true of ecosystems. Extinctions are a ubiquitous feature of life on earth, as a sort of meta natural selection. The same selection process that applies to individuals is true for species as a whole.
估计有1000万个不同的物种，其中只有不到20%被编入目录。在任何系统中，部件不断磨损并需要更换是很自然的。生态系统也是如此。灭绝是地球上生命的一个无处不在的特征，是一种元自然选择。适用于个体的选择过程对于整个物种也是如此。

The catch is that the same evolutionary process that ensures a species' survival can also be its downfall. Natural selection within a stable environment tends to be a process of refinement. A species will become more and more tuned to the precise adaptations it needs to survive. This is ideal in reliable conditions, but it can mean a species lacks the resilience it needs to survive any changes.
问题是，确保一个物种生存的同样的进化过程也可能成为它的衰亡。在一个稳定的环境中，自然选择往往是一个完善的过程。一个物种将变得越来越适应它生存所需的精确适应性。这在可靠的条件下是理想的，但它可能意味着一个物种缺乏在任何变化中生存所需的复原力。

So while the best-adapted organisms may be the strongest during normal conditions, they may struggle to survive volatility. Generalist species are far more resilient than specialists. A rat or a cockroach can survive almost anywhere, a panda less so. One of the main ways species guard against extinction is by having a lot of offspring, fast. The population can quickly restock after events like a new disease.
因此，虽然适应性最好的生物体在正常条件下可能是最强的，但它们可能在波动中挣扎着生存。通才物种比专才的复原力要强得多。一只老鼠或一只蟑螂几乎可以在任何地方生存，而熊猫就不行了。物种防止灭绝的主要方式之一是快速拥有大量的后代。在发生新的疾病等事件

后，种群可以迅速重新补充。

Species that breed slowly are more vulnerable, although they can find ways around it, as humans have done. While extinction is an extreme event, it's often normal for large numbers of a species to die out. Deer and elk starve in large numbers on a regular basis. Once the population in an area gets too big, there isn't enough food available. The periodic mass starvations end up benefiting the species.
繁殖缓慢的物种更容易受到伤害，尽管它们可以找到绕过它的方法，就像人类所做的那样。虽然灭绝是一个极端事件，但一个物种的大量死亡往往是正常的。鹿和麋鹿经常性地大量饿死。一旦一个地区的人口变得太多，就没有足够的食物可用。周期性的大规模饥饿最终会使该物种受益。

As brutal as this is, it's necessary for the whole species to endure. Extinctions happen all the time. This is when species are continuously dying out but at a steady pace and from a range of causes. By contrast, a mass extinction is when a lot of species disappear in one go. This involves the disappearance of a lot of species at once. It tends to be the result of a single cause, such as a sudden change in climate conditions like those caused by a meteor. Thus, natural selection and extinction are two very important concepts from evolution.
尽管这很残酷，但对于整个物种来说，这是必要的。灭绝一直在发生。这是指物种不断地消亡，但速度稳定，而且有一系列的原因。相比之下，大规模灭绝是指大量的物种一次性消失。这涉及到很多物种一次性的消失。它往往是单一原因的结果，例如像流星造成的气候条件的突然变化。因此，自然选择和灭绝是进化论中两个非常重要的概念。

Together they explain why and how organisms respond to changing environments and what happens when the responses fail. These same principles can be used to look at the development and progression of nonliving things and to better understand why certain social or cultural artifacts change and thrive while others fall out of favor or disappear altogether.
它们共同解释了生物体为什么以及如何对不断变化的环境做出反应，以及当反应失败时发生了什么。这些同样的原则可以用来观察非生物的发展和进步，并更好地理解为什么某些社会或文化艺术品会发生变化并蓬勃发展，而另一些则失宠或完全消失。

> So how does a business survive in constantly changing environments?When change hits, a common response is denial or trying to adapt with a business model that no longer works. We can influence the outcome in changing environments more rapidly by first recognizing that we actually need to survive and then moving to survive with new ideas.
> 那么，企业如何在不断变化的环境中生存？当变化袭来时，一个常见的反应是否认或试图用一个不再有效的商业模式来适应。我们可以在变化的环境中更快地影响结果，首先认识到我们实

> 际上需要生存，然后用新的想法去生存。
> ——罗伯塔•邦达尔 Roberta Bondar

The evolution of language 语言的演变

Why do some customs, products and social norms thrive, and others disappear from the landscape? Natural selection is a lens we can apply to understand how environmental pressures promote certain changes, leading to growth and dominance. And why the same process penalizes those populations that are unable to meet those pressures.
为什么有些习俗、产品和社会规范会蓬勃发展，而另一些则从景观中消失？自然选择是我们可以应用的一个镜头，以了解环境压力如何促进某些变化，导致增长和主导地位。以及为什么同样的过程会惩罚那些无法满足这些压力的种群。

A fascinating example to illustrate the constant interaction between environment and species that leads to evolution is to look at how some languages grow and become global, and others go extinct. Over human history, there have been thousands of languages used by humans to communicate. Some of these never spread beyond narrow regional dialects used only by a small group of people.
说明环境和物种之间不断互动导致进化的一个迷人的例子是看一些语言如何成长并成为全球性语言，而另一些语言则灭绝。在人类历史上，有成千上万种人类用来交流的语言。其中有些语言从未传播到只有一小部分人使用的狭窄的地区方言之外。

Others spread far beyond their original environment to be used by people in all areas of the world. Languages are, in a sense, subject to the pressures of natural selection, which means they can also die out if they aren't well suited to their environment. French is one of the successful languages. It evolved from the Romance languages spoken in the region of present-day France.
另一些则远远超出了它们的原始环境，被世界上所有地区的人们所使用。从某种意义上说，语言受制于自然选择的压力，这意味着如果它们不能很好地适应环境，它们也会消亡。法语是成功的语言之一。它是从现今法国地区的罗曼斯语言演变而来。

The roots of the language that became modern French had remarkable adaptability. As it evolved, French picked up words from many of the different languages it came into contact with, so that even today it retains words that have origins in Norse, Gaulish, Frankish, Arabic, Spanish, and Italian. Environmental pressures on languages predominantly come in the form of geopolitical changes.
成为现代法语的语言的根部具有非凡的适应性。随着它的发展，法语从它所接触到的许多不同的语言中吸取了一些词汇，因此，即使在今天，它仍然保留着起源于北欧语、高卢语、法兰克语、阿拉伯语、西班牙语和意大利语的词汇。环境对语言的压力主要是以地缘政治变化的形式

出现。

Shifts in power result in shifts of language usage. Jean-Benoit Nadeau and Julie Barlow explain in The Story of French that “three main events pushed the language from one phase to the next: the fall of the Roman Empire, the conquest of England, and the rise and fall of Paris as a center of power.” Early French responded to these changes by mutating—picking up words from other languages—which helped it survive by keeping it useful.
权力的转移导致了语言使用的转移。Jean-Benoit Nadeau和Julie Barlow在《法语的故事》中解释说，"三个主要事件将语言从一个阶段推向另一个阶段：罗马帝国的衰落，英国的征服，以及巴黎作为权力中心的兴衰"。早期的法语通过变异来应对这些变化--从其他语言中撷取词汇--这使它保持了实用性而得以生存。

For centuries, the development of the French language was a series of successful adaptations. Use of the language spread all over Europe through conquest and invasion, and thus speaking the language was desirable. It became the only real common language of the region. French was used as the language of administration, and gradually “people who wanted power knew they needed French.”
几个世纪以来，法语的发展是一系列成功的改编。通过征服和入侵，这种语言的使用传遍了整个欧洲，因此说这种语言是可取的。它成为该地区唯一真正的通用语言。法语被用作行政管理的语言，渐渐地 "想要权力的人知道他们需要法语"。

The mutations it picked up spread throughout the population, reproducing as more and more people began teaching French to their children as their mother tongue. The spread of French meant that the language faced more complex environmental pressures. It began to settle into the modern version of the language in response to these pressures.
它的突变在整个人口中传播开来，随着越来越多的人开始把法语作为母语教给他们的孩子而复制。法语的传播意味着这种语言面临更复杂的环境压力。为了应对这些压力，它开始沉淀为现代版本的语言。

First, “by the 12th century writers from around Paris were making a conscious effort to eliminate dialectical characteristics in their writing so they could be understood by a larger number of people.” Second, as it became the pan-European language of business, its grammar, spelling and precise meanings had to be set so as to avoid disputes based on interpretation.
首先，"到了12世纪，巴黎周围的作家们正在有意识地努力消除他们写作中的辩证特征，以便让更多的人理解"。其次，随着它成为泛欧的商业语言，它的语法、拼写和精确的含义必须被设定，以避免基于解释的争议。

Finally, the growing popularity of printed materials pressured the language to commit to

rules and standards, as well as concise characters to save on cost. French was able to adapt accordingly. Gothic characters were replaced with Roman ones, and dissemination of printed French materials helped communicate and solidify a common understanding of the language. French speakers furthered the use of French by creating dictionaries and grammars that increased utility.
最后，印刷品的日益普及迫使该语言致力于规则和标准，以及简洁的字符以节省成本。法语能够进行相应的调整。哥特式字符被罗马式字符所取代，法语印刷品的传播有助于沟通和巩固对该语言的共同理解。讲法语的人通过创建字典和语法来提高法语的实用性，从而促进了法语的使用。

“Because it was defined, French in the seventeenth and eighteenth centuries was regarded as easier to learn.” These measures served to create accessibility. The easier it is to learn a language, the more appeal there is in making the attempt. When geopolitics shifted and colonialism became the goal of many European countries, French again was able to adapt and infiltrate new ecosystems. It continued to incorporate words from other languages confronted in new territories, thereby showing flexibility, which encouraged uptake.
"因为有了定义，十七和十八世纪的法语被认为更容易学习。这些措施的作用是创造可及性。学习一种语言越容易，尝试的吸引力就越大。当地缘政治发生变化，殖民主义成为许多欧洲国家的目标时，法语再次能够适应并渗透到新的生态系统中。它继续吸收在新领土上遇到的其他语言的词汇，从而显示出灵活性，这鼓励了人们的吸收。

As Nadeau and Barlow explain, many French explorers and missionaries understood that communication was a key to relationship building and so taught French and correspondingly learned native languages all over the globe. When colonialism ended, French was often the only common language in an area that had multiple local dialects. French, however, does not have a perfect record of adaptation. In many ways the language, although global, was heavily influenced by the culture of France.
正如纳多和巴洛所解释的那样，许多法国探险家和传教士明白沟通是建立关系的关键，因此在全球范围内教授法语并相应地学习当地语言。当殖民主义结束时，在一个有多种地方方言的地区，法语往往是唯一的通用语言。然而，法语并没有一个完美的适应记录。在许多方面，这种语言虽然是全球性的，但却受到法国文化的严重影响。

One of the impacts of this situation, for example, was that some cultural prejudices worked against the evolution of French in the colonial era. “An important segment of the [French] elite was simply not interested in questions of industry, science, technology, money or markets— issues that were vital to the development of a trading empire. The French Academy, of course, completely ignored scientific and 13 technical vocabulary, as well as new vocabulary from the colonies.” The bias of French culture limited the language.

例如，这种情况的影响之一是，一些文化偏见不利于法语在殖民时代的演变。"[法国]精英的一个重要部分对工业、科学、技术、货币或市场问题根本不感兴趣--这些问题对一个贸易帝国的发展至关重要。当然，法国学院完全忽视了科学和13个技术词汇，以及来自殖民地的新词汇"。法国文化的偏见限制了语言的发展。

You aren't going to use a language to try to communicate your ideas if it has no words for the elements you need to express. French eventually overcame the lack of words in scientific and technical fields and contributed many inventions and innovations to the world. But the point is that in order for languages to evolve, they must have the flexibility to adapt.
如果一种语言没有你需要表达的元素的词汇，你是不会使用这种语言来试图传达你的想法的。法国人最终克服了在科学和技术领域缺乏词汇的问题，为世界贡献了许多发明和创新。但问题是，为了使语言得以发展，它们必须有适应的灵活性。

Any measures that try to constrain flexibility risk the language becoming unusable and eventually extinct. To this day France responds to the pressures on French created by the global prominence of English (and Mandarin, and Spanish) by trying to make it easy for people to learn French. "French lexicographers do their spring cleaning regularly so that the language doesn't hold on to words it doesn't need." And more significantly, there are French schools all over the globe. Many are part of the private Alliance Française, and others are run by the French government, but the vast majority are open to anyone who wants to learn French.
任何试图限制灵活性的措施都有可能使语言变得无法使用并最终消亡。时至今日，法国为了应对英语（以及普通话和西班牙语）在全球的突出地位给法语带来的压力，努力使人们更容易学习法语。"法国的词典编纂者定期进行春季大扫除，这样语言就不会停留在它不需要的词汇上。而更重要的是，全球各地都有法语学校。许多是私营的法语联盟的一部分，还有一些是由法国政府管理的，但绝大多数是对任何想学习法语的人开放的。

Other concentrations of French speakers, such as those in North America and Africa, actively promote the use of French through language laws and cultural associations. Mandating usage is one way of keeping a language useful. Evolution can be threatening if you can glimpse some of it happening. The changes you observe can suggest that your own fitness may be lacking, and that the products of the evolution of your species will be unrecognizable. The evolution of language faces a similar challenge—will it still be French if the language evolves in such away asto be in comprehensibe to contemporary speakers ?
其他讲法语的人集中的地方，如北美和非洲，通过语言法和文化协会积极促进法语的使用。强制使用是保持一种语言有用的一种方式。如果你能瞥见一些演变的发生，那就会有威胁性。你所观察到的变化可以表明，你自己的体质可能是缺乏的，而你的物种进化的产物将是不可识别的。语言的进化也面临着类似的挑战--如果语言进化到让当代人无法理解的程度，它还会是法

语吗？

Letters evolve, and so do languages. Part of the tension in French is about trying to resolve the conflicting pressures placed on the language by changes in the environment. Nadeau and Barlow write that entire tenses have been dropped from usage, and slang is being adopted at a rate that makes it hard for dictionaries to keep up. Some people react by fighting to keep the language “pure” and consistent with centuriesold usage.
字母在进化，语言也在进化。法语的部分紧张是关于试图解决环境变化给语言带来的矛盾压力。Nadeau和Barlow写道，整个时态已经从使用中消失，而俚语被采用的速度使字典难以跟上。一些人的反应是为保持语言的 "纯正 "和与几个世纪前的用法一致而斗争。

They advocate a top-down approach to language development. Others accept changes and innovations and view them as a source of creativity and way of staying relevant. The lens of evolution and natural selection suggests that trying to freeze a language, or trying to maintain tight control on its evolution, is the exact wrong reaction in terms of preventing extinction. If a language cannot adapt it will cease to be useful.
他们主张用自上而下的方法来发展语言。其他人则接受变化和创新，并将其视为创造力的来源和保持相关性的方式。进化和自然选择的视角表明，试图冻结一种语言，或试图保持对其进化的严格控制，就防止灭绝而言，是完全错误的反应。如果一种语言不能适应，它将不再有用。

If it ceases to be useful, it will go extinct. The story of the evolution of French can be contrasted with that of Latin. Latin is perhaps the best-known dead language. The debate over what makes a dead language and whether any particular language falls in that category is endless. By the strictest definition, a language is only dead when no living people speak it.
如果它不再有用，它就会灭绝。法语的演变过程可以与拉丁语的演变过程进行对比。拉丁语也许是最著名的死亡语言。关于什么是死亡语言以及任何特定语言是否属于这一类别的争论是无休止的。根据最严格的定义，一种语言只有在没有活人说它的时候才是死语言。

The more typical definition is when a language is no longer native to any community who would speak it as their mother tongue. Latin originated in Rome then spread across Europe and Africa as the Romans took over the surrounding areas. The oldest surviving example of written Latin dates back to the 7th century BCE. According to legend, Rome was founded about half a century earlier.
更典型的定义是，当一种语言不再是任何社区的母语时，他们就会把这种语言作为他们的母语。拉丁语起源于罗马，然后随着罗马人对周围地区的占领而传播到欧洲和非洲。现存最古老的拉丁文书写实例可以追溯到公元前7世纪。根据传说，罗马是在大约半个世纪前建立的。

In an era when most people spent their entire lives close to where they were born and had

little reason to interact much with anyone outside of their own community, Italy was home to numerous small languages, of which Latin was just one. It was pure luck that Latin ended up taking on such significance. By most estimates, Latin ceased to be anyone's mother tongue and diverged entirely into separate languages by the 7th century CE.
在那个时代，大多数人的一生都在他们出生地附近度过，没有什么理由与他们社区以外的人进行交流，意大利是众多小语种的故乡，而拉丁语只是其中之一。拉丁语最终具有如此重要的意义，完全是运气使然。据大多数人估计，到了公元7世纪，拉丁语不再是任何人的母语，而是完全分化为不同的语言。

While geopolitical changes after the fall of the Roman Empire strengthened French, they gradually killed Latin. This doesn't mean no one knows it or that it is not in use in any manner. Latin remains the official language of Vatican City and has a significant role in Catholicism, often used in writing by officials. It's used in some traditional, ceremonial situations, like the graduation ceremonies at Oxford University in England. In addition, a significant portion of the technical terminology used in medicine, epistemology, taxonomy, law, and other fields is Latin.
虽然罗马帝国灭亡后的地缘政治变化加强了法语，但它们逐渐扼杀了拉丁语。这并不意味着没有人知道它或它没有以任何方式被使用。拉丁语仍然是梵蒂冈城的官方语言，在天主教中具有重要作用，经常被官员用于写作。它被用于一些传统的、仪式性的场合，如英国牛津大学的毕业典礼。此外，在医学、认识论、分类学、法律和其他领域使用的技术术语中，有很大一部分是拉丁语。

This is partly tradition and partly to give these fields a universal language to facilitate ease of communication across borders. Some schools still offer Latin classes, and many people still choose to study it. For scholars who study old texts, a knowledge of Latin is useful so they don't need to rely on translations, which may be subjective.
这一方面是传统，另一方面是为了给这些领域提供一种通用语言，以方便跨国交流。一些学校仍然提供拉丁语课程，许多人仍然选择学习它。对于研究古籍的学者来说，拉丁文知识很有用，这样他们就不需要依赖翻译，而翻译可能是主观的。

For these reasons, Latin is unlikely to disappear altogether. But the fact that it is not spoken as a native language puts it into the dead category. Just as a species that goes extinct can have descendant species that survive, incorporating some of its traits, dead languages can be the ancestors of living ones. Latin formed the basis many of the existing languages in nations that once fell under 17 the Roman Empire, including Italian, French, Portuguese, Romanian, and Spanish.
由于这些原因，拉丁语不太可能完全消失。但是，它不作为母语使用的事实使它进入了死亡之列。就像一个灭绝的物种可以有后裔物种存活下来，吸收它的一些特征一样，死亡的语言也可以成为活着的语言的祖先。拉丁语构成了曾经属于罗马帝国的许多国家的现有语言的基础，包

括意大利语、法语、葡萄牙语、罗马尼亚语和西班牙语。

The main reason Latin fell out of use is its complexity. Learning Latin is far more arduous than learning any of the languages it spawned as there are numerous ways to modify each word depending on the context. The selection pressures on languages tend to push them toward whatever form is easiest to learn. A language is well adapted to its environment if people can learn it and if they have a strong enough reason to learn it.
拉丁语不再被使用的主要原因是其复杂性。学习拉丁语比学习它所产生的任何一种语言都要艰辛得多，因为根据上下文的不同，每个词都有许多修改的方法。语言的选择压力倾向于把它们推向任何最容易学习的形式。如果人们能够学会一种语言，并且有足够的理由去学习它，那么这种语言就能很好地适应其环境。

Much like, in everyday use, we often contract words or drop syllables to make our speech easier, Latin evolved into a simpler form known as Vulgar Latin. Seeing as no central authority existed to codify and define the proper use of Latin, its simpler form diverged in different parts of what was once the Roman Empire, becoming a range of different languages.
就像在日常使用中，我们经常缩减单词或删除音节以使我们的语言更容易表达一样，拉丁语也演变成了一种更简单的形式，即粗俗拉丁语。由于没有中央权威机构对拉丁语的正确使用进行编纂和定义，其较简单的形式在曾经的罗马帝国的不同地区出现了分歧，成为一系列不同的语言。

As humans, we have a tendency to minimize energy output, which gives us a preference for languages that are easy to use and understand. That doesn't mean the simplest languages become the most popular. But it does mean that in the absence of formal, enforced standards, languages drift toward greater ease of use. This is part of what happened to Latin; it wasn't best suited to its environment. In addition, there were no laws requiring the use of Latin in particular areas. French, by comparison, was more formalized, with defined standards for its usage.
作为人类，我们有一种将能量输出降到最低的倾向，这使我们对易于使用和理解的语言有一种偏好。这并不意味着最简单的语言成为最流行的语言。但它确实意味着，在没有正式的、强制的标准的情况下，语言会朝着更容易使用的方向发展。这就是拉丁语的部分情况；它并不适合其环境。此外，也没有法律要求在特定地区使用拉丁语。相比之下，法语更加正规化，有明确的使用标准。

Being easier to learn likewise gave it an advantage in surviving long term. Beyond the languages that have direct links to its structures and grammar, other languages use Latin words or ones derived from them. It's estimated that more than 60% of English words are derived from Latin or Greek. For instance, "antique" and "ancient" come from antiqua,

meaning “old.”
同样，由于更容易学习，它在长期生存方面也有优势。除了与它的结构和语法有直接联系的语言外，其他语言也使用拉丁语词或从它们衍生出来的词。据估计，超过60%的英语单词来自于拉丁语或希腊语。例如，"antique "和 "cient "来自antiqua，意思是 "古老"。

Likewise, French uses numerous words of Latin origin, like agir (to act) which comes from agere, and bouteille (bottle) which comes from butticula. Thus, although Latin is a dead language, it has had a lasting and widespread influence on many languages that are still in use and spoken by millions of people. The contrast between French and Latin shows us how languages are subject to the pressures of natural selection. Languages also need to evolve to survive in a changing environment, or they decline in use and eventually go extinct.
同样，法语也使用了许多源自拉丁语的词汇，比如agir（行动）来自agere，bouteille（瓶子）来自butticula。因此，尽管拉丁语是一种死亡的语言，但它对许多语言产生了持久而广泛的影响，这些语言现在仍在使用，并被数百万人所使用。法语和拉丁语之间的对比向我们展示了语言是如何受到自然选择的压力的。语言也需要进化以在不断变化的环境中生存，否则它们的使用就会下降，最终灭绝。

Conclusion 结论

Natural selection and extinction are not just about plants and animals. It is important to understanding how the world changes over time, and how these changes force an adaptive response. If we resist adapting, we ultimately contribute to our own end. There is a constant interplay between environmental changes and a species’ response to them.
自然选择和灭绝不仅仅是关于植物和动物。它对于理解世界如何随着时间的推移而变化，以及这些变化如何迫使人们做出适应性反应是很重要的。如果我们抵制适应，我们最终会导致我们自己的结局。环境变化和一个物种对它们的反应之间存在着持续的相互作用。

The value of how a species responds is evaluated simply by survival. If we want to understand why some traits stick around, why some customs carry through many generations, and why some ideas take root and spread through a population, we have to look at their usefulness in their environment.
一个物种如何反应的价值仅仅是通过生存来评价的。如果我们想了解为什么有些特征会坚持下去，为什么有些习俗会延续很多代，为什么有些想法会在人群中扎根和传播，我们就必须看看它们在环境中的作用。

Evolution Part Two: Adaptation Rate and the Red Queen Effect 进化第二部分：适应率和红皇后效应

> Adaptation is as good as it has to be; it need not be the best that could be designed. Adaptation depends on context.
> 适应有多好就有多好；它不需要是可以设计的最好的。适应性取决于背景。"
> ——纪瑞特•韦尔梅 Geerat Vermeij

We have to deal with the environment we are in, not the one we wish we were in. Adaptations are successful relative to their performance in a specific environment, relative to the pressure and competition the organisms face. We don't have to be objectively best, just better than those we are competing against. "In other words, living things do only as well as they have to rather than optimize."
我们必须处理我们所处的环境，而不是我们希望所处的环境。适应的成功是相对于它们在特定环境中的表现而言的，是相对于生物体面临的压力和竞争而言的。我们不必在客观上做到最好，只需比我们的竞争者更好。"换句话说，生物体只做它们必须做的事，而不是优化。"

Adaptation refers to both the trait that is useful and the process of change it undergoes as it is passed on. It is both a noun and a verb. Adaptations start as genetic variations that occur in the right time and place to be useful—"Adaptability controls the sweet spot between reaction and prediction, providing an inherent ability to respond efficiently to a wide range of potential challenges, not just to those that are known or anticipated."
适应既指有用的特质，也指它在传递过程中经历的变化过程。它既是一个名词，也是一个动词。适应开始时是在正确的时间和地点发生的遗传变异，以便发挥作用。"适应性控制着反应和预测之间的甜蜜点，提供一种固有的能力来有效地应对广泛的潜在挑战，而不仅仅是应对那些已知或预期的挑战。"

The story of the peppered moth in Britain is a textbook example of adaptive change to specific environmental pressures. Normally very light, there were nonetheless variations produced that resulted in dark coloring. However, against the normal backdrop of their environment, they stood out and were quickly eaten. At least at first. However, during the Industrial Revolution, what was once a negative trait became a positive one.
英国胡椒蛾的故事是对特定环境压力的适应性变化的一个教科书般的例子。通常情况下非常轻，尽管如此，还是产生了一些变异，导致了深色的颜色。然而，在其环境的正常背景下，它们脱颖而出，很快就被吃掉了。至少一开始是这样。然而，在工业革命期间，曾经的负面特征变成了正面特征。

When blankets of sooty pollution were covering everything for miles, the lighter moths now stood out and became an easy target for their predators. The dark variants became far more successful at camouflaging in the dark soot and were therefore better able to survive and produce significantly more offspring. When gene mutation confers an

advantage, the frequency of that mutation in the population increases.
当烟尘污染的毯子覆盖了方圆几英里的一切时，浅色的飞蛾现在很突出，成为它们捕食者的一个容易的目标。深色变种在黑烟中的伪装变得更加成功，因此能够更好地生存并产生更多的后代。当基因突变带来优势时，该突变在群体中的频率就会增加。

Mutations are constantly being tested in the environment. It's interesting that now, with more efforts at pollution control due to the deleterious effects of smog, the lighter moth is making a comeback. Populations of organisms adapt in response to changes in both the organic and nonorganic environment. Less sunlight or warmer temperatures influence the process of adaptation, as do changes in the other organisms that occupy the same environment.
突变在环境中不断得到检验。有趣的是，现在，由于雾霾的有害影响，在控制污染方面做出了更多的努力，浅色飞蛾正在卷土重来。生物种群适应有机和非有机环境的变化。阳光减少或温度升高会影响适应过程，占据同一环境的其他生物的变化也是如此。

Predators adapt to changes in prey, and they also adapt to changes in their competitors. When it comes to adapting to environmental change, "remember that nature is limited to the raw materials at hand, and there's only so much you can do with them." One consequence is that there might be the same solution for different problems in different species. Adaptations can arise in multiple places, basically simultaneously.
捕食者适应猎物的变化，他们也适应其竞争对手的变化。当谈到适应环境变化时，"请记住，自然界仅限于手头的原材料，而你能做的只有这么多"。一个后果是，在不同的物种中可能有相同的解决方案来解决不同的问题。适应性可以在多个地方出现，基本上是同时出现。

Consider that "humans had earned a living by hunting and gathering wild foods for 10,000 generations, but in just a few, brief millennia, food production sprung up across the globe. It happened separately in at least a dozen places." Which brings up the full context of the word adaptation. There are genetic mutations that allow for direct adaptation, then there are the mutations that allow for learning and thus adaptation on a much shorter timescale.
想想看，"人类靠狩猎和采集野生食物谋生已经有一万代了，但在短短的几千年里，粮食生产就在全球范围内兴起。它至少在十几个地方分别发生"。这带来了适应这个词的全部背景。有允许直接适应的基因突变，然后有允许学习的突变，从而在更短的时间范围内适应。

> Adaptation requires leaving or being forced from your comfort zone and into a place where you observe and experience new threats to your security.
> 适应需要离开或被迫离开你的舒适区，进入一个你观察和体验对你安全的新威胁的地方。
> ——雷夫•萨加林 Rafe Sagarin

Identifying opportunities to adapt 找出适应的机会

When we think about World War II, most of us know that France was occupied by the Germans early on. The Nazis rolled into Paris in the spring of 1940, and not until D-Day four years later did the Allies get a toe back in the country. The French toiled under the Vichy government for the rest of the war, and some supported the allied effort through a small but potent resistance.
当我们想到第二次世界大战时，我们大多数人都知道，法国很早就被德国人占领了。纳粹在1940年春天进入巴黎，直到四年后的D日，盟军才重新进入这个国家。在战争余下的时间里，法国人在维希政府的领导下苦苦挣扎，一些人通过小规模但强大的抵抗力量支持盟军的努力。

Have you ever asked why France fell so fast? It's interesting to think about. After all, when the Treaty of Versailles concluded World War I, it was the Germans, not the French, who were greatly reduced militarily. Despite this, the French continued to be anxious about future German aggression. They maintained their military. They built the Maginot Line as a defensive structure in eastern France.
你有没有问过为什么法国沦陷得这么快？思考一下是很有意思的。毕竟，当《凡尔赛条约》结束第一次世界大战时，在军事上被大大削弱的是德国人而不是法国人。尽管如此，法国人仍然对未来德国的侵略感到焦虑。他们维持着自己的军队。他们在法国东部建立了马奇诺防线作为防御结构。

They strategized on how to protect their country. They bought tanks and kept up drills and vowed they would not suffer a repeat of World War I. Germany was in an entirely different situation. After the First World War, "Germany was left, as even the Allies admitted, with something closer to a police force than an army. When the promise of reductions in all armies failed to materialize in later years, it added to British unease about the German treaty and to German resentment.
他们就如何保护自己的国家制定了战略。他们购买了坦克，继续进行演习，并发誓他们不会重蹈第一次世界大战的覆辙。第一次世界大战后，"德国被留下了，甚至盟国也承认，留下的是更接近于警察部队的东西而不是军队。当削减所有军队的承诺在后来几年未能实现时，它增加了英国对德国条约的不安和德国的怨恨。

With an army of 100,000 men and a navy of 15,000, and with no air force, tanks, armored cars, heavy guns, dirigibles or submarines, Germany was to be put in a position where it could not wage an aggressive war." Germany's munitions were destroyed, and the country was not allowed to import anything that could be used as "war material."
德国拥有10万人的陆军和1.5万人的海军，而且没有空军、坦克、装甲车、重炮、飞艇或潜艇，它将被置于无法发动侵略战争的境地。" 德国的军火被销毁，该国不被允许进口任何可用作 "战争材料 "的东西。

They couldn't have cadets' and veterans' societies and "couldn't do anything of a military nature." Further, they were ordered to pay huge sums of money to the Allies, reducing their ability to rearm. Of course, later events showed that the Germans ignored many of the terms, and the Treaty of Versailles has been widely criticized for creating the conditions that led to World War II. However, the point here is that given the circumstances leading up to 1939, it is by no means obvious why the Germans were so successful in invading France.
他们不能有士官生和退伍军人协会，"不能做任何军事性质的事情"。此外，他们被命令向盟国支付巨额资金，降低了他们重新武装的能力。当然，后来的事件表明，德国人忽视了许多条款，《凡尔赛条约》因创造了导致第二次世界大战的条件而受到广泛批评。然而，这里的重点是，考虑到1939年之前的情况，德国人为何如此成功地入侵法国，这一点并不明显。

At the outbreak of the war, France had 110 divisions, "of which no less than were active divisions." The Germans, on the other hand, "had 98 divisions, 36 of which were untrained and unorganized." Explaining the technical capacity of each military in 1939, B. H. Liddell Hart says, "On the surface, it would appear that the French had ample superiority to crush the German forces in the west." So why didn't they even come close?
战争爆发时，法国有110个师，"其中不少是现役师"。另一方面，德国人 "有98个师，其中36个师没有经过训练，没有组织"。在解释1939年每支军队的技术能力时，B-H-利德尔-哈特说："从表面上看，法国人似乎有足够的优势来粉碎德国在西部的部队"。那么，为什么他们甚至没有接近呢？

Warfare in 1939 had many new components. It was a changed environment to which the French had not adapted. They hadn't undergone the selective pressures needed to be prepared for the German army. The Treaty of Versailles had, in a sense, been about maintaining the adaptive status quo. The hints World War I gave that warfare had fundamentally changed and thus required new thinking were largely ignored by the leaders of Europe. In France there was both "an incomprehension of the new idea of warfare, and official resistance to it."
1939年的战争有许多新的组成部分。这是一个改变了的环境，法国人还没有适应。他们没有经历过为应对德国军队而需要的选择性压力。从某种意义上说，《凡尔赛条约》是为了维持适应性的现状。第一次世界大战提示人们，战争已经发生了根本性的变化，因此需要新的思维，但欧洲的领导人在很大程度上忽视了这一点。在法国，既存在着 "对新的战争理念的不理解，也存在着对它的官方抵制"。

The French were twenty years out of date in their thinking. They had modern equipment, but "lacked modern organization." And they had not invested in air power to support their ground troops. On the human timescale, adaptability is about recognizing when the way you have done things in the past is becoming less and less successful in a changing

environment. It requires you to innovate, like mutations in the evolution timescale, to see if you can come up with ideas that will improve your chances of success. In the 1930s the French prepared themselves for a war they had already fought.
法国人的思维已经过时了20年。他们有现代化的设备，但 "缺乏现代化的组织"。他们也没有投资于空中力量来支持他们的地面部队。在人类的时间尺度上，适应性是指认识到你过去做事的方式在变化的环境中变得越来越不成功。它要求你进行创新，就像进化时标中的突变一样，看看你是否能想出一些能提高你成功机会的想法。在20世纪30年代，法国人为他们已经打过的战争做准备。

Hart writes that “the French High Command still regarded tanks through 1918 eyes—as servants of the infantry, or else as reconnaissance troops to supplement cavalry. Under the spell of this old-fashioned way of thought they had delayed organizing their tanks in armored divisions—unlike the Germans.” To be fair, the Germans had not fully worked out how to succeed in this new environment either.
哈特写道："法国最高统帅部仍然以1918年的眼光看待坦克--作为步兵的仆人，或者作为补充骑兵的侦察部队。在这种老式思维方式的影响下，他们推迟了将坦克编入装甲师的时间，与德国人不同"。公平地说，德国人也没有完全想好如何在这个新环境中取得成功。

It wasn’t like they had perfected which adaptations were going to work the best. They were “still far from being a really efficient and modernly designed force. At the same time the German High Command had, rather hesitatingly, recognized the new theory of high speed warfare and was willing to give it a try. ” And it was this willingness to adapt, even in only a few individuals at first, that was one of the reasons they were so successful in the early part of the campaign.
他们并没有完善哪种适应性是最有效的。他们 "仍然远远没有成为一支真正高效和现代化设计的部队。与此同时，德国最高统帅部相当犹豫地认识到了高速战争的新理论，并愿意试一试它。" 而正是这种适应的意愿，甚至一开始只有少数人的适应，是他们在战役早期如此成功的原因之一。

Like genetic mutations, improved fitness doesn’t require everyone to adapt at the same time. At the outset of the war many in the German High Command were remarkably similar to the French in how they thought the invasion would play out in terms of tactics and timing. There were just a few more Germans in positions of sufficient power who were willing to try new tactics.
就像基因突变一样，改善体质并不要求每个人都在同一时间适应。在战争开始时，德国最高统帅部的许多人在他们认为入侵的战术和时机方面与法国人惊人地相似。只是还有一些身居要职的德国人愿意尝试新的战术。

One of the more notable of these is General Guderian. Hart writes that “the Battle of

France is one of history's most striking examples of the decisive effect of a new idea, carried out by a dynamic executant." Hart's explanation of Guderian's actions is a chronicle of adaptation in action. "Guderian has related how, before the war, his imagination was fired by the idea of deep strategic penetration by independent armored forces—a long-range tank drive to cut the main arteries of the opposing army far back behind its front.
其中比较引人注目的是古德里安将军。哈特写道："法国之战是历史上最引人注目的例子之一，说明一个新的想法，由一个充满活力的执行者实施，产生了决定性的影响"。哈特对古德里安行动的解释是一部关于适应行动的编年史。

A tank enthusiast, he grasped the potentialities of this idea, arising from that new current of military thought in Britain after the First World War. When war came Guderian seized the chance to carry it out despite the doubts of his superiors." Guderian's adaptations took him right through the French defenses, giving him an unobstructed path to the Channel. It was his series of actions that the Germans built on to complete the occupation of France a year later.
作为一个坦克爱好者，他抓住了这个想法的潜力，这个想法产生于第一次世界大战后英国的新军事思想潮流。当战争来临的时候，古德里安抓住机会将其付诸实施，尽管他的上级对此有所怀疑"。古德里安的调整使他直接穿过了法国的防线，给了他一条通往英吉利海峡的畅通无阻的道路。正是他的这一系列行动使德军在一年后完成了对法国的占领。

Guderian led an adaptive German response to the changes in the warfare environment. Like the color of the peppered moth, the changes were successful only in very specific environment. The German responses to other environmental conditions were significantly less beneficial and contributed to their eventually losing the war and returning France to the French.
古德里安领导了德国对战争环境变化的适应性反应。就像飞蛾的颜色一样，这些变化只在非常特殊的环境下才会成功。德军对其他环境条件的反应明显不那么有利，导致他们最终输掉了战争，把法国还给了法国人。

Long live the Red Queen 红皇后万岁

> If feedback is positive, or reinforcing, cause and effect together unleash a runaway process with all the characteristics of an arms race. If negative, or stabilizing and self-limiting, feedback acts as a brake, muting change and damping fluctuations.
> 如果反馈是积极的，或者说是强化的，因果关系共同释放出一个具有军备竞赛所有特征的失控过程。如果是负反馈，或者说是稳定和自我限制的反馈，那么反馈就像一个制动器，使变化变弱并抑制波动。
> ———盖拉特•维梅伊 Geerat Vermeij

The Red Queen Effect is a compelling principle of evolutionary biology and vivid image to help understand the pressures that all organisms face just in surviving. The least fit of a species dies first. You can't stop adapting, because no one around you is stopping. If you do, your competitive position declines, bringing your survival into question.
红皇后效应是进化生物学的一个引人注目的原则，也是帮助理解所有生物在生存中所面临的压力的生动形象。一个物种中最不适合的人首先死亡。你不能停止适应，因为你周围的人都没有停止。如果你这样做，你的竞争地位就会下降，使你的生存受到质疑。

Every living thing is constantly on the lookout for opportunity, the place to accrue advantage, and thus adaptation is also driven as a response to changes in those with whom we share our environment. Staying the same as we are often means falling behind. The Red Queen Effect was first used in the context of evolutionary biology by Leigh Van Valen in 1973.
每个生物都在不断寻找机会，寻找可以积累优势的地方，因此，适应也是作为对与我们共享环境的人的变化的一种反应。保持我们的原样往往意味着落后。红皇后效应最早是由Leigh Van Valen于1973年在进化生物学的背景下使用的。

In his research, he noticed something interesting: that at no point was a species protected from extinction. Evolution is an ongoing process, and all species must continually respond to pressures in their environment or die off. What's more, constant adaptation is something that everyone is doing, all the time. Hence the use of the Lewis Carroll character from Alice's Adventures in Wonderland.
在他的研究中，他注意到了一些有趣的事情：在任何时候，一个物种都不会受到保护而灭绝。进化是一个持续的过程，所有的物种都必须不断地对其环境中的压力做出反应，否则就会死亡。更重要的是，不断适应是每个人都在做的事情，一直都在做。因此，我们使用了《爱丽丝梦游仙境》中的刘易斯-卡罗尔这个人物。

The Red Queen tells Alice, "Now, here, you see, it takes all the running you can do, to keep in the same place." At the biological level, organisms don't choose to adapt. A leopard doesn't sit up one day and say, "Wow, the antelope are getting faster. I need to do something about that." Rather, the increased speed of the prey means that only the fastest predators will get food and live long enough to reproduce.
红皇后告诉爱丽丝："现在，在这里，你看，你需要所有的奔跑，以保持在同一个地方。" 在生物层面上，生物体并不选择适应。一只豹子不会有一天坐起来说："哇，羚羊越来越快了。我需要对此做些什么。" 相反，猎物速度的提高意味着只有最快的捕食者才能获得食物，并活得足够长以进行繁殖。

Thus, over time, the average speed of the predator species increases. The pressures on 16 both the predator and prey are constant, which is what produces the Red Queen Effect.

However, this principle applies to the much smaller timescale of our lives as well. And, importantly, we can choose to do something about it. There are so many humans on the planet that even if only 20% were trying to move ahead, it's enough that they wouldn't leave much behind for the rest of us.
因此，随着时间的推移，捕食者物种的平均速度增加。16捕食者和猎物的压力是恒定的，这就是产生红皇后效应的原因。然而，这一原则也适用于我们生活中小得多的时间尺度。而且，重要的是，我们可以选择对此做些什么。地球上有这么多人类，即使只有20%的人在努力前进，也足以让他们不会给我们其他人留下什么。

There are enough people trying to get smarter, better, and more of the limited resources that are available, that it puts direct pressure on everyone to keep up.The Red Queen Effect is often applied to business strategy and human conflict. These two areas bookend the spectrum of the use of this model. Applied to business, it is an argument against complacency.
有足够多的人试图在有限的资源中获得更聪明、更好和更多的资源，这给每个人带来了直接的压力，使他们不得不跟上。"红皇后效应 "经常被应用于商业战略和人类冲突。这两个领域是这个模型的使用范围的典范。应用于商业，它是一个反对自满的论点。

As noted above, the originator of the hypothesis, Leigh Van Valen, observed that longevity does not protect species from extinction. No matter how long a species has survived, a failure to adapt can result in extinction. There is no plateau a 17 species can reach when it gets to say, "Okay, the hard work is done. I can coast now, getting by on what I have."
如上所述，该假设的提出者Leigh Van Valen观察到，长寿并不能保护物种免遭灭绝。无论一个物种生存了多长时间，如果不能适应就会导致灭绝。当一个17岁的物种可以说："好吧，艰苦的工作已经完成。我现在可以靠我所拥有的东西来维持生计了。"

Because all species are continually adapting, the pressure is constant. The same dynamic exists in business. Your competitors are always working to get ahead, and thus you must as well. Your customers' needs are always changing, and you need to be able to identify and meet these. Considering the actions of your competitors and the desires of your customers are part of the core, daily functions that your business must always perform.
因为所有的物种都在不断地适应，压力是持续的。同样的动态存在于商业中。你的竞争对手一直在努力争取领先，因此你也必须如此。你的客户的需求总是在变化，你需要能够识别并满足这些需求。考虑你的竞争对手的行动和你的客户的愿望，是你的企业必须始终履行的核心、日常职能的一部分。

Some organisms exist within an aggressive Red Queen Effect, which is the situation for many bacteria, while for others, like cockroaches, the pace is less intense. It is possible that high capacity in both flexibility and learning can slow one's particular experience of the

effect. Overall, when applied in business, this principle can promote an environment where there is an infinite capacity for innovation.
一些生物体存在于咄咄逼人的红皇后效应中，这是许多细菌的情况，而对于其他生物体，如蟑螂，节奏不那么激烈。有可能在灵活性和学习方面的高能力可以减缓一个人对该效应的特殊体验。总的来说，当应用于商业时，这一原则可以促进一个有无限创新能力的环境。

At the other end of the spectrum we may apply the Red Queen Effect to human conflict. As in an arms race, where one side invests resources to outdo the other, eventually the cost of the resources is immense, but no advantage is gained.
在光谱的另一端，我们可以将红皇后效应应用于人类冲突。就像在军备竞赛中，一方投入资源来超越另一方，最终资源的成本是巨大的，但没有获得任何优势。

An arms race points to the limits of using the Red Queen Effect as a model. In some scenarios, namely those where there is an end to beneficial adaptation, it is better to look at changing parts of the environment in which you are trying to survive instead of trying to keep up in a race that is undermining your overall ability to adapt. Actions that put the existence of an individual or a species in danger are not the goal of adaptation and not supported by the Red Queen Effect.
军备竞赛指出了使用红皇后效应作为模型的局限性。在某些情况下，即那些对有益的适应有尽头的情况下，最好是着眼于改变你试图生存的环境的一部分，而不是试图在破坏你整体适应能力的竞赛中跟上。将个人或物种的生存置于危险之中的行为不是适应的目标，也不被红皇后效应所支持。

One of the interesting problems for humans is that the pressures we face from each other are not isolated and often require a complex response. We are not just trying to run faster than an antelope. We are trying to be better in so many ways that we often feel like we are failing at everything. So we burnout or we give up. However, similar to velocity, the “speed of adaptation is not the same thing as effective adaptation.
对人类来说，一个有趣的问题是，我们面临的来自彼此的压力并不是孤立的，往往需要复杂的反应。我们不仅仅是想跑得比羚羊快。我们试图在许多方面做得更好，以至于我们经常感觉到我们在所有方面都是失败的。因此，我们倦怠了，或者放弃了。然而，与速度类似，"适应的速度与有效的适应不是一回事。

The point is that what matters is not the speed of adaptation, but what problems it helps you solve and what problems arise as a result of an enemy’s adaptations.” First of all, the principle of adaptation is that it is useful. Useful adaptations are well suited to life, and they increase your ability to be successful in that life. They have to improve your functioning.
关键是，重要的不是适应的速度，而是它帮助你解决了什么问题，以及由于敌人的适应而产生了什么问题"。首先，适应的原则是它是有用的。有用的适应是很适合生活的，它们能提高你

在这种生活中的成功能力。它们必须改善你的功能。

Also, adaptations come with tradeoffs. Increasing your fitness in one way will mean a decrease in fitness in other areas. Humans have big brains. A benefit is unmatched problem-solving ability. We can survive in a wide variety of situations for which we have no direct experience. The tradeoff? The bodies that house these big brains can't be fully grown inside the womb.
此外，适应也是有代价的。以一种方式增加你的体能将意味着在其他方面的体能下降。人类的大脑很大。一个好处是无可比拟的解决问题的能力。我们可以在各种我们没有直接经验的情况下生存。代价是什么？容纳这些大脑袋的身体不能在子宫内完全成长。

So, we are vulnerable for many years after birth. Adaptations are further constrained by the fact that an organism must be viable at all stages of the adaptation process. What this means on the human life timescale is that if you are compromising your physical health or your sanity, you are not adapting. You are instead weakening your ability to successfully respond to changes in your environment.
因此，我们在出生后的许多年里都很脆弱。适应被进一步限制，因为生物体在适应过程的所有阶段都必须是可行的。这意味着在人类生命的时间尺度上，如果你损害了你的身体健康或你的理智，你就不是在适应。相反，你正在削弱你成功应对环境变化的能力。

Adaptations are about being successful in your environment, so it becomes critical to define success. For animals it means living 18 long enough to pass on your genetics and, depending on your species, getting your young through the early vulnerable stages. Mammals, in particular, don't just need to have offspring, but need to teach them how to successfully navigate their environment.
适应是为了在你的环境中获得成功，因此，定义成功变得至关重要。对动物来说，这意味着要活够18年，以传承你的基因，并且根据你的物种，让你的孩子度过早期的脆弱阶段。特别是哺乳动物，不只是需要有后代，还需要教他们如何成功地驾驭他们的环境。

But beyond our biology, there is no universal definition of success that all humans would agree to. For some it's about power and recognition, for others it's about the freedom of choice, and others still would emphasize spiritual enlightenment and peace. However, a fundamental component of success must be that it involves benefit. You gain when you succeed.
但除了我们的生物学之外，没有一个所有人类都会同意的成功的普遍定义。对一些人来说，它是关于权力和认可，对另一些人来说，它是关于选择的自由，还有一些人仍然会强调精神启蒙和和平。然而，成功的一个基本组成部分必须是它涉及利益。当你成功时，你会获得好处。

Anything that compromises your ability to succeed is not justified by this model. Running

as fast as you can to stay in place is not a euphemism for 16-hour workdays. It should not be the reason you don't see your children or used to justify ignoring the needs of your body or soul.
任何有损于你成功能力的事情，在这个模式下都是不合理的。尽可能快地跑步以保持原地不动并不是16小时工作制的委婉说法。它不应该成为你不看孩子的理由，也不应该被用来为忽视你的身体或灵魂的需要辩护。

Vestigial Structures 残存的结构

Natural selection happens in imperceptible increments over vast periods of time. That means that sometimes we can see traces of its path.
自然选择是在漫长的时间里以难以察觉的方式进行的。这意味着，有时我们可以看到其路径的痕迹。

It's a misconception that organisms are perfectly formed and adapted to their environments. We can see the traces of natural selection, a slow and imperfect process, in vestigial structures.
认为生物体完美地形成并适应其环境是一种误解。我们可以从残存的结构中看到自然选择的痕迹，这是一个缓慢而不完美的过程。

These are traits that are present in a species or some members of a species, but no longer have any function or value. Vestigial structures may only be present during the embryonic stage or they may be a permanent feature. In the past, they served an important purpose that helped a species survive. For example, flightless birds like ostriches usually have small, useless wings that are the leftovers from the ones that once gave them flight.
这些是存在于一个物种或一个物种的某些成员中的特征，但不再有任何功能或价值。残存结构可能只存在于胚胎阶段，也可能是一个永久性的特征。在过去，它们发挥着重要的作用，帮助一个物种生存。例如，鸵鸟等不会飞的鸟类通常都有小而无用的翅膀，这些翅膀是曾经让它们飞起来的翅膀的遗留物。

The human goosebump reaction to stress or fear is a vestigial response, based on how our ancestors would have fluffed up their fur to look bigger when confronted with a predator. Some snakes have the remnants of a pelvis from the time when they had legs, as do whales.
人类对压力或恐惧的鸡皮疙瘩反应是一种遗留反应，基于我们的祖先在面对捕食者时，会把他们的毛发弄得蓬松，以看起来更大。一些蛇在有腿的时候有骨盆的残余，鲸鱼也是如此。

The presence or absence of pelvic remains is one way we classify snake species. Pigs have useless toes raised off the ground. The parasite responsible for malaria contains the vestiges of a chloroplast in its single cell. Moles have

skin-covered, deevolved eyes hidden beneath their fur, despite being blind.
骨盆残骸的存在与否是我们对蛇类物种进行分类的一种方式。猪有无用的脚趾抬离地面。导致疟疾的寄生虫在其单细胞中含有叶绿体的残余物。鼹鼠尽管是盲人，但它们的皮毛下隐藏着被皮肤覆盖的、已进化的眼睛。

So why don't vestigial structures just go away? It all comes down to natural selection. An organism's traits are only selected for or against by natural selection if they have any impact on its chances of survival.
那么，为什么残存的结构不会消失呢？这一切都归结于自然选择。一个生物体的特征只有在对其生存机会有任何影响的情况下才会被自然选择所接受或反对。

If a vestigial structure confers no benefit but causes no harm, there is no reason for it to disappear. Getting goosebumps during a horror movie isn't likely to reduce an individual's chances of reproducing, nor does it require enough energy to be a meaningful hindrance. So goosebumps will probably stick around for a good while longer unless random mutations eliminate the response or it becomes detrimental.
如果一个残存的结构没有带来任何好处，但也没有造成任何伤害，那么就没有理由让它消失。在看恐怖电影时起鸡皮疙瘩不可能减少个体的繁殖机会，也不需要足够的能量来成为一个有意义的障碍。所以鸡皮疙瘩可能还会存在一段时间，除非随机突变消除了这种反应，或者它变得有害。

Even when vestigial structures do go away, it happens gradually over many generations. At a certain point, they cease to be relevant to the process of natural selection. There are even instances when further shrinking or eliminating a vestigial structure would be more detrimental than leaving it in a diminished form, so it remains.
即使遗留结构真的消失了，它也是在许多代中逐渐发生的。在某一点上，它们不再与自然选择的过程有关。甚至在有些情况下，进一步缩小或消除一个残余结构会比让它保持一个减弱的形式更有害，所以它仍然存在。

For them to disappear completely may require overall structural changes in an organism which are not feasible, or not important enough to exert selective pressure.
要让它们完全消失，可能需要对生物体进行整体结构的改变，而这种改变是不可行的，或者说没有足够的重要性来施加选择压力。

Scientists are always learning more and sometimes a feature that seems to serve no purpose has one we haven't discovered yet. Vestigial structures can be helpful for learning about evolution and determining if species have a common

ancestor.
科学家们总是在学习更多的东西，有时一个似乎没有作用的特征有一个我们还没有发现。残存的结构对学习进化和确定物种是否有一个共同的祖先很有帮助。

Don’t reinvent the wheel, repurpose it 不要重新发明轮子，要重新利用它

There is a lot of opportunity that already exists in your world. You don’t have to start from scratch with adaptation. In evolutionary biology, making use of things you already have is sometimes referred to as an exaptation. The term “exaptation” was first proposed by Stephen Jay Gould and Elisabeth Vrba in 1982 to make the point that a trait’s current use does not necessarily explain its historical origin.
有很多机会已经存在于你的世界中。你不需要从头开始适应。在进化生物学中，利用你已经拥有的东西有时被称为 "适应"。"适应 "一词最早是由斯蒂芬-杰伊-古尔德和伊丽莎白-弗尔巴在1982年提出的，以说明一个性状的当前用途不一定能解释其历史起源。

In other words, just because A is used for B by species C does not necessarily mean that species C evolved A for the purpose of doing B. It may very well be the case that B is something that this species learned to do after the adaptation of A. For example, although today most birds use their feathers to fly, it would be incorrect to say that this means that feathers emerged in these birds specifically for flight.
换句话说，仅仅因为A被物种C用于B，并不一定意味着物种C进化A的目的是为了做B，很可能B是这个物种在适应A之后学会做的事情。

In fact, feathers first emerged in dinosaurs for the purposes of insulation or attracting mates, not flight. Natural selection selected for dinosaurs that had feathers because they better allowed them to survive and reproduce. This is the adaptation: feathers first provided heat and attractiveness. Later on, however, feathers also became useful for flight as observed in the modern bird.
事实上，羽毛在恐龙中出现的最初目的是为了保温或吸引配偶，而不是为了飞行。自然选择选择了有羽毛的恐龙，因为它们能更好地生存和繁衍。这就是适应性：羽毛首先提供热量和吸引力。然而，后来，正如在现代鸟类中观察到的那样，羽毛也变得对飞行有用。

Once the structure was present, the function of flying became possible. The structure did not emerge for the purposes of flying, but it was repurposed to support this new use. It was an exaptation. There are many other examples of exaptation in the animal world. All of them demonstrate that exaptations are useful to survival because they expand our options in responding to changing environmental conditions.
一旦有了这种结构，飞行的功能就成为可能。这种结构并不是为了飞行而出现的，但它被重新

利用来支持这种新的用途。这是一种适应性的变化。在动物世界中还有许多其他适应性的例子。所有这些例子都表明，适应对生存是有用的，因为它们扩大了我们应对不断变化的环境条件的选择。

Pandas have a wrist bone, the radial sesamoid, that allows them to easily manipulate bamboo stems, their primary source of food. Most mammals and reptiles have this same bone, yet none eat bamboo or otherwise use the bone to assist in feeding. The bone is available to all of them, but only the panda needs it. Should the environment put certain kinds of pressure on the other species requiring them to adapt their feeding habits, this bone is available as an exaptation that would aid in survival.
熊猫有一块腕骨，即桡侧芝麻骨，这使它们能够轻易地操纵竹子的茎，这是它们的主要食物来源。大多数哺乳动物和爬行动物都有这种骨头，但没有人吃竹子或以其他方式使用这种骨头来协助进食。所有的动物都有这种骨头，但只有熊猫需要它。如果环境给其他物种带来某种压力，需要它们调整自己的进食习惯，那么这块骨头就可以作为一种适应性的东西，帮助它们生存。

In other words, structures that arise for the purposes of fulfilling an associated function, like echolocation in bats, are adaptations, while structures that arise that are then used for a function other than the one they originally performed, like feathers in birds, are exaptations. The distinction between adaptation and exaptation is not always a clear one, which is why we put them together as a model. What we can get out of this overlap is insight into repurposing already acquired skills and knowledge.
换句话说，为实现相关功能而出现的结构，如蝙蝠的回声定位，是适应，而出现的结构，然后用于它们最初执行的功能以外的功能，如鸟类的羽毛，是适应。适应和外适应之间的区别并不总是很清楚，这就是为什么我们把它们放在一起作为一个模型。我们可以从这种重叠中得到的是对重新利用已经获得的技能和知识的见解。

The surprising evolution of the self-playing piano 自弹钢琴的惊人演变

Inventions are almost never solitary, isolated creatures; they depend on other inventions that complete them or endow them with new applications that their original inventors never considered.
发明几乎从来不是孤独的、孤立的生物；它们依赖于其他的发明，这些发明完成了它们，或者赋予了它们新的应用，而它们的原始发明者从未考虑过。
———史蒂芬•约翰逊 Steven Johnson

About 1200 years ago in Baghdad there lived three brothers: Muhammad, Ahmad, and al-Hasan, collectively known as the Banu Musa. They were scholars who wrote many books on topics such as mathematics and astronomy.

大约1200年前，在巴格达有三兄弟。穆罕默德、艾哈迈德和哈桑，统称为巴努-穆萨家族。他们是学者，写了许多关于数学和天文学等主题的书。

One of their most fascinating works was The Book of Ingenious Devices. This book was a catalogue of machines, including a self-trimming lamp, an automatic flute player, and a programmable machine. This last was “the Instrument Which Plays by Itself,” a detailed design for a hydraulic organ which played music notes triggered by small divots in a pinned cylinder.
他们最吸引人的作品之一是《巧妙装置之书》。这本书是一个机器目录，包括一个自动修剪的灯，一个自动吹笛子的人，以及一个可编程的机器。最后一个是 "自弹自唱的乐器"，这是一个液压管风琴的详细设计，它通过钉在圆柱体上的小凹槽来播放音符。

Thus, a human did not interact with the machine directly; instead they “programmed” the machine via the instructions on the cylinder. In Wonderland: How Play Made the Modern World, Steven Johnson traces the technology of the musical machine devised by the Banu Musa through music boxes and mechanical toys and player pianos, and shows how the innovations generated in the pursuit of this entertainment were the foundation of the frequencyhopping technology so essential to our wireless age in the form of cellular phones, Bluetooth, and Wi-Fi.
因此，人类并不直接与机器互动；相反，他们通过圆柱体上的指令对机器进行 "编程"。在《仙境》中。玩耍如何创造了现代世界》中，史蒂文-约翰逊通过音乐盒、机械玩具和弹奏钢琴，追溯了巴努-穆萨设计的音乐机器的技术，并展示了在追求这种娱乐时产生的创新是如何成为我们无线时代所必需的跳频技术的基础，即手机、蓝牙和Wi-Fi的形式。

How did the technology make this leap? In 1940, near the beginning of World War II, the Battle of the North Atlantic was raging. German submarines were sinking boats with regularity, resulting in a devastating loss of both military and civilian life. Hedy Lamarr, Hollywood actress, and George Antheil, composer, teamed up to try to do something about it. Their goal was to invent a remote-controlled torpedo to attack German submarines.
该技术是如何实现这一飞跃的？1940年，在第二次世界大战即将开始的时候，北大西洋之战正在激烈进行。德国潜艇经常击沉船只，造成军队和平民生命的毁灭性损失。好莱坞女演员海蒂-拉马尔和作曲家乔治-安泰尔合作，试图为此做些什么。他们的目标是发明一种遥控鱼雷来攻击德国潜艇。

One of the main challenges was the vulnerability of the frequency used to control the torpedo. Using one frequency meant that it could be easily discovered and jammed. They needed to find a way for the remote controller and the torpedo to “frequency hop” in synchrony. This way it would be near impossible to find, and the Allies could direct their

torpedo without interference.
主要挑战之一是用于控制鱼雷的频率的脆弱性。使用一个频率意味着它很容易被发现和干扰。他们需要找到一种方法，让远程控制器和鱼雷同步 "跳频"。这样它就几乎不可能被发现，而盟军可以不受干扰地指挥他们的鱼雷。

When faced with a challenge, where does one look for inspiration? Usually you start with concepts you already understand, and materials you already have. This is the essence of exaptation. Lamarr and Antheil were faced with the challenge of synchronizing the movement of frequencies. Antheil looked into his current store of knowledge and realized he'd faced a similar challenge before—trying to synchronize the musical notes of multiple player pianos in a composition of his called the Ballet Mécanique. "
当面临一个挑战时，一个人在哪里寻找灵感？通常情况下，你会从你已经理解的概念和你已经拥有的材料开始。这就是适应性的本质。拉马尔和安泰尔面临着频率同步运动的挑战。安泰尔查看了他目前的知识储备，意识到他以前也面临过类似的挑战--在他的一部名为《机械芭蕾》的作品中，试图使多台钢琴的音符同步。"

This is where Antheil's experience…supplied the missing element that completed Lamarr's invention. He proposed a control system whereby the instruction for frequencies were encoded in two perforated ribbons. Where the holes in the piano roll signaled a musical note, the holes in the ribbons signaled a frequency change." What was invented or learned for one purpose stays available to be used for entirely different functions. "For almost a thousand years we had that meta-tool [programmability] in our collective toolbox and we did nothing with it other than play music."
这就是安泰尔的经验.....提供了完成拉马尔发明的缺失因素。他提出了一个控制系统，根据这个系统，频率的指令被编码在两条穿孔带中。钢琴卷上的小孔表示一个音符，色带上的小孔表示一个频率的变化"。为一种目的而发明或学习的东西，可以被用于完全不同的功能。"近一千年来，我们的集体工具箱里有这种元工具[可编程性]，而我们除了演奏音乐外，什么也没做。"

And then we branched out with this tool. We started programming textile looms, torpedoes and computers. Programmability in all the functions in which we use it today has become indispensable, and we can pretty much guarantee this wasn't what the Banu Musa had in mind when they came up with that original ingenious device.
然后，我们用这个工具进行了扩展。我们开始为纺织机、鱼雷和计算机编程。在我们今天使用的所有功能中，可编程性已经变得不可或缺，而我们几乎可以保证这并不是巴努-穆萨在想出那个最初的巧妙装置时的想法。

Innovation without a plan 没有计划的创新

Exaptations in evolution do not necessarily have to be new uses from current adaptations—

traits that already have a purpose. They can develop from bits lying around that were started for no particular use at all, which has a parallel in technology. Sometimes people invent things solely for the sake of the invention. They don't have a fundamental social use or business model in mind.
进化中的适应性不一定是当前适应性的新用途--那些已经有目的的特性。它们可以从周围的零星部分发展而来，而这些零星部分的开始根本就没有什么特别的用途，这在技术中也有类似的情况。有时人们发明东西完全是为了发明而发明。他们并没有考虑到基本的社会用途或商业模式。

There are far more patents than things we use on a regular basis. Sometimes, those isolated inventions provide a foundation for innovations that were not at all anticipated. What we learn from exaptation is that we don't always know the value of something at the outset, and there doesn't always have to be a justification for doing everything.
专利的数量远远多于我们经常使用的东西。有时，这些孤立的发明为完全没有预期的创新提供了基础。我们从适应性学习到的是，我们并不总是在一开始就知道某物的价值，而且做任何事也不一定要有理由。

Sometimes things that have no apparent purpose at the outset can later be co-opted into use. Having to know the benefit of everything before you begin leads to missed opportunities. No one has a crystal ball—you can't anticipate all that will be required or have use as our global environment changes. The history of commercial products is littered with exaptations.
有时，一开始没有明显目的的东西，后来也能被合用起来。在你开始之前必须知道所有事情的好处，这会导致错过机会。没有人有水晶球--你不可能预料到随着我们全球环境的变化，所有的东西都会被需要或被使用。商业产品的历史充斥着各种突变。

Bubble wrap was invented in 1957 by Alfred W. Fielding and Marc Chavannes by sealing two shower curtains together and capturing bubbles of air on the inside. Obvious use? No. They first tried to sell it as wallpaper, but there were no takers. Then they tried marketing it as greenhouse insulation, but this failed. Then the company took it to IBM as a way to protect all their new business computers while in transit.
1957年，Alfred W. Fielding和Marc Chavannes将两个浴帘密封在一起，并在里面捕捉气泡，发明了泡沫包装。明显的用途？他们首先试图将其作为墙纸出售，但没有人问津。然后，他们试图将其作为温室的绝缘材料进行销售，但失败了。然后，该公司把它拿给IBM，作为在运输过程中保护他们所有新的商业电脑的一种方式。

The usage took off and the product developed into the bubble wrap we have today. Time and place also matter for exaptation. A use that might be perfect in one country might seem irrelevant in another. Or a product marketed at one point in history may fall flat but

succeed at another time. If they'd tried marketing bubble wrap as wallpaper in the 1970s when wacky wallpaper and plastic clothing were a trend, it might have taken off. Exaptation is all about context. If birds hadn't faced environmental pressures to fly, feathers may have remained as a form of insulation or evolved to serve a different function.
使用量大增，产品发展成为我们今天的气泡膜。时间和地点对适应性也很重要。在一个国家可能是完美的用途，在另一个国家可能显得无关紧要。或者一个产品在历史上的某个时间点销售可能会平淡无奇，但在另一个时间点却很成功。如果在20世纪70年代，当古怪的墙纸和塑料服装成为一种趋势时，他们试图将气泡膜作为墙纸进行营销，它可能会起飞。适应是关于背景的。如果鸟类没有面临飞行的环境压力，羽毛可能仍然是一种绝缘的形式，或者进化成不同的功能。

There's also Play-Doh. It had a 20-year career as wallpaper cleaner, in the days when coal was the primary home fuel. Using coal turned the walls sooty, and the substance that became PlayDoh was used to remove that soot. But then coal began to be replaced by heating systems based on electricity or natural gas, and Play-Doh wasn't needed anymore to clean walls.
还有橡皮泥。在煤炭是主要家庭燃料的时代，它曾有过20年的墙纸清洁剂生涯。使用煤会使墙壁变灰，而后来成为橡皮泥的物质被用来清除这些灰烬。但后来煤炭开始被基于电力或天然气的加热系统所取代，橡皮泥不再需要用来清洁墙壁。

Developed by Cleo McVicker and his brother Noah, Play-Doh was a product without a future. But McVicker's sister-in-law, a teacher, had been using Play-Doh as a craft medium in her primary classes. She convinced him to investigate marketing it as a child's toy. It was fun, nontoxic, and lasted a while if sealed properly in between uses. McVicker got prime product placement with children's show star Captain Kangaroo, and sales exploded, making it one of the most popular children's products of all time.
由Cleo McVicker和他的兄弟Noah开发的橡皮泥是一个没有前途的产品。但麦克维克的嫂子是一名教师，她在小学课堂上一直将橡皮泥作为一种工艺媒介。她说服他研究将其作为儿童玩具进行销售。它很有趣，无毒，如果在两次使用之间适当密封，可以持续一段时间。McVicker得到了儿童节目明星袋鼠船长的主要产品位置，销售量爆炸性增长，使其成为有史以来最受欢迎的儿童产品之一。

Or there is the story of Botox. It's a toxin and "is a naturally occurring by-product of the microorganism that causes botulism, a potentially lethal paralytic disease caused by eating contaminated preserved food." The bacteria have likely been around a long time and have killed a lot of people. It wasn't until the 19th century that the anaerobic bacteria that cause botulism were isolated and identified. In the 1970s, a form of the toxin was used to treat eye disorders, including uncontrollable blinking and crossed eyes.
还有一个关于肉毒杆菌的故事。它是一种毒素，"是引起肉毒杆菌的微生物的自然发生的副产

品，肉毒杆菌是一种可能致命的麻痹性疾病，由食用受污染的腌制食品引起"。这种细菌很可能已经存在了很长时间，并且已经杀死了很多人。直到19世纪，引起肉毒杆菌的厌氧菌才被分离出来并被确认。在20世纪70年代，这种毒素的一种形式被用来治疗眼部疾病，包括无法控制的眨眼和交叉眼。

By the 1980s “the toxin was widely applied by both ophthalmologists and neurologists as a remedy for facial, eyelid, and limb spasms.” In 1987, Jean Carruthers, an ophthalmologist, inadvertently discovered cosmetic uses for Botox when a patient mentioned how her eye treatments were relaxing her face. It took a 30 31 32 few more years for Botox to hit the mainstream, but it eventually achieved widespread cosmetic application.
到了80年代，"这种毒素被眼科医生和神经科医生广泛用于治疗面部、眼睑和肢体痉挛"。1987年，一位眼科医生Jean Carruthers无意中发现了肉毒杆菌的美容用途，当时一位病人提到她的眼部治疗如何使她的面部放松。又过了30 31 32年，肉毒杆菌才进入主流，但它最终实现了广泛的美容应用。

Thus, what exaptation is fundamentally about is flexibility. We cannot know the exact pressures we will face in the future. So what we need is a box of diverse tools that can be used and combined in almost a limitless number of ways to meet the challenges we face. Some of these pieces will never have any use, and some will be complete game changers. But no one can divine this ahead of time. Survival of a business often depends on being able to change quickly.
因此，适应性从根本上说是指灵活性。我们无法知道我们在未来将面临的确切压力。因此，我们需要的是一盒多样化的工具，可以以几乎无限的方式使用和组合，以应对我们面临的挑战。这些工具中的一些将永远不会有任何用途，而一些将是完全改变游戏规则的。但没有人能够提前预知这一点。一个企业的生存往往取决于是否能够迅速改变。

You can’t do that if you have to start from a blank slate every time environmental pressures push you to develop and innovate. It also teaches us that as individuals we must not underestimate the options we have at our disposal. Too often we get stuck in “functional fixedness,” a mindset where we see in things only their intended use, rather than their potential use.
如果每次环境压力迫使你开发和创新时，你不得不从一张白纸开始，你就无法做到这一点。这也告诉我们，作为个人，我们决不能低估我们所拥有的选择。我们常常陷于 "功能固定"，这种心态使我们在事物中只看到它们的预期用途，而不是它们的潜在用途。

A fork doesn’t have to be just a tool to put food in your mouth. It could also be a hook, tack, or hair detangler. It may be combined with other household objects to fulfill even more purposes. As the saying goes: do what you can, with what you’ve got, where you are.

In fact, one of the tests used to measure creativity by psychologists is to ask people to come up with as many uses as possible for an everyday object like a brick.
叉子不一定只是一个把食物放进嘴里的工具。它也可以是一个钩子、大头针或头发整理器。它可以与其他家用物品结合起来，实现更多的用途。俗话说：尽你所能，用你所得到的，在你所处的地方。事实上，心理学家用来衡量创造力的测试之一是要求人们为一块砖头这样的日常物品想出尽可能多的用途。

The more exaptations someone can envision, the more creative they're considered. The knowledge we've accrued, the lessons we've learned, are all available to us at any given moment to forge new paths in the environments we are in. The most amazing part of this concept is that it happens on two levels. There is the conscious one, where you look around at what you have and actively search out what you can repurpose.
一个人能够设想出的用途越多，他们就被认为越有创造力。我们所积累的知识，我们所学到的教训，在任何时候都可以在我们所处的环境中开辟新的道路。这个概念最神奇的地方在于它发生在两个层面。有意识的是，你环顾四周，看看你所拥有的东西，积极寻找你可以重新利用的东西。

But these abilities also manifest on an unconscious level. Like the bird, who did not say, "Hey, maybe I can use these feathers to fly," but instead had feathers that influenced its behavior in situations they were not originally selected for, we too navigate our world differently the more knowledge and skills we can draw on in any given situation.
但这些能力也体现在无意识的层面上。就像那只鸟，它没有说："嘿，也许我可以用这些羽毛来飞"，而是有了羽毛，在原来没有选择的情况下影响了它的行为，我们也以不同的方式驾驭我们的世界，在任何特定情况下我们可以利用更多的知识和技能。

Conclusion 结论

Adaptations, and their counterpart exaptations, are part of a continuous process. Adaptations for one function can be used for another, and exaptations further refined through an adaptive process. When you look for ways to apply what you already know in new contexts, understand that the knowledge can and will still develop for the situation you are in.
适应，以及与之相对应的适应，是一个连续的过程的一部分。对一种功能的适应可以用于另一种功能，而适应则通过适应过程进一步完善。当你寻找方法将你已经知道的东西应用到新的环境中时，要明白这些知识仍然可以并将为你所处的环境发展。

Complacency will kill you. The stronger we are relative to others, the less willing we generally are to change. We see strength as an immediate advantage that we don't want to compromise. However, it's not strength that survives, but adaptability. Strength

becomes rigidity. Eventually your competitors will match your strength or find innovative ways to neutralize it. Real success comes from being flexible enough to change, to let go of what worked in the past, and to focus on what you need to thrive in the future.
骄傲自满会害死你。相对于其他人，我们越是强大，一般就越不愿意改变。我们把实力看作是一种直接的优势，我们不愿意妥协。然而，生存的不是力量，而是适应性。力量变成了僵硬。最终，你的竞争对手会与你的实力相匹配，或者找到创新的方法来抵消它。真正的成功来自于足够灵活的改变，放下过去的工作，专注于你在未来发展所需要的东西。

Competition 竞争

Competition is a driving force of the biological world. All living things are out to survive and breed as much as possible. This puts them in competition for finite resources like food, status, territory, and mates. This may be between whole species or individuals.
竞争是生物界的一种驱动力。所有的生物都是为了尽可能地生存和繁殖。这使它们处于对有限资源的竞争中，如食物、地位、领土和配偶。这可能是整个物种或个体之间的竞争。

The fight for resources is a zero-sum game. The more one individual receives, the less there is for others. So competition is inherently harmful to the losers. If a species cannot attain the resources it needs, it will go extinct. The availability of resources dictates the type and intensity of competition. The scarcer the resource, the more aggressive the competition.
对资源的争夺是一个零和游戏。一个人得到的越多，其他人得到的就越少。因此，竞争本质上对失败者是有害的。如果一个物种不能获得它所需要的资源，它就会灭绝。资源的可用性决定了竞争的类型和强度。资源越稀缺，竞争就越激烈。

Intraspecific competition occurs within species when members fight for the same resource. For example, male zebras engage in vicious fights over females. The urge to spread their genes is so strong that losers may die in the process. Male zebras will also kill the offspring of rivals. Interspecific competition occurs between species.
物种内的竞争发生在物种内部，成员为同一资源而战。例如，雄性斑马为争夺雌性斑马而进行恶性争斗。传播其基因的冲动是如此强烈，以至于失败者可能在这个过程中死亡。雄性斑马也会杀死对手的后代。种间竞争发生在物种之间。

If they live in the same area and need the same resources, they’re forced to compete. Trees in a forest compete to grow the tallest and get the most sunlight. All species are constantly engaged in both types of competition. The distinction is not as clear-cut as it might seem. Everything a species does

impacts others within the same ecosystem.
如果它们生活在同一地区，需要同样的资源，它们就会被迫竞争。森林中的树木为长得最高和获得最多的阳光而竞争。所有的物种都在不断地参与这两种类型的竞争。这种区别并不像它看起来那样明显。一个物种所做的一切都会影响同一生态系统中的其他物种。

Competition can be direct or indirect. If living things must actively fight each other for a resource, it’s direct. If there is no confrontation, it’s indirect. We cannot understand any of the biological mental models without also considering competition. It’s the reason the natural world is so diverse.
竞争可以是直接或间接的。如果生物必须积极地相互争夺资源，那就是直接的。如果没有对抗，它就是间接的。如果不考虑竞争，我们就无法理解任何生物心理模式。这也是自然界如此多样化的原因。

As Darwin recognized, all life is a struggle for survival. Species that are able to fight for the resources they need to survive and reproduce are the successful ones. The type and intensity of competition is dictated by the availability of resources. The scarcer a resource is within a region, the more aggressively organisms must compete for it.
正如达尔文所认识到的，所有的生命都是为生存而斗争。能够为生存和繁殖所需的资源而斗争的物种是成功的物种。竞争的类型和强度是由资源的可用性决定的。一个地区的资源越稀缺，生物必须更积极地竞争它。

When resources are more abundant, competition may be less intense. This, however, typically allows a species to breed until its numbers reach a level where individuals are forced to compete. Competition doesn’t just occur in biology. It’s also the driving force behind many human systems.
当资源比较丰富时，竞争可能不那么激烈。然而，这通常允许一个物种繁殖，直到其数量达到个体被迫竞争的程度。竞争不只是发生在生物学中。它也是许多人类系统背后的驱动力。

The upside of competition is that it forces improvements. Competition is an important concept in business. Companies are constantly fighting for market share. This process is beneficial for consumers, because it forces companies to keep prices low and quality high whenever possible. Monopolies—when one company dominates an entire market and customers have no other option—are discouraged because they allow for abuse and create stagnation.
竞争的好处是，它迫使人们改进。竞争是商业中的一个重要概念。公司不断为市场份额而战。这个过程对消费者是有利的，因为它迫使公司尽可能地保持低价和高质量。垄断--当一家公司主宰整个市场，客户没有其他选择--是不受欢迎的，因为它允许滥用，并造成停滞。

Ecosystem 生态系统

In biology, an ecosystem encompasses a community of interacting species and their nonliving environment. All components play a part in determining the characteristics, from the type of soil to the amount of sun or water available. Some animals cooperate, others compete, and changes in any component can affect both the fitness of individual species and the health of the entire system.
在生物学中，一个生态系统包括一个相互作用的物种群落和它们的非生物环境。从土壤的类型到可用的阳光或水的数量，所有的组成部分都在决定其特性方面发挥着作用。一些动物进行合作，另一些则进行竞争，任何组成部分的变化都会影响个别物种的健康和整个系统的健康。

When you learn about ecosystems, you gain insight into how diverse components interact in defined environments in a way that promotes the continued existence of the system. Individual species may gain and lose, and the system itself exposed to challenges that it must adapt to and recover from, but the web of interaction that has developed supports the holistic functioning of the system.
当你学习生态系统时，你会深入了解不同的组成部分如何在确定的环境中以促进系统持续存在的方式进行互动。单个物种可能会得到或失去，系统本身也会面临必须适应和恢复的挑战，但已经形成的互动网络支持了系统的整体运作。

An interconnected web 一个相互联系的网络

The key point to understand about ecosystems is that they are systems. The different parts don’t exist in isolation; they interact and interconnect in myriad ways. If we intervene in them, we can’t expect the outcomes to be predictable. We need to look at them as a whole and respect that it’s sometimes better to leave them alone than to try improving them.
了解生态系统的关键点是它们是系统。不同的部分并不是孤立存在的；它们以无数的方式相互作用和相互联系。如果我们对它们进行干预，我们不能期望结果是可预测的。我们需要把它们作为一个整体来看待，并尊重有时让它们单独存在比试图改善它们更好。

But we often suffer from intervention bias, the desire to always do something instead of leaving things alone, when it comes to ecosystems. We forget that they’ve evolved to manage quite well if we let them get on with it. For instance, in areas that are prone to forest fires, the local fire department may attempt to put out every single fire they hear about as soon as possible, regardless of size.
但是，当涉及到生态系统时，我们常常受到干预偏见的影响，即总是想做些什么，而不是让事情静止。我们忘记了，如果我们让它们继续生存下去，它们已经进化到可以很好地管理。例

如，在容易发生森林火灾的地区，当地的消防部门可能会试图尽快扑灭他们所听到的每一场火灾，无论大小。

The problem is that fire is a natural part of these ecosystems. It is only humans that view naturally occurring fires as a problem. As destructive as wildfires can be, they also have ecological benefits. Burning dead plants releases the nutrients they contain back into the soil, helping to fertilize the next generation of plants. Fires cut through the thickest areas of plants, letting sunlight through to reach new areas.
问题是，火是这些生态系统的一个自然组成部分。只有人类将自然发生的火灾视为一个问题。尽管野火具有破坏性，但它们也有生态方面的好处。焚烧死去的植物会将它们所含的养分释放到土壤中，有助于为下一代植物施肥。火灾切开了植物最厚的区域，让阳光通过，到达新的区域

They wipe out alien species and diseased plants. Perhaps most importantly, regular small fires burn up accumulating plant matter. If humans intervene and put these out, larger amounts of fuel build up and pave the way for fires that are beyond the scope of what the ecosystem can handle. Often, the harder we try to control ecosystems, the harder they fight back.
它们消灭了外来物种和有病的植物。也许最重要的是，定期的小火烧掉了累积的植物物质。如果人类干预并扑灭这些火，大量的燃料就会积累起来，为超出生态系统所能处理的范围的火灾铺平道路。通常，我们越是努力控制生态系统，它们就越是努力反击。

Likewise, our efforts to save endangered species from extinction often focus on interventions, rather than on preserving the natural ecosystems they need to survive in. Take the case of elephants. African elephants are currently considered vulnerable, not endangered, but it is believed they may end up extinct in a matter of years if current rates of poaching and habitat destruction continue.
同样，我们拯救濒临灭绝的物种的努力往往集中在干预措施上，而不是保护它们需要生存的自然生态系统。以大象为例。非洲象目前被认为是脆弱的，而不是濒危的，但据说如果目前的偷猎和栖息地破坏率继续下去，它们可能在几年内就会灭绝。

Asian elephants are classed as critically endangered. The best thing we can do for elephants is to preserve their habitats, allowing them to live and breed naturally. But much of the effort to save elephants from extinction is focused on captive breeding programs, especially artificial insemination. While this works and is safer than other methods of captive breeding, elephant artificial insemination is a classic case of us failing to recognize and support the value of ecosystems.
亚洲象被归类为极度濒危。我们能为大象做的最好的事情就是保护它们的栖息地，让它们自然地生活和繁殖。但拯救大象免于灭绝的大部分努力都集中在圈养繁殖项目上，特别是人工授

精。虽然这很有效，而且比其他圈养方法更安全，但大象人工授精是我们没有认识和支持生态系统价值的一个典型案例。

It is incredibly expensive and produces results that are far more limited than if we were to hypothetically use the same funds to preserve elephant habitat. In addition, artificial insemination only produces more captive elephants which are deprived of the space they need to roam and the social ties they would otherwise enjoy. They have much higher infant mortality rates than wild elephants and a substantial number die from conditions related to their limited space for movement.
它是非常昂贵的，产生的结果比我们假设用同样的资金来保护大象的栖息地要有限得多。此外，人工授精只会产生更多的圈养大象，这些大象被剥夺了它们需要的漫游空间和它们本来可以享受的社会关系。它们的婴儿死亡率比野生大象高得多，而且有相当多的人死于与它们有限的活动空间有关的疾病。

Ecosystems are not just about their individual parts. Sometimes we're too focused on trying to reinvent and improve upon them that we forget they're quite capable of self-organizing. There is no size restriction on ecosystems. Isolated puddles in rocks have their own ecosystems, but so too does the ocean. Matter and energy move across ecosystems.
生态系统不仅仅是它们的个别部分。有时，我们太专注于试图重新发明和改进它们，而忘记了它们有很强的自我组织能力。生态系统没有大小的限制。岩石中孤立的水坑有自己的生态系统，但海洋也是如此。物质和能量在生态系统中流动。

Animals migrate, pollen blows around, and water can transport a variety of species or materials to other systems. Very few ecosystems are completely closed. Longdistance migration of many species ties ecosystems together. Organisms within an ecosystem have varying degrees of importance for the maintenance of that system. Some are foundational to its survival.
动物迁徙，花粉四处飘散，水可以将各种物种或材料运送到其他系统。很少有生态系统是完全封闭的。许多物种的远距离迁移将生态系统联系在一起。一个生态系统内的生物对维持该系统有不同程度的重要性。有些是其生存的基础。

These are known as keystone species: organisms that would cause an ecosystem to completely change or collapse altogether if they were not present. Without them, new and possibly destructive organisms could take over the same niche. The name comes from zoologist Robert T Paine, who compared them to the special stone known as a keystone, that is used at the top of an arch to ensure its structural stability.
这些被称为关键物种：如果没有它们，会导致生态系统完全改变或完全崩溃的生物。如果没有它们，新的和可能具有破坏性的生物可能会接管相同的生态位。这个名字来自于动物学家罗伯特-T-佩恩，他把它们比作被称为基石的特殊石头，它被用于拱门的顶部，以确保其结构稳定。

Without the keystone, the arch would collapse. It is a small component, but everything else depends on it. Keystone species can be hard to identify, as they may only be present in low numbers or may not be highly visible species. We can only know for sure that an organism is a keystone if its numbers drop and we see the knock-on effects of that. It is common for keystone species to be predators (organisms that eat other, usually smaller, organisms) as they play a crucial role in maintaining the numbers of their prey.
没有基石，拱门就会坍塌。它是一个小部件，但其他一切都取决于它。基石物种可能很难识别，因为它们可能只存在于较低的数量中，或者可能不是高度可见的物种。只有当一种生物的数量减少，并且我们看到其连锁反应时，我们才能确定它是一个关键的生物。关键物种通常是捕食者（吃其他通常较小的生物的生物），因为它们在维持其猎物的数量方面起着关键作用。

Predators tend to be present in relatively small numbers compared to their prey. In other cases, herbivores (organisms that eat plants) are important for maintaining the levels of certain plants, thereby keeping the habitat in a favorable state for other organisms. Some species can have reciprocal relationships [see the chapter on Reciprocity] wherein the loss or reduction of one would harm the other and the effects would ripple out to the rest of the ecosystem.
与其猎物相比，捕食者的数量往往相对较少。在其他情况下，食草动物（吃植物的生物）对维持某些植物的水平很重要，从而使栖息地处于对其他生物有利的状态。一些物种可以有互惠的关系[见互惠一章]，其中一个物种的损失或减少会损害另一个物种，其影响会波及生态系统的其他部分。

So, in general the value of keystone species is dependent on their ability to either provide what other species need to survive or to control population levels. An example of a keystone species is the sea otter, which lives in kelp forests. Sea otters eat sea urchins, which in turn eat kelp. If there are enough sea otters in the ecosystem, they prevent the numbers of sea urchins from getting too high. Without the sea otters, all the kelp would get eaten, which would eventually also lead to the demise of the urchins.
因此，一般来说，关键物种的价值取决于它们提供其他物种生存所需的能力或控制人口水平的能力。一个关键物种的例子是海獭，它生活在海带森林中。海獭吃海胆，而海胆又吃海带。如果生态系统中有足够多的海獭，它们可以防止海胆的数量变得太高。没有海獭，所有的海带都会被吃掉，这最终也会导致海胆的消亡。

In addition, kelp plays a valuable role in removing carbon dioxide from the atmosphere, benefiting the environment as a whole, and supporting a wide variety of other species. Without the sea otters, the ecosystem could not survive. No other predator in the same habitat could fill the same niche as the sea otter. If their numbers drop too low, it could have a genuine impact on global climate change.

此外，海带在清除大气中的二氧化碳方面发挥着宝贵的作用，有利于整个环境，并支持各种其他物种。没有海獭，这个生态系统就无法生存。在同一栖息地，没有其他捕食者能像海獭一样填补同样的利基。如果它们的数量降得太低，可能会对全球气候变化产生真正的影响。

Finally, ecosystems aren't static. The internal dynamics are constantly changing as the system adjusts to and recovers from disturbances. Some ecosystems are robust, others more fragile. Some have a high capacity for resistance, which is the tendency of a system to remain close to its equilibrium state. It takes a significant disturbance to affect these ones.
最后，生态系统并不是静止的。当系统适应干扰并从干扰中恢复时，其内部动态是不断变化的。有些生态系统很强大，有些则比较脆弱。有些具有较高的抵抗能力，也就是一个系统保持接近其平衡状态的趋势。要想影响这些系统，需要有重大的干扰。

Resistance is contrasted with sensitivity, describing those systems for whom very weak disturbances can have a profound effect. Also measurable is a system's resilience, which is the speed it recovers after a disturbance. The strength of an ecosystem is thus better considered in more than one dimension. Sensitive systems with very high resiliency can be just as strong as highly resistant systems that have trouble bouncing back.
抵抗力与敏感性形成对比，后者描述的是那些非常微弱的干扰可以产生深远影响的系统。同样可以测量的是一个系统的复原力，即它在受到干扰后的恢复速度。因此，一个生态系统的强度最好从一个以上的维度来考虑。具有非常高的恢复力的敏感系统与难以反弹的高抗性系统一样强大。

This is why ecosystem is such a useful mental model. The parallels with human organization are clear. Our family units tend to function as their own system and so can our teams at work. But we are also part of the larger ecosystems of our cities or organizations, and people can move across ecosystems with ease, bringing change and challenge.
这就是为什么生态系统是一个如此有用的心理模型。与人类组织的相似之处很明显。我们的家庭单位往往作为他们自己的系统运作，我们的工作团队也可以这样。但我们也是我们的城市或组织的更大的生态系统的一部分，人们可以轻松地在生态系统中移动，带来变化和挑战。

The Law of the Minimum 最低限度法则
The Law of the Minimum states that the yield of a crop will always be dictated by the essential nutrient that is available at the lowest level. No matter how abundant the other essential nutrients are, being deficient in one will always limit the crop's growth. If the level of that nutrient is increased, another will become the limiting factor. One way to envision this is as a bucket with a hole through which water leaks out.

最低法则指出，作物的产量总是由最低水平的基本养分决定的。无论其他基本营养素多么丰富，缺少一种营养素总是会限制作物的生长。如果增加该营养素的水平，另一种营养素将成为限制因素。有一种方法可以把它想象成一个有孔的水桶，水从孔中漏出。

The bucket cannot fill to the brim as a result. The deficient nutrient is the hole in the bucket. The law comes from botanist Carol Spregnel, who formulated it in the 1820s. Biochemist Justus von Liebig later popularized the concept. It is an important concept for farmers to understand. When the price of a particular fertilizer increases, some farmers are tempted to use less of it and more of cheaper nutrients.
因此，水桶不能装满水。缺少的营养物质就是桶里的洞。该定律来自植物学家Carol Spregnel，他在19世纪20年代制定了该定律。生物化学家Justus von Liebig后来推广了这个概念。对于农民来说，这是一个需要理解的重要概念。当某一特定肥料的价格上涨时，一些农民会受到诱惑，减少使用该肥料，而使用更多的廉价营养物质。

But this stunts the growth of their crops, as the other nutrients do not compensate for the deficient one. It is not necessarily what is available that matters. What is scarce can be paramount too. We can see this in our own lives as well. If you skip on sleep to have more time, tiredness then becomes the limiting factor to your productivity, not time. In manufacturing, a bottleneck is a similar concept.
但这阻碍了他们的作物生长，因为其他的营养物质不能补偿所缺乏的营养物质。重要的不一定是可用的东西。稀缺的东西也可能是最重要的。我们在自己的生活中也可以看到这一点。如果你为了有更多的时间而跳过睡眠，那么疲倦就会成为限制你生产力的因素，而不是时间。在制造业中，瓶颈是一个类似的概念。

A factory process can only move as fast as the slowest step. Likewise, in mathematics we refer to multiplying by zero which is akin to the Law of the Minimum—put a zero at the end of a multiplicative calculation and it cancels out the numbers before it, no matter how high.
一个工厂的流程只能像最慢的步骤一样快速前进。同样，在数学中，我们指的是乘以零，这类似于最小法则--在乘法计算的最后加上一个零，它就会抵消前面的数字，无论多高。

> Over time, closed systems produce fewer and fewer innovations, because closed systems, by definition, are based on certain increasingly unchallengeable fundamental principles.
> 随着时间的推移，封闭系统产生的创新越来越少，因为根据定义，封闭系统是基于某些越来越不可挑战的基本原则。
> ———加里•哈特 Gary Hart

Trade ecosystems 贸易生态系统

Examining the silver trade between China and Spain in the 16th century brings out many of the nuances of ecosystems, demonstrating how there are limits to their organization and infrastructure and how more is accomplished when you work within them. The first lesson comes from the results of China trying to maintain a closed trading system.
考察16世纪中国和西班牙之间的白银贸易带来了生态系统的许多细微差别，证明了它们的组织和基础设施是如何有局限性的，以及当你在其中工作时如何完成更多的任务。第一个教训来自于中国试图维持一个封闭的贸易系统的结果。

For various reasons, over a long period the imperial government did not want to trade with other countries. Fearing a weakening of power or thinking that there was not much to bother trading for, the government in Beijing banned all trade. Trade with China, however, didn't stop, it was just done in a different way. No policies, customs, duties or official infrastructure meant that trade was carried out primarily by smugglers and pirates.
由于各种原因，在很长一段时间内，帝国政府不想与其他国家进行贸易。由于担心权力被削弱，或者认为没有什么值得费心的贸易，北京政府禁止了所有贸易。然而，与中国的贸易并没有停止，只是以一种不同的方式进行。没有政策、海关、关税或官方基础设施，意味着贸易主要由走私者和海盗进行。

European merchants knew that China was the largest economy in the world and therefore represented a huge economic opportunity. Once they figured out how to get there, Europeans became part of the environment. Certain individuals and groups in China adapted accordingly, integrating the opportunities the Europeans offered into the trade ecosystem.
欧洲商人知道，中国是世界上最大的经济体，因此代表了一个巨大的经济机会。一旦他们弄清楚如何到达那里，欧洲人就成为环境的一部分。中国的某些个人和团体相应地进行了调整，将欧洲人提供的机会融入贸易生态系统中。

The disruption caused by the arrival of the Europeans with their goods created opportunities for smaller players to compete with those traditionally at the top of society. The result was an extensive criminal network that soon threatened the power of the government, and which became a contributing factor to Beijing repealing the trade laws and opening up somewhat for business.
欧洲人带着他们的货物到来所造成的混乱，为较小的参与者创造了与传统上处于社会顶端的人竞争的机会。其结果是一个广泛的犯罪网络，很快就威胁到了政府的权力，这也成为北京废除贸易法并在一定程度上对商业开放的一个因素。

The second lesson about ecosystems comes from looking at what happened in China

when trade was opened up. To start, we need a little background. Another motivation for the trade policy change was that Beijing needed money. The traditional currencies, either bronze or paper, had been rendered completely useless by short-sighted policies that put political image ahead of economic sense.
关于生态系统的第二个教训来自于对中国贸易开放后所发生的事情的观察。首先，我们需要了解一点背景。改变贸易政策的另一个动机是，北京需要钱。传统的货币，无论是青铜还是纸币，都因为短视的政策而变得完全无用，这些政策将政治形象置于经济意义之上。

By the time those European ships sailed up, everyone in China was paying for goods with the little silver bits and shaved-off lumps carried around in their pockets. The problem was that China's silver mines were depleted. There was no way to infuse new currency into the system when it was needed, and an economic system without the raw materials to produce new currency is like a forest that stops getting light.
当那些欧洲船只驶来的时候，中国的每个人都在用他们口袋里的小银块和刮掉的小块来支付货物。问题是，中国的银矿已经枯竭。没有办法在需要的时候向系统注入新的货币，而一个没有原材料生产新货币的经济系统就像一个停止发光的森林。

The Chinese government needed the Spanish ships with their tons of silver mined in the Americas. Trade policy changes can be likened to an environmental change that impacts an ecosystem—a new, invasive species, a persistent change in the amount of rainfall. Changes that affect the environment in a widespread fashion will inevitably produce successes and failures.
中国政府需要西班牙的船只和他们在美洲开采的数吨白银。贸易政策的变化可以比喻为影响生态系统的环境变化--新的、入侵的物种，降雨量的持续变化。以广泛的方式影响环境的变化将不可避免地产生成功和失败。

Some species will adapt and take on new territory or create a new niche, and others will die off, unable to respond to the challenges. In China, there were many individuals and groups who adapted, capitalizing on the instability brought about by the changing trade laws. These adaptations in turn forced others one or two steps removed from direct trade to adapt to the resulting new businesses with their labor and land requirements. Thousands of acres were planted with the trees that hosted the worms that produced silk. Raw silk was produced by the ton.
一些物种会适应并占据新的领地或创造新的利基，而另一些物种则会因无法应对挑战而死亡。在中国，有许多个人和团体进行了适应，利用不断变化的贸易法所带来的不稳定性。这些适应性反过来又迫使其他与直接贸易相差一两步的人去适应由此产生的新业务及其劳动力和土地要求。数千英亩的土地上种植了容纳生产丝绸的虫子的树木。生丝是以吨为单位生产的。

And now that the Chinese had a market, other adaptations to the changing ecosystem

followed. As they got to know their customers, according to Quan Hanshen, the Taiwanese historian, they acquired samples of Spanish clothing and upholstery and in China made perfect knockoffs of the latest European styles. Into the galleons went stockings, skirts, and sheets; vestments for cardinals and bodices for coquettes; carpets, tapestries, and kimonos; veils, headdresses, and passementeries; silk gauze, silk taffeta, silk crepe, and silk damask. According to Charles C. Mann, who charts the changes to China that were a result of the silver trade in his book 1493, the Chinese began making an exceptional variety of goods to sell to the European market.
现在，中国人有了市场，其他适应不断变化的生态系统的措施也随之而来。根据台湾历史学家全汉臣的说法，随着他们对客户的了解，他们获得了西班牙服装和装饰品的样品，并在中国制造了最新欧洲风格的完美山寨品。大帆船上有丝袜、裙子和床单；红衣主教的法衣和女郎的胸衣；地毯、挂毯和和服；面纱、头饰和门帘；丝绸纱布、丝绸塔夫绸、丝绸绉绸和丝绸绫缎。查尔斯-C-曼在他的《1493》一书中描绘了白银贸易给中国带来的变化，根据他的说法，中国人开始制造各种各样的商品卖给欧洲市场。

Whatever the Chinese charged, it was still cheaper than the goods the Europeans could make themselves, and China paid more for silver than anyone else in the world. The leadership in Beijing didn't adapt so well to the changing economic ecosystem. They could not direct the resulting business boom to stave off inflation, and the silver itself was a double-edged sword. It financed state projects, but the silver "was ever a political threat to the dynasty, because it controlled neither the trade nor the source."
无论中国人收多少钱，都比欧洲人自己制造的商品便宜，中国为白银支付的费用比世界上任何其他国家都高。北京的领导层并没有很好地适应不断变化的经济生态系统。他们无法引导由此产生的商业繁荣来抵御通货膨胀，而白银本身就是一把双刃剑。它为国家项目提供资金，但白银 "永远是王朝的政治威胁，因为它既不控制贸易也不控制来源"。

And "so much silver flooded into China that the price eventually dropped," resulting in significant loss of revenue for the government. When ecosystems change, new species can become dominant and keystone as the interaction between species alters. Silver changed the economic ecosystem so significantly that the power relationships between various groups in China changed and evolved.
无论中国人收多少钱，都比欧洲人自己制造的商品便宜，中国为白银支付的费用比世界上任何其他国家都高。北京的领导层并没有很好地适应不断变化的经济生态系统。他们无法引导由此产生的商业繁荣来抵御通货膨胀，而白银本身就是一把双刃剑。它为国家项目提供资金，但白银 "永远是王朝的政治威胁，因为它既不控制贸易也不控制来源"。

The third interesting lesson regarding ecosystems comes from the mini-ecosystem that grew within the larger changes to China's trade policy: a very resilient Chinese community in Manila. This community originally started when trade with the mainland was outlawed,

presumably to have a place to actually conduct trade. The community grew, and when the trade policy was changed it grew some more.
关于生态系统的第三个有趣的教训来自于在中国贸易政策的大变化中成长起来的小型生态系统：马尼拉的一个非常有弹性的华人社区。这个社区最初是在与大陆的贸易被取缔时开始的，大概是为了有一个实际进行贸易的地方。这个社区不断壮大，而当贸易政策改变时，它又进一步壮大。

As Mann describes, Manila's Chinese inhabitants far outnumbered their Spanish counterparts in the European enclave in the city. The Spaniards were constantly uneasy about this Chinese community. They didn't understand it and looked down on it, but were also quite dependent on it. The Chinese could produce better goods at lower prices than the Europeans could produce or import themselves, but their foreignness and their numbers meant that the Spanish were always psychologically on the defensive.
正如曼恩所描述的那样，马尼拉的中国居民人数远远超过了该市欧洲飞地中的西班牙人。西班牙人对这个华人社区一直感到不安。他们不理解中国人，看不起中国人，但也相当依赖中国人。中国人能够以更低的价格生产出比欧洲人自己生产或进口的更好的商品，但他们的外来性和他们的数量意味着西班牙人在心理上总是处于守势。

It was like the Spanish were rare components in the ecosystem of Manila, who did not appreciate the value the far more common components, the Chinese, provided. There is no evidence for any Chinese plot to oust the Spaniards—which would have made zero economic sense—but perhaps the legacy of a century of conquering caused the Spanish to view all Chinese actions through the lens of potential aggression. Whatever the reason, the Spanish introduced restrictions that caused rebellion by the Chinese, which the Spanish took as reason to massacre the population.
这就像西班牙人是马尼拉生态系统中的稀有组成部分，他们并不欣赏更为普通的组成部分--中国人所提供的价值。没有证据表明中国人有任何赶走西班牙人的阴谋--这在经济上毫无意义--但也许一个世纪以来的征服遗产使西班牙人从潜在侵略的角度来看待中国人的所有行动。不管是什么原因，西班牙人推出的限制措施引起了中国人的反抗，西班牙人将此作为屠杀人口的理由。

However, the ecosystem of Manila was very resilient. The abundance of both Chinese goods and people that could keep filling a necessary role in this ecosystem was the source of resiliency. Despite the Spanish committing seven separate massacres of the Chinese population in Manila, the trade and the town always came back. New residents came; more goods were exchanged.
然而，马尼拉的生态系统是非常有弹性的。丰富的中国商品和人员可以不断地在这个生态系统中发挥必要的作用，这就是弹性的来源。尽管西班牙人对马尼拉的中国人口进行了七次单独的屠杀，但贸易和城镇总是回来了。新的居民来了；更多的货物被交换。

The value of the trade, to both the Spanish and Chinese, from the level of individuals to government, created a system that could bounce back after each significant event, and there was no shortage of the raw materials and humans that the community required. The economic infrastructure was valuable, attractive and efficient. It got goods moving, made a lot of people some money, and a few people wealthy.
对西班牙人和中国人来说，贸易的价值，从个人到政府，创造了一个在每次重大事件后都能反弹的系统，而且社区所需的原材料和人力都不缺乏。经济基础设施是有价值的、有吸引力的和高效的。它让货物流动起来，让很多人赚了一些钱，也让一些人富裕起来。

The trade also facilitated a projection of power for both the Chinese government (via the infrastructure developments they made with the silver) and the Spanish (via perceived control over lucrative overseas trade.) So, despite the periodic catastrophes of widespread murder, the system had evolved to have high resiliency.
贸易也促进了中国政府（通过他们用白银进行的基础设施建设）和西班牙人（通过对有利可图的海外贸易的控制）的权力投射。 所以，尽管有周期性的大范围谋杀的灾难，这个系统已经进化到具有高度的弹性。

> The diversity of species present seems to impart long-term survival to an ecosystem.
> 存在的物种多样性似乎给一个生态系统带来了长期的生存。
> ——雷夫•萨加林 Rafe Sagarin

A new approach to building the perfect football team 建立完美足球队的新方法

The lessons we can learn from ecosystems are ones that we can apply in our organizations. After all, any business is dependent on a web of interactions and influences that includes employees working in different areas, customers, competitors, regulation and governments, and trends and changes in the global environment.
我们可以从生态系统中吸取的教训是我们可以在我们的组织中应用的。毕竟，任何企业都依赖于一个互动和影响的网络，包括在不同领域工作的员工、客户、竞争对手、法规和政府，以及全球环境的趋势和变化。

So how can we integrate the value of considering the system in how we develop our businesses? We can look at an example from the world of American football. In 1979, Bill Walsh became the general manager and head coach of the worst team in the American National Football League. By 1989, he had developed a dynasty of championship winners. His accomplishment is credited to one meta-factor: he created a culture in the San Francisco 49ers' organization that recognized the exceptional value a well-functioning ecosystem can provide.

那么，我们如何将考虑系统的价值融入到我们的业务发展中呢？我们可以看一下美式足球世界中的一个例子。1979年，比尔-沃尔什成为美国国家橄榄球联盟中最差球队的总经理和主教练。到1989年，他已经发展了一个冠军王朝。他的成就归功于一个元因素：他在旧金山49人队的组织中创造了一种文化，认识到一个运作良好的生态系统可以提供的特殊价值。

As Michael Lombardi explains in Gridiron Genius, “In short, Walsh took over a team with no high draft picks, no quarterback, and no hope. Three years later, that team won the Super Bowl. It got there following Walsh’s formula, what he called his Standard of Performance: an exacting plan for constructing and maintaining the culture and organizational DNA behind the perfect football franchise.” Walsh recognized that a football organization’s culture is ultimately the system that will determine if a team can sustain the effort needed to win a championship.
正如迈克尔-隆巴尔迪在《格斗天才》中解释的那样，"简而言之，沃尔什接管了一支没有高额选秀权、没有四分卫、没有希望的球队。三年后，这支球队赢得了超级碗。它是按照沃尔什的公式实现的，他称之为绩效标准：一个构建和维护完美的橄榄球特许经营权背后的文化和组织DNA的严格计划。" 沃尔什认识到，一个橄榄球组织的文化最终将决定一支球队是否能够持续努力，赢得冠军的系统。

When Walsh took over the 49ers and began rebuilding the organization, he was “relying on one premise… that all the components of the 49ers’ structure had to be a single unitary construction, all pointed toward the same direction, all generating the same energy, interdependent in the goal of creating a great football team, from the janitors on up.”
当沃尔什接手49人队并开始重建该组织时，他 "依赖于一个前提.....49人队结构的所有组成部分必须是一个单一的单元结构，都指向同一个方向，都产生同样的能量，在创建一支伟大的足球队的目标中相互依赖，从看门人开始。"

In an ecosystem, all species have a role to play. On the African savannah, the elephants and lions may receive a lot of the attention from tourists, but their survival depends on the less glamorous beetles and baobabs making their contributions. Walsh believed that “everyone has a role, and every role is essential.” By making this philosophy a cornerstone of the 49ers’ culture, Walsh sought to demonstrate that winning football is the product of a well-functioning system; each individual knowing what was required of them and what their contribution was supposed to be was vital for success.
在一个生态系统中，所有物种都有自己的作用。在非洲大草原上，大象和狮子可能会受到游客的大量关注，但它们的生存取决于不太引人注目的甲虫和猴面包树做出的贡献。沃尔什认为，"每个人都有自己的角色，而且每个角色都是必不可少的"。通过使这一哲学成为49人队文化的基石，沃尔什试图证明，胜利的足球是一个运作良好的系统的产物；每个人都知道对他们的要求是什么，他们的贡献应该是什么，这对于成功至关重要。

It was the organization that was going to win. Not the coach. Not the individual players. “The critical factor whenever people work together,” according to Walsh, “is that they expect something of each other. It’s not just that the coach expects a lot of the players—it’s the fact that the players expect a lot of each other.” Species migrate. Players get traded. Walsh was determined to build a culture that could survive and positively respond to inevitable change.
要赢的是组织，而不是教练。而不是教练。而不是个别球员。"沃尔什说："只要人们在一起工作，关键因素是他们对彼此有期望。这不仅仅是教练对球员有很多期望，而是球员对彼此有很多期望。" 物种迁移。球员会被交易。沃尔什决心建立一种能够生存并积极应对不可避免的变化的文化。

In his book, Finding the Winning Edge, he wrote, “The structure of an organization must have the flexibility and adaptability to meet unexpected obstacles, crises, or developments.” The stronger and more resilient a system, the easier it can adapt and bounce back. This is why, for Walsh, a successful organization wasn’t about superstar players or running a particular offensive formation.
他在《寻找赢家》一书中写道："一个组织的结构必须具有灵活性和适应性，以应对意外的障碍、危机或发展"。一个系统越强大、越有弹性，它就越容易适应和反弹。这就是为什么，对沃尔什来说，一个成功的组织不是关于超级明星球员或运行一个特定的进攻阵型。

It was about building a culture that could be flexible in effectively responding to ever-changing environmental pressures. Walsh also understood that his cultural ecosystem wasn’t closed. What happened off the field in the personal lives of his team could have an impact on their ability to maintain the 49ers’ culture. He thus expanded the culture to include initiatives that could help prevent disturbances from which his ecosystem might not be able to recover. One of these was a “Life Skills Program” for the players that had “four major thrusts, all aimed at equipping otherwise unprepared players for adult life.”
它是关于建立一种文化，可以灵活地对不断变化的环境压力作出有效反应。沃尔什也明白，他的文化生态系统并不封闭。他的团队在场外的个人生活中发生的事情可能会对他们维持49人队文化的能力产生影响。因此，他扩大了文化的范围，将有助于防止他的生态系统可能无法恢复的干扰的举措纳入其中。其中之一是为球员制定的 "生活技能计划"，该计划有 "四个主要目标，都是为了让没有准备好的球员为成人生活做好准备"。

There was a continuing education program, a confidential personal and family counseling program, a confidential drug counseling program, and a financial advisory program. As David Harris observes in The Genius, “Most coaches just use a kind of one-size-fits-all approach, but Bill understood that different guys have different buttons. Fifty guys weren’t all motivated the same way.
有一个继续教育计划，一个保密的个人和家庭咨询计划，一个保密的药物咨询计划，以及一个

财务咨询计划。正如大卫-哈里斯在《天才》一书中所观察到的，"大多数教练只是使用一种一刀切的方法，但比尔明白，不同的人有不同的按钮。五十个人的动机并不都是一样的。

Bill put in the extra work to figure out each of their personalities and what drove each." In scouting for talent, Walsh said, "Don't just say he can't do this and can't do that. Find every player's possible contribution and identify the reason to take him rather than just the reasons not to." Maybe the way a player could contribute wasn't needed by the 49ers at that time, but Walsh seemed to recognize that it takes a wide array of skills and specialties to help a team reach optimum performance, and thus it was important to keep an open mind when looking for talent.
比尔付出了额外的努力，以弄清他们每个人的个性和驱动力。" 在侦察人才方面，沃尔什说："不要只说他不能做这个，不能做那个。找到每个球员可能做出的贡献，并找出接受他的理由，而不是只找出不接受的理由。" 也许当时49人队并不需要球员的贡献方式，但沃尔什似乎认识到，要帮助一支球队达到最佳表现，需要各种各样的技能和特长，因此，在寻找人才时，必须保持开放的心态。

One other fascinating property of ecosystems is that different organisms produce different systems, even if the environments are extremely similar. A desert in the Sudan does not have an identical 25 26 27 look and operations to a desert in Australia. This concept might explain why teams following the same system do not necessarily produce the same results.
生态系统的另一个迷人的特性是，不同的生物体产生不同的系统，即使环境极其相似。苏丹的沙漠与澳大利亚的沙漠没有相同的25 26 27外观和操作。这个概念也许可以解释为什么遵循相同系统的团队不一定会产生相同的结果。

As Michael Lombardi explains, "Many have tried to copycat Walsh's offense by hiring his former assistants and associates or anyone else who could lay claim to the West Coast lineage, believing that simply employing someone to run the scheme is enough to create the kind of success Walsh had with it." Most of them failed. Why? Essentially, ingredients matter.
正如迈克尔-隆巴尔迪所解释的，"许多人试图模仿沃尔什的进攻，雇用他以前的助手和同事或其他任何可以声称是西海岸的人，认为只要雇用某人来执行这个计划就足以创造沃尔什的那种成功。" 他们中的大多数人都失败了。为什么？从本质上讲，成分很重要。

Finally, with all complex systems, which ecosystems are, the results of the interactions are not always predictable. Accordingly, the culture of the organization did not always translate into an output of wins. The 49ers didn't win the Super Bowl all the time. The dynamics involved in winning a football championship are too complex to be able to identify and adjust for every factor.
最后，对于所有复杂的系统（生态系统就是这样），相互作用的结果并不总是可以预测的。因

此，该组织的文化并不总是转化为胜利的产出。49人队并不是一直都能赢得超级碗。赢得橄榄球冠军所涉及的动态因素过于复杂，无法识别和调整每一个因素。

Walsh's system though, did better than anyone else's. He won three Super Bowls in his 10 years with San Francisco, which is an exceptional achievement in that league.
不过，沃尔什的系统做得比其他人的都好。他在为旧金山队效力的10年中赢得了三座超级碗，这在该联盟中是一项特殊的成就。

The Reality of Living in a Web 生活在网络中的现实

Too much of any one external factor can effectively kill a system. If you think about the narrow range of temperatures that humans can exist in, compared to all the possible temperatures that exist in our solar system, you can appreciate that significant change in external factors like light, air quality, etc. can devastate the stability of an ecosystem. So too with any business.
任何一个外部因素太多，都可以有效地杀死一个系统。如果你想一想，与我们太阳系中所有可能存在的温度相比，人类可以存在的温度范围很窄，你就可以理解，光照、空气质量等外部因素的重大变化可以破坏一个生态系统的稳定性。任何企业也是如此。

External stability is important for overall success. Even if you can't control the external factors, you must pay attention to them. In order to have customers you need a large pool of people with enough money to buy your product. In order to run an office, you need a stable economic environment and tax system. In order to have employees, you need a strong education system that teaches the skills you require, and an urban structure that allows people to live a satisfying life on the income you provide.
外部稳定性对整体成功很重要。即使你不能控制外部因素，你也必须关注它们。为了拥有客户，你需要一大批有足够资金购买你产品的人。为了运行一个办公室，你需要一个稳定的经济环境和税收制度。为了拥有员工，你需要一个强大的教育系统，教授你所需要的技能，以及一个城市结构，使人们能够依靠你提供的收入过上满意的生活。

If we love our system, we must also do what we can to influence the external factors that are required to keep our system going. Conclusion Nothing exists in isolation. Everything is connected. The ecosystem lens reveals that the actions of any one species have consequences for many others in the same environment.
如果我们热爱我们的系统，我们也必须尽我们所能去影响那些维持我们系统运转所需的外部因素。结论 没有任何东西是孤立存在的。一切都是相互联系的。生态系统透镜显示，任何一个物种的行为都会对同一环境中

的许多其他物种产生影响。

Many systems can take care of themselves, possessing abilities to correct and compensate for changes and external pressures. We need to take the time to learn how the components of our system are interconnected so we can understand how our actions will impact the connections and affect the outcome we are trying to produce.
许多系统可以照顾自己，拥有纠正和补偿变化和外部压力的能力。我们需要花时间了解我们系统的各个组成部分是如何相互联系的，这样我们就能理解我们的行动将如何影响这些联系并影响我们试图产生的结果。

Niche 利基

> Generalists can survive and flourish in just about any setting. But specialists tend to be much less comfortable with habitat change.
> 通才可以在几乎任何环境中生存和发展。但专家往往对栖息地的变化不太适应。
> ——彼得-昂格尔 Peter Ungar

In the biological world, some species are categorized as generalists, who cover a large territory and face more competition but are flexible in meeting their needs. Others are specialists who occupy a smaller territory and face less competition but are more rigid in their requirements.
在生物界，一些物种被归类为通才，它们覆盖着大片领土，面临更多的竞争，但在满足其需求方面却很灵活。另一些是专家，他们占据较小的领地，面临较少的竞争，但对自己的要求更加严格。

Both are vulnerable in their own ways. It is not always better to be one or the other but knowing which you are can help you strategize your continued survival. The ecological niche of a species refers to the role it plays in the ecosystem in which it is found. Every species in an ecosystem has a niche. A species' niche includes everything that affects its ability to reproduce and survive.
两者都有各自的弱点。成为其中一种并不总是更好，但知道你是哪一种可以帮助你制定继续生存的战略。一个物种的生态位是指它在它所处的生态系统中所扮演的角色。一个生态系统中的每个物种都有一个生态位。一个物种的生态位包括影响其繁殖和生存能力的一切。

For example, the amount of water and sunlight it needs, the temperatures it can tolerate, and how much space it requires to live are all part of its niche and are called abiotic

factors, meaning the non-living aspects of an ecosystem. Generalist organisms have a broad niche. Those with a broad niche can survive in a variety of places as they are usually capable of eating different foods and are able to tolerate different environmental conditions.
例如，它所需要的水和阳光的数量，它能容忍的温度，以及它需要多少生活空间，都是其生态位的一部分，被称为非生物因素，意味着生态系统的非生物方面。通才生物有一个广泛的生态位。那些具有广泛利基的生物可以在各种地方生存，因为它们通常能够吃不同的食物，能够容忍不同的环境条件。

This usually means that they can protect themselves from different predators, tolerate hot and cold or and wet and dry conditions, and eat a wide variety of meats and plants and other foods. For this reason, generalists are not greatly affected by rapidly changing environmental conditions and so they can maintain large populations. Such organisms include cockroaches, rats, raccoons, and humans.
这通常意味着它们可以保护自己不受不同捕食者的伤害，可以忍受冷热或和干湿条件，可以吃各种肉类和植物及其他食物。由于这个原因，通吃者不会受到快速变化的环境条件的很大影响，因此它们可以维持大量的种群。这样的生物体包括蟑螂、老鼠、浣熊和人类。

Specialist organisms, on the other hand, have a very distinct set of roles in the ecosystem. For example, some specialists can only survive in specific locations or eat particular foods. They are more prone to extinction. Specialists, therefore, have a harder time maintaining large population sizes because it is common for land conditions to change and for resources such as foods to diminish over time.
另一方面，专家型生物体在生态系统中有一套非常独特的作用。例如，一些专家只能在特定的地点生存或吃特定的食物。它们更容易被灭绝。因此，专家们更难维持庞大的种群规模，因为土地条件的变化和食物等资源随着时间的推移而减少是很常见的。

However, in places like tropical rain forests with stable environmental conditions, it is advantageous to be a specialist because they tend to have fewer competitors, whereas most of the generalists must compete against each other. Another reason why specialists do well under stable environmental conditions is that they possess mechanisms that allow them to not only survive but thrive in those particular locations.
然而，在热带雨林这样环境条件稳定的地方，成为专家是有利的，因为他们往往有较少的竞争对手，而大多数通才必须相互竞争。专家在稳定的环境条件下表现良好的另一个原因是，他们拥有一些机制，使他们不仅能够在这些特定的地方生存，而且能够茁壮成长。

For example, some animals can eat foods that are toxic to other animals, and tiger salamanders have developed the unique ability to seek out and breed only in ponds without fish so their larvae will not be eaten. This means that they will thrive in

environments full of their particular requirements but do poorly when they are placed in environments are lacking these.
例如，有些动物可以吃对其他动物有毒的食物，而虎纹蜾蠃已经发展出独特的能力，只在没有鱼的池塘中寻找和繁殖，这样它们的幼虫就不会被吃掉。这意味着它们会在充满其特殊要求的环境中茁壮成长，但当它们被置于缺乏这些要求的环境中时，则表现不佳。

Think of koalas and their particular diet of eucalyptus, or the giant panda struggling to avoid extinction in part because its specialized diet consisting mostly of bamboo makes it unable to adapt to changing environmental conditions. Social animals allow for divisions of labor within their groups, such as having defense specialists. For humans, the species may be a generalist, but as individuals we strongly specialize.
想想考拉和它们特殊的桉树食物，或者大熊猫正在努力避免灭绝，部分原因是它的特殊食物主要由竹子组成，使它无法适应不断变化的环境条件。社会性动物允许在其群体内进行分工，例如有防御专家。对于人类来说，物种可能是一个通才，但作为个体，我们有强烈的专业性。

> The generalist method is adequate if stakes are low, but increasing specialization is often mandated when the stakes—the standards of performance in competition—are high.
> 如果利害关系不大，通才的方法是足够的，但当利害关系--竞争中的表现标准--很高时，越来越多的专业化常常被强制要求。
> ———纪晓岚 Geerat Vermeij

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Competitive Exclusion Principle 竞争性排除原则

The competitive exclusion principle, also known as Gause's Law, states that perfect competition between two species requiring the same resources to survive in the same niche is impossible. Georgii Frantsevich Gause first identified the principle in 1934 when he found that two species of bacteria requiring the same resources could not coexist in a petri dish.
竞争性排斥原则，也被称为戈斯法则，指出两个需要相同资源才能在同一生态位生存的物种之间的完全竞争是不可能的。格奥尔基–弗兰切维奇–戈斯于1934年首次发现这一原则，当时他发现两个需要相同资源的细菌物种不能在培养皿中共存。

One species will find its own niche by becoming increasingly specialized to require different resources from the other. This is known as resource partitioning. If it doesn't, the second species' slight advantages will become significant enough to wipe out the first. For instance, if there are two carnivores in the same area that hunt the same prey animals, one species will
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always have some meaningful advantage, like greater speed or camouflage.
一个物种将通过变得越来越专门化，从另一个物种那里需要不同的资源来找到自己的生态位。这就是所谓的资源分割。如果它不这样做，第二个物种的轻微优势将变得足够大，从而消灭第一个物种。例如，如果在同一地区有两种食肉动物捕食相同的猎物，其中一个物种将总是有一些有意义的优势，如更大的速度或伪装。

This will enable it to outpace its competitor, which will have to find another food source or face extinction. The competitive exclusion principle explains why we see such a diverse range of organisms within ecosystems. Even though they inhabit in the same area, each occupies its own niche and has traits that distinguish it from its neighbors.
这将使它能够超越它的竞争对手，而后者将不得不寻找另一个食物来源，否则将面临灭绝。竞争性排斥原则解释了为什么我们在生态系统内看到如此多样的生物。尽管它们居住在同一地区，但每一种都占据着自己的利基，并具有区别于其邻居的特征。

Natural selection only allows the fittest organisms to survive. Fitness refers not only to how well suited a population of organisms is to its environment, but also how well adapted it is in comparison to its competitors. For instance, red squirrels were once the UK’s sole squirrel species. They thrived in coniferous forests and deciduous woods for around 10,000 years. In the 1870s, gray squirrels were introduced to the UK. Since gray and red squirrels inhabit the same biological niche, living in the same areas and eating the same foods, they couldn’t coexist.
自然选择只允许最合适的生物体生存。适者生存不仅指一个生物种群对其环境的适应程度，而且还指与竞争对手相比，它的适应程度。例如，红松鼠曾经是英国唯一的松鼠物种。它们在针叶林和落叶林中繁衍了大约1万年。在19世纪70年代，灰松鼠被引入英国。由于灰松鼠和红松鼠居住在相同的生物位，生活在相同的地区，吃相同的食物，它们无法共存。

Red squirrels have now been eliminated from many areas of the UK. They mainly survive in areas where the two species are kept apart, such as on islands. Population figures are estimated at around 140,000 red squirrels and 2.5 million gray squirrels. The larger numbers of gray squirrels mean they consume the available supply of acorns first and take over suitable shelter. They also carry a virus that can be deadly to red squirrels. Gray squirrels have stronger digestive systems, so they can derive more energy from their food. Despite extensive conservation efforts, it is possible red squirrels may be extinct within years.
现在红松鼠已经从英国的许多地区被消灭了。它们主要生存在两个物种被隔离的地区，如岛屿上。人口数字估计约为14万只红松鼠和250万只灰松鼠。灰松鼠的数量较多，意味着它们首先消耗可用的橡子供应，并占据合适的住所。它们还携带一种病毒，对红松鼠来说可能是致命的。灰松鼠有更强的消化系统，因此它们可

以从食物中获取更多的能量。尽管进行了广泛的保护工作，红松鼠有可能在几年内灭绝。

> Species that can't handle an environmental makeover have three options: move, die, or change.
> 不能处理环境改造的物种有三个选择：移动、死亡或改变。
> ——彼得-昂格尔 Peter Ungar

Surviving and thriving 生存和繁荣

Invention is an area where this model fits well. If the invention is useful for everyone, like the light bulb or telephone, it's essentially a generalist forging into new territory. Specialists from your previous environment can't follow quickly because they don't have the capacity to adapt easily to the new environment. But once that new environment is open for competition, the other generalists will be right on your heels. You need to lock down as large a territory as you can defend before the other generalists arrive.
发明是这个模式很适合的一个领域。如果发明对每个人都有用，如灯泡或电话，它基本上是一个通才进入新领域。来自你以前环境的专家不能迅速跟进，因为他们没有能力轻易适应新环境。但一旦这个新环境开放竞争，其他通才就会紧跟你的脚步。你需要在其他通才到来之前，锁定一个你能防守的尽可能大的领地。

This territory must have everything you need to reproduce and survive. If it does, it becomes your base, the place from which you can continue to grow and take on the other generalists. Specialized invention, in contrast, focuses on catering to a smaller niche. The advantages of this are that once you own the niche, you are incredibly hard to dislodge. Your invention fills the niche so completely, there is very little incentive for anyone to invest in developing a competing product. Your growth is capped, but as long as the environment remains stable, as long as there is a continued need for your invention, you have significantly less competition to deal with than the generalists. An example of specialization is Zildjian cymbals.
这个领地必须拥有你繁殖和生存所需的一切。如果它有，它就会成为你的基地，你可以在那里继续发展并对付其他通才的地方。相比之下，专业化的发明则侧重于满足一个较小的利基。这样做的好处是，一旦你拥有了这个利基市场，你就很难被赶走。你的发明完全填补了这一利基市场，任何人都没有什么动力去投资开发竞争产品。你的增长是有上限的，但只要环境保持稳定，只要对你的发明有持续的需求，你要处理的竞争就比一般人少得多。专业化的一个例子是Zildjian镲片。

The company has been around since 1623 and has become so synonymous with great music and the artistry of drumming that they have no real competition among professional

drummers. The group of professionals is small enough that there is no incentive to try to compete with Zildjian cymbals. If you want to sell cymbals, better off going after larger groups, say, to people who teach music, or even people who listen to music and want to bang around on a drum kit at weekends. A generalist faces more competition every day. Surviving and reproducing are a constant struggle.
该公司自1623年以来一直存在，并已成为伟大的音乐和打鼓艺术的代名词，他们在专业鼓手中没有真正的竞争。专业人士的群体很小，没有动力去尝试与Zildjian镲片竞争。如果你想出售镲片，最好去追求更大的群体，比如说，教音乐的人，甚至是听音乐的人，周末想在鼓上敲敲打打。一个通才每天都面临着更多的竞争。生存和繁衍是一场持续的斗争。

So, for them it would seem that stress is part of existence. To be means to compete—for territory, for food, for a mate. This is reflected in how we talk about the large, generalist companies: the constant fight for market share to stay ahead of the changing market conditions by offering new and better products and merging with or taking over other companies to grow even bigger.
因此，对他们来说，压力似乎是生存的一部分。存在意味着竞争--为了领土，为了食物，为了配偶。这反映在我们谈论大型综合公司的方式上：不断争夺市场份额，通过提供新的和更好的产品，与其他公司合并或兼并，以保持在不断变化的市场条件下的领先地位。

Specialists, on the other hand, have less of a daily struggle. No one else wants their territory, like the fishless ponds where tiger salamanders breed, or their food, like the panda's staple of crunchy, nonnutritious bamboo. Their day-to-day stress is lower. But as soon as the environment starts to change, the stress explodes. Being unable to adapt means death. At the species level, it means extinction. When no one needs what you are selling anymore, like encyclopedias to put on your bookshelf, there is nowhere else to go.
另一方面，专家们的日常斗争较少。没有人想要他们的领地，比如虎皮蝾螈繁殖的无鱼池塘，或者他们的食物，比如熊猫的主食--松脆的、没有营养的竹子。他们的日常压力较小。但是一旦环境开始变化，压力就会爆发。无法适应意味着死亡。在物种层面上，这意味着灭绝。当没有人再需要你所销售的东西时，就像放在书架上的百科全书，就没有别的地方可去了。

Your niche disappears. Most people don't realize that the fax machine, something that sends images over wires, was invented in the 1840s. We tend to think of it as this failed technology that started with a short-lived boom in the early 1980s. But no, as soon as we could send information over wires, we experimented to discover what the full scope of that information could be. Images were an early example of what could be sent. The fax survived for over 150 years in part because it lurched from niche to niche, staking out the few small but often powerful areas where the ability to transmit images was game changing. How did it do this? To start, fax users didn't exist.
你的利基消失了。大多数人没有意识到，传真机这种通过电线发送图像的东西，是在19世纪

40年代发明的。我们往往认为它是这种失败的技术，在20世纪80年代初以短暂的繁荣开始的。但事实并非如此，当我们能够通过电线发送信息时，我们就开始实验，以发现信息的全部范围。图像是可以发送的一个早期例子。传真之所以能存活超过150年，部分原因是它从一个利基市场发展到另一个利基市场，在少数几个小而强大的领域中占据一席之地，在这些领域中传输图像的能力改变了游戏规则。它是如何做到这一点的？首先，传真用户并不存在。

If you never had the ability to send images, if you didn't even know it was possible, then it isn't something you were likely pining away for. Therefore, developers of fax technology identified and sought out small groups of potential users to create a market. Appeal to small, unrelated groups, was one of the main challenges for the technology for almost a hundred years.
如果你从来没有发送图像的能力，如果你甚至不知道它是可能的，那么它就不是你可能渴望的东西。因此，传真技术的开发者确定并寻找小型的潜在用户群体，以创造一个市场。对不相关的小群体的吸引力，是该技术近百年来的主要挑战之一。

It was never very obvious who the technology would be extremely useful for. As Jonathan Coopersmith explains in Faxed, "Despite numerous efforts by inventors and some state support, pushes to develop facsimile technology never created corresponding significant pulls by market demand." In addition, the fax niche was a protected environment. "For facsimile, that protected niche was both institutional and technological.… These protected environments allowed a fragile and expensive technology to survive."
该技术对谁非常有用从来都不是很明显。正如乔纳森-库珀史密斯在《传真》一书中所解释的，"尽管发明家们做出了许多努力，也得到了一些国家的支持，但推动传真技术的发展从来没有通过市场需求创造出相应的重大拉动作用"。此外，传真领域是一个受保护的环境。"对于传真来说，这种受保护的环境既是制度上的，也是技术上的....。这些受保护的环境使一种脆弱而昂贵的技术得以生存。"

Fax developers deliberately sought out markets with less competition "where faxing received greater resources (including users willing to pay the high costs) and support, giving it an opportunity to mature and develop." Faxing needed a specialist niche because it couldn't compete with the early generalist of the telegraph. The telegraph "had enormous advantages of easier use, much lower cost, less interference in transmission, and an already-developed infrastructure as well as users who had [by now] incorporated the standard telegram into their business routines." Fax's first niche was with the newspapers—a niche that it helped solidify by creating an expectation that only faxed photographs could fill. "Judged strictly by numbers, facsimile was a minor technology. Less than a thousand transmitters and receivers existed in 1940.
传真开发者有意寻找竞争较少的市场，"在那里，传真得到了更多的资源（包括愿意支付高额费用的用户）和支持，使它有机会成熟和发展。" 传真需要一个专门的利基市场，因为它无法

与早期的通用电报竞争。电报 "有巨大的优势，使用更方便，成本更低，传输中的干扰更少，而且有一个已经发展起来的基础设施，以及[到现在]已经将标准电报纳入他们的商业惯例的用户。" 传真的第一个利基是在报纸上--它通过创造一个只有传真的照片才能满足的期望，帮助巩固了这个利基。"严格按照数字来判断，传真是一项小技术。1940年，只有不到一千台发射器和接收器。

Their impact was greatly out of proportion to their numbers, however, because they enabled newspapers to print the latest photographs with the latest stories, visually transforming the news and strengthening the role of photographs in newspapers." Once the public had photographs with their news, there was no going back. It might have been a small niche, but it was one that, at the time, only faxing could fill. Faxes stayed around and progressed because there were some niches that they fit perfectly.
然而，它们的影响与它们的数量不成比例，因为它们使报纸能够将最新的照片与最新的故事一起印刷出来，从视觉上改变了新闻，加强了照片在报纸中的作用。" 一旦公众将照片与他们的新闻结合起来，就没有回头路了。这可能是一个小的利基，但在当时，只有传真可以填补这个空缺。传真一直存在并不断发展，因为有一些利基市场它们完全适合。

The military was another early consumer, and its requirements were filtered back into the development of the technology. Anyone who needed images was interested in fax, as well as anyone who needed messages with as little room for error as possible. Both of these were requirements for the military. From weather diagrams to direct orders, by directly copying images, faxing ensured that as long as the technology and necessary infrastructure worked well, nothing was lost in translation.
军队是另一个早期消费者，它的要求又被过滤到技术的发展中。任何需要图像的人都对传真感兴趣，以及任何需要尽可能减少错误空间的信息的人。这两点都是军队的要求。从天气图到直接命令，通过直接复制图像，传真确保了只要技术和必要的基础设施运作良好，就不会在翻译中丢失任何东西。

There was a downside to focusing on niche markets. It allowed the technology to develop with complete incompatibility across the different manufacturers as they competed for the same small pool of clients. "In reality, deliberate incompatibility fragmented the market and scared away potential users fearful of choosing the wrong system." In the world of business, fax was originally adopted as an intraoffice tool, and machines compatible with those of another organization were not needed.
专注于利基市场有一个弊端。它允许技术的发展在不同的制造商之间完全不兼容，因为他们竞争的是同一个小客户群。"实际上，故意的不兼容使市场变得支离破碎，吓跑了害怕选错系统的潜在用户。" 在商业世界中，传真最初是作为办公室内部的工具，不需要与另一个组织的机器兼容。

This lack of compatibility and standards had to be addressed before fax could 7 8 become the generalist of the 1980s and '90s. “Starting in the early 1980s, the combination of increasing deregulation, true compatibility, quickly dropping costs, and rapid technological change created a blossoming of new machines, applications, and services.” Fax was finally able to survive out of the niche. In terms of information over wires, telegraphy, then telephony, became the generalists in the environment. Faxing could not compete with their lower cost and ease of use. It was through identifying and marketing to niches that fax managed to survive until the conditions changed, and the technological advancement and social interest allowed it to flourish as a generalist for a time.
在传真成为20世纪80年代和90年代的通用工具之前，这种缺乏兼容性和标准的问题必须得到解决。"从20世纪80年代初开始，日益放松的管制、真正的兼容性、迅速下降的成本和快速的技术变革相结合，造就了新机器、应用和服务的蓬勃发展。传真终于能够从利基市场中生存下来。就电线上的信息而言，电报，然后是电话，成为环境中的通才。传真无法与它们的低成本和易用性竞争。正是通过对利基市场的识别和营销，传真得以生存，直到条件发生变化，技术进步和社会兴趣使其作为通才而繁荣了一段时间。

> Natural selection has a limited repertoire of potential forms from which to choose, and convergent evolution is the result.
> 自然选择可供选择的潜在形式是有限的，而趋同进化就是结果。
> ———George R. McGhee

Convergence 融合

In biology, convergence refers to the process wherein organisms evolve analogous traits that were not present in their last common ancestor. In other words, species that are not closely related to each other will find the same solutions to the same problems in their quest to survive. This occurs when different unrelated species occupy niches with the same qualities and constraints, for instance, if two species both live in areas at a high altitude with little water, or in densely wooded, humid areas—but on different continents.
在生物学中，趋同指的是生物体进化出其最后的共同祖先所不具备的类似特征的过程。换句话说，相互之间没有密切关系的物种在寻求生存的过程中会找到相同问题的解决方案。当不同的不相关的物种占据具有相同品质和约束的壁龛时，就会出现这种情况。例如，如果两个物种都生活在海拔高、水少的地区，或者生活在树木茂密、潮湿的地区，但却生活在不同的大陆上。

We call traits that emerge through convergence “analogous structures” or “homoplasies” (convergence is also known as homoplasy). Homoplasies can include body shapes, the presence of organs, behaviors, markings, types of intelligence, social structures, vocalizations, breeding habits and so on. While they are unlikely to be entirely identical, they have the same form or purpose. Convergence is fascinating because it shows us that

biology does involve a degree of predetermination. Evolution is not an entirely random process.
我们把通过趋同出现的性状称为 "类似结构 "或 "同质性"（趋同也被称为同质性）。同型结构可以包括身体形状、器官的存在、行为、标记、智力类型、社会结构、发声、繁殖习惯等等。虽然它们不太可能完全相同，但它们有相同的形式或目的。趋同是迷人的，因为它向我们表明，生物学确实涉及一定程度的预先决定。进化不是一个完全随机的过程。

Certain features and behaviors recur again and again for the simple reason that they are the best way of surviving within an environment with certain characteristics. Take the example of flight; an ability that has evolved in birds, bats, some types of dinosaurs, and insects. Each species is unrelated, and each evolved wings as a means of getting around, tens of millions of years apart. The wings of both birds and bats started off as regular limbs for land-based locomotion and still contain traces of finger bones.
某些特征和行为一再出现，原因很简单，它们是在具有某些特征的环境中生存的最佳方式。以飞行为例；这种能力已经在鸟类、蝙蝠、某些类型的恐龙和昆虫中进化出来。每个物种都是没有关系的，每个物种都进化出了翅膀作为一种出行的手段，相隔数千万年。鸟类和蝙蝠的翅膀一开始都是用于陆上运动的普通肢体，并且仍然含有指骨的痕迹。

Take a look at the bones in a bat's 11 wing, and you'll see something with a structure not unrecognizably unlike your own hands, elongated into the spidery structure of a wing. There are obvious differences. A bat's wing consists of thin skin stretched over bones, whereas birds' wings are covered in feathers. The reason why bats and birds converged is simple. Both lineages evolved in niches where flight became essential for their survival.
看看蝙蝠的11个翅膀中的骨头，你会看到一些结构与你自己的手并无二致的东西，被拉长成翅膀的螺旋状结构。这其中有明显的区别。蝙蝠的翅膀由伸展在骨头上的薄皮组成，而鸟类的翅膀则由羽毛覆盖。蝙蝠和鸟类融合的原因很简单。这两个品系都是在飞行成为其生存所必需的利基环境中进化而来的。

The number of potential ways to fulfill a function is finite. A more widespread example is the evolution of eyes. It might seem natural to us that most animals, except ones living underground or at the depths of the sea, have eyes. But the fact that so many unrelated lineages evolved organs that look the same and function in the same way is extraordinary.
实现一种功能的潜在方式的数量是有限的。一个更广泛的例子是眼睛的进化。在我们看来，除了生活在地下或海洋深处的动物外，大多数动物都有眼睛，这可能是很自然的。但是，这么多不相关的血统进化出外观相同、功能相同的器官的事实是非同寻常的。

The eye of a squid has much the same structure as that of a spider. Human and octopus eyes are similar, despite the closest common ancestor having lived 550 million years ago and only possessing a basic eyespot. Echolocation, another way of "seeing," evolved in

unconnected lineages: cetaceans, bats, shrews, tenrecs, some birds, and possibly hedgehogs. Clearly these are the best possible traits for certain types of biological niches. Due to convergence, we can tell by looking at a niche what kind of organisms would occupy it even without seeing them.
乌贼的眼睛与蜘蛛的眼睛结构基本相同。人类和章鱼的眼睛很相似，尽管最接近的共同祖先生活在5.5亿年前，而且只拥有一个基本的眼窝。回声定位，另一种 "看 "的方式，在不相干的品系中进化出来：鲸类、蝙蝠、鼩鼱、腾蛇、一些鸟类，可能还有刺猬。显然，这些是某些类型的生物龛的最佳可能特征。由于趋同，我们可以通过观察一个壁龛来判断什么样的生物会占据它，即使没有看到它们。

For instance, if scientists discover a new nectar-producing plant, they can also predict the existence of an insect specially evolved to feed from it, even if said insect hasn't been discovered yet. If there's a keyhole, there's also a key somewhere that fits it. In popular culture, organisms from other planets are generally depicted as wildly different to anything on earth. But convergent evolution suggests that might not be the case and that other life forms could have evolved to be recognizably similar to ones on earth.
例如，如果科学家发现了一种新的产蜜植物，他们也可以预测存在一种专门进化成以它为食的昆虫，即使上述昆虫还没有被发现。如果有一个钥匙孔，在某个地方也有一把适合它的钥匙。在流行文化中，来自其他星球的生物体通常被描述为与地球上的任何东西都有很大的不同。但是趋同进化论表明，情况可能并非如此，其他生命形式可能已经进化到与地球上的生命形式有可识别的相似性。

As humans, we are in part the product of the pressures of our environment. Each of us occupies various niches throughout our lives, which we must adapt ourselves to fit. By and large, the same pressures acting on people and the same incentives seem to produce the same outcomes. If you took a baby from an Amazonian tribe and switched it with a baby from a wealthy family in Canada, would it grow up any different from other Canadian babies? Probably not. While some traits may be inbuilt, it would have to adapt to its ecosystem.
作为人类，我们在一定程度上是我们环境压力的产物。我们每个人在一生中都占据着各种壁龛，我们必须使自己适应这些壁龛。总的来说，作用在人们身上的相同压力和相同的激励措施似乎会产生相同的结果。如果你把一个来自亚马逊部落的婴儿和一个来自加拿大富裕家庭的婴儿调换一下，他长大后会和其他加拿大婴儿有什么不同吗？可能不会。虽然有些特征可能是与生俱来的，但它必须适应其生态系统。

Convergence explains why people in disconnected cultures throughout history have made similar tools, told similar stories, organized themselves in similar social structures, cooked similar food, and generally found analogous solutions to the problems they faced. John Thomas Osmond Kirk, writing in Science & Certainty, compares biological traits to

mathematical concepts in the way that they seem to exist beyond our definition of them, reappearing again and again everywhere we turn, as if they are laws of the universe. It's important to understand that it is the environment that makes the organism. When we look at the behavior of others, it's easy to imagine we would never do the same if we find them abhorrent.
趋同解释了为什么历史上互不相干的文化中的人们会制造类似的工具，讲述类似的故事，在类似的社会结构中组织起来，烹饪类似的食物，并普遍找到类似的解决方案来解决他们面临的问题。约翰-托马斯-奥斯曼-柯克（John Thomas Osmond Kirk）在《科学与确定性》（Science & Certainty）一书中写道，将生物特征比作数学概念，因为它们似乎存在于我们对它们的定义之外，在我们所到之处反复出现，仿佛它们是宇宙的规律。重要的是要明白，是环境造就了有机体。当我们看别人的行为时，很容易想象，如果我们觉得他们可恶，我们就不会做同样的事。

For instance, a corrupt politician stealing aid money or a neighbor turning on a neighbor during a genocide. But it's possible that if we were in the same niche, we would act in much the same way. It's a lot easier to be empathetic if we look at the environment that shaped someone instead of merely considering the end result. 15 To a certain extent, we are all more predictable than we would like to admit. We misunderstand that equivalent problems tend to have equivalent solutions, as convergence shows us. Our own problems may feel unique, which leads us to ignore the solutions that worked for others in equivalent situations. Yet just as bats and birds found analogous ways to solve the problem of flight, often what works for others would work for us too.
例如，一个腐败的政治家偷窃援助资金，或者在种族灭绝期间，一个邻居背叛了一个邻居。但是，如果我们处于相同的利基市场，我们有可能会以同样的方式行事。如果我们看一下塑造某人的环境，而不是仅仅考虑最终的结果，就更容易产生同情心。15 在某种程度上，我们都比我们愿意承认的更容易预测。我们误以为同等的问题往往有同等的解决方案，正如收敛性向我们展示的那样。我们自己的问题可能感觉很独特，这导致我们忽略了在同等情况下对其他人有效的解决方案。然而，正如蝙蝠和鸟类找到了解决飞行问题的类似方法一样，往往对别人有效的方法对我们也有效。

Defining a generalist 界定通才

Generalists face more daily competition, but they are more adaptable. They maintain a large population that occupies a broad niche. In the world of consumer products, Coca-Cola used advertising to become one of the world's most successful generalists. Coke's spread and ability to compete in most geographical and socioeconomic markets was all down to its advertising campaigns.
通才者每天面临更多的竞争，但他们的适应能力更强。他们保持着大量的人口，占据着广泛的利基。在消费产品的世界里，可口可乐公司利用广告成为世界上最成功的通才之一。可口可乐

的传播和在大多数地理和社会经济市场的竞争能力都归功于它的广告宣传。

Originally a medicinal tonic, Coke's first advertising efforts were a turn away from these roots to market its product as a beverage for "relaxation and enjoyment." As the 19th century turned into the 20th, Coke created an image associated with refinement and the upper class. Instead of isolating its product as being out of reach, it was one of the first examples of selling first an idea before a product.
可口可乐最初是一种药用补品，它的第一次广告努力偏离了这些根源，将其产品作为一种 "放松和享受 "的饮料进行营销。随着19世纪进入20世纪，可乐创造了一个与精致和上流社会相关的形象。它没有把自己的产品孤立起来，认为它遥不可及，而是成为在销售产品之前首先销售理念的首批例子之一。

Anyone could join that upper echelon by buying the right brand, in this case a five-cent Coke. Using pretty women, celebrity endorsements, and vast sums of money—$750,000 in 1909 alone, which is over $18 million in today's dollars—Coke convinced consumers that they weren't just buying a drink. They were buying a lifestyle. "By the 1920s Coke had established itself as the national brand of soft drink." Their advertising created an image in which everyone could participate. To drink Coke was to live a better life.
任何人都可以通过购买合适的品牌加入上层社会，在这种情况下，就是5美分的可乐。可乐利用美女、名人代言和巨额资金--仅在1909年就有75万美元，以今天的美元计算，超过1800万美元--说服消费者，他们不仅仅是在购买一种饮料。他们购买的是一种生活方式。"到20世纪20年代，可口可乐已经确立了自己作为软饮料国家品牌的地位"。他们的广告创造了一个人人都能参与的形象。喝可乐是为了过上更好的生活。

In The Coke Machine, Michael Blanding chronicles that "as it became more and more a part of the landscape, lifestyle started imitating advertising: Films began incorporating the drink into scenes, music started spontaneously referring to it in lyrics." Thus, Coke became a ubiquitous part of life. It was just there. Everywhere. From these roots, Coke attained success as a generalist.
在《可乐机器》中，迈克尔-布兰丁记录了 "随着它越来越成为景观的一部分，生活方式开始模仿广告。电影开始将这种饮料纳入场景，音乐开始自发地在歌词中提到它"。因此，可口可乐成为生活中无处不在的一部分。它就在那里。无处不在。从这些根基出发，可口可乐作为一个通才获得了成功。

It survived in different environments because it appealed to a diversity of consumers. There were no class or ethnic barriers to Coke. The lifestyle associated with a Coke was available to everyone. Whereas other brands had previously tended to market by class or gender or location or other identifiers, Coke just sold itself to people. That was arguably the company's greatest innovation.

它在不同的环境中生存下来，因为它吸引了不同的消费者。可乐没有阶级或种族障碍。每个人都能享受到与可乐相关的生活方式。其他品牌以前倾向于按阶级、性别、地点或其他识别因素进行营销，而可乐只是向人们推销自己。这可以说是该公司最大的创新。

The 1920s saw the company come up with the first of many memorable slogans. By far the most popular at the time was “the pause that refreshes.” This slogan positioned Coke as “a momentary time-out.” Again, this is a generalist approach, because a break from the frantic pace of each day is something everyone wants and needs. Who doesn’t want a pause that refreshes? Coke slogans became particularly captivating during the Depression, a period in which Coke sales did well. Drinking the beverage became a momentary escape.
20世纪20年代，该公司提出了许多令人难忘的口号中的第一个。到目前为止，当时最流行的是 "让人焕然一新的暂停"。这个口号将可乐定位为 "瞬间的暂停"。同样，这是一种通用的方法，因为从每天疯狂的节奏中休息一下是每个人都想要和需要的东西。谁不希望有一个能让人精神振奋的暂停呢？可口可乐的标语在大萧条时期变得特别吸引人，在这一时期，可乐的销售情况很好。喝饮料成为一种瞬间的逃避。

“A better life was only the pop of a bottle cap away.” World War II made Coke international as bottling facilities started all over the world so that American troops could have easy access to the drink that reminded them of home. When times change, generalists can adapt more easily, and this was what happened with Coke during the war.
"更好的生活只在一个瓶盖的爆裂声中"。第二次世界大战使可乐成为国际产品，因为世界各地都开始了装瓶设施，这样美国军队就可以很容易地获得这种使他们想起家乡的饮料。当时代发生变化时，通才更容易适应，这就是可乐在战争期间的情况。

They used the sentiments of soldiers and Coke’s new international presence to inform new advertising campaigns that associated Coke with US prosperity. Directed at soldiers, the campaigns reminded them what they were fighting for, and in the war-torn international markets it offered foreigners a piece of American luxury. When Coke had to position itself against Pepsi, its most significant competitor, “Coke marketed itself as the product for everyone—workmen and businessmen, soldiers and socialites— [while] Pepsi focused solely on young middle-class families.” Pepsi tried to carve itself a small niche in Coke’s vast territory. Over time, everyone from Santa Claus to polar bears has been seen drinking Coke. In 1963 Coke had the number one ad budget in the United States, spending 53 million dollars a year on ads and targeted consumer research.
他们利用士兵的情绪和可口可乐新的国际存在，为新的广告活动提供信息，将可口可乐与美国的繁荣联系起来。这些活动针对士兵，提醒他们为什么而战，而在饱受战争蹂躏的国际市场上，它为外国人提供了美国的奢侈品。当可口可乐不得不与它最重要的竞争对手百事可乐竞争时，"可口可乐将自己推销为每个人--工人和商人、士兵和社会名流--的产品，[而]百事可乐只专注于年轻的中产阶级家庭。" 百事可乐试图在可口可乐的广阔领域中为自己开辟一个小天

地。随着时间的推移，从圣诞老人到北极熊都被看到喝可乐。1963年，可口可乐的广告预算在美国排名第一，每年花费5300万美元用于广告和有针对性的消费者研究。

“After the challenge from Pepsi, Coke redoubled its efforts to associate Coke subliminally with almost everything.” Around this time, they “created the first successful Coke slogan in years: ‘Things go better with Coke.’ What went better didn’t matter so much—Coke could just as well spark romance as childhood friendship. It was left to the consumer to fill in the blank.” Advertisements no longer talked about what Coke tasted like or contained. It didn’t matter. In such vast territory, Coke had to be adaptable to different environmental pressures.
"在受到百事可乐的挑战后，可口可乐加倍努力，将可口可乐与几乎所有东西潜移默化地联系起来"。大约在这个时候，他们 "创造了多年来第一个成功的可口可乐口号：'有了可口可乐，事情会变得更好'。什么会更好并不重要--可乐可以像激发童年友谊一样激发浪漫。让消费者来填补这个空白"。广告不再谈及可乐的味道或含量。这并不重要。在如此广阔的领域，可口可乐必须能够适应不同的环境压力。

It was this flexibility that was the key to its success. The general image could be adapted to suit any particular. The ability to survive and flourish in any setting was brought home by the New Coke failure. “Consumers rejected the two sodas they actually liked better in blind taste tests, in exchange for the one whose brand image made them feel better.” Being a generalist in the world of beverages wasn’t about taste. People were attached to Coke not as a drink, but as a representative of the nostalgia of good moments. Coke’s malleability was how it conquered such a large spectrum of the population.
正是这种灵活性是其成功的关键。一般的形象可以适应任何特定的情况。在任何环境中生存和发展的能力在新可乐的失败中得到了体现。"消费者在盲测中拒绝了他们实际上更喜欢的两种苏打水，而选择了品牌形象让他们感觉更好的一种。在饮料的世界里成为一个通才并不是关于口味。人们对可乐的感情不是作为一种饮料，而是作为美好时光的怀旧的代表。可口可乐的可塑性是它如何征服了这么大范围的人群的。

Conclusion 结论

An ecosystem is comprised of niches, and we can think of these as roles to be filled. There is a trade-off between specialization— dominating a smaller niche—and generalization, occupying a larger niche. Specialists have less competition and stress, but only in times of stability. Generalists face a greater day-to-day challenge for resources and survival but have more flexibility to respond when times change.
一个生态系统是由利基点组成的，我们可以把这些看作是需要填补的角色。在专业化--主宰一个较小的利基--和普遍化--占据一个较大的利基之间，存在着一种权衡。专家的竞争和压力较小，但只有在稳定的时候。通才在资源和生存方面面临更大的日常挑战，但在时代变化时有更

大的灵活性来应对。

Self-Preservation 自我保护

Pain = bad 痛苦=坏事

Self-preservation or survival instincts are innate behaviors that all organisms possess for the sake of protection from harm. They are considered both fundamental and useful, and govern a lot of our behavior. Surviving and thriving are very reliable human biological motivators. We all want to live with the best life possible. However, how each person responds to these driving forces is diverse among and within populations. There is no universal human definition of a great life. Sometimes these instincts push us to reject the status quo, leading to new opportunities. And sometimes they hold us back, preventing us from realizing our potential.
自我保护或生存本能是所有生物体为保护自己不受伤害而拥有的先天行为。它们被认为既基本又有用，并支配着我们的许多行为。生存和兴旺是非常可靠的人类生物动机。我们都希望尽可能过上最好的生活。然而，每个人对这些驱动力的反应在人群中和内部都是不同的。人类对伟大的生活没有一个普遍的定义。有时这些本能推动我们拒绝现状，导致新的机会。而有时它们会阻碍我们，使我们无法实现我们的潜力。

Knowing how to manage your self-preservation instincts can help you truly understand how to motivate yourself and others. Think of reflexes. These are involuntary, automatic actions that our bodies perform in response to a stimulus. For example, if you put your hand on a hot stove, a reflex will cause you to remove your hand right away even before a “hot!” message is sent to the brain. This reaction protects the body from serious burns. Blinking is another example. When dust or bugs approach the eye, the eye lid automatically closes without having to voluntarily contract any muscle to close the eye. These simple examples demonstrate that self-preservation is hardwired in.
知道如何管理你的自我保护本能可以帮助你真正了解如何激励自己和他人。想想条件反射。这些是我们的身体对刺激所做的非自愿的、自动的动作。例如，如果你把你的手放在一个热炉子上，反射会使你立即移开你的手，甚至在一个 "热！"的信息被发送到大脑之前。这种反应可以保护身体免受严重烧伤。眨眼是另一个例子。当灰尘或虫子接近眼睛时，眼睑会自动关闭，而不需要自愿收缩任何肌肉来关闭眼睛。这些简单的例子表明，自我保护是硬性规定的。

The better your survival reflexes, the greater chances of survival, and so these systems are easily selected for in the evolutionary process. A more complex self-preservation instinct is the fight, flight, or freeze response in humans and other mammals. When human beings are faced with imminent danger, this mechanism kicks in with the mobilization of the

sympathetic nervous system. The results in the body are a sharp increase in blood sugar levels, constriction of blood vessels, increase in heart rate, and the diversion of blood from nonessential organs to heart and skeletal muscles. These are responses that help the mammal deal most effectively with the situation they are in. Sometimes the survival of a group can require the sacrifice of certain members. The survival of some species is contingent on sacrifices within the breeding process.
你的生存反射越好，生存的机会就越大，因此这些系统在进化过程中很容易被选中。一个更复杂的自我保护本能是人类和其他哺乳动物的战斗、逃跑或冻结反应。当人类面临迫在眉睫的危险时，这一机制随着交感神经系统的动员而启动。身体的结果是血糖水平急剧上升，血管收缩，心率加快，血液从非必要的器官转移到心脏和骨骼肌。这些都是帮助哺乳动物最有效地处理它们所处的情况的反应。有时一个群体的生存可能需要某些成员的牺牲。一些物种的生存取决于繁殖过程中的牺牲。

This is known as kin selection and is a form of natural selection concerning populations, not individuals or individual lineages. Many species of animals only stick around because individuals have evolved to display completely selfless behaviors. If a behavior is beneficial overall for a population, despite its impact on the individual, it is likely to be selected for. Just like human mothers, many animals are willing to go to great lengths to ensure the survival of their offspring and therefore their species in turn. Some will literally sacrifice their own lives, like the black lace weave spider, which will allow its babies to eat it. Some animals, like African elephants, zebras, and sea lions will work together in large groups to protect the offspring of others. Orcas and dolphins remain awake for a full month after the birth of their young to care for and protect them.
这被称为亲属选择，是一种关于种群的自然选择，而不是关于个人或个别品系的选择。许多动物物种之所以能坚持下来，是因为个体已经进化到可以表现出完全无私的行为。如果一种行为对种群总体上是有益的，尽管它对个体有影响，那么它就有可能被选择。就像人类的母亲一样，许多动物愿意不惜一切代价来确保其后代的生存，从而确保其物种的生存。有些动物会实实在在地牺牲自己的生命，比如黑花边编织蜘蛛，它可以让自己的孩子吃掉它。有些动物，如非洲象、斑马和海狮会在大群体中一起工作，以保护其他动物的后代。虎鲸和海豚在它们的孩子出生后整整一个月都保持清醒，以照顾和保护它们。

Other animals, including polar bears and penguins, may go months without eating for the sake of their offspring. Marmots will delay their own reproduction if others in their group need help with childcare. Worker honeybees even completely neglect to reproduce so they can look after their queen's babies—and if they don't, the other bees destroy their eggs. Once they become too old to be useful for foraging, the other bees will either kill the workers or refuse to let them into the hive, leaving them to starve to death. Drones, which are male bees, die during the mating process, having successfully passed on their genes. Any drones that don't manage to mate are likewise killed by other bees, so the hive

does not need to waste resources feeding them. Bad for the individuals, excellent for the hive. From a natural selection standpoint, this makes sense because it ensures the survival of their own genes.
其他动物，包括北极熊和企鹅，可能会为了它们的后代而数月不吃东西。如果它们群体中的其他人需要帮助照顾孩子，旱獭会推迟自己的繁殖。工蜂甚至完全忽略了繁殖，以便它们可以照顾蜂后的婴儿--如果它们不这样做，其他蜜蜂就会毁掉它们的卵。一旦它们变得太老，不能用于觅食，其他蜜蜂就会杀死工蜂或拒绝让它们进入蜂巢，让它们饿死。无人蜂是雄蜂，在交配过程中死亡，成功地传递了它们的基因。任何未能成功交配的无人机也同样会被其他蜜蜂杀死，因此蜂巢不需要浪费资源来喂养它们。对个体来说是坏事，对蜂群来说是好事。从自然选择的角度来看，这是有道理的，因为这可以确保它们自己的基因的生存。

Even in a herd, protecting the offspring of others makes sense because the animals in that population are likely to be at least distantly related or even immediate family. This has the long-term effect of selecting for altruistic genes and not selecting for selfish ones. Other animals will end their own lives to protect their buddies. One species of ant, Colobopsis explodens, will explode when threatened by a predator, killing the individual but helping the group survive by releasing a poisonous substance. Bees and some types of termites behave similarly, attacking predators by destroying themselves. Belding's ground squirrels announce the presence of a predator through alarm calls that make themselves more conspicuous and therefore vulnerable.
即使在畜群中，保护他人的后代也是有意义的，因为该种群中的动物可能至少是远亲甚至是直系亲属。这具有选择利他主义基因而不选择自私基因的长期效果。其他动物会结束自己的生命来保护它们的伙伴。有一种蚂蚁，Colobopsis explodens，在受到捕食者的威胁时就会爆炸，杀死个体，但通过释放一种有毒物质帮助群体生存。蜜蜂和某些类型的白蚁也有类似的行为，通过破坏自己来攻击捕食者。贝尔丁的地松鼠通过报警的叫声宣布捕食者的存在，使自己更显眼，因此更容易受到伤害。

Why are automatic reactions programmed in? The desire for survival seems a given, but it exists in organisms that don't have anywhere near the size of cortex that we do. These widespread instincts exist without the ability to philosophize about them because the longer an organism survives, the greater its chances of passing along its genetics, and that is the ultimate point of evolution. Humans are also, however, capable of overriding our own biological survival instincts. Sometimes it is innocuous, like when we go on a roller coaster. We tell ourselves it's perfectly safe, so the biological reaction of terror gets processed as a thrill. Sometimes, though, we override them because our situation seems to demand it, and we put ourselves in situations of chronic stress and pressure. So self-preservation instincts are complex. The biological motivation is to ensure one's own survival, but not if it comes at the cost of the survival of one's own genes.
为什么自动反应是程序化的？对生存的渴望似乎是一个既定事实，但它存在于那些没有像我们

这样的大脑皮层大小的生物体中。这些广泛的本能存在，而没有能力对其进行哲学思考，因为生物体生存的时间越长，其遗传基因传递的机会就越大，而这正是进化的最终意义。然而，人类也有能力凌驾于我们自己的生物生存本能之上。有时它是无害的，比如我们去坐过山车。我们告诉自己这是完全安全的，所以恐怖的生物反应被处理成一种刺激。但有时，我们推翻了它们，因为我们的情况似乎需要这样做，我们把自己置于长期的紧张和压力的环境中。所以自我保护的本能是复杂的。生物学上的动机是确保自己的生存，但如果是以自己的基因的生存为代价，就不是这样了。

Territorial Behavior 领土行为

A core component of self-preservation for all organisms is ensuring access to the resources necessary to survive. This manifests as territorial behavior. An organism or population's territory is loosely defined as the geographical region containing both the resources it needs to survive and the mating opportunities needed to ensure the survival of its species. Only the areas that an organism makes an active effort to defend count as its territory, as there may be additional areas where it also lives.

所有生物体自我保护的一个核心组成部分是确保获得生存所需的资源。这表现为领地行为。一个生物体或种群的领地被宽泛地定义为包含其生存所需资源和确保其物种生存所需的交配机会的地理区域。只有一个生物体积极努力保卫的区域才算作它的领地，因为它也可能有其他的生活区域。

For an organism to maintain its territory, it must compete with other species, or with other members of its own species. Some animals use scents to mark out their territory, as a warning to others to stay out. Others release unpleasant chemicals or make visible markings. Some actively guard their area, attacking any intruders. Others, birds in particular, use threatening calls. Maintaining a territory often requires a great deal of time and energy, which is always a signal that a trait confers some serious survival advantage. Territorial behavior is not necessary if resources are abundant and organisms will generally cease to engage in it over time if this is the case. The scarcer resources prove to be, the more aggressive the territorial behavior is likely to be.

一个生物体要维持自己的领地，就必须与其他物种竞争，或与自己物种的其他成员竞争。有些动物用气味来标出自己的领地，以警告其他人不要靠近。其他动物则释放令人不快的化学物质，或做出明显的标记。有些动物积极地守护自己的区域，攻击任何入侵者。其他人，特别是鸟类，则使用威胁性的叫声。维护一个领地往往需要大量的时间和精力，这总是一个信号，表明一个特征赋予了一些严重的生存优势。如果资源丰富，领地行为是不必要的，如果是这种情况，生物体一般会随着时间的推移而停止参与。事实证明，资源越稀缺，领地行为就可能越具有侵略性。

Self-preservation means more than survival 自我保护不仅仅意味着生存

At first glance, self-preservation seems fairly straightforward. You run from a suspicious-looking person on the street. You fight back against a bully. You freeze when your boss yells at you for the fourteenth time in one day and you are too vulnerable to do anything else. We choose fight or flight when we think we have a chance to succeed. Freeze mode usually takes over when the accumulation of stressors is so great that we can no longer really function. By freezing we hope to preserve the little life we have left. The drive for survival is deeply ingrained in our behavioral responses. How then do we understand people who risk their lives for a cause? What propels someone to put their immediate survival in jeopardy in support of a possible future? Gioconda Belli was not an obvious choice to join the Sandinista revolution in Nicaragua in the 1970s.
乍一看，自我保护似乎相当直截了当。你从街上一个形迹可疑的人那里跑开。你对欺负你的人进行反击。当你的老板一天内第十四次对你大喊大叫，而你又太脆弱，无法做其他事情时，你就会僵住。当我们认为我们有机会成功时，我们选择战斗或逃跑。冻结模式通常在压力的积累大到我们无法再真正发挥作用时才会出现。通过冻结，我们希望能保留我们所剩无几的生命。生存的动力在我们的行为反应中根深蒂固。那么，我们如何理解那些为某种事业而冒生命危险的人呢？是什么促使一个人为了支持可能的未来而将自己眼前的生存置于危险之中？
Gioconda Belli在20世纪70年代加入尼加拉瓜的桑地诺革命，并不是一个明显的选择。

She was married with two young daughters. She came from an upper-middle-class family and had a decent life under the Somoza dictatorship that had been in power in Nicaragua for 40 years. However, she didn't like the oppression, corruption, and poverty she saw in her country. She sought political and social change and concluded that joining the revolutionary Sandinista organization was the best way to achieve it. In her memoir, The Country Under My Skin, she writes that she knew "joining the Sandinistas was a risky proposition. It meant putting my life in the line of fire." From the beginning of the Sandinista movement, suspected revolutionaries were arrested and tortured by the Somoza dictatorship.
她已经结婚，有两个年幼的女儿。她来自一个中上阶层的家庭，在尼加拉瓜执政40年的索摩查独裁统治下，过着体面的生活。然而，她不喜欢在她的国家看到的压迫、腐败和贫穷。她寻求政治和社会变革，并得出结论，加入革命的桑地诺组织是实现这一目标的最佳途径。在她的回忆录《我皮肤下的国家》中，她写道，她知道 "加入桑地诺组织是一个冒险的提议。这意味着把我的生命放在火线上"。从桑地诺运动一开始，被怀疑的革命者就被索摩查独裁政权逮捕和拷打。

As the revolution progressed, there were horrific accounts of the measures the regime took to suppress the revolutionaries, including throwing people to their deaths from helicopters. Deciding to face potential torture and death seems to be the opposite of self-preservation. Belli deliberately and knowingly put her life at risk to try to achieve political and social change that was far from guaranteed. Self-preservation is such a useful model because it helps us understand seemingly counterintuitive actions: sacrificing short-term guarantees for long-term possibilities, like the animals we looked at who sacrifice themselves for their offspring or their group. Belli was not fully committed to the revolution right away.
随着革命的进展，有一些关于该政权为镇压革命者所采取的措施的可怕描述，包括将人从直升机上扔下死亡。决定面对潜在的酷刑和死亡似乎是自我保护的反面。贝利故意明知故犯，将自己的生命置于危险之中，试图实现远不能保证的政治和社会变革。自我保护是一个非常有用的模型，因为它可以帮助我们理解看似反直觉的行为：为了长期的可能性而牺牲短期的保证，就像我们看过的那些为了后代或群体而牺牲自己的动物。Belli并没有立即完全投入到革命中。

She had moments of doubt, both about the Sandinista organization and the wisdom of putting her daughters in a position that they might have to grow up without a mother. She quotes a friend of hers trying to help her reconcile being a revolutionary with being a mother: “Your daughter is precisely the reason you should do it,” he said. “You should do it for her, so that she won’t have to do the job you are not willing to do.” In a sense Belli was motivated by trying to create a world for her daughters where they would not have to make a similar sacrifice.
她有过怀疑的时候，既怀疑桑地诺组织，也怀疑把她的女儿放在一个可能要在没有母亲的情况下长大的位置是否明智。她引用了她的一个朋友的话，试图帮助她协调作为一个革命者和作为一个母亲的关系。"他说："你的女儿正是你应该这样做的原因。"你应该为她而做，这样她就不必做你不愿意做的工作了。" 在某种意义上，贝利的动机是试图为她的女儿们创造一个世界，让她们不必做出类似的牺牲。

We can understand it like deferred preservation: a more equitable and stable world would give her genes the best possible chance of carrying on. It’s important, however, not to frame her choice simply in terms of calculated biological preservation. When she was contemplating committing to the Sandinistas, Belli explains that she saw participating in the revolution as her “only way into a more meaningful existence.” There is a nuance here: that for humans survival is not merely a binary like dead/alive. We don’t want to just continue breathing, but to have a life that we perceive as having meaning, value, or at least a point. Working with the Sandinistas was perilous.
我们可以像延缓保存一样来理解：一个更加公平和稳定的世界会给她的基因带来最好的延续机会。然而，重要的是，不要把她的选择简单地定格在经过计算的生物保存方面。当她考虑加入桑地诺组织时，贝利解释说，她认为参加革命是她 "进入一个更有意义的生活的唯一途径"。这

里有一个细微的差别：对人类来说，生存不仅仅是死/活这样的二元论。我们不希望只是继续呼吸，而是要有一个我们认为有意义、有价值或至少有意义的生活。与桑地诺组织合作是危险的。

Belli writes of being followed, interrogated, and exiled to neighboring Costa Rica after having been convicted by the Somoza government of being a traitor. She spent a lot of time separated from her children and went through personal turmoil as she tried to navigate two marriages that failed under the pressure of her activities. Watching many comrades jailed or killed, she writes of being afraid that “so many dreams and efforts might be wasted.” Belli was, however, driven by the desire to stop the actions of the Somoza regime that kept so many Nicaraguans poor and desperate while the leaders lined their pockets with international aid money. She explains: “At twenty-four, I was a citizen of a terrible, destitute country, but no misfortune seemed eternal to me.
贝利写道，在被索摩查政府判定为叛徒后，她被跟踪、审讯，并被流放到邻近的哥斯达黎加。她花了很多时间与孩子们分开，并经历了个人的动荡，因为她试图驾驭两段婚姻，但在她的活动压力下失败了。看着许多同志入狱或被杀，她写道，她害怕 "这么多的梦想和努力可能被浪费掉"。然而，贝利的动力来自于阻止索摩查政权的行动，这些行动使许多尼加拉瓜人陷入贫困和绝望，而领导人却用国际援助资金来满足他们的口袋。她解释说。"24岁时，我是一个可怕的、贫穷的国家的公民，但对我来说，没有什么不幸是永恒的。

I was sure we could change everything and build a bright future.” Working with the Sandinistas meant joining a tribe of sorts. Belli explains, “I understood how strong the bond between those of us who were in the struggle was.” Therefore, individuals were prepared to take actions that put their own lives at risk in order to increase the chances of survival of the group. Belli writes of the many times she smuggled guns, money, and fake identification across borders bringing them to others in the revolution, jeopardizing her own freedom in order to help the Sandinista movement. Belli admits to questioning the desire of people to put the group first. “Were we all mad?” she writes.
我确信我们可以改变一切，建立一个光明的未来。" 与桑地诺主义者一起工作意味着加入一个类似的部落。贝利解释说："我明白我们这些参加斗争的人之间的联系是多么强烈"。因此，个人准备采取使自己的生命受到威胁的行动，以增加团体的生存机会。贝利写道，她多次偷运枪支、金钱和假身份证，越过边界，把它们带给革命中的其他人，为了帮助桑地诺运动而危及自己的自由。贝利承认自己质疑人们把团体放在第一位的愿望。"我们都疯了吗？"她写道。

“What mystery in human 7 8 9 genes accounted for the fact that men and women could override their personal survival instincts when the fate of the tribe or collective was at stake?” What makes us take a risk on an uncertain future instead of sticking with guaranteed immediate survival? Belli herself offers an interesting perspective when she explains how she pushed through the setbacks and stress of exile: “If I gave in to fear, I

would end up killing my soul to save my body." She also writes of explaining to her children "the obligation to be responsible to other people," to be responsible to the group. The Sandinista revolution was successful in that it successfully removed Somoza from power in Nicaragua.
"当部落或集体的命运受到威胁时，男人和女人可以超越他们个人的生存本能，这是人类7 8 9基因中的什么奥秘？" 是什么让我们在不确定的未来上冒险，而不是坚持保证眼前的生存？贝利自己提供了一个有趣的观点，她解释了她如何在流亡的挫折和压力中坚持下来。"如果我向恐惧屈服，我最终会杀死我的灵魂来拯救我的身体"。她还写道，向她的孩子们解释了 "对他人负责的义务"，对团体负责。桑地诺革命是成功的，因为它成功地将索摩查从尼加拉瓜的权力中赶走。

With the dictatorship gone, the Sandinistas tried to rebuild the country's political and social infrastructure based on the ideals they had developed and refined as a revolutionary organization. Belli's main contributions to the ultimately successful revolution were in communications and public relations. She wrote press releases and recruiting letters, trying to explain the goals of the Sandinistas and recruit people to the cause. She traveled abroad many times to represent the movement and gain international support.
随着独裁政权的消失，桑地诺主义者试图根据他们作为一个革命组织所发展和完善的理想来重建国家的政治和社会基础设施。贝利对最终成功的革命的主要贡献是在通信和公共关系方面。她撰写新闻稿和招募信，试图解释桑地诺主义者的目标并招募人们加入这一事业。她多次出国代表该运动并获得国际支持。

But she explains that "Sandinismo was a fundamental element of my identity," which propelled her to take whatever action necessary to support the group. As the revolution approached she continued her efforts from her exile in Costa Rica, "but I was anxious for the moment when I could join in the one, most basic contribution to the struggle: combat in Nicaragua." Very often, her course of action had her saying goodbye to her children as if it could be the last time she saw them. But she did it anyway. Her self-preservation instincts were focused on doing everything she could to see her children grow up in the world "safely and happily."
但她解释说，"桑地诺主义是我身份的一个基本要素，"这促使她采取一切必要的行动来支持该团体。随着革命的临近，她在流亡的哥斯达黎加继续努力，"但我急于等待我能够加入对斗争的一个最基本贡献的时刻：在尼加拉瓜作战"。很多时候，她的行动方针使她不得不与她的孩子们告别，好像这可能是她最后一次见到他们。但她还是这样做了。她的自我保护本能集中在尽一切可能看到她的孩子在这个世界上 "安全和快乐地成长"。

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Permanent Record 永久记录
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We humans preserve ourselves not just through the genetics that we download into our offspring, but by preserving a record of who we are. Around the time that humans first started writing, we began to keep the most permanent records we could in libraries. Almost immediately we decided that it wasn't enough to record, but far more important to preserve our records. The knowledge that we have captured over millennia allows us to leave a legacy of remembering who we are. In 1849, Austen Henry Layard found Nineveh, an ancient Assyrian city that had once been the center of a civilization. It had been completely destroyed by fire in 612 BCE, and in the intervening millennia had been reduced to fiction.
我们人类不仅通过下载到后代的基因来保存自己，还通过保存我们是谁的记录来保存自己。大约在人类第一次开始写作的时候，我们开始在图书馆里保留我们可以保留的最永久的记录。我们几乎立即决定，仅仅记录还不够，更重要的是保存我们的记录。几千年来我们所掌握的知识使我们能够留下一笔遗产，记住我们是谁。1849年，奥斯汀-亨利-莱亚德发现了尼尼微，一座曾经是文明中心的亚述古城。它在公元前612年被大火完全摧毁，在这几千年里，它已经沦为虚构。

The destruction by fire, however, had an extremely valuable side effect: it had preserved the clay tablets that were contained in the city's remarkable library. The city's last king, Ashurbanipal, had collected texts from all over Mesopotamia, so the library was full of tablets chronicling not only Assyrian life, but Sumerian and Babylonian as well. Finding the library brought to life people, cities, and customs that had disappeared from history. The "library contained dictionaries and grammars, treatises on botany, astronomy, metallurgy, geology, geography, chronology, tracts on religion and history, and a collection of royal edicts, proclamations, laws, and decrees."
然而，火灾的破坏有一个非常有价值的副作用：它保存了该城市卓越的图书馆中的泥板。该城的最后一位国王阿舒尔巴尼帕尔收集了美索不达米亚各地的文字，因此图书馆里充满了不仅记录亚述人生活的石板，还有苏美尔人和巴比伦人的。找到图书馆后，那些已经从历史中消失的人、城市和风俗都变得生动起来。图书馆"包含了字典和语法，关于植物学、天文学、冶金学、地质学、地理学、年代学的论文，关于宗教和历史的小册子，以及一套皇家诏书、公告、法律和法令"。

The find gave us more context to understand human history. A tablet was discovered that chronicled a flood story similar to the one found in the Bible, but from centuries earlier. Another find, the Law Code of Hammurabi, provides insight into cultural norms that influenced later civilizations. Knowledge like this helps to trace, with more and more comprehension, the story of humanity. Without what is contained in libraries, we would have had to reinvent and reimagine everything all of the time. Preserving knowledge allows us to transfer it more easily, supporting the preservation of the species.
这一发现为我们了解人类历史提供了更多的背景。发现的一块石碑记载了与《圣经》中发现的洪水故事相

似，但却是几个世纪以前的故事。另一个发现，即《汉谟拉比法典》，提供了对影响后来文明的文化规范的洞察力。诸如此类的知识有助于以越来越多的理解力来追踪人类的故事。如果没有图书馆中的内容，我们将不得不一直重新发明和重新想象一切。保存知识使我们能够更容易地转移知识，支持物种的保存。

Derinkuyu: Turkey's ancient underground city 德林库伊：土耳其的地下古城

It may be a myth that ostriches bury their heads in the sand, but during times of danger, humans have often looked beneath their feet for safety. During the Great Fire of London in 1666, people buried valuables in their gardens. The Dead Sea Scrolls were found underground in a cave. And in the Central Anatolia region of Turkey, a number of persecuted groups over the course of thousands of years moved their lives beneath the ground in a move that illustrates the incredible lengths we will go to for self-preservation.
鸵鸟把头埋在沙子里可能是一个神话，但在危险的时候，人类经常在脚下寻找安全。在1666年的伦敦大火中，人们将贵重物品埋在花园里。死海古卷是在一个山洞的地下发现的。而在土耳其的安纳托利亚中部地区，数千年来，一些受迫害的群体将他们的生活转移到了地下，此举说明了我们为了自我保护会付出令人难以置信的代价。

Derinkuyu is the deepest of the cities yet discovered beneath Cappadocia. In 1963, a Turkish man renovating his basement found something astounding: an entire room behind its wall. From there, archaeologists discovered a whole city snaking beneath the ground, carved into the soft yet sturdy rock. Descending 200-280 feet underground, it has different levels capable of housing as many as 20,000–30,000 people at a time. Future excavations may find it to have been even bigger than that. Derinkuyu is far from just being a maze of tunnels to huddle in and wait for danger to pass. It is a complete city, containing everything its residents needed to comfortably thrive for a while, not just survive. Archaeologists have uncovered schools, areas for worship, bedrooms, bathrooms, areas for storing food and equipment for making olive oil and wine, tombs, stables for horses and other animals, and community meeting spaces. In addition to fresh food and water, the residents had fresh air from above through at least 52 shafts that kept the city well ventilated.
德林库伊是目前在卡帕多西亚地下发现的最深的城市。1963年，一个土耳其人在翻修他的地下室时发现了令人震惊的事情：在其墙壁后面有一整个房间。从那里，考古学家发现整个城市在地面下蜿蜒，被雕刻在柔软而坚固的岩石上。在地下200-280英尺处，它有不同的层次，能够同时容纳多达20,000-30,000人。未来的挖掘工作可能会发现它甚至比这更大。Derinkuyu远不只是一个可以蜷缩在其中等待危险过去的迷宫式隧道。它是一个完整的城市，包含了其居民所需的一切，可以舒适地繁荣一段时间，而不仅仅是生存。考古学家已经发现了学校、礼拜场所、卧室、浴室、储存食物和制作橄榄油和葡萄酒的设备的区域、坟墓、马和其他动物的马

厩，以及社区会议场所。除了新鲜的食物和水，居民们还通过至少52个竖井从上面获得新鲜空气，使城市保持良好的通风。

Some experts attribute the construction of Derinkuyu to the Phrygians, an ancient race of Indo-Europeans from the southern Balkans who migrated to the area in the 12th century BCE, according to accounts by the Greek historian Herodotus. The Phrygians may have built it to hide from the Assyrians. Derinkuyu could also be the work of the Persians or the Hittites. Historians have suggested that the Hittites may have dug tunnels for storage before other groups turned them into cities. Alternatively, the Hittites may have sheltered in Derinkuyu during their 12th-century BCE war with the Thracians.
一些专家将德林库伊的建造归功于弗里吉亚人，根据希腊历史学家希罗多德的描述，弗里吉亚人是来自巴尔干半岛南部的一个古老的印欧人种族，他们于公元前12世纪迁移到该地区。弗里吉亚人建造它可能是为了躲避亚述人。Derinkuyu也可能是波斯人或赫梯人的作品。历史学家认为，赫梯人可能在其他群体将其变成城市之前，就已经挖好了隧道用于储存。另外，赫梯人可能在公元前12世纪与色雷斯人的战争中，在德林库尤避难。

Romans, early Christians, and Turks all used them at various points. Some go as far as to claim they are prehistoric, first dug as protection from the heat, due to the discovery of 10,000-year-old stone cutting tools in the area. The variation in the quality of the tunnels lends support to this theory. Regardless of who dug the first tunnel, subsequent groups expanded upon and advanced Derinkuyu to the extent that it is hard to view it as the property of any single group. Derinkuyu belongs to the region. We don't know, and may never know, exactly which group of people created Derinkuyu in the first place.
罗马人、早期基督教徒和土耳其人都在不同时期使用过这些地方。有些人甚至声称它们是史前的，最初是为了避暑而挖掘的，因为在该地区发现了1万年的石制切割工具。隧道质量的变化为这一理论提供了支持。不管是谁开凿了第一条隧道，后来的群体在Derinkuyu的基础上进行了扩展和提升，以至于很难将其视为任何一个群体的财产。Derinkuyu属于这个地区。我们不知道，也可能永远不知道，究竟是哪一群人首先创造了Derinkuyu。

But it's clear why they did it. The region of Anatolia has spent much of its history in a stew of conflict and uncertainty. Its position between Asia and Europe made it an appealing target for major world powers who have, again and again, sought to control the region. For the residents to survive the endless wars and confusion, they needed to take drastic action. Derinkuyu and the other underground cities in Cappadocia have repeatedly saved the area's residents from extinction. During the seventh century, the Persian Wars took place in Cappadocia, tearing the region apart.
但他们为什么这样做是很清楚的。安纳托利亚地区的大部分历史都是在冲突和不确定性中度过的。它在亚洲和欧洲之间的位置使它成为世界主要大国的诱人目标，这些大国一次又一次地试图控制该地区。为了让居民在无休止的战争和混乱中生存，他们需要采取激烈的行动。德林库

伊和卡帕多西亚的其他地下城市多次将该地区的居民从灭亡中拯救出来。七世纪时，波斯战争在卡帕多西亚发生，将该地区撕裂。

That conflict was scarcely over when Muslim Arab armies arrived and caused a complete civil breakdown. Based on its design, Derinkuyu was intended to provide protection during conflict, like a turtle retreating into its shell. The tunnels were narrow enough to require walking along them in single file, hunched over. This would have prevented attackers from moving into Derinkuyu, as the residents could easily pick off soldiers emerging one by one from tunnels. Huge carved stone disks weighing eleven hundred pounds rolled in front of entrances when the residents wanted to prevent anyone else entering, with small holes in the middle which may have allowed arrows to be fired through.
那次冲突几乎没有结束，阿拉伯穆斯林军队就来到了这里，造成了彻底的内乱。根据其设计，Derinkuyu的目的是在冲突期间提供保护，就像乌龟退缩到它的壳里。隧道很窄，需要弯腰单排行走。这可以防止攻击者进入德林库伊，因为居民可以很容易地挑掉从隧道里一个个出现的士兵。当居民想阻止其他人进入时，巨大的石雕盘子重达1100磅，滚在入口处，中间有小孔，可能可以射出箭来。

Derinkuyu even had a tunnel, based on preliminary excavations, stretching several kilometers to another underground city. If its defenses were somehow breached, the inhabitants could hastily take refuge elsewhere. When we feel threatened, flight is often a first response. We want to get away from the danger and hide. The people who sheltered in Derinkuyu and other underground cities in the region did so because it put them in a situation where they had maximum leverage. They had everything they needed to survive in relative comfort for long periods of time. Even if any attackers did manage to get into Derinkuyu, they could only do so one at a time and were easy to defeat.
根据初步挖掘，德林库伊甚至有一条隧道，延伸到另一个地下城市，长达数公里。如果它的防御系统以某种方式被攻破，居民可以匆忙地到其他地方避难。当我们感到受到威胁时，逃跑往往是第一反应。我们想远离危险，躲起来。在Derinkuyu和该地区其他地下城市避难的人之所以这样做，是因为这使他们处于一种有最大影响力的境地。他们拥有在相对舒适的环境中长期生存所需的一切。即使任何攻击者设法进入Derinkuyu，他们也只能一次一个，很容易被打败。

The strategy of fleeing and hoarding worked well for the residents of Cappadocia, but this self-preservation response can backfire. Hoarding supplies beneath the ground may have made sense for them in the short term. While there is much left for researchers to learn about Derinkuyu, it seems unlikely that people could have remained entirely underground in the long-term. They could only store so much food, and over extended periods of time would have suffered serious vitamin deficiencies from the lack of sunlight or fresh food. If

their enemies had decided to start a siege, it wouldn't have worked so well. An underground city is a vivid image, but the ways the same impulse can influence our behavior can be less obvious.
逃离和囤积的策略对卡帕多西亚的居民来说很有效，但这种自我保护的反应会适得其反。在地面下囤积物资对他们来说可能在短期内是有意义的。虽然研究人员对Derinkuyu还有很多东西需要了解，但人们似乎不太可能长期完全呆在地下。他们只能储存这么多的食物，而且随着时间的推移，由于缺乏阳光或新鲜食物，他们会出现严重的维生素缺乏症。如果他们的敌人决定开始围攻，效果也不会太好。地下城是一个生动的形象，但同样的冲动可以影响我们的行为的方式可能不那么明显。

Acting in survival mode is not sustainable long-term. Hoarding and hiding are not lifelong strategies. As humans, we're always on hair trigger to hoard at the slightest sign of scarcity, even if doing so ends up worsening that scarcity. If people at a company fear impending layoffs, they may make like the residents of Derinkuyu and metaphorically hide away from everyone else, hoarding information. They feel that keeping all the information to themselves makes them more valuable to the company. They might hoard work, refusing to delegate and taking on irrelevant responsibilities. It might make them indispensable in the short term, but in the long-term trust breaks down and less work gets done, putting the company, and thus their job, at risk. In reality, this self-presevation instinct has the opposite effect. Not helping others or sharing the leverage is worse for everyone. Any time we're fighting to preserve ourselves in an emergency situation, we need more of a concrete plan than hiding and hoarding. In addition to our natural instincts, we need to move beyond our evolutionary programming and consider how we can survive long-term. Sometimes our immediate self-preservation instinct scan backfire, putting us in situations of little long-term benefit.
在生存模式下行动是不能长期持续的。囤积和隐藏并不是终身的策略。作为人类，我们总是一有匮乏的迹象，就会立即触发，进行囤积，即使这样做最终会使匮乏的情况恶化。如果一个公司的人害怕即将到来的裁员，他们可能会像Derinkuyu的居民一样，比喻为躲避其他人，囤积信息。他们觉得把所有的信息都留给自己，使他们对公司更有价值。他们可能会囤积工作，拒绝授权，承担不相关的责任。这可能会使他们在短期内变得不可或缺，但从长期来看，信任破裂，工作完成得更少，使公司，也就是他们的工作面临风险。在现实中，这种自我安慰的本能有相反的效果。不帮助别人或分享杠杆对每个人来说都更糟糕。任何时候，我们在紧急情况下为保存自己而战，我们需要更多的具体计划，而不是躲藏和囤积。除了我们的自然本能之外，我们还需要超越我们的进化程序，考虑我们如何能够长期生存。有时，我们眼前的自我保护本能扫描会适得其反，使我们处于没有长期利益的情况下。

Conclusion 结论

Self-preservation is a core instinct that explains many of our actions including why we are

highly sensitive to situations of scarcity, why we try to increase our value at the expense of our organization, and why we make sacrifices to ensure legacy. Our notions of self-preservation are tied into our identities and a way to give meaning to our lives. If my children or my ideas survive, grow, and multiply, I have, in a sense, preserved myself.
自我保护是一种核心本能，它解释了我们的许多行为，包括为什么我们对匮乏的情况高度敏感，为什么我们试图以牺牲组织为代价来提高自己的价值，以及为什么我们做出牺牲以确保遗产。我们的自我保护观念与我们的身份联系在一起，是赋予我们生活意义的一种方式。如果我的孩子或我的想法能够生存、成长和繁殖，在某种意义上，我已经保存了自己。

Replication 复制

> In an adapted unit, most variation introduced by errors (mutations) in copying are harmful. For an adapted entity, therefore, increasing fidelity in copying, or mechanisms that concentrate error in parts of the code where they will be least harmful or most helpful, will be favored.
> 在一个适应性单位中，由复制中的错误（突变）引入的大多数变异是有害的。因此，对于一个适应性强的实体来说，提高复制的保真度，或将错误集中在代码中危害最小或最有帮助的部分的机制，将受到青睐。
> ——盖拉特•维梅伊 Geerat Vermeij

Replication in biology is ultimately about the ability of DNA to make a copy of itself during cell division. This is how we start life, and it is a process that continues in some of our cells until our death. Let's think about this process at the small level: cell replication. Our skin cells flake off by the millions every day, yet through our lives we never run out. That's because there are skin cells making copies of themselves all the time. This ability to make perfect copies is built into their structure, and without it we wouldn't last very long.
生物学中的复制最终是关于DNA在细胞分裂期间复制自身的能力。这是我们生命的开始，也是在我们一些细胞中持续到我们死亡的过程。让我们从小的方面来思考这个过程：细胞复制。我们的皮肤细胞每天以百万计地剥落，然而在我们的一生中，我们从未用尽。这是因为有皮肤细胞一直在复制自己。这种制作完美副本的能力是建立在它们的结构中的，如果没有它，我们就不会持续很长时间。

This type of replication is called mitosis. It refers to the entire process of replication of nonsexual cells, the result being two genetically identical daughter cells. Mitosis is the process that gives us more skin, more hair, more nails. This replication is far from mysterious and can be conceptualized as having certain basic requirements.
这种类型的复制被称为有丝分裂。它指的是非性细胞的整个复制过程，其结果是两个遗传上相同的子细胞。有丝分裂是使我们有更多皮肤、更多头发、更多指甲的过程。这种复制远非神

秘，可以被概念化为具有某些基本要求。

You need three things for replication to occur:
你需要三样东西来进行复制。

1. A code that represents what you wish to replicate
   一个代表你希望复制的东西的代码
2. A means of copying this code
   一个复制这个代码的方法
3. And a place to process the code and construct the replication.
   以及一个处理代码和构建复制的地方

This is how our skin cells are constructed. They possess a code of themselves, a mechanism to copy the code, and a place to execute the code—all to produce more skin cells. Furthermore, this replication machine is phenomenal. We never run out of skin. Replication is useful beyond skin cells. It has another amazing property—combination. Replications don't have to be exact copies. The components of cells can be combined in new ways to give us unique instances of existing things.
这就是我们的皮肤细胞是如何构建的。它们拥有自己的代码，一个复制代码的机制，以及一个执行代码的地方--所有这些都是为了生产更多的皮肤细胞。此外，这种复制机器是惊人的。我们的皮肤永远不会用完。复制的作用超越了皮肤细胞。它有另一个惊人的特性--组合。复制不一定是精确的副本。细胞的组成部分可以以新的方式组合，使我们获得现有事物的独特实例。

This is sexual reproduction, and it creates new opportunities. Called meiosis, a sex cell contains a copy of half a female's chromosomes and is combined with half a male's chromosomes to produce a new whole. The offspring of these parents are genetically unique due both to having two sources for their genes and from variation that occurs in the copying. Sexual reproduction is prevalent all over the biological world. Mammals, fish, and plants all partake. Why? Because, over several generations, a lack of sexual reproduction means less genetic variation, which leads to fewer options when the environment changes. And if you can't adapt to a new environment, you die.
这就是有性繁殖，它创造了新的机会。称为减数分裂，一个性细胞包含了女性一半染色体的副本，并与男性的一半染色体结合，产生一个新的整体。这些父母的后代在遗传上是独特的，这是因为他们的基因有两个来源，而且在复制过程中发生了变异。有性繁殖在整个生物界都很普遍。哺乳动物、鱼类和植物都参与其中。为什么呢？因为，经过几代人的努力，缺乏性繁殖意味着更少的遗传变异，这导致环境变化时的选择更少。如果你不能适应一个新的环境，你就会死亡。

Replication, then, is what allows for diversity in traits that can improve fitness and increase the chances of survival. Exact copies perpetuate bad mutations. The power of replication

combination prevents the accumulation of traits that impair fitness and lets us, as a species, try out new behaviors that can be super beneficial. Of course, there is a significant cost. We have to work hard to find another half with which to combine and not be intimidated by the diversity that might offer the best chance of producing successful adaptations.
那么，复制就是允许性状的多样性，可以改善体质，增加生存的机会。完全的复制会使坏的突变永久化。复制组合的力量可以防止损害健康的性状的积累，并让我们作为一个物种，尝试可能是超级有益的新行为。当然，这也有很大的代价。我们必须努力寻找另一半与之结合，不要被可能提供产生成功适应的最佳机会的多样性所吓倒。

Keeping it all in the family 把所有的东西都放在家里

When we have replication without diversity, the outcomes are disastrous. Replication can be thought of as sharing information, and "thus, like all forms of transmitting information, replication is inevitably accompanied by some degradation, or at least change, in content." It's not enough just to copy; there also need to be innovations and improvements to compensate for the errors that are inevitably introduced. Beginning in the 11th century and ending in the 18th, the Habsburg family dynasty ruled over a significant portion of Europe.
当我们有复制而没有多样性时，其结果是灾难性的。复制可以被认为是分享信息，"因此，像所有的信息传输形式一样，复制不可避免地伴随着一些内容的退化，或者至少是变化。" 仅仅复制是不够的；还需要有创新和改进，以弥补不可避免地引入的错误。从11世纪开始到18世纪结束，哈布斯堡家族王朝统治了欧洲的很大一部分地区。

Members of the family at various times ruled over Germany, England, Hungary, Ireland, Portugal, Spain, and other countries. As Benjamin Curtis writes in The Habsburgs: "The family's members were sure that they were born to rule… Their preeminence was longer lasting and their ambitions more grandiose than almost any other royal family." The Habsburgs guarded their power so jealously that they loathed marriages that required them to share it with other families. Whenever possible, they chose to marry close blood relatives—first cousins or nieces—to keep their veritable empire intact. One of their mottos was "Let others wage war; you, happy Austria, marry."
该家族的成员在不同时期统治着德国、英国、匈牙利、爱尔兰、葡萄牙、西班牙和其他国家。正如本杰明-柯蒂斯在《哈布斯堡家族》中写道："该家族的成员确信他们生来就是为了统治……他们的卓越地位比其他几乎所有的皇室家族都更持久，他们的野心也更宏大。" 哈布斯堡家族对自己的权力如此珍视，以至于他们厌恶要求他们与其他家族分享权力的婚姻。只要有可能，他们就会选择与近亲--嫡亲或侄女结婚，以保持其名副其实的帝国完整。他们的座右铭之一是 "让别人打仗；你，幸福的奥地利，结婚"。

Unsurprisingly, the lack of genetic variation caused by these consanguineous marriages carried serious consequences. The best-known result of the Habsburg's lack of diversity was their unusual jawline, with enlarged chin, an underbite, and thick lips. Even in their most flattering portraits, this feature is unmistakable. As the generations progressed, the results of their inbreeding led to extreme difficulties with basic things like speaking and eating. The Habsburgs' infant mortality rate was far higher than that of even the poorest members of society at the time. Between 1527 and 1661, the Spanish branch produced 34 children. Of these, half died in their first decade, and 10 before their first birthday.
不出所料，这些近亲结婚造成的遗传变异的缺乏带来了严重后果。哈布斯堡家族缺乏多样性的最著名的结果是他们不寻常的下巴线条，下巴增大，咬合力不足，嘴唇很厚。即使在他们最讨人喜欢的肖像画中，这一特征也是明确无误的。随着世代的发展，他们近亲繁殖的结果导致他们在说话和吃饭等基本事情上出现了极大的困难。哈布斯堡家族的婴儿死亡率甚至远远高于当时社会最贫穷的成员。在1527年至1661年期间，西班牙分支共产生了34个孩子。其中，有一半的孩子在头十年就死了，有10个孩子在一岁前就死了。

Closed systems, those without any new inputs, die in changing environments. Ultimately, after 16 generations of intermarriages, the Habsburgs ended up with such serious disabilities that they wiped the family out. Their success in controlling Europe proved to be a Pyrrhic victory. The final member, Charles II, was infertile and thus unable to produce an heir. He also experienced dire health from birth. He did not learn to speak until the age of four due to his distended jaw, could not walk until he was eight, frequently drooled, was of low intellectual ability, and was barely able to speak comprehensibly. His infertility may have been the result of a pituitary hormone deficiency, and he also suffered from kidney problems.
封闭的系统，那些没有任何新投入的系统，在不断变化的环境中死亡。最终，经过16代人的通婚，哈布斯堡家族最终出现了严重的残疾，以至于把这个家族消灭了。他们在控制欧洲方面的成功被证明是一场不折不扣的胜利。最后一个成员查尔斯二世不能生育，因此无法产生继承人。他从出生起就经历了糟糕的健康状况。由于下巴膨胀，他直到四岁才学会说话，八岁才会走路，经常流口水，智力低下，而且几乎不能理解地说话。他的不育症可能是脑垂体激素缺乏的结果，他还患有肾脏疾病。

Charles II died in his late thirties, young for someone of his wealth even at the time. He reportedly had the intellectual capabilities of a small child. Replication is necessary but not sufficient for survival. The more you copy something, the more it weakens. Thus, replication alone is not always beneficial. Imagine a teacher photocopying a worksheet for a class then throwing away the original. The next year they make photocopies of the photocopies then again throw away the originals. As the years go by, the quality of the sheet progressively gets worse because each copy will pass on errors and introduce new ones. Minor problems compound with each copy.

查理二世三十多岁就去世了，即使在当时以他的财富来说也很年轻。据报道，他的智力只有一个小孩子的水平。复制是必要的，但不是生存的充分条件。你复制的东西越多，它就越弱。因此，单单复制并不总是有益的。想象一下，一个老师为一个班级复印了一份工作表，然后扔掉了原件。第二年，他们对复印件进行影印，然后再次扔掉原件。随着时间的推移，工作表的质量会逐渐变差，因为每份复印件都会传递错误并引入新的错误。小问题会随着每份复印件的出现而加剧。

The same happened to the Habsburgs. Without genetic diversity, recessive mutations that would have otherwise failed to show up in children were reinforced and compounded over generations. Only with the relatively recent discovery of genetics did it become clear why this happens. Without diversity, replication only works if both the original and the copying mechanism are perfect. Otherwise errors build upon themselves.
哈布斯堡家族的情况也是如此。如果没有遗传多样性，本来不会在孩子身上出现的隐性突变就会在几代人的时间里得到加强和复合。只有在相对较新的遗传学发现之后，人们才清楚为什么会发生这种情况。如果没有多样性，复制只有在原始和复制机制都完美的情况下才会起作用。否则，错误就会越积越多。

The German secret to hitting the replication “sweet spot” 打击复制 "甜蜜点 "的德国秘密

There is a sweet spot to replication. The components have to be rigid enough to be easily copied but flexible enough to adapt to inevitable changes. As with genetic mutations piling up, replication of errors compounds errors in all fields of human endeavor. We often think of new things as polluting or diluting and try to stick with the old, but this doesn’t work. We need to inject newness, or the lack of variation proves destructive.
复制有一个甜蜜点。组件必须足够坚硬，以便于复制，但又足够灵活，以适应不可避免的变化。正如基因突变的堆积一样，复制的错误在人类努力的所有领域都会使错误复杂化。我们常常认为新事物会污染或稀释，并试图坚持旧事物，但这是行不通的。我们需要注入新的东西，否则缺乏变化就会被证明是破坏性的。

Relevant to everything from military campaigns to venture capital, figuring out how to replicate strategy or success is critical. How do you allow for adaptability and innovation without sacrificing your goals, values, or vision? After the Germans kept getting humiliated by Napoleon on the battlefield, they realized that his methods in war were different than any they had previously come across. If they wanted to win, they needed to change and try new tactics. Early in his career Napoleon employed the strategy of inserting his army between two opposing forces then striking at both before they could coordinate and combine.
与从军事行动到风险资本的一切相关，弄清楚如何复制战略或成功是至关重要的。你如何在不

牺牲你的目标、价值观或愿景的情况下允许适应性和创新？当德国人在战场上不断被拿破仑羞辱后，他们意识到，拿破仑的战争方法与他们以前遇到的任何方法都不同。如果他们想赢，就需要改变和尝试新的战术。在拿破仑职业生涯的早期，他采用的策略是将他的军队插入两支对立的部队之间，然后在他们能够协调和结合之前对他们进行打击。

He wrote, “it is contrary to all principle to make corps which have no communication act separately against a central force whose communications are open.” The traditional German armies, with “their linear tactics, iron discipline, blind obedience and intolerance of independent action,” were initially unequipped to deal with Napoleon’s approach. Recognizing the need for a new strategy, the Germans developed Auftragstaktik or what we now call commander’s intent, which is the idea of sharing the information necessary “to empower subordinate commanders on the scene.”
他写道："让没有通讯的军团单独对抗通讯畅通的中央部队，是违背所有原则的"。传统的德国军队，以其 "线性战术、铁的纪律、盲目的服从和对独立行动的不容忍"，最初没有能力应对拿破仑的方法。认识到需要一种新的战略，德国人发展了Auftragstaktik或我们现在所说的指挥官意图，即分享必要的信息 "以增强现场下级指挥官的能力 "的想法。

The theory underpinning commander’s intent is all about trying to construct the right circumstances for replication. Any given side in a confrontation wants to replicate their strategy to the point of execution. What is the best structure for this? Too rigid and the guy on the ground can’t adapt and innovate to execute the strategy when the circumstances change—which they will.
支撑指挥官意图的理论都是关于试图构建正确的复制环境。对抗中的任何一方都想把他们的战略复制到执行的时候。这方面的最佳结构是什么？太死板了，当环境发生变化时，地面上的人就无法适应和创新来执行战略--他们会的。

There is a direct connection with the challenges of replication in biology: “Rigid specialization—by a genetic code, for example—is not feasible, simply because the code would be excessively large, prone to breakdown, and inadequate for anticipating the many challenges and opportunities an economic entity is likely to encounter during its lifetime.” When the Germans faced Napoleon, they were experiencing problems related to their rigidity of organization. The guys on the front lines couldn’t adapt. Discouraged from ever considering the why or the rationale behind an order, the German troops had nothing to draw on when Napoleon changed his tactics midbattle.
这与生物学中复制的挑战有直接的联系。"例如，通过遗传密码的刚性专业化是不可行的，仅仅是因为密码会过于庞大，容易崩溃，而且不足以预测一个经济实体在其一生中可能遇到的许多挑战和机会。" 当德国人面对拿破仑时，他们正经历着与他们的组织僵化有关的问题。在前线的人无法适应。由于不愿意考虑命令背后的原因或理由，当拿破仑在战斗中改变战术时，德国军队没有任何可以借鉴的地方。

The environment always changes, which is why successful replication has a bit of flexibility built in. If there is not enough fidelity in the copying, however, the strategy gets polluted with too many errors and cannot be executed. Empowered subordinates can adapt to changing battlefield conditions, but giving flexibility cannot cost the commander the ability to synchronize events to execute the strategy. As Clausewitz explained in On War: Strategy is the employment of the battle to gain the end of the war; it must therefore give an aim to the whole military action, which must be in accordance with the object of the war; in other words, strategy forms the plan of the war, and to the said aim it links the series of acts which are to lead to the same, that is to say, it makes the plans for the separate campaigns, and regulates the combats to be fought in each.
环境总是在变化，这就是为什么成功的复制要有一定的灵活性。然而，如果复制的忠实度不够，战略就会被太多的错误所污染，无法执行。被赋予权力的下属可以适应不断变化的战场条件，但赋予灵活性不能让指挥官失去同步执行战略的能力。正如克劳塞维茨在《战争论》中所解释的那样：战略是为获得战争目的而进行的战斗；因此，它必须为整个军事行动提供一个目标，而这个目标必须符合战争的目的；换句话说，战略形成了战争的计划，并将导致同一目标的一系列行为联系起来，也就是说，它为各个战役制定计划，并对每个战役中的战斗作出规定。

As these are all things which to a great extent can only be determined on conjectures, some of which turn out incorrect, while a number of other arrangements pertaining to details cannot be made at all beforehand, it follows, as a matter of course, that strategy must go with the army to the field in order to arrange particulars on the spot, and to make the modifications in the general plan which incessantly become necessary in war. Strategy can therefore never take its hand from the work for a moment. How do you hit the sweet spot between execution of strategy and flexibility to adapt to changing conditions? There are four elements of commander's intent: formulate, communicate, interpret, and implement.
由于这些事情在很大程度上只能根据猜测来确定，而其中一些猜测结果是不正确的，而其他一些与细节有关的安排则根本无法事先确定，因此，作为一个问题，战略必须与军队一起到战场上，以便在现场安排细节，并对总体计划进行修改，这在战争中是不断必要的。因此，战略永远不能从工作中抽身。你如何在执行战略和灵活地适应不断变化的条件之间找到最合适的位置？指挥官的意图有四个要素：制定、沟通、解释和执行。

The first two are the responsibility of the senior commander, the latter two the job of the subordinate commander. In order to develop these skills commanders must consider four criteria:
前两个是高级指挥官的责任，后两个是下级指挥官的工作。为了发展这些技能，指挥官必须考虑四个标准。

1. Explain the rationale (not just the what and why, but how they arrived at a decision)
   解释理由（不仅仅是什么和为什么，而是他们是如何得出一个决定的
2. Establish operational limits (identify what is completely off the table)
   建立行动限制（确定什么是完全不允许的）。
3. Get feedback often (a continuous loop between levels)
   经常获得反馈（各级之间的连续循环）。
4. Recognize individual differences (the unique psychological makeup of each subordinate)
   承认个体差异（每个下属的独特心理构成）

In combination these criteria, when executed properly, hit the sweet spot of replication. They allow for the continuous application of strategy, while having room to adapt and innovate in the face of changing conditions.
这些标准结合在一起，如果执行得当，就能找到复制的甜蜜点。它们允许战略的持续应用，同时在面对不断变化的条件时有适应和创新的空间。

Replicating a culture 复制一种文化

The model of replication can also be used to help us understand why some products or customs propagate around the globe. Often, when exposed to other cultures, we notice the differences: The things that those others do or say that we find foreign and almost nonsensical. Ideas that seem to be barriers to communication and understanding. It is possible, however, to see these customs as being too rigid to allow for the necessary development that comes when new ways of doing things have to fit into existing cultures.
复制的模式也可以用来帮助我们理解为什么一些产品或习俗会在全球范围内传播。通常情况下，当接触到其他文化时，我们会注意到其中的差异。那些别人做的或说的事情，我们觉得很陌生，几乎是无稽之谈。那些似乎是沟通和理解障碍的想法。然而，我们有可能认为这些习俗过于僵化，以至于当新的做事方式必须适应现有文化时，无法进行必要的发展。

There are spectacular examples of customs that are near global, something that otherwise disparate cultures partake in, albeit in slightly different ways. One of the products that has had the flexibility to take root all over the world is tea. How it was able to replicate, not just biologically, but culturally, speaks to the value of being able to adapt. Tea-drinking cultures are all over the world. From China, Japan and Russia, to Iran, the United Kingdom, and Kenya, tea has spread everywhere. In most places, the development of a tea culture—simply understood as a place where a lot of people like drinking tea—followed a typical pattern.
有一些壮观的例子表明，这些习俗几乎是全球性的，否则不同的文化都会参与其中，尽管方式略有不同。有一种产品能够灵活地在世界各地扎根，那就是茶。它如何能够复制，不仅在生物学上，而且在文化上，说明了能够适应的价值。饮茶文化遍布世界各地。从中国、日本和俄罗

斯，到伊朗、英国和肯尼亚，茶叶已经传播到各地。在大多数地方，茶文化的发展--简单理解为一个有很多人喜欢喝茶的地方--遵循一个典型的模式。

First, a place was exposed to tea, whether from explorers, voyagers, or invaders. Once people got a taste for it, the country began trading for it. Then, after its uptake into the culture, countries would try to grow it themselves, climate permitting. This was a pattern that played out in many areas around the globe. Tea first started in China, as the tea plant is only native to a small region encompassing southwestern China and parts of India and Myanmar. Cultivation of the tea plant started there at least 3,000 years ago and as early as 400 CE was being describe as a drink that “lightens the body and changes the bones.”
首先，一个地方接触到了茶，无论是从探险家、航海家，还是从入侵者。一旦人们尝到了茶的味道，这个国家就开始进行茶叶贸易。然后，在茶叶被文化吸收后，如果气候允许，各国会尝试自己种植茶叶。这是一个在全球许多地区上演的模式。茶叶最早始于中国，因为茶树只原产于包括中国西南部以及印度和缅甸部分地区的一个小区域。茶树的栽培至少在3000年前就开始了，早在公元400年就被描述为一种 "减轻身体，改变骨骼 "的饮料。

Tea can taste wonderful, but now we also know that it has caffeine, which is no doubt a huge part of the reason for its initial and ongoing popularity. Tea has played a lot of roles in China. For many centuries it was one of the country’s greatest exports and has played a significant part in the country’s international relations with everyone from the Mongols to the British. Tastes changed and evolved over time in China, regarding the right way to brew a cup or the right tools required for serving. However, when it comes to tea, China is the original consumer of the plant, and it was ultimately from there that everyone else replicated their tea culture.
茶的味道很好，但现在我们也知道它有咖啡因，这无疑是它最初和持续流行的很大一部分原因。茶在中国扮演了很多角色。许多世纪以来，它是该国最大的出口产品之一，在该国与从蒙古人到英国人的国际关系中发挥了重要作用。在中国，随着时间的推移，口味发生了变化，关于冲泡一杯茶的正确方法或服务所需的正确工具，也在不断演变。然而，说到茶叶，中国是这种植物的原始消费者，而且最终其他国家都从那里复制了他们的茶文化。

Traveling Buddhist monks brought tea to Japan, where tea and its associated ceremonies became related to both political power and cultural expression. Tea came over from China a few times, but as Victory Mair and Erling Hoh explain in The True History of Tea, “It was not until 1191, when the Buddhist monk Myoan Eisai, having returned from studies in China, began to propagate Zen as a teaching that could save Japan, and tea as a medicine that could restore the Japanese people to health, that Japanese tea culture began to develop in earnest.”
旅行的佛教僧侣把茶带到了日本，在那里，茶和它的相关仪式与政治权力和文化表达都有关系。茶叶从中国过来过几次，但正如Victory Mair和Erling Hoh在《茶叶的真实历史》中解释

的那样，"直到1191年，佛教僧侣Myoan Eisai从中国学习归来后，开始宣传禅宗是可以拯救日本的教义，而茶是可以使日本人民恢复健康的药物，日本的茶文化才开始认真发展。"

Once the culture had started, the Japanese began to cultivate the tea plant themselves. Tea consumption became part of a much more elaborate cultural expression. The tea ceremony, or chanoyu, was long and complicated, and each participant was required to know their roles going in. But far from being a turn-off, this complicated way of consuming tea “was perfected as an art form that fuses nature, the crafts, philosophy, and religion, lending poignant expression to the Japanese spirit.”
一旦这种文化开始，日本人就开始自己种植茶树。茶叶消费成为一种更为复杂的文化表达方式的一部分。茶道，即chanoyu，是漫长而复杂的，每个参与者都需要知道他们的角色。但是，这种复杂的饮茶方式远非令人厌恶，"它作为一种艺术形式得到了完善，融合了自然、手工艺、哲学和宗教，对日本精神进行了深刻的表达"。

Tea had undergone its first total replication, leading to new cultural expression in Japan. In the 17th century, trading routes developed linking China and Russia. Tea was one of the most important commodities that made its way from China to Moscow, over 4,000 kilometers away. The Russians took to tea almost immediately. “From the gilded halls of the Kremlin, to the tarred cabins of the country’s peasants, tea became Russia’s national temperate drink, and the samovar, a metal urn used to boil water, the embodiment of the warm, hospitable Russian hearth.”
茶叶经历了它的第一次全面复制，导致了日本新的文化表达。在17世纪，连接中国和俄罗斯的贸易路线得到发展。茶叶是最重要的商品之一，它从中国运往4000多公里外的莫斯科。俄罗斯人几乎立刻就喜欢上了茶。"从克里姆林宫的镀金大厅，到全国农民的柏油小屋，茶叶成为俄罗斯的国家温带饮料，而萨莫瓦（一种用来烧水的金属罐）则是温暖、好客的俄罗斯炉灶的体现。"

The Russian temperance movement actively promoted tea as a means of reducing vodka consumption. Initially, Russia sustained its tea habit through trade with China. However, as time passed, Russia wanted to change its dependence on Chinese tea. So, “in 1893, the Popoff tea firm established the empire’s first tea garden in the Caucasus near the Georgian town of Batumi.” Thus, Russia began to cultivate its own tea, creating another cultural and industrial replication. The last place we will look at is the development of tea culture in Persia, the region now known as Iran.
俄罗斯的节制运动积极推广茶叶，作为减少伏特加酒消费的一种手段。最初，俄罗斯通过与中国的贸易维持其茶叶习惯。然而，随着时间的推移，俄罗斯希望改变对中国茶叶的依赖。因此，"1893年，波波夫茶叶公司在格鲁吉亚巴统镇附近的高加索地区建立了帝国的第一个茶园"。因此，俄罗斯开始种植自己的茶叶，创造了另一种文化和工业的复制。我们要看的最后一个地方是波斯的茶文化发展，这个地区现在被称为伊朗。

Tea came to this area not directly from China, but via the groups in central Asia who had already become addicted to tea, and who carted it into Persia for trading purposes. There, “by the first half of the 17th century it had become part of daily life.” Tea was well suited to Islamic culture given its prohibition of alcohol. It provided a religiously acceptable little boost. Tea taverns developed “where persons of good repute went to drink tea, smoke tobacco, and play chess.” Persian pilgrims took tea to the countries of the Arabian Peninsula, much like the Buddhist monks had taken tea all over China and to Japan. As tea culture firmly took hold, Persians too desired to reduce their dependency on outside sources for the plant.
茶叶不是直接从中国来到这个地区的，而是通过中亚的一些群体，他们已经对茶叶上瘾了，为了贸易目的，他们把茶叶运到波斯。在那里，"到17世纪上半叶，它已经成为日常生活的一部分"。鉴于伊斯兰文化对酒精的禁止，茶很适合伊斯兰文化。它提供了一种宗教上可接受的小刺激。茶馆发展起来，"有声望的人在那里喝茶、抽烟、下棋"。 波斯朝圣者把茶带到阿拉伯半岛各国，就像佛教僧侣把茶带到中国各地和日本一样。随着茶文化的深入人心，波斯人也希望减少对外部资源的依赖，以获得这种植物。

So “tea production was initiated at the beginning of the 20th century, when the Persian consul to India succeeded in smuggling some 3,000 Assam tea seedlings back to his country and had them planted in the Lahijan region on the southwestern side of the Caspian Sea.” And thus did the replication of tea as both industry and culture continue. What is it about tea that allowed it to be replicated all over the globe? For starters, tea has an inherent flexibility. There are multiple ways to make and consume tea, which can be modified based on cultural norms and social desires.
因此，"茶叶生产在20世纪初开始，当时波斯驻印度领事成功地将大约3000株阿萨姆茶苗走私回国，并将它们种植在里海西南侧的拉希扬地区。" 就这样，茶叶作为工业和文化的复制继续进行。是什么让茶叶在全球范围内被复制？首先，茶叶有一种固有的灵活性。有多种制作和饮用茶叶的方法，可以根据文化规范和社会愿望进行修改。

Different degrees of oxidization of tea leaves will produce green, oolong, or black tea. Each of these can flavored with different spices or milk, or whatever else is locally available. It lends itself to different brewing techniques based on local equipment and resources. But all outputs of seeping tea leaves in boiling water are uniformly called tea. So there is also a core structure that cannot be changed. Tea only comes from the tea plant. This combination of a firm concept within a flexible package is one clear explanation of how tea managed to spread from a tiny geographical location to have acolytes in almost every country on the planet
茶叶的不同氧化程度会产生绿茶、乌龙茶或红茶。每种茶都可以用不同的香料或牛奶，或其他当地可用的东西来调味。它可以根据当地的设备和资源，采用不同的酿造技术。但所有在沸水

中渗出的茶叶的产出都统一称为茶。因此，也有一个不能改变的核心结构。茶叶只来自于茶树。这种将坚定的概念与灵活的包装相结合的做法，清楚地解释了茶叶是如何从一个很小的地理位置传播到地球上几乎所有国家的信徒的。

Conclusion 结论

Replication as a mental model teaches us that we don't always need to reinvent the wheel. Often a good starting point is what others are doing. Once you get a sense and a feel for the environment you can adapt to better suit your own needs. What we need to remember is that effective replication requires enough structure and space to produce a copy, but enough flexibility to adapt that copy to changes in the environment. Just because something has worked for a while doesn't mean that it will continue to be effective in perpetuity. Maintaining a successful approach requires an ability to grow and modify that approach as required.
复制作为一种心理模式告诉我们，我们并不总是需要重新发明车轮。通常情况下，一个好的起点是别人正在做的事情。一旦你对环境有了认识和感觉，你就可以进行调整以更好地满足自己的需要。我们需要记住的是，有效的复制需要有足够的结构和空间来产生一个副本，但也要有足够的灵活性来使这个副本适应环境的变化。某个东西已经工作了一段时间，但并不意味着它将永久地继续有效。保持一个成功的方法需要有能力根据需要增长和修改该方法。

Cooperation 合作

> Cooperation is its own evolutionary force that contributes to an organism's immediate survival but also creates the possibility for adaptive responses to future challenges.
> 合作是其自身的进化力量，有助于生物体的直接生存，但也为适应未来挑战的反应创造了可能。
> ——雷夫•萨加林 Rafe Sagarin

Cooperation, or symbiosis, in biology rests on the idea that an organism that cannot perform an important function alone fills this particular gap by using the physical body of another organism, who also benefits from the interaction. It's often a way for species to increase their competitive prowess by giving them an advantage over their competitors. "All organisms are constrained in their adaptability at some point, and symbiotic relationships allow them to extend their inherent adaptive capacity to exploit new resources and environments or adapt to their own environment as it changes." We commonly think of biological cooperation as a win-win arrangement for the parties involved. You have a need. Someone fills it in.
生物学中的合作，或称共生，是基于这样的想法：一个不能单独完成一项重要功能的生物体通

过利用另一个生物体的身体来填补这一特殊的空白，而后者也从这种互动中受益。这通常是一个物种通过给予它们比竞争对手更多的优势来提高其竞争能力的方法。"所有的生物体在某些时候的适应性都受到限制，而共生关系使它们能够扩展其固有的适应能力，以利用新的资源和环境，或在环境变化时适应自己的环境。" 我们通常认为，生物合作是有关各方的双赢安排。你有一个需求。有人填补了它。

In exchange, you fill one of their needs. You don't require cooperation to survive, but with it the quality of your life improves. A shark doesn't need little fish to clean its teeth in order to live that day, but overall the quality of the shark's life is enhanced because clean teeth mean healthy teeth, which will give it more years to feed on prey. Cooperation significantly expands what's possible, by creating emergent properties that have more power than the individual components. The origin of mitochondria is an excellent example of cooperation in biology. Mitochondria are the energy-producing organelles of cells. They are now an indispensable component of cells, but they do not exist in cells as a product of natural selection. We are here because at some point a mitochondrion and another cell cooperated.
作为交换，你满足他们的一个需求。你不需要合作来生存，但有了它，你的生活质量就会提高。一条鲨鱼不需要小鱼来清洁它的牙齿，以便活到那一天，但总的来说，鲨鱼的生活质量得到了提高，因为清洁的牙齿意味着健康的牙齿，这将使它有更多的时间去捕食猎物。合作大大扩展了可能发生的事情，通过创造出比单个组件更有力量的新兴属性。线粒体的起源是生物学中合作的一个很好的例子。线粒体是细胞产生能量的细胞器。它们现在是细胞不可缺少的组成部分，但它们并不是作为自然选择的产物而存在于细胞中。我们之所以存在，是因为在某个时刻，一个线粒体和另一个细胞进行了合作。

According to one theory, mitochondria originally existed in nature as free prokaryotic cells (simple cells) and that one such mitochondrion was then acquired by an anaerobic, already eukaryotic cell (complex cell) for the purposes of converting toxic oxygen radicals into harmless water for the host. Another theory states that both the mitochondria and the host cell were prokaryotes and that the eukaryotic cell that now powers the vast majority of living organisms was then created as a result of the cooperation. Either way, the ancestor of mitochondria was a bacterium that got incorporated into a cell, from which a mutually beneficial relationship developed. Mitochondria produce adenosine triphosphate, or ATP, which can be thought of as the energy currency of the cell. Most chemical reactions in the cell need a lot of energy.
根据一种理论，线粒体最初作为自由原核细胞（简单细胞）存在于自然界中，然后一个这样的线粒体被一个厌氧的、已经是真核细胞（复杂细胞）获得，目的是将有毒的氧自由基转化为对宿主无害的水。另一种理论认为，线粒体和宿主细胞都是原核生物，现在为绝大多数生物体提供动力的真核细胞是合作的结果。无论哪种说法，线粒体的祖先是一种被纳入细胞的细菌，从那里发展出一种互利的关系。线粒体产生三磷酸腺苷，或称ATP，它可以被认为是细胞的能量

货币。细胞中的大多数化学反应需要大量的能量。

These reactions are possible because the mitochondria are on board to create a rich energy source. Because of the success of this new cell, the mitochondria began “living” in the host cell, and over time became a part of the host cell and reproduced in this manner. These events took place over 1 billion years ago. Without this cooperation between two types of cells, complex organisms would not have been able to evolve. The symbiosis between cows and the bacteria that live in their digestive systems is also interesting.
这些反应之所以可能，是因为线粒体的加入创造了丰富的能量来源。由于这个新细胞的成功，线粒体开始 "生活 "在宿主细胞中，并随着时间的推移成为宿主细胞的一部分，并以这种方式进行繁殖。这些事件发生在10多亿年前。如果没有两种类型的细胞之间的这种合作，复杂的生物体就不可能进化。牛和生活在其消化系统中的细菌之间的共生关系也很有趣。

These bacteria digest the cellulose found in hay and grass for the cow, while the cow offers nutrient-rich environments for the bacteria. It’s a win for both organisms. Combined with their multilayered stomach and short appendix, this relationship means cows can eat tough plant foods. Humans cannot digest cellulose in part because they do not have cellulose-digesting bacteria in their digestive systems! A final, fascinating example is the interaction of the Hawaiian squid and a bacterium, Vibrio fischeri. The bacteria emit light and live in the light-producing organ of the squid. This is a relatively safe environment for the bacteria, as anything that wants to consume them has to get through the squid.
这些细菌为奶牛消化干草和草地中的纤维素，而奶牛则为细菌提供营养丰富的环境。这对两个有机体都是一种胜利。再加上它们的多层胃和短盲肠，这种关系意味着牛可以吃坚硬的植物食物。人类不能消化纤维素，部分原因是他们的消化系统中没有消化纤维素的细菌! 最后一个迷人的例子是夏威夷鱿鱼和一种细菌--费氏弧菌的互动。这种细菌会发出光，并生活在乌贼的产光器官中。这对细菌来说是一个相对安全的环境，因为任何想吃它们的东西都必须通过乌贼。

The squid, in turn, uses the light produced by these bacteria to camouflage itself from predators in oceans.
反过来，乌贼利用这些细菌产生的光来伪装自己，躲避海洋中的捕食者。

Progress takes the fast track 进展走上了快车道

In some cases the cooperation can be so valuable to the organisms involved that they evolve to become part of each other permanently. As in the mitochondria example above, the benefits realized by those organisms cooperating provide a foundation for further development. When you can depend on the cooperation and the needs it addresses, you can leverage the freed energy to support growth and innovation.
在某些情况下，合作对所涉及的生物体是如此有价值，以至于它们进化成了彼此的永久组成部

分。正如上述线粒体的例子一样，这些生物体合作实现的利益为进一步发展提供了基础。当你可以依赖合作和它所解决的需求时，你可以利用释放的能量来支持增长和创新。

A human example of this is the development of the railroad and the telegraph. As inventions they were completely separate, but the cooperative relationship that developed between the two allowed them to take over the world. As Alfred D. Chandler writes: “The railroad and the telegraph marched across the continent in unison.”
这方面的一个人类例子是铁路和电报的发展。作为发明，它们是完全独立的，但两者之间形成的合作关系使它们能够占领世界。正如阿尔弗雷德-D-钱德勒所写的："铁路和电报齐头并进，横跨整个大陆"。

The telegraph provided train companies with a mechanism for communicating the progress of trains on the line– if they were late or early–so people could be ready to unload perishable goods and otherwise adjust their schedules. This extreme efficiency was key to the railroads being profitable. In return, the rail lines provided telegraph companies with an infrastructure on which to construct their system–from the poles and wires linking cities to the stations that often housed telegraph offices.
电报为火车公司提供了一种机制，用于传达火车在线路上的进展情况--如果它们晚点或提前，这样人们就可以准备好卸下易腐烂的货物，并以其他方式调整其时间表。这种极高的效率是铁路公司盈利的关键。作为回报，铁路线为电报公司提供了构建其系统的基础设施--从连接城市的电杆和电线到通常设有电报办公室的车站。

The cooperation was so successful that very quickly neither industry could conceive of doing business without the other. Their businesses became linked due to the mutual benefit each provided, and the benefits that further accrued from their symbiotic relationship. The interactions between the two technologies 5 “intensified the speed and volume of the flow of goods, passengers, and messages.” They helped each other to be better, and similar to cooperation among biological organisms, “what matters is that partnerships develop according to how effectively tasks are accomplished.”
这种合作是如此成功，以至于很快两个行业都无法想象在没有对方的情况下开展业务。他们的业务因各自提供的互利而联系在一起，并从他们的共生关系中进一步获得好处。这两种技术之间的相互作用 "加强了货物、乘客和信息流动的速度和数量"。他们互相帮助，使对方变得更好，类似于生物体之间的合作，"重要的是，伙伴关系的发展是根据任务的有效完成情况"。

The attachment between the railroad and telegraph was so strong that it could be depended on completely, allowing each industry to free up resources that would otherwise be spent on duplicating the other’s technology and infrastructure. The lesson here is, how often do you look for opportunities for collaboration? We often talk of the competition–what they are doing, what direction they are headed–so we can keep up

where we need to and not get blindsided or lose too much market share. But how many of us devote resources to looking for “the cooperation”—companies or industries with whom we can partner for mutual benefit?
铁路和电报之间的依附关系是如此之强，以至于可以完全依靠它，使每个行业释放出资源，否则这些资源将被用于复制对方的技术和基础设施。这里的教训是，你有多少次寻找合作的机会？我们经常谈论竞争--他们在做什么，他们在朝什么方向发展--这样我们就能在我们需要的地方跟上，而不会被忽悠或失去太多的市场份额。但是，我们中有多少人把资源用于寻找 "合作"--我们可以与之合作以实现互利的公司或行业？

Exceptional harmony 特殊的和谐

Writing about lichens, which are essentially a new organism produced through the symbiotic relationship between algae and fungi, Rafe Sagarin says of symbiosis that it “creates emergent properties that you wouldn’t predict from just looking at the two organisms on their own.”
地衣基本上是通过藻类和真菌之间的共生关系产生的一种新的生物体，雷夫-萨加林在写到共生关系时说，它创造了新兴的特性，而你仅仅看这两种生物体本身是无法预测的。

There is possibly no better example of the power of cooperation to transform existing structures and create new capabilities than the relationships required to achieve success as a symphony orchestra. The interaction between the musicians, and them with the conductor, involves a huge amount of trust and commitment to produce something that is greater than the sum of its parts. Alexander Shelley, conductor of the National Arts Centre Orchestra in Ottawa, Canada, describes the interaction of its members as such: “In the best-case scenario, they start to behave like a flock of birds. When you see a flock of birds moving around, you’re not quite sure who’s leading it or what’s happening.”
可能没有比作为一个交响乐团获得成功所需的关系更好的例子来说明合作改造现有结构和创造新能力的力量。音乐家之间的互动，以及他们与指挥家的互动，涉及到大量的信任和承诺，以产生比其各部分之和更大的东西。加拿大渥太华国家艺术中心管弦乐团的指挥亚历山大-谢利这样描述其成员之间的互动。"在最好的情况下，他们开始表现得像一群鸟。当你看到一群鸟在移动时，你不太确定谁在领导它或发生了什么"。

This speaks to the unusual collaboration that happens in symphony orchestras. It’s not a leader with a bunch of followers. It is not a rigid hierarchy of responsibility. Shelley says, “When it’s functioning correctly, it’s a symbiosis between me and the eighty musicians on stage.” Why does an orchestra pursue its goals in this way? Because this is what all the participants believe is required to truly make the music. Perfect cooperation is the difference between good and inspirational. Shelley describes an orchestra by saying, “When things are working well, a conductor and orchestra are in this state of absolute

coordination where the music is speaking the way it needs to speak."
这说明了交响乐团中发生的不寻常的合作。它不是一个领导者和一群追随者。它不是一个僵化的责任层次。谢利说，"当它正常运作时，它是我和舞台上八十名音乐家之间的共生关系。" 为什么一个乐团会以这种方式追求它的目标？因为这是所有参与者认为的真正创造音乐的要求。完美的合作是良好和鼓舞人心的区别。雪莱在描述一个乐团时说："当事情进展顺利时，指挥家和乐团处于这种绝对协调的状态，音乐是以它需要的方式说话的。"

Other conductors have made similar points. Conductor Valery Gergiev says, "I just go straight to the most important thing—what is the color, what is the character of this music, what is the principal voice? And that means we are working immediately on… the relationship between all the parts, which is a huge coordination between all of us." Conductor Mariss Jansons defines that moment of success for an orchestra as "when a good performance becomes a great one, a coming together of the piece, the performers, and the audience that creates a positive feedback loop of continuous enrichment and enchantment." Therefore, trust is an essential component of successful symphony orchestras.
其他指挥家也提出了类似的观点。指挥家瓦列里-格奥尔基耶夫说："我只是直接去做最重要的事情--什么是颜色，什么是这个音乐的特征，什么是主要的声音？而这意味着我们立即着手处理.....所有部分之间的关系，这是我们所有人之间的巨大协调。" 指挥家马里斯-詹森斯将乐团的成功时刻定义为："当一场好的演出变成一场伟大的演出时，作品、表演者和观众就会聚集在一起，形成一个持续丰富和迷人的正反馈循环。" 因此，信任是成功的交响乐团的一个重要组成部分。

Each musician hears the instruments closest to them best, and in some halls cannot rely on their ears at all if they have to collaborate with an instrument in a different section. To cooperate fully as a group, they have to trust each other, and they have to understand how their individual part contributes to what the rest of the orchestra is doing. In Music as Alchemy, Tom Service describes the musicians in the Berlin Philharmonic Orchestra as "a group of players who value themselves enormously as individual musicians, but who together create an instantly identifiable single sonic body in their performances." It's the complete cooperation that allows the emergence of the musical experience. An orchestra has to come together on many levels in order to make music.
每个音乐家都能听到离他们最近的乐器的声音，在一些音乐厅里，如果他们必须与不同区的乐器合作，就根本不能依靠他们的耳朵。要想作为一个团体充分合作，他们必须相互信任，而且他们必须了解自己的个人部分是如何为乐团的其他部分做出贡献的。在《音乐是炼金术》一书中，汤姆-斯蒂尔将柏林爱乐乐团的音乐家们描述为 "一群非常重视自己作为个体音乐家的演奏者，但他们在表演中共同创造了一个可以立即识别的单一音质体。" 正是这种完全的合作才使得音乐体验得以出现。一个管弦乐队必须在许多层面上走到一起，才能做出音乐。

To achieve the trust required to anticipate the needs of the performance the cooperation must be absolute. Each member has to be all in. An orchestra is an all-or-nothing situation. If one member is messing up and playing terribly, they can ruin the whole performance. Their playing jars with everyone else and throws them off. It requires total cooperation. A remarkable example of this cooperation and trust is the Montreal Women's Symphony Orchestra. Started in 1940, they were "the only complete all women's symphony orchestra in North America at that time—conducted by a woman, managed by women, and composed of women." This orchestra was born at a time when it was rare for women to play in orchestras, and if they did were confined to certain instruments that were considered "ladylike," such as the harp. Anything happening in the public sphere, even music, was still very much considered the purview of men.
为了实现预期演出需要的信任，合作必须是绝对的。每个成员都必须全身心投入。管弦乐队是一个全能或无能的局面。如果一个成员搞砸了，演奏得很糟糕，他们会毁了整个演出。他们的演奏与其他人的演奏相冲突，使他们的演奏受到干扰。这需要完全的合作。蒙特利尔女子交响乐团是这种合作和信任的一个显著例子。她们成立于1940年，是 "当时北美唯一一个完整的全部由女性组成的交响乐团--由女性指挥，由女性管理，由女性组成"。这个乐团诞生于一个女性很少在乐团中演奏的时代，如果她们这样做，也仅限于演奏某些被认为是 "淑女 "的乐器，如竖琴。在公共领域发生的任何事情，甚至是音乐，在很大程度上仍然被认为是男人的职权范围。

Of course, not everyone agreed, and two women, Madge Bowen and Ethel Stark, decided that there was enough untapped female talent in the city of Montreal to put together an all-female symphony orchestra. The only requirement to join the orchestra at the beginning was commitment and passion. Thus, the orchestra was comprised of women from many walks of life—professional musicians and amateurs, housewives, socialites, working class, and upper class. There were Jewish women, Christians, French, English, and white and black women, including Violet Grant, the first black Canadian to be a permanent member of a symphony.
当然，并不是每个人都同意，两位女性，马奇-鲍恩和艾瑟尔-斯塔克，决定在蒙特利尔市有足够的未开发的女性人才来组建一个全女性的交响乐团。一开始，加入乐团的唯一要求是承诺和热情。因此，乐团由来自各行各业的妇女组成--专业音乐家和业余爱好者、家庭主妇、社会名流、工人阶级和上层社会。其中有犹太妇女、基督徒、法国人、英国人、白人和黑人妇女，包括第一个成为交响乐团永久成员的加拿大黑人Violet Grant。

Their emphasis, under the guidance of their conductor Ethel Stark, was on teamwork and inclusiveness, so that "despite their differences, they came together for one purpose: to make music." The diversity of the group required a staggering amount of cooperation in order to make the orchestra succeed. They had to deal with social tensions that are still unresolved in contemporary society. Before the instruments could cooperate to make

music, the cooperation of the members was required to create the orchestra.
在指挥家埃塞尔-斯塔克的指导下，她们强调的是团队精神和包容性，因此，"尽管她们有分歧，但她们为了一个目的走到一起：创造音乐。" 这个团体的多样性需要大量的合作，以使乐团取得成功。他们必须处理当代社会中仍未解决的社会紧张关系。在乐器能够合作制造音乐之前，需要成员们的合作来创建管弦乐队。

Class divisions had to be set aside during rehearsal time in order for their dedication to the music to achieve fruition. Cooperation often comes about in a biological context due the latent understanding that no one can do everything. No species or individual is perfectly adapted to deal with the entire spectrum of possible environmental conditions. This applies equally well to an orchestra. There is no music without all the instruments, and these instruments cannot work together without people who are willing to trust each other to respond correctly to the demands of performance.
在排练期间，为了让他们对音乐的奉献取得成果，必须把阶级分歧放在一边。在生物背景下，合作往往是由于没有人可以做所有的事情这一潜在的理解而产生的。没有哪个物种或个体能完美地适应处理所有可能的环境条件。这同样适用于一个乐团。没有所有的乐器就没有音乐，而这些乐器如果没有愿意相互信任以正确应对演出要求的人，就无法一起工作。

The Montreal Women's Symphony Orchestra devoted themselves to their music, demonstrating, as Maria Noriega Rachwal describes in her biography of the group, "the power of music to transcend boundaries." Their dedication and talent were recognized after years of practice in basements and drafty industrial buildings, squeezing the music in between factory work and child-rearing, when the group became the first Canadian orchestra to be invited to play at Carnegie Hall in New York. The performance was exceptional; the music flowed out to rave reviews.
蒙特利尔女子交响乐团全身心地投入到他们的音乐中，正如玛丽亚-诺列加-拉赫瓦尔在她的传记中描述的那样，展示了 "音乐超越边界的力量"。他们在地下室和通风的工业建筑中进行了多年的练习，在工厂工作和育儿之间挤时间听音乐，他们的奉献精神和才能得到了认可，当时该乐团成为第一个被邀请到纽约卡内基音乐厅演出的加拿大乐团。演出非常出色；音乐流传开来，好评如潮。

Building on this success, the orchestra toured all over the world, as well as performing on television and radio. Never well-paid, the Montreal Women's Symphony Orchestra eventually had to shut down after being denied funding that was made available to other Canadian symphony orchestras. So it is truly their commitment to music and each other that led them to the successes they had. In terms of cooperation, theirs was absolute. The women in the orchestra were all in.
在这一成功的基础上，乐团在世界各地巡回演出，并在电视和广播上表演。蒙特利尔女子交响乐团从未获得过高薪，在被拒绝获得其他加拿大交响乐团的资金后，最终不得不关闭。因此，

确实是她们对音乐和彼此的承诺，使她们取得了成功。在合作方面，她们的合作是绝对的。乐团中的女性都在其中。

Shared Belief 共同的信念

In the book Sapiens, Yuval Noah Harari explains and examines how humans cooperate in extensive systems of shared belief. He points out that, uniquely among species on the planet, humans are able to imagine things that have no physical counterpart, and furthermore that this imagining allows us to function in the large, complex societies that we have. These shared beliefs are requirements for our lifestyles—“large numbers of strangers can cooperate successfully by believing in common myths.” These shared beliefs frame every aspect of our lives.
在《智人》一书中，尤瓦尔-诺亚-哈拉里解释并研究了人类如何在广泛的共同信仰系统中进行合作。他指出，在地球上的物种中，人类是独一无二的，他们能够想象没有物理对应物的事物，此外，这种想象使我们能够在我们拥有的大型复杂社会中运作。这些共同的信念是我们生活方式的要求--"大量的陌生人可以通过相信共同的神话而成功合作"。这些共同的信念构成了我们生活的每一个方面。

Our belief in the value of currency, laws, corporations, and nations is what allows us to work together and to live together. Without these shared beliefs, we wouldn’t own anything or have homes, jobs, or any social infrastructure. According to Harari, it is this ability to trust in shared beliefs that allowed humans to move from small groups focused on daily needs to the large, interconnected population that studies the past and worries about the future. Whether or not this gets a value judgment of “good” can be debated. As Harari argues, “most human cooperation networks have been geared toward oppression and exploitation.”
我们对货币、法律、公司和国家的价值的信念，使我们能够一起工作，一起生活。如果没有这些共同的信念，我们就不会拥有任何东西，也不会有房屋、工作或任何社会基础设施。哈拉里认为，正是这种信任共同信念的能力，使人类能够从专注于日常需求的小团体发展到研究过去、担忧未来的庞大、相互联系的人群。这是否得到了一个 "好 "的价值判断，可以进行辩论。正如哈拉里所认为的，"大多数人类合作网络都是以压迫和剥削为导向的"。

After all, it is only shared belief that explains why some people’s lives are easier than others—if we didn’t all buy in to the myth of money, it wouldn’t exist, let alone be useful to accumulate. And there is an element of inertia here. The more encompassing a shared belief gets, the more we forget it is a human construct. Eventually, the mass of belief becomes so large that we

consider it an inescapable part of the natural world. There is no doubt that we can no longer operate without cooperating in these shared beliefs.
毕竟，只有共同的信念才能解释为什么有些人的生活比其他人更容易--如果我们不都相信金钱的神话，它就不会存在，更不用说积累起来的好处。而且这里有一个惯性的因素。一个共同的信念越是包罗万象，我们就越是忘记它是一个人的构造。最终，信仰的质量变得如此之大，以至于我们认为它是自然世界不可避免的一部分。毫无疑问，如果不在这些共同信念中进行合作，我们就无法再运作。

Conclusion 结论

Cooperation teaches us to seek out and frame interactions based on not only what we can get, but also what we can give. If there was any one model that explains humanity, then this is it. Cooperation unleashed the potential of the human species. Working and collaborating with others gives us options and opportunities that are unavailable when we insist on going it alone. Furthermore, when you don't have time to evolve in response to changes in the environment, cooperation can significantly improve your chances of survival by pursuing relationships that bring mutual benefit.
合作教导我们不仅要根据我们能得到的东西，而且要根据我们能给予的东西来寻求和构建互动。如果有任何一种模式可以解释人类，那么这就是它。合作释放了人类的潜力。与他人合作和协作给了我们选择和机会，而这些选择和机会是我们坚持单干时无法得到的。此外，当你没有时间根据环境的变化进行进化时，合作可以通过追求带来互利的关系而大大改善你的生存机会。

Cooperation led to the powerful brains we have, capable of art and abstract thinking. Our complex societies are built on our ability to work with each other, believe in the same ideas, and share the same goals. Cooperation is the fuel that powers our day, from raising our children, to the jobs we perform, and the social structures that give us everything from leisure time to meaning and purpose. When we cooperate, we lighten our individual loads and sometimes create something brand new.
合作导致了我们拥有强大的大脑，能够进行艺术和抽象思维。我们复杂的社会是建立在我们相互合作、相信相同的想法和分享相同的目标的能力之上。合作是为我们每天提供动力的燃料，从养育我们的孩子，到我们从事的工作，以及给予我们从休闲时间到意义和目的的社会结构。当我们合作时，我们会减轻我们个人的负担，有时还会创造一些全新的东西。

Dunbar's Number 邓巴数

Robin Dunbar, an evolutionary anthropologist, argues that there is a limit to the number of people with whom one can maintain stable social relationships.

This limit, of about 150 persons, is set by our neocortex size. He explains that in groups beyond this number, neocortical limitations make it difficult for people to maintain relationships with everyone, as they suffer from information overload. Using studies by field anthropologists working with primates, Dunbar suggested that there was a direct correlation between the number of neocortical neurons and the number of social relationships that can be monitored. To support this argument, Dunbar refers to historical communities that were about 150 in number.
进化人类学家罗宾-邓巴（Robin Dunbar）认为，一个人能够与之保持稳定的社会关系的人数是有限制的。这个极限约为150人，是由我们的新皮层大小设定的。他解释说，在超过这个数字的群体中，新皮质的限制使人们难以与每个人保持关系，因为他们遭受信息过载。邓巴利用田野人类学家对灵长类动物的研究，提出新皮层神经元的数量与可监测的社会关系的数量之间有直接的关联。为了支持这一论点，邓巴提到了数量约为150的历史社区。

These include hunter-gatherer communities, military units, successful businesses, communities counted in the Domesday Book, Neolithic villages, and Christmas-card networks, to name a few. Because we are limited by our brain capacity, Dunbar's research suggests that the fitness advantage of larger social groups was a driver in the evolution of parts of the brain. Other scientists have corroborated this idea that our larger brains are primarily a social versus ecological adaptation. It wasn't because we happened to have a bigger brain for say, hunting, that we pursued complex social relationships, but rather that these relationships were critical for the evolutionary development of neocortical capacity.
这些社区包括狩猎采集者社区、军事单位、成功的企业、《多姆塞德书》中统计的社区、新石器时代的村庄和圣诞卡网络，仅举几例。由于我们的大脑容量有限，邓巴的研究表明，更大的社会群体的健身优势是大脑部分进化的一个驱动力。其他科学家已经证实了这一观点，即我们较大的大脑主要是一种社会与生态的适应。并不是因为我们碰巧有一个更大的大脑用于例如狩猎，我们才追求复杂的社会关系，而是这些关系对新皮质能力的进化发展至关重要。

This means that being socially successful is critical for our survival, both as a species and an individual. There is, however, a limit to how many social relationships we can successfully navigate. Thus, being socially successful is about knowing our limits and investing our time accordingly. Dunbar identified the following scale of closeness for humans in groups. Note that each group includes the ndividuals from the smaller groups, and each number is about the maximum that could be maintained at that level.
这意味着，无论是作为一个物种还是个人，在社会上取得成功对我们的生存至关重要。然而，我们能成功驾驭多少社会关系是有限制的。因此，社交上的成功是关于了解我们的极限并相应地投资我们的时间。邓巴确

定了人类在群体中的亲密程度的以下尺度。请注意，每个群体包括来自较小群体的个体，每个数字大约是可以维持在该水平的最大限度。

* 5 people: This is our inner core of closeness, the people who we support and who support us on a daily basis, such as partners, family, best friends.
5个人。这是我们内在的亲密关系核心，是我们支持的人，也是每天支持我们的人，如伙伴、家人、最好的朋友。

* 15 people: This is our close friend group. These people are integrated into our lives to the extent that we have an excellent understanding of their behavior, even if we may not see them all the time.
15个人。这是我们的亲密朋友群体。这些人已经融入我们的生活，以至于我们对他们的行为有很好的理解，即使我们可能不经常见到他们。

* 50 people: This includes our basic friends and acquaintances. We hang out occasionally, probably more often in groups, and know a bit about what is happening in their lives.
50人。这包括我们的基本朋友和熟人。我们偶尔会出去玩，可能更多的是在团体中，对他们生活中发生的事情有一定的了解。

* 150 people: This is the size where you feel you are a part of a community. “This is the number of people you can have a relationship with involving trust and obligation—there’s some personal history, not just names and faces.”
150人。这是你觉得自己是一个社区的一部分的规模。"这是你可以和涉及信任和义务的人建立关系的数量--有一些个人历史，而不仅仅是名字和脸。

* 500 people: This category includes friends of friends, people you know something about but don’t know as well and don’t make a sustained effort to know.
500人。这类人包括朋友的朋友，你知道一些事情，但不太了解，也没有做出持续努力去了解的人。

* 1500 people: This is the upper limit and includes all the faces you can put names to.
1500人。这是上限，包括所有你能说出名字的人。

Dunbar’s number is useful in terms of reminding us about working with our biology. Our brains can only process so much of the information required to maintain social groups.
邓巴的数字在提醒我们与我们的生物学合作方面是有用的。我们的大脑只能处理这么多维持社会群体所需的

信息。

The larger the group, the more brain power required. Eventually we are going to run out. In addition, and we do this all the time, is he cost/benefit analysis. At what point does an increase in my social efforts start to bring diminishing returns? At around 150 people we max out, according to Dunbar. Too far beyond this and we will have trouble keeping track of who everyone is and how they relate to everyone else.
群体越大，需要的脑力就越多。最终我们会耗尽。此外，我们一直在做这个，就是成本/效益分析。在什么时候，我增加的社会努力开始带来递减的回报？根据邓巴的说法，在150人左右的时候，我们就会达到极限。如果超过这个数字，我们就很难掌握每个人是谁以及他们与其他人的关系。

To invest effort beyond this may be more than our brains are capable of performing. Also, less related to scientific research but very relevant to life experience, relationships of any sort require a time investment. How much time we have to devote to social maintenance has a definite cap.
投入的努力超出了我们的大脑所能执行的范围。另外，与科学研究关系不大但与生活经验非常相关的是，任何形式的关系都需要投入时间。我们有多少时间可以投入到社会维护中去，是有明确上限的。

Hierarchical Organization 层次分明的组织

Hierarchies can be found across the animal world. They are a form of social structuring characterized by a linear or almost linear dominance ranking between individuals that live close to one another. These types of organizing structures are most common in social mammals such as baboons and wolves, but are also found in chickens, bears and elephant seals. All else being equal, hierarchies are relatively stable over time, as the individuals within a lower group are aware and accept their position and thus do not directly challenge those on top. Organizing this way generally means there is less fighting and more order.
等级制度可以在整个动物世界中找到。它们是一种社会结构形式，其特点是生活在一起的个体之间有一个线性或几乎是线性的支配地位排名。这些类型的组织结构在社会性哺乳动物中最为常见，如狒狒和狼，但在鸡、熊和象海豹中也能找到。在其他条件相同的情况下，等级制度随着时间的推移是相对稳定的，因为较低群体中的个体意识到并接受他们的地位，因此不会直接挑战上面的人。这样的组织方式通常意味着有更少的争斗和更多的秩序。

Getting to the top 走向顶层

There is a contract implied in a hierarchy. The dominant member of a group has certain responsibilities to execute in relation to the other members. Specifically “a) direction each day for food, b) protection each day from predators and other dangers, and c) the maintenance of order every day by orienting members to their places and roles, by resolving conflicts when they break out, and by reinforcing social norms whenever transgressions occur.”
等级制度中隐含着一种契约。一个团体中的主导成员对其他成员有一定的责任要执行。具体来说，"a）每天为食物指明方向，b）每天保护自己免受捕食者和其他危险的侵害，c）每天维持秩序，为成员指明位置和角色，在冲突爆发时解决冲突，并在发生违法行为时加强社会规范。"

It was the Norwegian researcher Thorleif Schjelderup-Ebbe who first studied hens to explore how dominance hierarchies, and consequently peace, was maintained in their flocks. He recognized that peace was found only in already established flocks where a dominance hierarchy had been set—each hen knew who it could dominate and who it was subordinate to. Each hen was able to remember the pecking order, and in his experiments, he discovered that one hen had extraordinarily recognized 27 other hens from different flocks.
挪威研究人员Thorleif Schjelderup-Ebbe首次研究了母鸡，以探索在鸡群中如何维持支配地位的等级制度，以及由此带来的和平。他认识到，只有在已经建立的鸡群中才会有和平，在这些鸡群中，统治等级已经确定--每只母鸡都知道它可以统治谁，以及它从属于谁。每只母鸡都能记住啄食顺序，在他的实验中，他发现一只母鸡能超乎寻常地认出27只来自不同鸡群的其他母鸡。

This shows that hierarchical organizations are respected by these birds and form the basis of their way of living. In chimpanzees, “the alpha male usually wins his position not because he is physically stronger, but because he leads a large and stable coalition. These coalitions play a central part not only during overt struggles for the alpha position, but in almost all day-to-day activities. Members of a coalition spend more time together, share food, and help one another in time of trouble.” One of the drawbacks of hierarchies is the lack of perceived value of those who are at the bottom. “An efficient new gathering strategy devised by a low-ranking chimpanzee, for example, might not get replicated just because of her status in society.”
这表明，等级组织受到这些鸟类的尊重，并构成了它们生活方式的基础。在黑猩猩中，"雄性首领通常赢得他的地位，不是因为他身体更强壮，而是因为他领导着一个大型的、稳定的联盟。这些联盟不仅在争夺首领地位的公开斗争中起着核心作用，而且在几乎所有的日常活动中也起着核心作用。联盟的成员花更多的时间在一起，分享食物，并在遇到困难时互相帮助。"等级制度的缺点之一是那些处于底层的人缺乏可感知的价值。"例如，一只低级别的黑猩猩设

计的高效的新聚集策略，可能不会因为她在社会中的地位而得到复制。"

Hierarchies in the human world act as information filters causing us to potentially miss opportunities and ideas. The way we organize ourselves is often a default to our instincts on leadership and authority. Sometimes this is optimal, sometimes it isn't. If it isn't getting us what we need, either as individuals or as a society, it is within our power to make different choices emphasizing the values and strengths that would be beneficial. Our hierarchical organizations are where we derive our ego, status, and reputation, and they are what conditions us to focus on growing ourselves rather than growing others. The interesting thing about hierarchies in humans is that their benefits aren't always obvious at first.
人类世界中的等级制度作为信息过滤器，导致我们有可能错过机会和想法。我们组织自己的方式往往是对我们关于领导和权威的本能的一种默认。有时这是最理想的，有时不是。如果它没有给我们带来我们需要的东西，无论是作为个人还是作为社会，我们有能力做出不同的选择，强调有利于我们的价值和力量。我们的等级组织是我们获得自我、地位和声誉的地方，也是我们专注于发展自己而不是发展他人的条件。关于人类等级制度的有趣之处在于，它们的好处一开始并不明显。

Few people would say they like them, unless they happen to be at the top of the pile. Most of us hate having to defer to our parents, our bosses, the state. Hierarchies reduce creativity. They put extra stress on those at the bottom, potentially increasing their mortality levels. They put a lot of pressure on those at the top too, forcing them to constantly worry about maintaining their position. Most organizations promote cultures that emphasize rather than de-emphasize an individual's status, power, and place, which is part of the reason they get torn apart. Hierarchies are inherently and inevitably unequal and unfair. Hierarchies, however, clearly confer a benefit that is large enough to balance out their costs.
很少有人会说他们喜欢等级制度，除非他们碰巧是在这堆人的顶端。我们大多数人都讨厌不得不听从我们的父母、老板和国家。等级制度降低了创造力。它们给底层的人带来额外的压力，可能会增加他们的死亡率。它们也给高层的人带来了很大的压力，迫使他们不断担心如何维持自己的地位。大多数组织提倡的文化是强调而不是不强调个人的地位、权力和位置，这也是他们被撕裂的部分原因。等级制度在本质上不可避免地是不平等和不公平的。然而，等级制度显然赋予了一个足以平衡其成本的好处。

In the absence of an imposed structure, people have a natural instinct to self-organize. In organizations that claim to have a flat structure with no leaders, people often just end up more frazzled than normal as they attempt 3 to navigate the inevitable unspoken power structures. Even anarchist movements end up with leaders. Leadership is important. Getting rid of the title of "captain" or "boss" doesn't change the fact that someone in the

locker room or the boardroom is going to set the example for others, so it's best to ask who we want that person to be.
在没有强加的结构时，人们有一种自我组织的自然本能。在那些声称拥有扁平结构、没有领导的组织中，人们在试图驾驭不可避免的不言而喻的权力结构时，最终往往会比正常人更加焦头烂额。即使是无政府主义运动，最终也会有领导者。领导是很重要的。摆脱 "队长 "或 "老板 "的头衔并不能改变这样一个事实，即在更衣室或会议室里有人要为其他人树立榜样，所以最好问问我们希望这个人是谁。

If we can't avoid hierarchies, we need to recognize their presence and focus on structuring them in the most beneficial way for everyone involved, like having prestige associated with belonging to the group rather than being conferred on individuals. The key is to be aware of hierarchies and work with, not against them. We want to use hierarchies as a tool, not be used by them.
如果我们不能避免等级制度，我们需要认识到它们的存在，并专注于以对每个人最有利的方式构建它们，比如让威望与属于团体相关，而不是赋予个人。关键是要意识到等级制度，并与之合作，而不是反对它们。我们要把等级制度作为一种工具，而不是被它们所利用。

A place for everyone and everyone in their place 每个人都有自己的位置，每个人都有自己的位置

According to both Plato and Plotinus, another major ancient Greek philosopher, the entire universe is arranged in a hierarchical structure. At the bottom, we have inanimate objects like pebbles or soil. Next, we have plants, then animals, then humans. Then god is at the top of the hierarchy, superior to everything else in the universe.
根据柏拉图和另一位主要的古希腊哲学家普罗提诺的说法，整个宇宙是按等级结构排列的。在底层，我们有卵石或土壤等无生命的物体。接下来，我们有植物，然后是动物，然后是人类。然后，上帝处于等级制度的顶端，高于宇宙中的其他一切。

As Charles van Doren explains in A History of Knowledge, it was this idea that informed human society from the very beginning. The assumption that humans can be organized into a hierarchy from the lowest up to the individual with the most power and perceived importance has always been integral to the way we've constructed our world. Look at any ancient civilization, and you'll find someone at the top, with only that group's god above them. Following Plato and Plotinus, people used their ideas about hierarchy to justify a stratified society.
正如查尔斯-范多伦在《知识史》中所解释的那样，从一开始，正是这种想法为人类社会提供了信息。人类可以被组织成一个等级制度，从最低的到拥有最多权力和被认为最重要的个人，这种假设一直是我们构建世界的方式的组成部分。看看任何古代文明，你会发现有人处于顶端，上面只有那个群体的神。在柏拉图和普罗提诺之后，人们用他们关于等级制度的想法来证

明一个分层社会的合理性。

Yet people have always, at various times, rebelled against hierarchies. As van Doren points out, many of the individuals, in particular religious leaders, to whom we've accorded the highest esteem throughout history, are those who have questioned and thought against existing, unequal hierarchies. This is especially true when a hierarchy becomes so severely stratified that only a handful of individuals can benefit from it. The French Revolution is one of the most iconic instances of people fighting to overthrow a flawed social hierarchy. Prior to the French Revolution, French society was divided into three main groups, known as estates. The First Estate consisted of the Catholic clergy, who oversaw the Catholic church 4 and had some other duties, like giving the monarch advice. They didn't have to pay taxes, collected tithes, and owned lands.
然而，人们总是在不同时期对等级制度进行反抗。正如范多伦所指出的，在历史上我们给予最高敬意的许多人，特别是宗教领袖，都是那些质疑和思考反对现有不平等等级制度的人。当一个等级制度变得如此严重的分层，以至于只有少数人可以从中受益时，这一点尤其真实。法国大革命是人们为推翻有缺陷的社会等级制度而斗争的最具代表性的例子之一。在法国大革命之前，法国社会被分为三个主要群体，被称为庄园。第一产业由天主教神职人员组成，他们负责监督天主教堂，并承担一些其他职责，如为君主提供建议。他们不必缴税，收取什一税，并拥有土地。

As with each of the estates, it was further divided into hierarchical levels, with higher-ranking individuals in Paris and Versailles having very different lives to rural parish priests. The Second Estate consisted of aristocrats with inherited titles. Like the First Estate, they didn't need to pay taxes, but they could collect them. Into the Third Estate went everyone else, about 96–98% of the population. At the highest level of the Third Estate were the bourgeoisie, including those in finance, medicine, law, and trade.
与每个庄园一样，它也被进一步划分为不同的等级，巴黎和凡尔赛的高级人员与农村的教区牧师的生活截然不同。第二产业由拥有继承权的贵族组成。和第一等级一样，他们不需要交税，但可以收税。其他所有人都属于第三等级，约占人口的96-98%。第三产业的最高层是资产阶级，包括金融、医药、法律和贸易领域的人。

They could become wealthy, just without gaining any political power or influence. Next were the sans-culottes, artisans, and other city workers. The final layer was the peasants who labored on farms, paid heavy taxes, and had essentially no rights or influence. They owned land, but few had enough to feed their families. For instance, between 1720–1729 and 1780–1789, land rents rose by 142%, while the prices of agricultural products rose by only 60%. About three-quarters of peasants had less than the minimum amount of land needed to survive, five hectares.
他们可以成为富人，只是没有获得任何政治权力或影响力。其次是无产阶级、工匠和其他城市

工人。最后一层是农民，他们在农场劳动，缴纳重税，但基本上没有任何权利或影响力。他们拥有土地，但很少有人拥有足够的土地来养活他们的家人。例如，在1720-1729年和1780-1789年之间，土地租金上升了142%，而农产品的价格只上升了60%。大约四分之三的农民拥有的土地少于生存所需的最低数量，即5公顷。

In many areas, at least a quarter of peasants had just one hectare. At the top of society was the king, who had absolute power and few limitations on his behavior. This system of power, known as absolutism, was popular in Europe at the time. Not only was arguing against it dangerous, but some people did also see the system as positive due to its ability to maintain order. It's worth noting that absolutism was not like other monarchy systems, like the ones used during the medieval era, because here the king did not share his power.
在许多地区，至少有四分之一的农民只有一公顷。社会的顶层是国王，他拥有绝对的权力，对他的行为几乎没有限制。这种权力体系被称为绝对主义，在当时的欧洲很受欢迎。反对它的争论不仅是危险的，而且有些人确实也认为这种制度是积极的，因为它能够维持秩序。值得注意的是，绝对主义与其他君主制不同，比如中世纪时期使用的君主制，因为这里的国王不分享他的权力。

When King Louis XIV said "L'etat, c'est moi" (I 5 am the state), he meant it. For everyone but the king and a few nobles, the system was entirely unfair. During the French Revolution, people fought for a more equal society without the intense divisions of the estates. The vast majority of the French population were trapped in harsh poverty with too little to eat and no rights whatsoever. The wealthy minority merrily spent their tax income and racked up a growing national debt. People began to question the age-old notion of an absolute ruler with a monopoly on force and no restrictions on their behavior. They saw that the social hierarchy was arbitrary and could be overthrown.
当国王路易十四说 "L'etat, c'est moi"（我就是国家）时，他就是这个意思。对于除了国王和少数贵族以外的所有人来说，这个制度是完全不公平的。在法国大革命期间，人们为一个没有激烈的庄园划分的更平等的社会而斗争。绝大多数法国人被困在严酷的贫困中，吃得太少，没有任何权利。少数富有的人乐此不疲地花着他们的税收收入，使国债不断增加。人们开始质疑古老的绝对统治者垄断武力和不限制行为的概念。他们看到，社会等级制度是任意的，可以被推翻。

When the common people seized weapons and means of exercising force in Paris, they upended the hierarchy. What they had more trouble with was finding a system to replace it. During the interim period between the end of the monarchy and the rise of Napoleon, the French people tried out different hierarchical structures and leaders, each of which failed. Here is the summary of those years: Between 1789 and 1815 the country went through roughly five phases. From 1789 to 1792 France was a constitutional monarchy.
当老百姓在巴黎夺取武器和行使武力的手段时，他们颠覆了等级制度。他们更头疼的是如何找

到一种制度来取代它。在君主制结束和拿破仑崛起之间的过渡时期，法国人民尝试了不同的等级结构和领导人，每一个都失败了。以下是对这些年的总结。在1789年至1815年间，国家大致经历了五个阶段。从1789年到1792年，法国是一个君主立宪制国家。

During that time Louis XVI came to be seen as a despot, and in 1792 he was tried and beheaded. That marked the beginning of the most radical period of the Revolution, called the Terror, when France was run by the Committee of Public Safety, headed by Maximilien de Robespierre. Robespierre quelled civil war within the country and waged war on the neighboring countries hostile to the Revolt.
在此期间，路易十六被视为一个暴君，1792年他被审判并被斩首。这标志着大革命最激进时期的开始，被称为 "恐怖"，当时法国由以马克西米利安-德-罗伯斯庇尔为首的公共安全委员会管理。罗伯斯庇尔平息了国内的内战，并向敌视叛乱的邻国发动了战争。

Some seventeen thousand opponents of his regime were beheaded and another thirty-five thousand jailed, but in 1794 Robespierre himself was led to the guillotine in a countercoup. The country was then run for five years by the government of the Directory, staffed mostly by the bourgeois class. What's interesting is that within a few years, the old hierarchy was effectively back in place. When Napoleon came to power in the late 1790s, he reinstated absolutism, although he did not call himself a king. Napoleon seized power in 1799, and in 1804 declared himself emperor.
约有1.7万名反对他的政权的人被斩首，另有3.5万人被监禁，但在1794年，罗伯斯庇尔本人在一次反政变中被送上断头台。随后，国家由目录政府管理了五年，其工作人员主要由资产阶级组成。有趣的是，在几年内，旧的等级制度又有效地回到了原位。当拿破仑在1790年代末上台时，他恢复了专制主义，尽管他没有自称是国王。拿破仑于1799年夺取政权，并于1804年宣布自己为皇帝。

Hardly a revolutionary move. Napoleon had absolute power and was not answerable to anyone. He maintained this by violently quashing any dissent. France did not emerge from the Revolution as a country without a hierarchy. Instead, Napoleon instituted a system that was more based on ability than class, although it is still debatable whether a meritocracy is even possible or what a true one might look like. In addition, Napoleon saw France as at the top of the hierarchy of European countries and therefore sought to make the others subordinate.
这几乎不是一个革命性的举措。拿破仑拥有绝对权力，不对任何人负责。他通过暴力镇压任何异议来维持这一局面。法国并没有从大革命中脱颖而出，成为一个没有等级制度的国家。相反，拿破仑建立了一个更多基于能力而非阶级的制度，尽管功绩制是否可能或真正的功绩制会是什么样子仍有争议。此外，拿破仑认为法国处于欧洲国家等级制度的顶端，因此试图使其他国家处于从属地位。

This was part of the rise of nationalism, the belief that one's own country is superior to all others and must be willing to fight to expand its borders. Napoleon was then defeated by the British and sent into exile in 1815. The period from 1789 to 1815 thus saw a constant jostling of the hierarchy in France, as various groups and individuals tried to take and maintain power. One of the lessons of the French revolution is that upending a hierarchy creates instability, and 7 many people will maneuver to influence what the old hierarchy will be replaced with.
这是民族主义兴起的一部分，认为自己的国家比其他国家优越，必须愿意为扩大自己的边界而战斗。随后，拿破仑被英国人打败，并于1815年被流放。因此，从1789年到1815年这段时间，法国的等级制度不断发生变化，各种团体和个人都试图夺取和维持权力。法国革命的教训之一是，颠覆等级制度会造成不稳定，许多人都会想方设法影响旧的等级制度将被取代。

A new hierarchy might have different rules and different roles, but it will still be a hierarchy. Surviving the establishment of a new order is by no means easy. Take the story of Charles Maurice de Talleyrand, "who simply kept reinventing himself in order to ride France's political roller coaster." Talleyrand was Bishop of Autun in the Loire Valley when he joined the Revolution. When things got extreme, he went into exile. In 1797 he returned, became foreign minister under the Directory [government], and remained there under Napoleon. But in 1807, as Napoleon's ambitions began to become alarming, Talleyrand turned against the Emperor. In 1814 he represented France during the peace negotiations of the Congress of Vienna as foreign minister during the brief reign of Louis XVIII. Talleyrand thrived by finding a way to maintain position in the constantly changing hierarchy.
一个新的等级制度可能有不同的规则和不同的角色，但它仍然是一个等级制度。在建立一个新秩序的过程中生存下来绝非易事。以查尔斯-莫里斯-德-塔列朗的故事为例，"他只是不断地重塑自己，以便乘坐法国的政治过山车"。塔列朗参加革命时是卢瓦尔河谷的奥屯主教。当事情变得极端时，他就流亡了。1797年，他回来了，成为目录[政府]下的外交部长，并在拿破仑统治下留在那里。但在1807年，由于拿破仑的野心开始变得令人担忧，塔列朗转向反对皇帝。1814年，他作为路易十八短暂执政期间的外交部长，在维也纳会议的和平谈判中代表法国。塔列朗在不断变化的等级制度中找到了维持地位的方法，从而得到了发展。

Another important lesson from the French Revolution is that when contemplating the hierarchy we want to live with, it is worth asking what kind of leaders our hierarchical system will produce. Our hierarchical instincts are not always right in getting us the most efficient organization to deal with the challenges we are facing. Writing about sports teams, Sam Walker argues in The Captain Class that the best performers are not the best leaders. We seem to want our leaders to be the alpha performers. The guys and gals who dazzle us with their play. Walker writes that "all too often, the people who propose themselves for positions of power are quick to trumpet their abilities. And those of us who make these decisions [on who should lead] are often swayed by the force of their

personality."
法国大革命的另一个重要教训是，在考虑我们想要的等级制度时，值得一问的是我们的等级制度会产生什么样的领导人。我们的等级制度本能并不总是能让我们得到最有效的组织来处理我们所面临的挑战。萨姆-沃克（Sam Walker）在《队长阶层》（The Captain Class）一书中写到，表现最好的人并不是最好的领导者。我们似乎希望我们的领导者是最优秀的表演者。那些用他们的表现让我们眼花缭乱的家伙和姑娘们。沃克写道："很多时候，那些提议自己担任权力职位的人都会迅速吹嘘自己的能力。而我们这些做出这些决定[谁应该领导]的人往往被他们的个性力量所左右"。

For example, the leader becomes dominant because of skills displayed in the competitive process of becoming leader—strength, smarts, etc. This means that the leader is just the most powerful competitor, like Robespierre or Napoleon. His or her skills are exemplary for winning the competition of dominance. They are not necessarily the most skilled for actually running the show. Maybe the role would benefit from some of the strengths exhibited by others, but because those traits didn't help in the competitive process, the leader doesn't possess them—to the detriment of the entire hierarchy. We then end up with leaders who don't actually have the skills to lead.
例如，领导者之所以成为主导，是因为在成为领导者的竞争过程中所展示的技能--力量、智慧等。这意味着，领导者只是最强大的竞争者，就像罗伯斯庇尔或拿破仑。他或她的技能在赢得主导权的竞争中堪称典范。他们不一定是最有技巧的人，不一定是真正的管理者。也许这个角色会从其他人表现出的一些优势中受益，但因为这些特质在竞争过程中没有帮助，所以这个领导者不具备这些特质--这对整个等级制度是不利的。这样，我们就会出现那些实际上不具备领导能力的领导人。

The French Revolution, with its focus on ending absolutism and subsequent return of absolute power and the rise of nationalism, can show us a lot about our hierarchical instincts. People could not destroy the hierarchy altogether; they just ended up with a new form of it. One of the lessons here then, is that allowing for the fact of hierarchical instincts is critical in the development and leadership of any organization.
法国大革命的重点是结束绝对主义，以及随后绝对权力的回归和民族主义的兴起，可以向我们展示很多关于我们等级制度的本能。人们不可能完全摧毁等级制度；他们只是以一种新的形式结束了它。因此，这里的一个教训是，允许等级本能的事实在任何组织的发展和领导中都至关重要。

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Status Symbol 身份象征

The history of fashion can be read, in part, as a chronicle of humans trying to
establish and negotiate social hierarchies. How we dress communicates
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information to people about our status. In Survival of the Prettiest, Nancy Etcoff says of magazines that “the fashions they feature are as much products of social competition as the finest bird feathers or the sweetest birdsong.” Thinking about fashion exposes the ongoing tension in human hierarchies. On the one hand we are comfortable when we can place people quickly in the hierarchy.
时尚的历史在某种程度上可以被解读为人类试图建立和交涉社会等级制度的编年史。我们的穿着向人们传达了关于我们地位的信息。在《最美的生存》一书中，南希-埃特科夫谈到杂志时说："它们所介绍的时尚就像最好的鸟类羽毛或最动听的鸟鸣一样，是社会竞争的产物。" 对时尚的思考暴露了人类等级制度的持续紧张。一方面，当我们能够迅速地将人们置于等级制度中时，我们感到很舒服。

From their clothing we infer information about their relative power and wealth in the society we inhabit. On the other hand, we continually chafe at the restraints of whatever position of the hierarchy we happen to find ourselves in. I may be limited by my biology, but I certainly don’t want to be limited by the messages of the clothes I wear. Yuval Harari observes, “Hierarchies serve an important function. They enable complete strangers to know how to treat one another without wasting the time and energy needed to become personally acquainted.” In different times and places, the hierarchy of fashion has been legally mandated in the form of sumptuary laws.
从他们的服装中，我们推断出他们在我们居住的社会中的相对权力和财富的信息。另一方面，我们不断地对我们碰巧发现自己所处的等级制度的任何位置的限制感到不安。我可能被我的生物学所限制，但我当然不想被我所穿的衣服的信息所限制。尤瓦尔-哈拉里说："等级制度有一个重要的功能。它们使完全陌生的人能够知道如何对待彼此，而不必浪费亲自熟悉所需的时间和精力"。在不同的时间和地点，时尚的等级制度已经在法律上以军法的形式被授权。

They were often enforced—not legally, which was logistically challenging, but socially. If your status meant you weren’t allowed to wear purple and yet you showed up at court decked out head-to-toe in violet, you were risking a lot. You probably wouldn’t be arrested, but you could be snubbed by your peers, laughed at by those higher up, and left off the list for the next social occasion or business opportunity. Fashion laws thus meant that you could easily place people in their social position and act toward them accordingly.
它们经常被强制执行--不是法律上的，这在后勤上具有挑战性，而是社会上的。如果你的身份意味着你不允许穿紫色的衣服，但你却从头到脚都穿着紫色的衣服出现在法庭上，你就会冒很大的风险。你可能不会被逮捕，但你可能被你的同龄人冷落，被更高的人嘲笑，并被排除在下一个社交场合或商业机会的名单之外。因此，时尚法意味着你可以很容易地将人们置于他们的社会地位，并相应地对他们采取行动。

Taken to the extreme, some markers of high status were intended solely to convey that status. Black teeth were fashionable in the Elizabethan era to show

that one could afford sugar, and very long nails demonstrated the lack of a need to work. Of course, hierarchies are dynamic, with ongoing challenges for top position. Fashion and accessories were a way to make it harder for those lower in the hierarchy to successfully compete, mostly through cost. Silk, gold, silver, precious stones—these long-recognized components of “luxury adornment” have always put those who could afford them “at the top of the pyramid, setting apart the haves from the have-nots.”
走到极端，一些高地位的标志只是为了传达这种地位。在伊丽莎白时代，黑牙是一种时尚，以表明一个人能够买得起糖，而很长的指甲则表明不需要工作。当然，等级制度是动态的，对最高地位的挑战不断。时尚和配饰是一种让等级制度中的低层人士更难成功竞争的方式，主要是通过成本。丝绸、黄金、白银、宝石--这些长期以来被公认的 "奢侈装饰品 "的组成部分总是把那些买得起它们的人 "置于金字塔的顶端，把富人和穷人区分开来"。

Cost barriers to various goods are an easy and long-lived way to set up and define social hierarchies. The upper class also shows status through wearing clothes that are totally impractical for doing any labor, reflecting participation in expensive activities and having more than one actually needs. “Charlemagne owned 800 pairs of fine gloves at a time when gloves were difficult to produce and clean,” notes Etcoff. We can admit to ourselves that not a lot has changed. Status is still frequently demonstrated through fashion. Labels, fabric, the cut of a suit or a hoodie, communicate a lot. Yes, it is often nuanced. For example, even though luxury goods in some contexts are still markers of status, dressing scruffy when you don’t have to is also a form of 3 4 demonstrating one’s privileged place in the hierarchy. The academic in a shirt with soup stains, the CEO in battered jeans, the billionaire in a tracksuit—these are all examples of them announcing to the world that their status is so secure they don’t need to indicate it through luxury clothing. In so many cases, what we wear “helps us negotiate our relations with the outside world and provide us with comfort and protection.”
各种商品的成本壁垒是建立和定义社会等级制度的一种简单而长久的方式。上层阶级还通过穿着完全不适合做任何劳动的衣服来显示地位，反映出对昂贵活动的参与和拥有超过实际需要的衣服。"查理曼大帝拥有800双精美的手套，而当时手套很难生产和清洗，"埃特科夫指出。我们可以对自己承认，没有太多的改变。地位仍然经常通过时尚来体现。标签、面料、西装或连帽衫的剪裁，传达了很多东西。是的，它往往有细微的差别。例如，尽管奢侈品在某些情况下仍然是地位的标志，但在没有必要的情况下穿得邋里邋遢也是显示一个人在等级制度中的特权地位的一种形式。穿着有汤渍的衬衫的学者，穿着破旧牛仔裤的首席执行官，穿着运动服的亿万富翁--这些都是他们向世界宣布他们的地位是如此安全，不需要通过奢侈的服装来表明。在许多情况下，我们的穿着 "帮助我们与外部世界的关系进行谈判，并为我们提供舒适和保护"。

Underground hierarchies 地下等级制度

Hierarchies are critical in survival situations and in combat. In these scenarios, we primally crave leadership. In chaotic, life-anddeath situations, sheepdogs magically appear to herd the sheep. Even in the US Special Forces, which are designed to be as flat as an organization can be within a military service, hierarchical decision making immediately emerges and takes over in combat or when there are time constraints. How do hierarchies form and break down? There are, broadly, two components: biological enablers and cultural constraints.
等级制度在生存环境和战斗中是至关重要的。在这些情况下，我们原始地渴望得到领导。在混乱的、生死攸关的情况下，牧羊犬会神奇地出现来放羊。即使在美国特种部队中，其设计是在军事服务中尽可能的扁平化，但在战斗中或时间紧迫时，等级决策会立即出现并接管。等级制度是如何形成和分解的？大体上有两个组成部分：生物促成因素和文化约束。

These two dynamics influence how our tendency toward hierarchies manifest. To get insight into these dynamics, let's look at the 2010 Copiapó mining accident in northern Chile, when a cave-in at the San Jose copper-gold mine trapped 33 miners 700 feet underground. The miners were completely isolated in a physically stressful environment. It was hot, humid, and dark. The ground was unstable, and debris and rocks continued to fall. They retreated to a refuge that had only enough provisions for ten miners for two days. Luis Urzua was the shift foreman, a position which granted him automatic authority. He "held formal leadership, for in the Chilean mining culture the authority of the shift foreman was absolute."
这两种动力影响着我们的等级制度倾向如何表现出来。为了深入了解这些动力，让我们看看2010年智利北部的科皮亚波矿难，当时圣何塞铜金矿的一个洞穴将33名矿工困在地下700英尺。矿工们被完全隔绝在一个物理压力很大的环境中。那里炎热、潮湿、黑暗。地面不稳定，碎石和岩石不断落下。他们撤退到一个避难所，那里的食物只够10名矿工使用两天。路易斯-乌尔苏阿是班长，这个职位自动赋予他权力。他 "拥有正式的领导权，因为在智利的采矿文化中，班长的权力是绝对的"。

Urzua, however, had worked at the San Jose mine for less than three months. He hadn't had time to develop a bond with the miners on his team to back up the authority implied by his title. In the small power vacuum created, two other miners, Mario Sepulveda and Mario Gomez, "rallied the miners to explore escape 11 routes and send signals to rescue workers." Although these two may have had the right characteristics for leadership, they could not take a place at the top of the hierarchy on account of not having the culture-supported authority. Thus, in the first 24 hours, "most miners felt accountable to no one" and "stayed in sub-groups based on kinship and past friendships."
然而，乌尔苏阿在圣何塞矿场工作了不到三个月。他还没有时间与团队中的矿工建立联系，以

支持他的头衔所隐含的权威。在这个小小的权力真空中，另外两名矿工马里奥-塞普尔韦达和马里奥-戈麦斯，"召集矿工探索逃生11路线，并向救援人员发送信号"。虽然这两人可能具有领导的正确特征，但由于没有文化支持的权威，他们无法在高层占据一席之地。因此，在最初的24小时内，"大多数矿工感到不对任何人负责"，"停留在基于亲属关系和过去友谊的小团体中"。

Our desire for hierarchy, for leadership, is most present in survival situations. It will emerge. For the miners in Chile, days two to five saw the emergence of spiritual leadership by one of the team who had pastoral experience. A democratic process was instituted to make decisions about allotment of the food supply and bathroom rules. Mario Sepulveda, clearly having natural leadership instincts, used them in a way that exploited the culture he was in; he urged the group to "respect Urzua and suggested that if Urzua were willing to lead, the miners should accept him as their leader. If Urzua were unwilling to lead, Sepulveda would be willing to take charge." Leadership was necessary not only to get tasks done, but for the comfort it would offer to the group. By day five, "throughout the day, the miners gave more authority and respect to both Urzua and Sepulveda.
我们对等级制度的渴望，对领导的渴望，在生存的情况下是最存在的。它将会出现。对于智利的矿工来说，在第二至第五天，团队中一位有牧养经验的人出现了精神领导。建立了一个民主程序，对食物供应的分配和浴室规则作出决定。马里奥-塞普尔韦达（Mario Sepulveda）显然具有天生的领导本能，但他却利用了他所处的文化环境；他敦促大家 "尊重乌尔苏阿，并建议如果乌尔苏阿愿意领导，矿工们应该接受他作为他们的领导。如果乌尔苏阿不愿意领导，塞普尔维达就愿意负责"。领导是必要的，不仅是为了完成任务，而且是为了给大家带来安慰。到了第五天，"一整天下来，矿工们对乌尔苏阿和塞普尔维达都给予了更多的权力和尊重。

Gomez was also widely respected for his experience and wisdom. Sepulveda had started to assign specific tasks to people based on their skills, experience, and mental stability." Good leadership is about acting in the interests of the group. In The Captain Class, Sam Walker, in one of the most counterintuitive conclusions in his book, explains it this way: "When it comes to competition, most people believe that the leader of a team is the person who does something spectacular when the chips are down." This, however, is actually not true. Walker's conclusions about the real qualities of great captains apply to the dynamics of the miners in Chile. "The great captains lowered themselves in relation to the group whenever possible in order to earn the moral authority to drive them forward in tough moments. The person at the back, feeding the ball to others, may look like a servant —but that person is actually creating dependency.
戈麦斯也因其经验和智慧而受到广泛尊重。塞普尔韦达已经开始根据人们的技能、经验和精神稳定性，将具体任务分配给他们。" 好的领导力就是要以群体的利益为出发点。在《上尉班》中，萨姆-沃克在他书中最反直觉的结论之一，这样解释。"当谈到竞争时，大多数人认为，团队的领导者是在筹码下降时做出惊人之举的人"。然而，这实际上是不正确的。沃克关于伟大

队长的真正素质的结论适用于智利矿工的动态。"伟大的队长尽可能地降低自己与群体的关系，以便在艰难的时刻赢得道德权威，推动他们前进。在后面的人，把球喂给其他人，可能看起来像个仆人--但这个人实际上在制造依赖性。

The easiest way to lead, it turns out, is to serve." It's possible that Sepulveda, by supporting the leadership of Urzua, was doing the most valuable thing he could to serve the interests of the group. The hierarchy developed in the early days held until day 17. During this time, there was widespread despair about the success of the rescue efforts, with the miners rationed down to one bite of food every 36 hours. Hope was low, but the hierarchy served its purpose of maintaining a structure that supported a maximum chance of survival. On day, a "breakthrough shaft" reached the refuge where the miners were located. Not large enough for rescue, it was used to get items to the miners, including food, medical supplies, letters from their families, and a television.
事实证明，最简单的领导方式就是服务。" 有可能塞普尔维达通过支持乌尔苏阿的领导，正在做他能做的最有价值的事情，为团体的利益服务。早期形成的等级制度一直保持到第17天。在这段时间里，人们对救援工作的成功普遍感到绝望，矿工们每36小时只能得到一口食物的配给。希望很低，但等级制度达到了它的目的，即维持一个支持最大生存机会的结构。有一天，一个 "突破井 "到达矿工所在的避难所。这条井不够大，无法进行救援，但它被用来向矿工运送物品，包括食物、医疗用品、家人的信件和一台电视。

At this point the hierarchy of the 33 miners began to break down, because there was a new top of the pyramid. Control shifted to people above ground. The miners were no longer accountable to just each other. "Fights occurred about which channels to watch," and "discipline gradually declined alongside their humility as the miners began to digest the news of their celebrity status."
在这一点上，33名矿工的等级制度开始瓦解，因为出现了一个新的金字塔顶端。控制权转移到地面上的人。矿工们不再只对彼此负责。"发生了关于看哪个频道的争吵"，"随着矿工们开始消化他们的名人地位的消息，纪律逐渐与他们的谦逊一起下降。"

As the days continued, the hierarchy that had maintained order while they were isolated and scared continued to fade. Miners 17 18 began developing relationships with doctors and media advisors, fighting for more information from their loved ones. Some miners began receiving drugs in their communications from family, which shifted relationships and allegiances underground.
随着时间的推移，在他们被隔离和恐惧时维持秩序的等级制度继续消退。17-18岁的矿工开始与医生和媒体顾问建立关系，争取从他们的亲人那里获得更多信息。一些矿工开始在他们的通信中收到来自家人的药物，这使得地下的关系和忠诚度发生了转变。

The hierarchy, though, didn't completely disappear. It was as though they were pulled

between two different hierarchies, the one below ground that had gotten them this far, and that above ground which offered promise of rescue. As they passed 60 days underground, “the miners’ behaviors…oscillated between extremes, indulging in petty fights one minute and promising never to break their fraternal bonds the next minute.” The rescue started on day 70. The miners were lifted out one by one, with Urzua coming up last. They had expressed the desire to leave San Jose as a group, which they did with the world watching.
不过，等级制度并没有完全消失。仿佛他们被拉到两个不同的等级制度之间，一个是让他们走到今天的地下等级制度，另一个是提供救援承诺的地上等级制度。当他们在地下度过60天时，"矿工们的行为……在两个极端之间摇摆不定，前一分钟还沉浸在小打小闹中，后一分钟就承诺绝不破坏他们的兄弟情谊"。救援工作从第70天开始。矿工们一个接一个地被抬出来，乌尔苏阿是最后一个。他们曾表示希望作为一个团体离开圣何塞，在全世界的注视下，他们这样做了。

Boss vs. Leader 老板与领导

There is a nuance here between authority and leadership. Those at the tops of hierarchies have authority that they are expected to use to solve problems and address issues facing the hierarchy. But as Ronald Heifetz points out in his article Leadership, we can easily think of examples of people with lots of authority who don’t actually lead or who don’t have the solutions in times of crisis, and lots of people who exhibit leadership without having any authority.
在权威和领导之间存在着细微的差别。处于等级制度顶层的人拥有权威，他们被期望用来解决问题和解决等级制度面临的问题。但正如罗纳德-海菲兹在他的《领导力》一文中指出的那样，我们可以很容易地想到一些拥有大量权力的人实际上并不具备领导力，或者在危机时没有解决方案的例子，还有很多人在没有任何权力的情况下表现出领导力。

Conclusion 结论

Hierarchy is a core instinct. While we can modify hierarchies and try to make them work for us, it is hard to do away with them all together. We operate as if a leaderless environment provides more threats than one with a bad leader. However, the model demands balance. Too much hierarchy can also lead to unrest and instability. Most organizations promote cultures that emphasize rather than de-emphasize an individual’s status, power, and place, which is part of the reason they get torn apart, as the fight to get to the top of the hierarchy takes precedence over the success of the organization. We all look for leaders, even if we are looking at ourselves.
等级制度是一种核心本能。虽然我们可以修改等级制度并试图使其为我们所用，但很难完全取消它们。在我们的操作中，似乎无领导的环境比有坏领导的环境提供更多威胁。然而，这个模

式需要平衡。过多的等级制度也会导致动荡和不稳定。大多数组织提倡的文化是强调而不是不强调个人的地位、权力和位置，这也是他们被撕裂的部分原因，因为争取到等级制度的顶端比组织的成功更重要。我们都在寻找领导者，即使我们是在寻找自己。

Incentives 激励措施

> Never, ever, think about something else when you should be thinking about the power of incentives.
> 当你应该考虑激励机制的力量时，千万不要考虑其他事情。
> ——–查理-芒格 Charlie Munger

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.
激励措施塑造了所有动物的行为。我们朝着奖励的方向前进，并会很容易地采取步骤来避免惩罚。人类，当我们对激励措施深思熟虑时，会改变我们的行为，以达到一个可感知的利益。我们会通过同样的行为圈来绕过感知到的不利因素。然而，识别和回应激励措施的能力是我们生物构成的内在组成部分。因此，它们对我们行为的影响并不总是理性的。我们经常通过一个由我们的自尊、我们的个人叙述和我们的生理状态组成的令人难以置信的偏颇的镜头来评估一个激励措施的价值。

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.
行为修正行为可以是对内部和外部因素的反应。多项研究表明，在大鼠和人类中，持续但不频繁的奖励比那些一直给予的奖励能产生更强烈的行为变化。一只老鼠学会了某种杠杆有时会产生食物。这总是同一个杠杆，但它并不总是有食物。在不给食物后，老鼠会继续按那个杠杆，时间远远长于一直给食物但有一天突然停止的杠杆。

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.”
我们的行为变化既基于实际的奖惩，也基于我们对它的看法。如果我们所做的事情产生了一些好的结果，仅仅是对再次拥有这种好东西的预期就会刺激我们重复这种行为。负面的经历也是如此。仅仅是重复惩罚的可能性就使我们想在未来避免类似的情况。储存脂肪或食物等东西的能力使我们在应对激励方面具有灵活性。钱可以被认为是一种储存形式--所有潜在的购买力都被储存起来，直到用于购买东西。"也许人类社会最伟大的经济创新是货币的发明，这是一种可交换的商品，实际上储存了购买和销售商品的能力。"

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 2 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.
这就是货币的部分激励作用。你可以选择如何和何时花费它，而储蓄它意味着你不那么容易受到不得不调整和应对每一个小的或有风险的激励的影响。对某种激励的发现和强化可以改变我们的行为。就像帮助建立机制，2让大象记住如何和在哪里找到远距离的水一样，我们可以在获得奖励时建立新的神经通路。不确定的奖励，也可以对生存有益。

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.
通过对赌博或忠诚计划的研究，研究人员推测，对不确定的激励措施的容忍是必要的，因为我们对新事物的许多尝试在最初的几次尝试中都失败了。激励措施的阴暗面是，有时追求我们的愿望会使大脑重新连接，使这些愿望成为要求。

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.
这在研究毒品成瘾的研究中已经看到。在因为感觉良好的奖励而反复追逐激励后，大脑不再因为使用毒品的感觉而追求激励，而是因为这些愿望已经成为自己的奖励的硬性规定。这就像现在是得到了毒品才会有快乐，而不是实际使用毒品本身。因此，激励措施也会对我们的生物学产生强大的影响。

The long-term influence of short-term incentives 短期激励的长期影响

One of the main challenges with incentives is that they are a factor everywhere: our needs, our wants, short-term interests, and longterm 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 selfinterest.
激励措施的主要挑战之一是，它们是一个无处不在的因素：我们的需要、我们的愿望、短期利益和长期目标。在对我们周围的人进行的基本调查中，人类一般来说似乎并不能优先考虑延迟回报的激励措施，而不是那些能给我们带来即时快乐的激励措施。正如亚里士多德在两千多年前指出的那样，这是民主制度的一个问题。就其政治吸引力而言，它们基本上是由数以百万计的人按照自己的利益行事来管理的。

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 Fergusson writes in Civilization, "We love our grandchildren.
而这些利益往往是由提供即时回报的激励措施所驱动的。选民们希望听到对他们的生活有直接、积极影响的政策。大多数人对那些几年甚至几代人都不会有任何明显好处的政策不感兴趣。正如Niall Fergusson在《文明》中写道："我们爱我们的孙子。

But our great-great-grandchildren are harder to relate to." 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.
但我们的曾曾孙却更难相处。" 政治家们别无选择，只能对短期思考的激励作出回应；否则，他们就不会获得选民的支持。因此，他们提出的政纲强调了如果他们获胜将奇迹般地出现的好处。由于人们担任政治职务的时间相对较短，任何特定的政治家都很难在这段时间内做出重大的积极改变。

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.
他们被快速的反馈回路所包围，而这些反馈回路取决于他们能否快速显示出结果--短暂的选举周期，频繁的民意调查，媒体每时每刻的报道，以及社交媒体的即时讨论。其结果是，在这个系统中，政治家几乎没有动力去考虑当前的选举周期。以类似的方式，上市公司受到激励，为了在季度报告中显示利润而牺牲了长期增长。首席执行官的短暂任期和他们的巨额奖金造成了不正当的激励。

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. 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.
因此，公司很难投资于那种随着时间推移而复利的改进。例如，许多公司觉得有必要抓住其市场内的每一个新趋势，以利用其客户的注意力。这导致了一个新调整的仓鼠轮，而不是公司专注于建立永恒的产品和服务。一些大型组织的预算激励了不计后果的支出。拥有 "用完即走 "预算的联邦机构在财政年度的最后一周平均花费8.7%的预算，几乎是典型周支出的五倍。

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.
此外，在最后一周资助的项目被评为低质量的可能性是一年中其他时间的项目的2到6倍。此外，在这些组织中，管理人员的浮动工资往往与预算支出挂钩。激励措施具有强大的影响力，像池塘上的涟漪一样扩散开来。政治和商业中的短期激励措施影响着我们生活的每个领域。为了改变一个涉及人类的系统，我们需要改变激励机制。

Aligning Incentives 调整激励机制

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.” When you can’t go back, your motivation is to go forward together.
领导力的挑战之一是调整激励机制。你如何让人们朝着同一个方向前进而不被眼前的回报所迷惑？孙子在两千多年前提出，一个好的领导者 "带领他的人去战斗，就像一个人爬到高处，踢开梯子"。当你不能回头的时候，你的动力就是一起向前走。

Manipulated by incentive 被激励所操纵

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.
我们很容易受到激励的影响--无论是来自金钱、声望还是权力。最隐蔽的是，当一个激励措施是为了吸引我们对自己是什么样的人的个人叙述。没有人愿意被认为是坏人，所以我们经常进行智力上的扭曲，以证明我们对某项激励的追求是正确的。沙利度胺是一种有着悲惨历史的药物。

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,” 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.
20世纪50年代，一家西德药品制造商发现并开发了这种药物，并作为镇静剂和止痛剂广泛销售，它对成千上万的婴儿死亡和畸形负责。这个故事是如何发生的，暴露了很多激励措施的细微差别。沙利度胺最早是由格鲁南塔尔化学公司生产的。它是 "一种没有疾病的药物"，因此在动物和人类身上进行的第一次试验实际上是为了找到它可以治疗的东西。那里的科学家们无法找到足以杀死老鼠的剂量，而且在任何测试的动物身上都没有观察到副作用。

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. 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.
由此他们得出结论，这种药物是完全无毒的。他们仍然不知道人类可以用它来治疗什么，但这

些最初的动物试验结果构成了他们持久的信念的基础，即这种药物不会伤害任何人。格鲁宁塔尔公司随后开始向医生派发免费样品。当时没有我们现在所理解的临床试验。相反，该药物的最初使用者就是临床试验。沙利度胺被投放到世界上，在人们不知情或不同意的情况下对他们进行 "测试"。

The general population was the lab. 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.
普通人群就是实验室。正如特伦特-D-斯蒂芬斯在《黑暗疗法：沙利度胺的影响及其作为一种重要药物的复兴》中所解释的那样，这种药物不能杀死老鼠，所以格伦特认为它必须是安全的。该公司开展了大规模的营销活动，将这种药物作为镇静剂出售。他们与其他国家的药品制造商合作，将这种药物推向世界各地的市场。在大多数国家，这种药物无需处方即可获得。医生们经常得到确认该药物安全性的营销信息，并将其传递给他们的病人。

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.
沙利度胺以各种品牌名称出售，但保证它就像阿司匹林一样：温和、有用，当然不会伤害你。然而，事实并非如此。慢慢地，不同国家的医生开始注意到身体上的影响，而这些病人唯一的共同点就是使用沙利度胺。

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 formed limbs.
首先是手和脚的永久性神经损伤，然后是其他健康母亲的胎儿出现重大出生缺陷。研究开始显示，沙利度胺在妊娠期造成的畸形非常严重，婴儿出生后往往无法存活。如果他们活下来了，也是带着衰弱和痛苦的畸形，最常见的是缺乏正常形成的四肢。

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. 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.” One way to understand how this happened is to look at the story through the lens of incentives.
格鲁宁塔尔公司加倍宣传，对讨论沙利度胺危险的医学文章表示怀疑，并攻击撰写这些文章的医生的可信度。在随后的几年里，Grunenthal公司从未承认过错误或不法行为。所有销售沙利度胺的药品制造商都在法庭外解决了所有赔偿要求。没有一家公司因为没有核实他们对药物的声明（如 "对孕妇安全"）就销售药物而被追究刑事责任。理解这种情况如何发生的一种方法是通过激励机制的角度来看待这个故事。

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.”
你可以想象，在沙利度胺如何进入市场的故事中，贯穿着经济激励。发现该药物的团队负责人获得了该药物销售利润的一定比例。而沙利度胺是一个大卖家。全球有一个巨大的镇静剂市场，在一些国家，它成为第二大销量的药物。药品公司与格伦特公司合作，也有很大的经济激励作用。这意味着他们可以 "避免研究、开发和测试的成本"。

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. 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.
而对格伦特公司本身来说，通过不对人类进行适当的临床试验，它节省了大量的资金。沙利度胺作为镇静剂的主要竞争对手是一类叫做巴比妥类的药物。这些药物有已知的不良副作用，因此，医生推荐沙利度胺的动机是，据称它比其他药物更安全。药品公司经常向医生支付报酬，甚至为他们起草实验室文章。这就产生了更多的激励。第一个经济上的激励是付款，但是，一旦你的名字与对一种药物的认可联系在一起，你就有动力通过继续为这种药物辩护来保持你的声誉。

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 RichardsonMerrell 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.
在后来的刑事审判和民事诉讼中，很多药品公司的高管指出，他们的法律和道德责任是对他们的股东负责。以大笔红利的形式让他们的股东满意的激励措施，远比公平赔偿受害者更重要。沙利度胺故事的一个迷人之处在于，它从未被批准在美国销售。RichardsonMerrell公司已经获得了向美国市场销售的权利，因此寻求获得食品和药物管理局的批准。1960年的药物审批程序与今天不同。

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. 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. Neither Richardson-Merrell nor Grunenthal could provide any documentation to back up their claims of safety for both mother and fetus during pregnancy.
食品和药物管理局有责任评估所有新药的安全性和有效性，这是它在1938年因另一起制药悲剧而获得的权力。但他们的努力往往集中在药品上市后，而上市前的测试和评估则不太规范，容易被人操纵。对理查森-梅里尔来说，不幸的是，对全国其他地区来说，幸运的是，弗朗西斯-凯尔西博士刚刚开始在那里工作。作为一名多年的研究人员，她对该药物的安全性缺乏证据深感担忧。Richardson-Merrell和Grunenthal都不能提供任何文件来支持他们关于怀孕期间对母亲和胎儿安全的说法。

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.
凯尔西博士认为，他们没有办法通过研究知道沙利度胺不会穿过胎盘屏障。她尽可能地拖延审批时间，多次以不完整为由退回他们的申请。她后来解释说，她批准这种药物的动机很低，因为这不是一种拯救生命的药物。拖延战术起了作用，她能够将沙利度胺挡在美国市场之外，直到关于其可怕影响的报告如此广泛，以至于各国开始将其下架。

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

> situation.
> 激励是一颗子弹，一把钥匙：一个往往很小的物体，却有惊人的力量改变一个局面。
> ———史蒂芬-D. Steven D.

Levitt and Stephen J. Dubner 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.
Levitt和Stephen J. Dubner 激励机制是如何让人们似乎失去理智的？让正常人对他们不道德的决定加倍努力？鉴于许多药厂高管和医生从未承认沙利度胺造成了如此可怕的影响，值得对激励机制的力量进行更多解释。最初的财务部分很容易理解。

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."
金钱是令人向往的，因此它是一种常见的激励措施，在任何地方都能改变行为。但是，仅靠金钱往往是不够的。毫无疑问，如果你问人们是否会为了钱而伤害成千上万的孩子，大多数人都会说不会。因此，为了理解激励措施的真正力量，你必须看一看它们所创造的心理条件。人类不喜欢认知失调--"当一个人持有两种在心理上不一致的认知（想法、态度、信念、意见）时，就会出现紧张状态。"

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 14 15 16 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.
我们进行自我辩解的修辞来减少这种不协调。在奖励代言人的情况下，通常下意识的思维过程可能是这样的。"我是个好人。我支持 这种药物。一个好人不会支持一种有害的药物。因此，这种药物不可能是有害的，因为我是一个好人"。我们没有看到这些联系，所以产生的是药物是好的观点，而没有看到让我们达到这个目的的心理体操的窗口。

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."
卡罗尔-塔夫里斯（Carol Tavris）和埃利奥特-阿伦森（Elliot Aronson）曾写道，由于医疗行业的激励措施，认知失调的表现。"医生，像科学家一样，希望相信他们的诚信不会受到损害。然而，每当医生接受几块钱或其他奖励来进行某些测试和手术，把他们的一些病人引向临床试验，或开出一种并不比老药更好或更安全的昂贵的新药时，他们就在平衡病人的福利和他们自己的关切。"

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."
考虑一下安德鲁-韦克菲尔德的故事，他是发表在《柳叶刀》上的论文的主要作者，声称发现了疫苗和自闭症之间的正相关关系。这篇文章后来被揭穿，但在导致疫苗接种率普遍下降，造成不必要的死亡之前，这篇文章被撤回了。他没有在撤稿上签字，为什么？他有 "一个没有向杂志披露的利益冲突：他代表代表自闭症儿童父母的律师进行研究。韦克菲尔德获得了超过80万美元的报酬，以确定是否有理由采取法律行动"。

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." 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.
塔夫里斯和阿伦森证明，"然而，与真正独立的科学家不同，他没有动力去寻找疫苗和自闭症之间的相关证据，而有动力去忽略其他解释。这就是为什么理解激励的力量既关键又棘手的原因。接受最初的激励措施会产生一种心理状态，使我们投入到维护带来这种激励的任何故事中去，这样我们就可以证明我们接受这种激励的合理性。

The greater danger to the public comes from the selfjustifications 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. 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.
塔夫里斯和阿伦森证明，"然而，与真正独立的科学家不同，他没有动力去寻找疫苗和自闭症之间的相关证据，而有动力去忽略其他解释。这就是为什么理解激励的力量既关键又棘手的原因。接受最初的激励措施会产生一种心理状态，使我们投入到维护带来这种激励的任何故事中去，这样我们就可以证明我们接受这种激励的合理性。

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.
通过意识到可能指导我们行动的激励因素，我们可以认识到任何不光彩的影响，并通过考虑我们真正重视的东西来重新关注。我们可能被金钱、注意力和权力等奖励所驱使，但我们实际上可能重视对世界产生积极影响、善良和诚实等事情。如果奖励与我们的价值观不一致，我们不需要盲目地追随。

> Motivated by Uncertainty 受不确定性的激励
>
> 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 that 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.
> 类也会受到不确定性的严重激励。在一些特殊情况下，我们发现追求可能的回报而不是肯定的东西更有说服力。为什么？因为它往往更具有刺激性，这本身就是一种激励。想想每周六和一群朋友聚在一起玩棋盘游戏。许多研究表明，如果我们知道我们每次都会赢，我们就会停止这种行为。胜利是有趣的。有保证的胜利则不然。这方面的限制是，当结果的价值超过了过程的价值。赢得与朋友的比赛并不会改变生活，因此，在

游戏过程中获得乐趣的激励比肯定会赢的激励更有说服力。相反，如果涉及到一笔钱，可以让我们辞掉工作，环游世界，那么我们每次都会选择有把握的胜利。

Conclusion 结论

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.
考虑影响我们选择的真正动机总是值得的。我们经常告诉自己，我们的动机是基于善良，或做正确的事情，但实际上我们是被奖励的诱惑所激励。人类的一个问题是，我们很难拒绝眼前利益的快乐，比如说一粒糖或银行账户中的意外之财，而选择未来的满足和回报。我们经常做出导致长期负面后果的选择。

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.
一个甜甜圈可能提供即时的能量奖励，但多年来每天吃一个甜甜圈会导致长期的健康问题。今天为了最大限度地满足自己而做出的选择往往会导致未来的回报减少。因此，有时从你所期望的最终回报的角度来确定你的选择，并从激励措施的能力方面来评估它们，这样做是有益的。了解激励措施如何激励我们可以帮助我们不那么容易被操纵。广告商知道我们什么时候更容易受到伤害，于是用激励措施轰炸我们以获得短期的快乐。有时，屈服是可以的。你饿了，而那些甜甜圈看起来真的很好吃。然而，当我们在充满激励的日常生活中穿行时，我们需要注意激励对自己和他人的影响。

Tendency to Minimize Energy Output 节省能量

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.
所有生物都需要能量来完成其日常功能，包括睡眠。随着时间的推移，物种已经发展出不同的机制来提高其能量效率。生物体保存其能量的倾向是确保它们在需要增加时有额外的能量可供利用。对于人类来说，我们必须小心谨慎，以确保尽量减少能量输出能提高我们的效率，而不会导致懒惰。

Saving it up 储存它

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.
有许多冷血物种。由于没有维持稳定的内部体温的生物要求，这些动物不需要为此目的消耗能量，使它们能够为其他活动节省能量。例如，一些海龟可以在非常寒冷的水域底部过冬而不移动，因为它们的身体部位可以在极端温度下保持其完整性。此外，这些海龟有强大的机制，在这些时候引导血液流向基本器官。它们还具有先进的能量储存能力，当它们处于营养匮乏的环境中时，就会利用这种能力。鲨鱼的皮肤是另一个生物能源效率的例子。皮肤是由向后结构的鳞片组成，可以减少水的阻力。伴随着它们移动的波浪形运动，这些鳞片使鲨鱼能够以高效的能源方式以难以置信的速度游泳。对于那些在处理其环境的持续、重复要求方面形成效率的生物来说，其生存潜力有很大的提高。对大多数生物来说，变化是昂贵的。继续做迄今为止能保

证其生存的事情，比尝试可能失败、浪费能源或危及它们的新事物要容易。尽量减少能量输出的本能会导致我们抵制变化或承担风险。使用这个模型作为镜头，可以帮助我们更好地了解我们的默认思维倾向，以及我们的运动模式如何影响我们的物理环境。

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Desire Paths 欲望之路

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.
穿过森林和田野、雪地和碎石，是由那些想尽可能有效地往返于两点之间的人的脚所创造的道路。我们倾向于最大限度地减少我们的能量输出，这意味着我们并不总是遵从为我们设置的道路。有时，这些欲望之路不知不觉地践踏了敏感的植被，或造成其他环境的断裂。但其他时候，它们被城市或公园规划者用来设计交通流和周围的空间。当设计师和规划者没有考虑到我们尽量减少能量消耗的想法时，我们最终得到的是阻碍我们行动的空间，人们必须以不同的方式使用这些空间。
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> 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.
> 人们解决问题的方式首先是拥有大量的常识性知识，比如可能有5000万个轶事或条目，然后拥有一些未知的系统，在这5000万个老故事中找到似乎与情况最相关的5或10个。这就是类比推理。
> ——马文•明斯基 Marvin Minsky

The lazy brain 懒惰的大脑

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.
人类，像其他物种一样，是能量最小化者--强烈的能量。我们的大脑已经发展为能量最小化器，我们身体的其他部分也是如此。心理学家对我们思考的效率机制有一个词：启发式。当我们考虑做一个决定时，无论大小，我们都会使用从我们长期的世界经验中发展出来的捷径；用象棋术语来说，我们不会考虑1000万个不同的动作，而是迅速选择最可能成功的两三个。

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.
决策带有 "认知负荷"，意味着它们需要脑力。花时间分析1000万步棋需要付出巨大的努力，这就需要消耗大量的能量。我们不可能在一天中停下来做在所有情况下做出最优化决定所需的工作。启发式方法是一种捷径，因此需要我们耗费较少的能量。结果可能并不总是最好的（通常不是），但对于我们所处的任何情况来说，它们往往是足够好的。在一个被称为 "满足 "的过程中，我们经常会在大脑中寻找第一个能满足我们最低可接受条件的东西。这节省了时间和精力，但这并不意味着我们得到了最好的结果。一些启发式方法是根据以前的经验发展起来的。

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. 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. Why? Fires are governed by rules of chemistry and physics, and thus exhibit consistent behaviors.
如果以前的经验本身是相当一致的，这些就会是最可靠的。启发式方法在环境稳定、经常接触（大样本量）和即时、明确的反馈的情况下更可能是准确的。例如，在他对消防员的研究中，加里-克莱因证明了消防员在工作过程中做出的快速决定的准确性，以及这种准确性如何随着时间的推移而增加。为什么呢？火是由化学和物理规则所支配的，因此表现出一致的行为。

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.
你与火灾的互动越多，你就越能建立知识，使你在未来的火灾情况下凭直觉做出好的决定。以前的经验越不可靠，例如太复杂而无法确定真正的因果关系，或基于太小的样本量，你的启发式方法就越可能不是特别有用。

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.
临床治疗也有这个问题。这种情况的性质使得你很难收到关于治疗是否真的有效的即时反馈。可能有许多其他因素促成了最终的改善，甚至是简单的回归平均值。治疗过程的保密性和通常较长的持续时间使每个从业者很难在大量的样本中积累经验。其他启发式方法似乎是建立在我们的大脑运作方式上。其中最有名的是锚定（anchoring）、可用性（availability）和代表性（representativeness），由Daniel Kahneman和Amos Tversky进行广泛的研究。他们证明了这些启发式方法在本质上是人类大脑与生俱来的。

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?)."
它们只是我们做事的方式，即使相对简单地证明它们往往是无效的，并且充满偏见。在《思考的快与慢》中，卡尼曼也写到了情感启发法，"人们通过咨询他们的情感来做出判断和决定。我喜欢它吗？我讨厌它吗？我对它的感觉有多强烈？" 卡尼曼解释说，"情感启发式是一个替代的例子，在这个例子中，对一个简单问题（我对它的感觉如何？）的回答可以作为对一个更难的问题（我对它的看法如何？

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.
回答容易的问题不一定是坏事；我们用情绪反应代替思考反应是因为我们必须这样做。我们绝对必须做出反应，并且相信我们的反应，以便处理我们一天中的许多互动。我们的大脑会做出情感反应，因为弄清我们对某件事情的感受所需要的能量比做知情的工作要少。通常这是很有用的，因为它让我们把最小的努力投入到影响不大的决定中，例如根据你对洗衣粉气味的喜爱来购买洗衣粉。然而，有时候，如果我们把精力放在回答我们对某件事情的看法这个更难的问题上，而不是依赖情感上的捷径，我们的技能和知识就会增加。启发式方法之所以存在，是因为它们的效率更高--在能量使用方面的效率，不一定在获得最有用的答案方面的效率。

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.” 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.
正如卡尼曼所解释的，"一个一般的'最小努力法则'适用于认知和体力消耗。该定律认为，如果有几种方法可以实现同一目标，人们最终会倾向于选择要求最低的行动方案。在行动的经济中，努力是一种成本，而技能的获得是由利益和成本的平衡来驱动的。懒惰已经深入到我们的天性中"。我们经常做感觉良好的事情。使用较少的能量往往比在精神上对自己施加压力感觉更好。我们落到了我们的进化程序的水平，而不是我们最好的，往往是天真的意图。当我们认为我们可以克服我们的基本本能时，我们忘记了我们的大脑想做的事情正好相反。

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. 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.
好消息是，当我们愿意花费精力时，卡尼曼为启发式方法的倾向提供了几个修正：记住基本比率并注意信息的质量。如果你知道20%的人喜欢巧克力冰淇淋，80%的人喜欢香草，你可以很容易地猜到你的新朋友更喜欢香草。即使在你接触到一系列关于当前运动员参加可可-鳄梨冰淇淋的趋势的新闻报道后，你仍然可以安全地猜测你的朋友对香草的偏爱。

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.
始终回到基本比率，然后问你所掌握的这个新信息是否会对这些比率产生足够大的影响，使你改变你的猜测。如果没有这种警惕性，在被要求猜测你朋友最喜欢的冰淇淋时，新闻报道的可用性或可可这个词的主播很可能会促使你选择巧克力。但这个新信息与你的情况没有关系，除非你的新朋友是个职业足球运动员。你的最佳猜测是基准率所表示的概率。尽可能耗费最少能量的思考往往是感觉最自然的。但有时，我们不得不投入额外的卡路里来获得更多相关的、有用的结果。

To cubicle or not to cubicle 隔间或不隔间

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.
设计专注的环境，给人们空间和时间去做他们真正需要做的事情，将使能源效率最大化。就像水动力鲨鱼的鳞片允许最小的水阻力一样，我们需要开发一些机制来促进我们每天进行的持续、重复的活动的效率。开放式住宅可以有利于减少能源支出。有了一个开放式的生活空间，你可以在做晚饭的同时观察你的孩子。你可以从沙发上发现你留在走廊里的钥匙。

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.
你可以轻松地走动，在不同的空间和活动之间过渡，而不需要打开和关闭门。自然光可以从正确的角度涌入。根据不同的需要调整空间，例如移动客厅的家具，为晚餐聚会腾出空间，这很

简单。但我们的家与我们的办公室非常不同。它们是一个我们要被我们信任的人包围的空间，在那里我们可以放下戒备，放松自己。我们可以随心所欲地重新塑造它们，而且我们不受别人的规则限制。

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.
此外，即使是大部分的开放式住宅，也往往有私人空间，如卧室、浴室和书房，可以退而求其次。当涉及到办公室时，开放式布局并不能减少整体的能源支出。它们可能使人们更容易走动，但它们大大增加了集中精力和完成工作所需的努力，而这正是办公室里最重要的东西。在一个开放的办公室里，工人们不得不忽视不断涌现的刺激和干扰--电话的叮当声、饮料的啜饮声、耳机里漏出的音乐声、脚步声、笑声、同事们拍打肩膀问问题的烦躁声、关门声等等。

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-onone 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.
他们不仅在工作上耗费精力，还在无视干扰因素上耗费精力，这意味着工作更加疲惫，没有更多的成果。如果不能控制我们何时何地进行互动，我们就会超负荷工作并被耗尽。此外，在一个开放的办公室里谈话的人无法控制谁在听，谁没有在听。他们无法形成强大的、一对一的社会联系。当总是有听众时，社会互动变得更加肤浅和表演性。当人们需要隐私而又没有允许隐私的空间时，他们就会转而采用不会被偷听的交流方式。这比保持警惕看谁在偷听要省力得多。

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. What is really interesting is that open-plan offices are far from modern and have indeed been the standard throughout much of history.
开放式办公室吸引雇主和设计师的很大一部分原因是它们能降低成本。它们在网站的招聘页面上或向投资者展示时也令人印象深刻。然而，任何声称它们也能增加合作和减少信息孤岛的说法往往没有得到研究的证实，这意味着从长远来看，它们实际上可能会增加成本。例如，面对面的互动减少了70%之多，更多的电子邮件、信息和其他形式的数字通信弥补了这一差距。真正有趣的是，开放式办公室远非现代意义上的办公室，实际上在历史上大部分时间都是标准。

Although their design has taken on many different iterations, their deficiencies are not new. 6 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. Wright designed the desks to be spaced out enough to reduce distraction and enable free movement within the space.
虽然他们的设计已经有了许多不同的迭代，但他们的缺陷并不新鲜。6 弗兰克-劳埃德-赖特，这位标志性的建筑师，在20世纪30年代为强生蜡业总部设计了第一个现代开放式办公室。该总部的特点是令人难以置信的高天花板，让自然光照射进来，精致的支撑柱设计得像树。尽管它的周围是工业环境，但建筑内部却给人以通风和自然的感觉。行政人员在夹层上有自己的私人办公室，因此他们可以集中精力，享受隐私，同时仍然是办公楼层的一部分。赖特设计的办公桌有足够的间距，以减少分心，并能在空间内自由移动。

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.
柱子和文件柜也充当了非官方的划分。随着强生蜡公司总部的成功，开放式办公室变得越来越流行，但它们缺乏赖特作品中的精心设计和充足的空间，并演变成一排排拥挤的办公桌。在20世纪50年代，一个德国设计团体设计了 "办公室景观"，用隔板将公司的不同部分分割开来，以反映信息需要流动的方式。从本质上讲，办公室景观是为了最大限度地减少人们合作或集中精力所需的能量。

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.
如果某人的需求发生了变化，他们就可以随意移动隔板。在20世纪60年代，设计师罗伯特-普罗普斯特看到了开放式办公室的一些问题，为了扩大办公室景观，开发了行动办公室，作为一种中间方式。它涉及灵活的家具和可移动的隔墙，可以适应员工的日常需要。

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.
行动办公室是支持联系和隐私的完美妥协，但它太昂贵了，无法成为主流。雇主们只是简单地采用了隔墙的基本概念，并以此为基础，创造了臭名昭著的隔间农场式办公室，每个人都坐在小盒子里，敲敲打打。现代开放式办公室在某种程度上是摆脱这种强加的隔离的一种手段。

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.
因此，这是一个开放办公室作为对隔间的反应，然后隔间作为对开放办公室的反应的循环。显而易见的是，有效的办公室设计需要承认并尊重人类的倾向，即以赖特最初的方式尽量减少能源输出。人们需要专注的空间，也需要四处走动，而不是需要增加完成工作所需能量的环境。

Conclusion 结论

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.
有时我们节约能源的倾向会帮助我们，有时则会伤害我们。虽然最小化我们的产出可以确保我们在需要增加的时候有额外的能量可以利用，但它也会妨碍我们的学习。没有反思，经验就不会变成学习，而反思是一种能量消耗。如果我们想发展我们的思维，并从我们的环境中获得最大的收益，那么我们必须意识到最小化能量输出的自然倾向，并在这样做能创造价值的情况下纠正它。